



# C305 - Eastern Running Tunnels

## I&M Close out report for Limehouse DLR Viaduct – 3D Prisms, ATS and Sockets (Drive Y)

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Stakeholder submission required LU  RIL  Purpose of submission For no objection   
 NR  LO  For information   
 DLR  Other: \_\_\_\_\_

This document has been reviewed by the following individual for coordination, compliance, integration and acceptance and is acceptable for transmission to the above stakeholder for the above stated purpose:

Sign: [Redacted] Role: [Redacted] Name: [Redacted] Date: 13/07/16  
 Sign: \_\_\_\_\_ Role: \_\_\_\_\_ Name: \_\_\_\_\_ Date: \_\_\_\_\_

### 2b. Review by Stakeholder (if required):

Stakeholder Organisation	Job Title	Name	Signature	Date	Acceptance
					<input type="checkbox"/>
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### 3. Acceptance by Crossrail:

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I&M Close Out Report for ATS & Track Levelling at Limehouse DLR Viaduct (Drive Y)				
<i>C305 Crossrail Eastern Running Tunnels</i>				
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APPENDIX A: LOCATION OF THE WORKS

APPENDIX B: SUMMARY OF INSTRUMENTATION INSTALLED ON SITE

Learning Legacy Document

**1. CLOSE OUT REPORT PURPOSE**

As stated in the specification: C122-OVE-Z4-RSP-CR001-00007 Rev 7.0, the purpose of this close-out report is to summarize the data from the instrumentation included in this document and to relate the recorded movements to the construction activities which produce any observed changes. For construction activities it is intended excavation of the C305 twin bored tunnels and dewatering/construction of cross passages; impacts from other CRL contracts are not included in this report.

The long term readings have been used to demonstrate that the subsequent movement has reached an acceptably stable rate within the accuracy of the system in order to decommission and/or that C305 works are no longer impacting the area concerned.

As stated in the specifications the settlement rate of 2 mm/yr has been defined. Where this is not achieved this report seeks agreement from all parties that the rate is acceptably low enough to cease monitoring and decommission.

**2. LOCATION OF THE WORKS**

The works covered by this report are related to monitoring of the Limehouse DLR viaduct between project chainages 81400 and 81900, in Area 6 between Canary Wharf and Stepney Green. Instrumentation was installed on the DLR viaduct (a Grade II listed structure) to monitor potential movements of the asset.

See Appendix A for the instrument location.

**3. DOCUMENTATION SUMMARY**

CROSSRAIL NUMBER	DOCUMENT NAME	TYPE OF DOCUMENT
C305-DSJ-C-GMS-CRG03-50014	Method Statement for the Installation of Instrumentation at DLR Limehouse Viaduct (ATS & Track Levelling)	Main Method Statement
C305-DSJ-C2-GMS-CRG03-50032	I&M Limehouse ATS power installation	Main Method Statement
C305-DSJ-C-CCN-CRG03-50013	Short Notice Change I&M Limehouse Resection Prisms and new ATS locations	Short Notice Change
C305-DSJ-C2-RGN-CRG03-50394	I&M Installation Report for Limehouse DLR Viaduct – 3D Prisms, ATS and Sockets (Drive Y)	Installation report
C305-DSJ-C2-RGN-CRG03-50127	Baseline monitoring report – DLR Limehouse Viaduct	Baseline report



**4. SUMMARY OF INSTALLED INSTRUMENTATION ON SITE**

Monitoring activities have been performed with the following methods:

- Control of DLR viaduct by automatic total stations (ATS) with 3D prisms, and sockets.

The total number of instruments installed, as per installation report listed above, is:

- 8 – Automatic Total Stations
- 190 – 3D Prisms
- 12 – Sockets
- Control of track (Levelling) movement by manual monitoring at 3 m centres within the influence area of the running tunnel construction.

Appendix B includes detailed information of the installed instrumentation, the average value of the commissioning readings included in Appendix B has been used as a baseline for the relative movements illustrated in the graphs of this report.

Appendix B also includes the full list of track levelling points with their coordinates.

**5. CONSTRUCTION ACTIVITY**

TBM Passage

DRIVE Y	RINGS	PROJECT CHAINAGE	DATES
Eastbound	1683-2007	81900-81400	17/09/2013 to 05/10/2013
Westbound	1698-2015	81900-81400	20/11/2013 to 06/12/2013

Stoppage Periods

Eastbound TBM	Ring 1989 (Project chainage 81410)	02/10/2013
Westbound TBM	Ring 1710 (Project chainage 81850)	21/11/2013

The periods of TBM passage and stoppage are related to the rings located close to the instrumentation included in this close out report.

Cross passage 11:

Dewatering/depressurization: 1<sup>st</sup> May 2014 to 16<sup>th</sup> January 2015

Construction: 11<sup>th</sup> July 2014 to 26<sup>th</sup> September 2014

Sump construction: 9<sup>th</sup> October 2014 to 26<sup>th</sup> October 2014

## 6. METHODOLOGY

To determine the settlement rate the following methodology has been used. A Linear Regression has been applied for a defined period using long term readings is recorded after TBM construction. This uses the following formula:

$$b = \frac{\sum_{i=1}^n (X_i - \bar{X}_i) \cdot (Y_i - \bar{Y}_i)}{\sum_{i=1}^n (X_i - \bar{X}_i)^2}$$

Where:

B =gradient

X = date

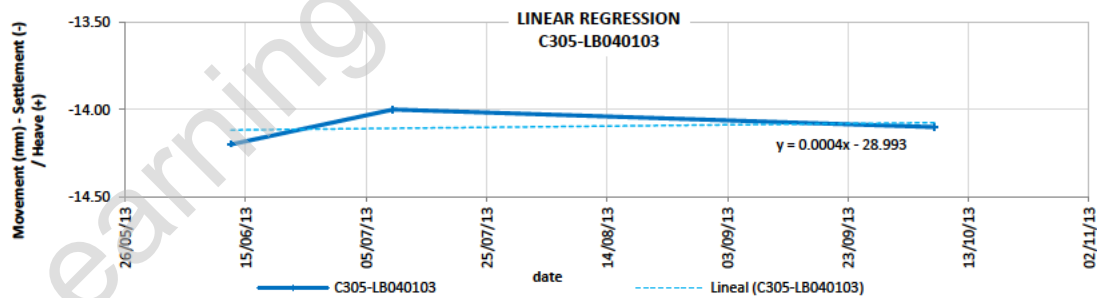
Y = vertical movement

From this, the settlement rate per day can be calculated and rate per year determined (negative value is for settlement, positive is for heave). For these values, the percentage at or below 2 mm/year will be used to determine the trend of the section/area being considered. Also for comparison, values at or below 3mm/year are presented to highlight that the rate is close to achieving the 2 mm/year.

Note the percentages of settlement rate presented in the sections below refer to values rounded to the nearest integer.

One example of this calculation can be seen below for the socket C305-LB040103.

	Registered movement (mm)			RATE mm/year
	12/06/2013	09/07/2013	07/10/2013	
C305-LB040103	-14.20	-14.00	-14.10	0.146



CALCULATION - C305-LB040103

$X_i$	$Y_i$	$X_i - \bar{X}_i$	$Y_i - \bar{Y}_i$	$(X_i - \bar{X}_i)^2$	$(X_i - \bar{X}_i) \cdot (Y_i - \bar{Y}_i)$
12/06/2013	-14.2	-47.94	-0.10	2298.67	4.794
09/07/2013	-14	-21.03	0.10	442.17	-2.103
07/10/2013	-14.1	68.97	0.00	4757.17	0.000

$\bar{X}_i$	41485.53	
$\bar{Y}_i$	-14.10	
$\sum_{i=1}^n (X_i - \bar{X}_i)^2$	7498.00	(2)
$\sum_{i=1}^n (X_i - \bar{X}_i) \cdot (Y_i - \bar{Y}_i)$	2.692	(1)
m (SLOPE)	(1)/(2)	0.0004
Rate (mm/year)	m * 365	0.146

7. SUMMARY OF THE DATA

The methodology explained in section 6 is applied here to sockets and track levelling points. Additionally, graphs of deflection, cant and twist of the DLR Eastbound and Westbound rail track are presented.

This report summaries the directional data recorded by 3D prisms.

Note: For the following data plots:

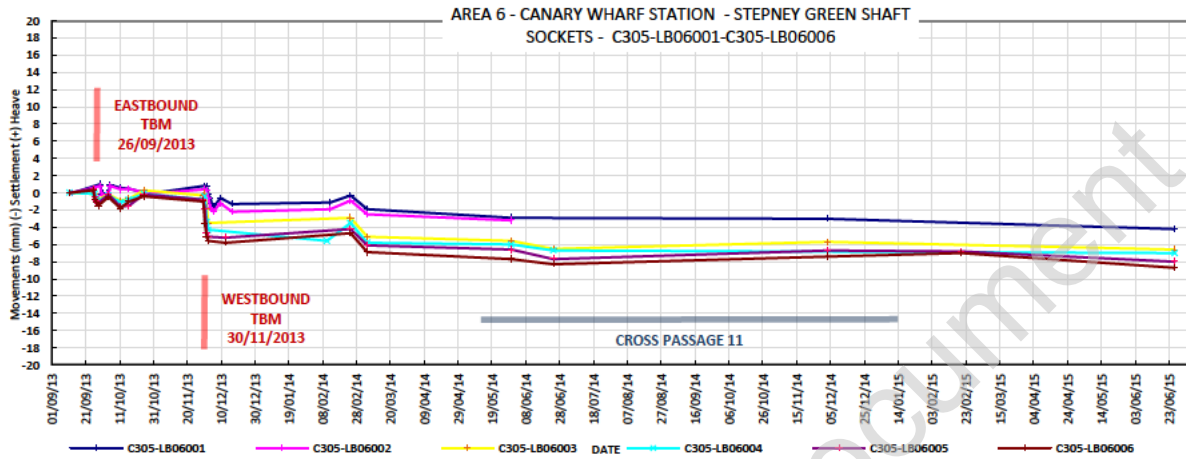
- #N/A refers to instances where readings were not taken for that sensor (e.g. damaged sensor, no access, etc.)

The indicating bar for Cross passage 11 includes all construction and dewatering/depressurization activities

**SOCKETS**

**C305-LB06001 - C305-LB06006**

The graph presented below shows the readings from the sockets in this array. A maximum settlement of -2 mm is recorded after the Eastbound TBM transit and -6 mm after Westbound TBM transit.



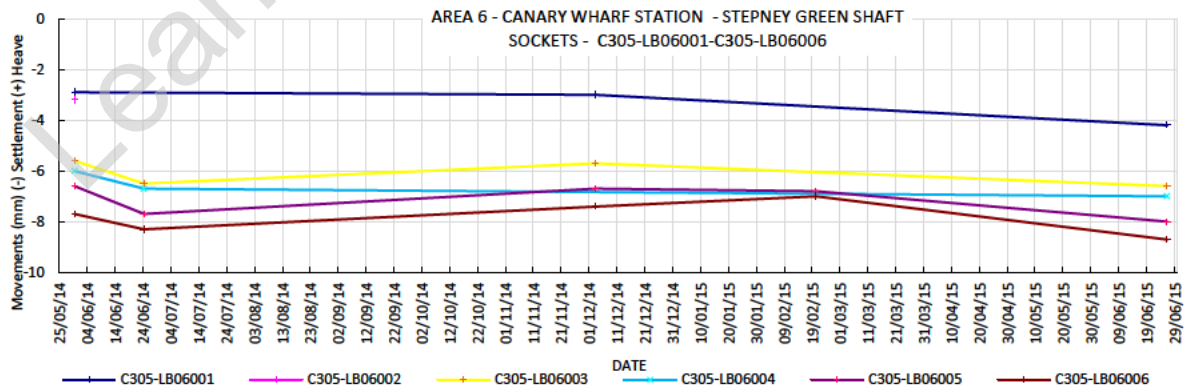
The table below illustrates the annual settlement rate for the sockets in this array.

	Registered movement (mm)					Rate mm/Year
	30/05/2014	24/06/2014	03/12/2014	20/02/2015	26/06/2015	
C305-LB06001	-2.90	#N/A	-3.00	#N/A	-4.20	-1.241
C305-LB06002	-3.20	#N/A	#N/A	#N/A	#N/A	-
C305-LB06003	-5.60	-6.50	-5.70	#N/A	-6.60	-0.475
C305-LB06004	-6.00	-6.70	#N/A	#N/A	-7.00	-0.657
C305-LB06005	-6.60	-7.70	-6.70	-6.80	-8.00	-0.548
C305-LB06006	-7.70	-8.30	-7.40	-7.00	-8.70	-0.219
	Rate less than -2.5 mm/year				% less 2 mm/ year	100.00%
	Rate greater than -3.5 mm/year				% less 3 mm/ year	100.00%

Note: All the movements are in mm. (-) Settlement / (+) Heave

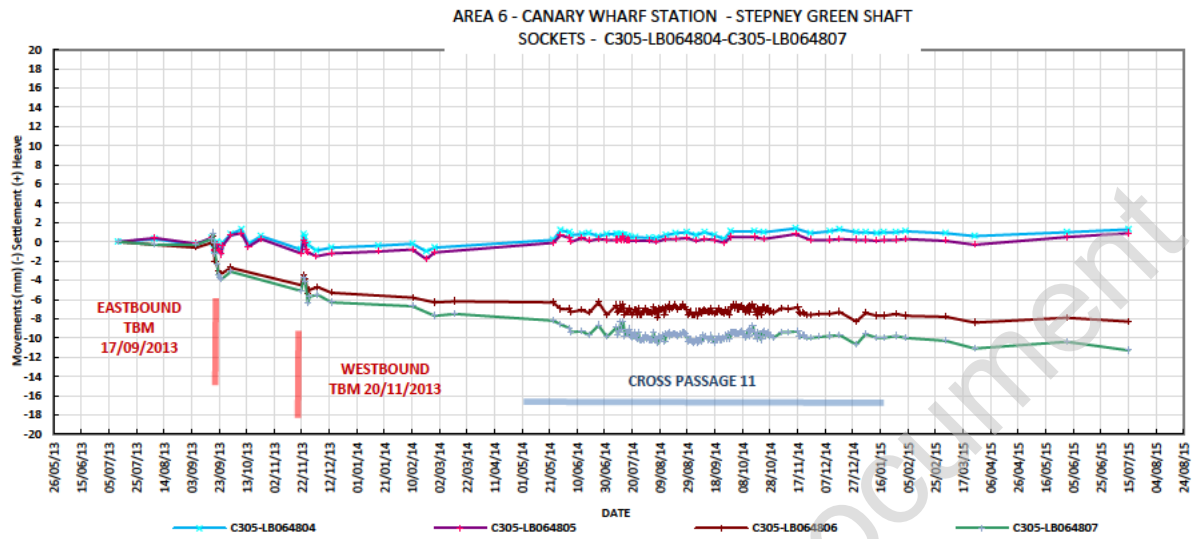
The percentage of the sockets with a settlement rate less than 2 mm/year is 100%.

The next plot shows the trend line adjustment for the sockets in this array.



**C305-LB064804 - C305-LB064807**

The graph presented below shows the readings from the sockets in this array. A maximum settlement of -4 mm is recorded after the Eastbound TBM transit and -6 mm after Westbound TBM transit.



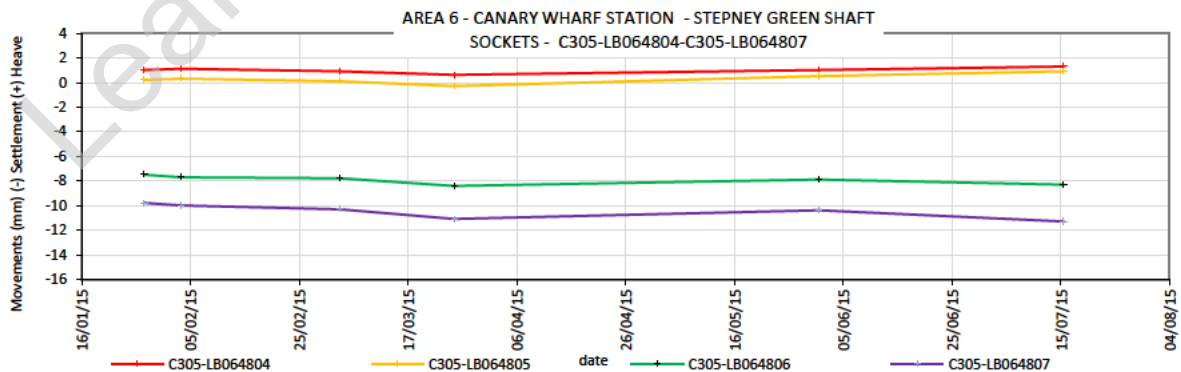
The table below illustrates the annual settlement rate for the sockets in this array.

	Registered movement (mm)						Rate mm/Year
	27/01/2015	03/02/2015	04/03/2015	25/03/2015	31/05/2015	15/07/2015	
C305-LB064804	1.00	1.10	0.90	0.60	1.00	1.30	0.511
C305-LB064805	0.20	0.30	0.10	-0.30	0.50	0.90	1.460
C305-LB064806	-7.50	-7.70	-7.80	-8.40	-7.90	-8.30	-1.241
C305-LB064807	-9.80	-10.00	-10.30	-11.10	-10.40	-11.30	-2.446
	Rate less than -2.5 mm/year				% less 2 mm/ year		100.00%
	Rate greater than -3.5 mm/year				% less 3 mm/ year		100.00%

Note: All the movements are in mm. (-) Settlement / (+) Heave

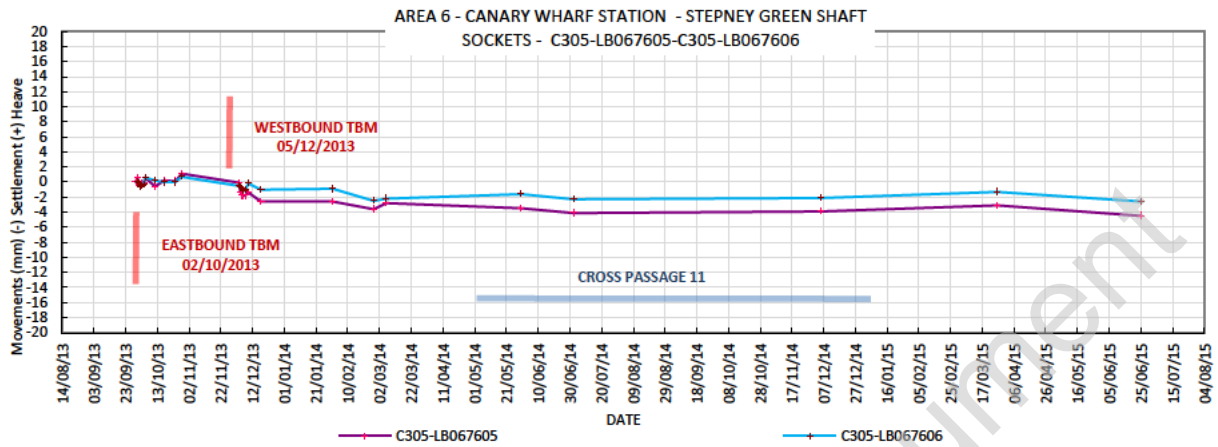
The percentage of the sockets with a settlement rate less than 2 mm/year is 100%.

The next plot shows the trend line adjustment for the sockets in this array.



**C305-LB067605- C305-LB067606**

The graph presented below shows the readings from the sockets in this array. A maximum settlement of -1 mm is recorded after the Eastbound TBM transit and -3 mm after Westbound TBM transit.



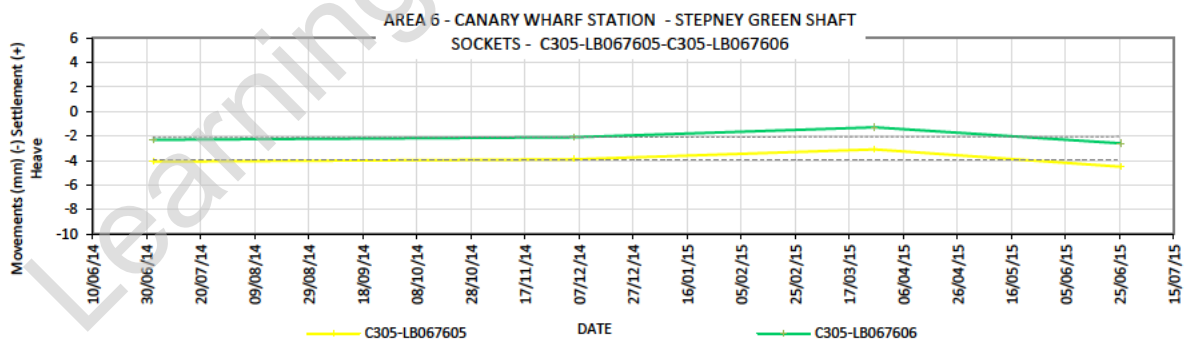
The table below illustrates the annual settlement rate for the sockets in this array.

	Registered movement (mm)				Rate mm/Year
	02/07/2014	05/12/2014	26/03/2015	25/06/2015	
C305-LB067605	-4.10	-3.90	-3.10	-4.50	-0.007
C305-LB067606	-2.30	-2.10	-1.30	-2.60	0.073
	Rate less than -2.5 mm/year		% less 2 mm/ year		100.00%
	Rate greater than -3.5		% less 3 mm/ year		100.00%

Note: All the movements are in mm. (-) Settlement / (+) Heave

The percentage of the sockets with a settlement rate less than 2 mm/year is 100%.

The next plot shows the trend line adjustment for the sockets in this array.





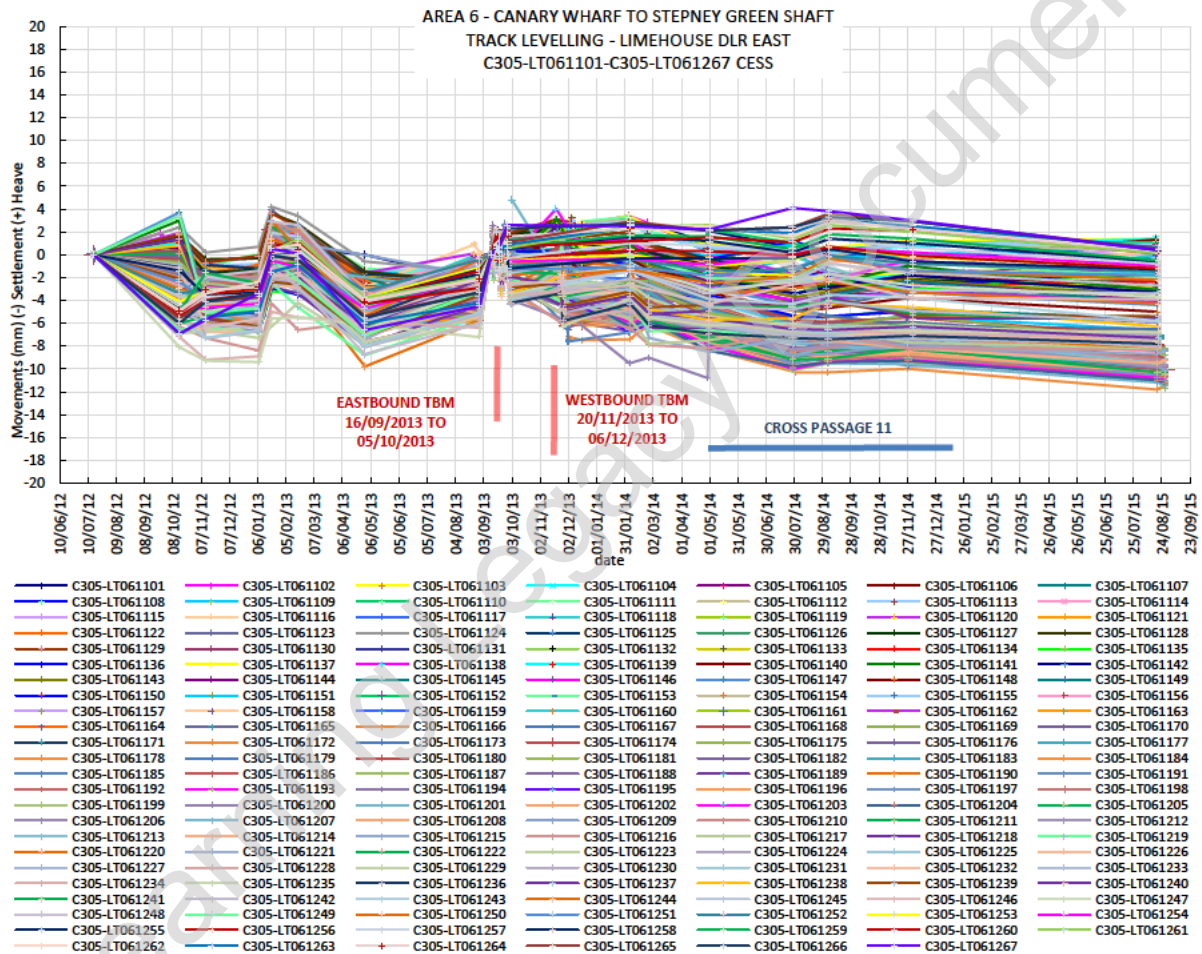
**DLR TRACK LEVELLING**

Graphs presented in this section show the effect of the TBM and Cross Passages construction activities on the DLR viaduct rail tracks.

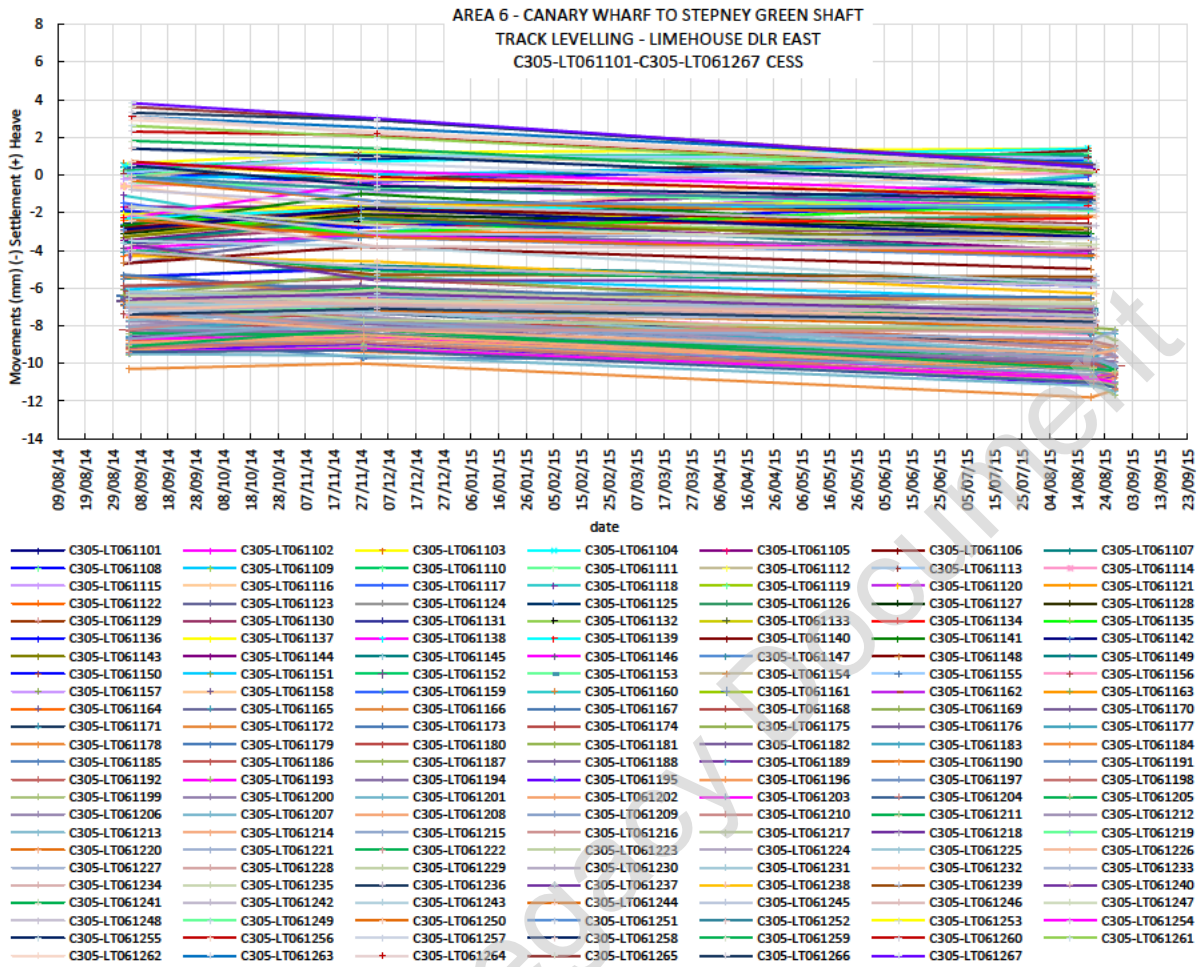
A new zero readings was applied on all four rails immediately prior to the eastbound TBM arrival.

**DLR EASTBOUND TRACK**

The graph presented below is the track levelling for the eastbound Cess, and it shows a maximum settlement of -4 mm recorded after the Eastbound TBM transit and -6 mm after Westbound TBM transit.



The next plot shows the trend line adjustment for the track levelling in eastbound Cess.



The table below shows the annual rate for the track levelling in eastbound Cess.

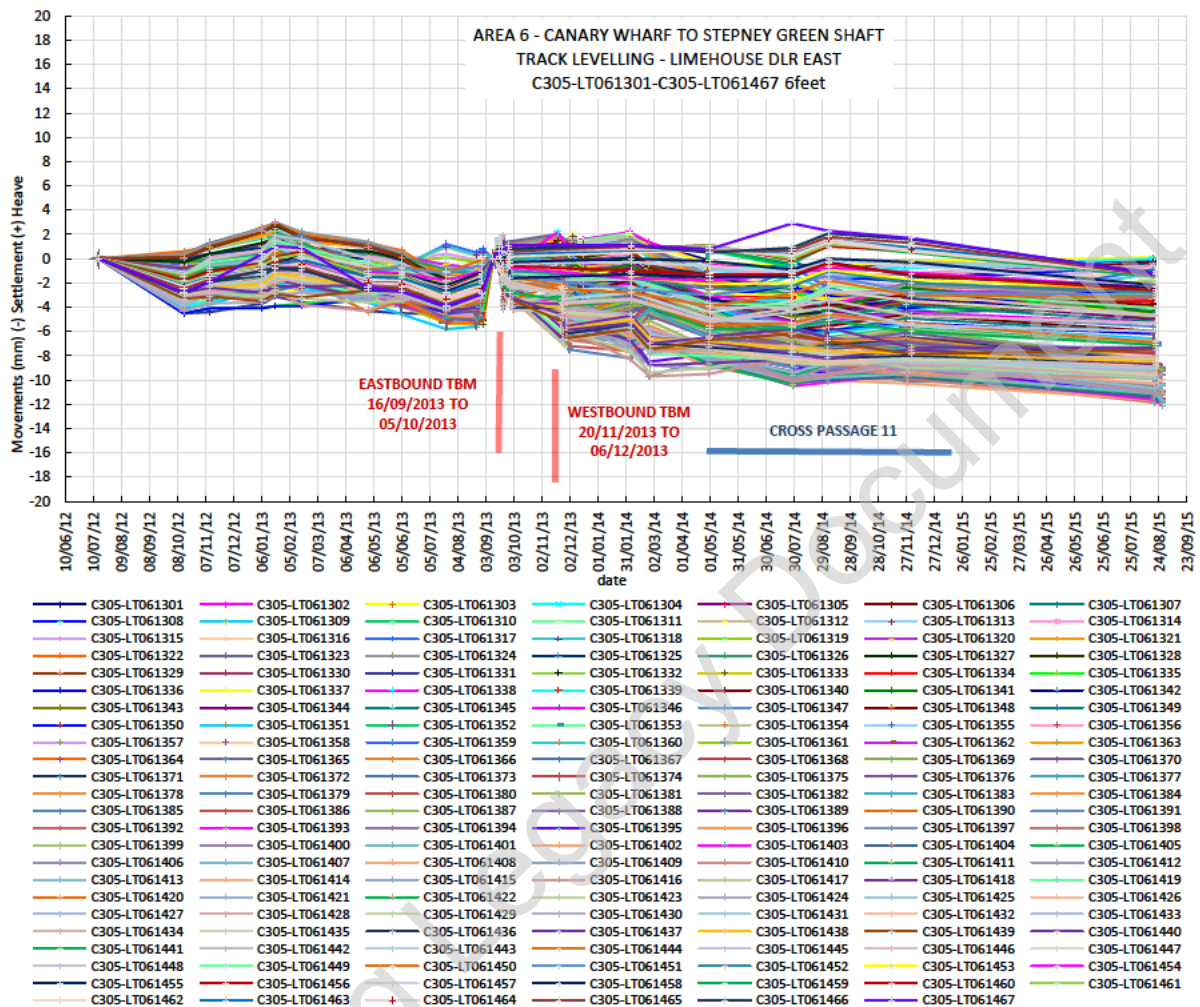
CESS		REGISTERED MOVEMENT FROM 02/09/2014 TO 28/05/2015			
ID-LT	RATE (mm/year)	ID-LT	RATE (mm/year)	ID-LT	RATE (mm/year)
C305-LT061101	0.654	C305-LT061157	-1.344	C305-LT061213	-2.064
C305-LT061102	0.523	C305-LT061158	-1.390	C305-LT061214	-1.855
C305-LT061103	0.701	C305-LT061159	-1.633	C305-LT061215	-1.093
C305-LT061104	0.945	C305-LT061160	-1.618	C305-LT061216	-1.145
C305-LT061105	1.123	C305-LT061161	-2.080	C305-LT061217	-1.435
C305-LT061106	1.399	C305-LT061162	-1.838	C305-LT061218	-1.262
C305-LT061107	1.142	C305-LT061163	-1.824	C305-LT061219	-1.123
C305-LT061108	0.950	C305-LT061164	-1.889	C305-LT061220	-1.562
C305-LT061109	0.945	C305-LT061165	-1.567	C305-LT061221	-0.993
C305-LT061110	0.748	C305-LT061166	-1.018	C305-LT061222	-1.486
C305-LT061111	0.392	C305-LT061167	-1.051	C305-LT061223	-0.755
C305-LT061112	0.167	C305-LT061168	-1.474	C305-LT061224	-0.567
C305-LT061113	0.602	C305-LT061169	-1.701	C305-LT061225	-1.191
C305-LT061114	0.687	C305-LT061170	-1.665	C305-LT061226	-1.361
C305-LT061115	1.161	C305-LT061171	-2.096	C305-LT061227	-0.912
C305-LT061116	1.616	C305-LT061172	-1.946	C305-LT061228	-1.074
C305-LT061117	2.163	C305-LT061173	-2.048	C305-LT061229	-0.893
C305-LT061118	1.892	C305-LT061174	-2.148	C305-LT061230	-0.922
C305-LT061119	1.550	C305-LT061175	-2.103	C305-LT061231	-0.448
C305-LT061120	1.347	C305-LT061176	-2.004	C305-LT061232	-0.717
C305-LT061121	0.780	C305-LT061177	-1.830	C305-LT061233	-0.624
C305-LT061122	0.695	C305-LT061178	-1.587	C305-LT061234	-0.690
C305-LT061123	0.260	C305-LT061179	-1.686	C305-LT061235	-0.354
C305-LT061124	0.307	C305-LT061180	-1.707	C305-LT061236	-0.542
C305-LT061125	0.635	C305-LT061181	-1.470	C305-LT061237	-0.878
C305-LT061126	0.654	C305-LT061182	-2.132	C305-LT061238	-2.146
C305-LT061127	-0.104	C305-LT061183	-2.066	C305-LT061239	-1.081
C305-LT061128	-0.203	C305-LT061184	-1.813	C305-LT061240	-1.410
C305-LT061129	-0.348	C305-LT061185	-1.243	C305-LT061241	-1.674
C305-LT061130	0.266	C305-LT061186	-1.741	C305-LT061242	-1.769
C305-LT061131	0.463	C305-LT061187	-2.490	C305-LT061243	-2.489
C305-LT061132	0.120	C305-LT061188	-2.470	C305-LT061244	-1.850
C305-LT061133	0.101	C305-LT061189	-2.203	C305-LT061245	-1.467
C305-LT061134	0.449	C305-LT061190	-2.052	C305-LT061246	-1.484
C305-LT061135	0.923	C305-LT061191	-2.374	C305-LT061247	-1.930
C305-LT061136	0.857	C305-LT061192	-2.296	C305-LT061248	-1.881
C305-LT061137	0.509	C305-LT061193	-2.242	C305-LT061249	-1.590
C305-LT061138	-0.030	C305-LT061194	-1.838	C305-LT061250	-1.786
C305-LT061139	0.622	C305-LT061195	-1.866	C305-LT061251	-1.498
C305-LT061140	-0.391	C305-LT061196	-2.050	C305-LT061252	-1.351
C305-LT061141	-1.001	C305-LT061197	-1.641	C305-LT061253	-1.737
C305-LT061142	-0.806	C305-LT061198	-1.886	C305-LT061254	-1.669
C305-LT061143	-0.806	C305-LT061199	-1.916	C305-LT061255	-1.674
C305-LT061144	-0.950	C305-LT061200	-	C305-LT061256	-1.881
C305-LT061145	-1.095	C305-LT061201	-2.053	C305-LT061257	-2.218
C305-LT061146	-0.564	C305-LT061202	-1.637	C305-LT061258	-2.120
C305-LT061147	-0.596	C305-LT061203	-1.779	C305-LT061259	-2.457
C305-LT061148	-0.629	C305-LT061204	-2.022	C305-LT061260	-2.408
C305-LT061149	-0.340	C305-LT061205	-1.832	C305-LT061261	-2.618
C305-LT061150	-0.690	C305-LT061206	-1.758	C305-LT061262	-2.618
C305-LT061151	-0.788	C305-LT061207	-2.055	C305-LT061263	-2.618
C305-LT061152	-0.979	C305-LT061208	-1.861	C305-LT061264	-2.861
C305-LT061153	-0.578	C305-LT061209	-1.786	C305-LT061265	-3.261
C305-LT061154	-0.932	C305-LT061210	-1.967	C305-LT061266	-3.131
C305-LT061155	-1.586	C305-LT061211	-1.783	C305-LT061267	-3.566
C305-LT061156	-1.264	C305-LT061212	-2.122		
Rate less than -2.5 mm/year			% less 2 mm/ year		95.78%
Rate greater than -3.5 mm/year			% less 3 mm/ year		99.40%

The percentage of the levelling points with a settlement rate less than 3 mm/year is 99.40%

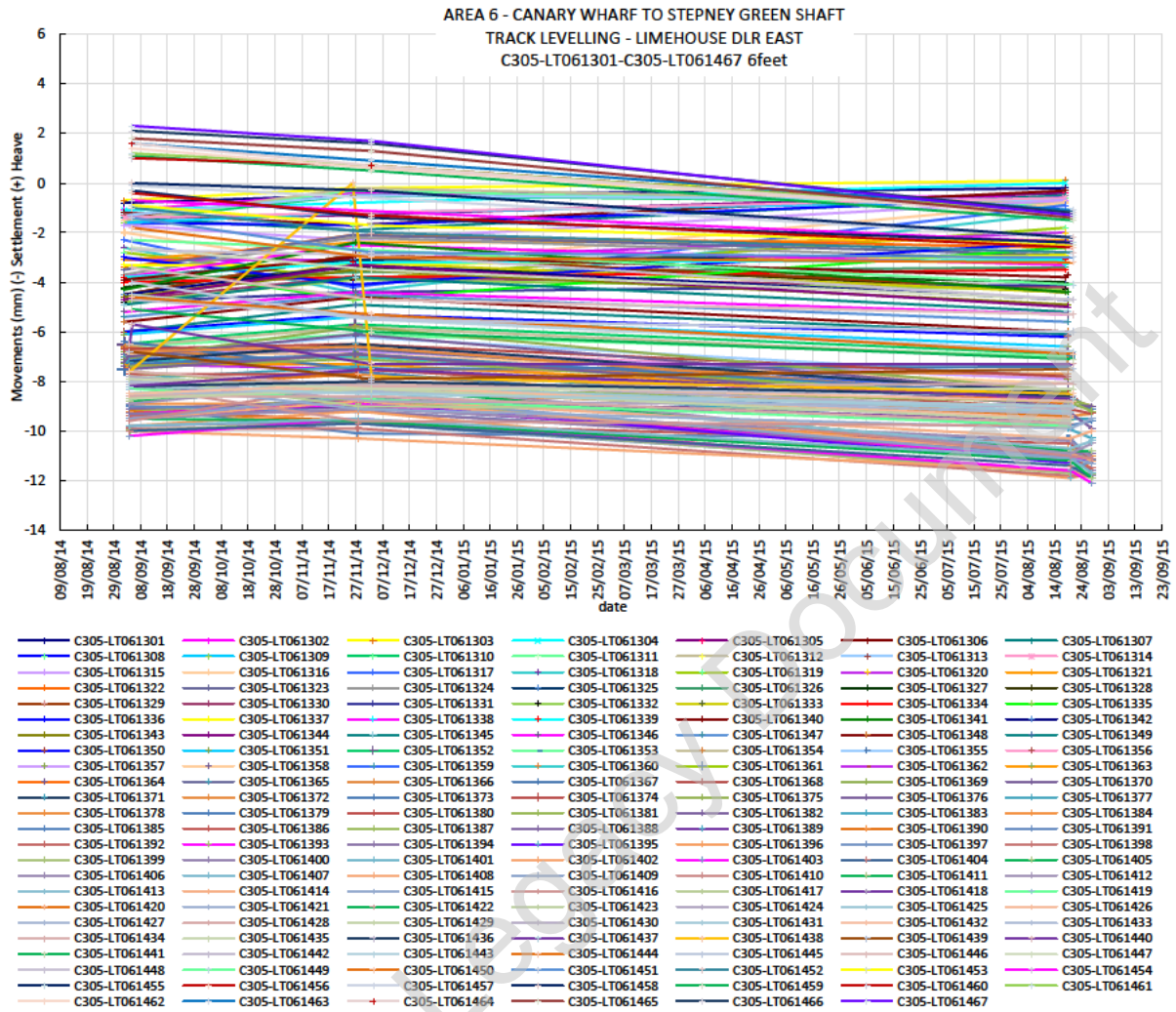


The graph presented below shows the track levelling for the eastbound 6-Ft Limehouse DLR.

A maximum settlement of -4 mm is recorded after the Eastbound TBM transit and -7 mm after Westbound TBM transit.



The next plot shows the trend line adjustment for the track levelling in eastbound 6-Ft.



The table below shows the annual rate for the track levelling in eastbound 6-Ft.

6-FEET		REGISTERED MOVEMENT FROM 02/09/2014 TO 28/05/2015			
ID-LT	RATE (mm/year)	ID-LT	RATE (mm/year)	ID-LT	RATE (mm/year)
C305-LT061301	0.575	C305-LT061357	-1.232	C305-LT061413	-2.280
C305-LT061302	0.331	C305-LT061358	-1.344	C305-LT061414	-1.993
C305-LT061303	0.734	C305-LT061359	-1.488	C305-LT061415	-1.391
C305-LT061304	1.136	C305-LT061360	-1.633	C305-LT061416	-1.336
C305-LT061305	1.090	C305-LT061361	-1.651	C305-LT061417	-1.177
C305-LT061306	1.175	C305-LT061362	-1.614	C305-LT061418	-1.407
C305-LT061307	1.175	C305-LT061363	-1.567	C305-LT061419	-1.553
C305-LT061308	1.156	C305-LT061364	-1.842	C305-LT061420	-1.469
C305-LT061309	0.879	C305-LT061365	-1.665	C305-LT061421	-
C305-LT061310	0.457	C305-LT061366	-0.939	C305-LT061422	-
C305-LT061311	0.279	C305-LT061367	-0.762	C305-LT061423	-1.160
C305-LT061312	0.359	C305-LT061368	-1.297	C305-LT061424	-1.035
C305-LT061313	0.411	C305-LT061369	-1.878	C305-LT061425	-1.204
C305-LT061314	0.832	C305-LT061370	-1.600	C305-LT061426	-1.136
C305-LT061315	1.320	C305-LT061371	-2.165	C305-LT061427	-0.930
C305-LT061316	1.807	C305-LT061372	-2.404	C305-LT061428	-1.236
C305-LT061317	2.196	C305-LT061373	-1.925	C305-LT061429	-1.136
C305-LT061318	2.163	C305-LT061374	-	C305-LT061430	-0.956
C305-LT061319	1.484	C305-LT061375	-1.767	C305-LT061431	-0.802
C305-LT061320	1.235	C305-LT061376	-1.943	C305-LT061432	-0.461
C305-LT061321	0.668	C305-LT061377	-2.015	C305-LT061433	-0.624
C305-LT061322	0.471	C305-LT061378	-1.576	C305-LT061434	-0.372
C305-LT061323	0.214	C305-LT061379	-1.868	C305-LT061435	-0.323
C305-LT061324	0.181	C305-LT061380	-1.825	C305-LT061436	-0.511
C305-LT061325	0.780	C305-LT061381	-1.302	C305-LT061437	-
C305-LT061326	0.463	C305-LT061382	-1.467	C305-LT061438	-0.946
C305-LT061327	-0.038	C305-LT061383	-1.980	C305-LT061439	-0.440
C305-LT061328	-0.413	C305-LT061384	-2.210	C305-LT061440	-1.167
C305-LT061329	-0.301	C305-LT061385	-1.358	C305-LT061441	-1.962
C305-LT061330	0.266	C305-LT061386	-1.812	C305-LT061442	-2.138
C305-LT061331	0.654	C305-LT061387	-2.644	C305-LT061443	-2.267
C305-LT061332	0.266	C305-LT061388	-2.616	C305-LT061444	-2.362
C305-LT061333	-0.156	C305-LT061389	-2.162	C305-LT061445	-1.772
C305-LT061334	0.496	C305-LT061390	-2.213	C305-LT061446	-1.723
C305-LT061335	1.246	C305-LT061391	-2.182	C305-LT061447	-2.074
C305-LT061336	1.035	C305-LT061392	-2.453	C305-LT061448	-2.183
C305-LT061337	0.449	C305-LT061393	-2.255	C305-LT061449	-1.895
C305-LT061338	0.134	C305-LT061394	-1.848	C305-LT061450	-1.193
C305-LT061339	0.589	C305-LT061395	-2.204	C305-LT061451	-1.355
C305-LT061340	-0.391	C305-LT061396	-2.502	C305-LT061452	-1.706
C305-LT061341	-0.730	C305-LT061397	-1.698	C305-LT061453	-1.544
C305-LT061342	-0.614	C305-LT061398	-2.146	C305-LT061454	-1.773
C305-LT061343	-0.694	C305-LT061399	-2.142	C305-LT061455	-2.011
C305-LT061344	-0.791	C305-LT061400	-2.231	C305-LT061456	-2.187
C305-LT061345	-0.694	C305-LT061401	-	C305-LT061457	-2.201
C305-LT061346	-0.372	C305-LT061402	-1.858	C305-LT061458	-2.376
C305-LT061347	-0.517	C305-LT061403	-2.158	C305-LT061459	-2.731
C305-LT061348	-0.773	C305-LT061404	-1.994	C305-LT061460	-2.376
C305-LT061349	-0.470	C305-LT061405	-2.284	C305-LT061461	-2.538
C305-LT061350	-0.452	C305-LT061406	-1.586	C305-LT061462	-2.780
C305-LT061351	-0.788	C305-LT061407	-1.939	C305-LT061463	-2.811
C305-LT061352	-0.708	C305-LT061408	-2.042	C305-LT061464	-2.973
C305-LT061353	-0.611	C305-LT061409	-2.292	C305-LT061465	-3.436
C305-LT061354	-0.820	C305-LT061410	-2.255	C305-LT061466	-3.549
C305-LT061355	-1.235	C305-LT061411	-2.505	C305-LT061467	-3.854
C305-LT061356	-1.264	C305-LT061412	-2.397		
Rate less than -2.5 mm/year		% less 2 mm/ year		92.59%	
Rate greater than -3.5 mm/year		% less 3 mm/ year		98.77%	

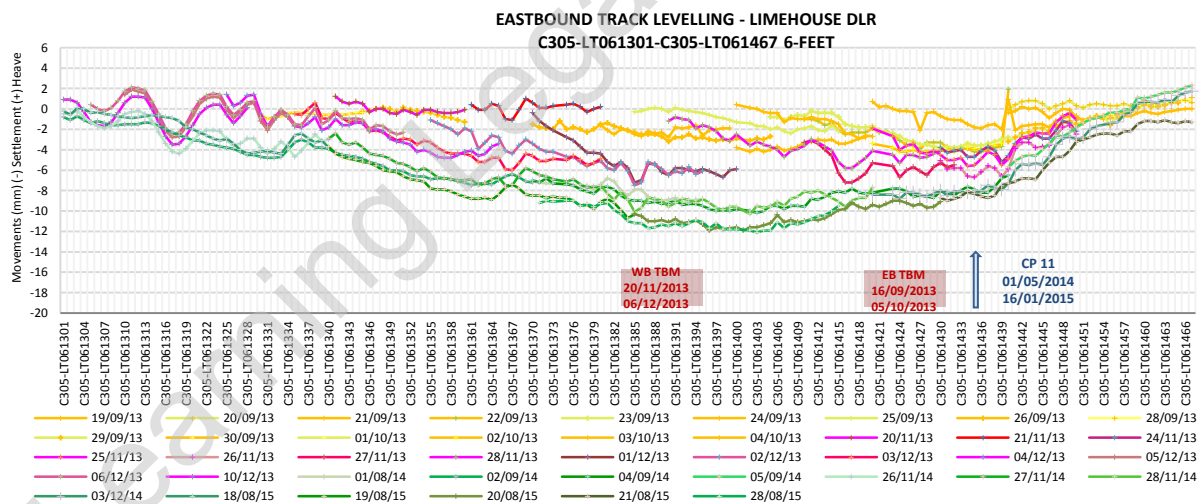
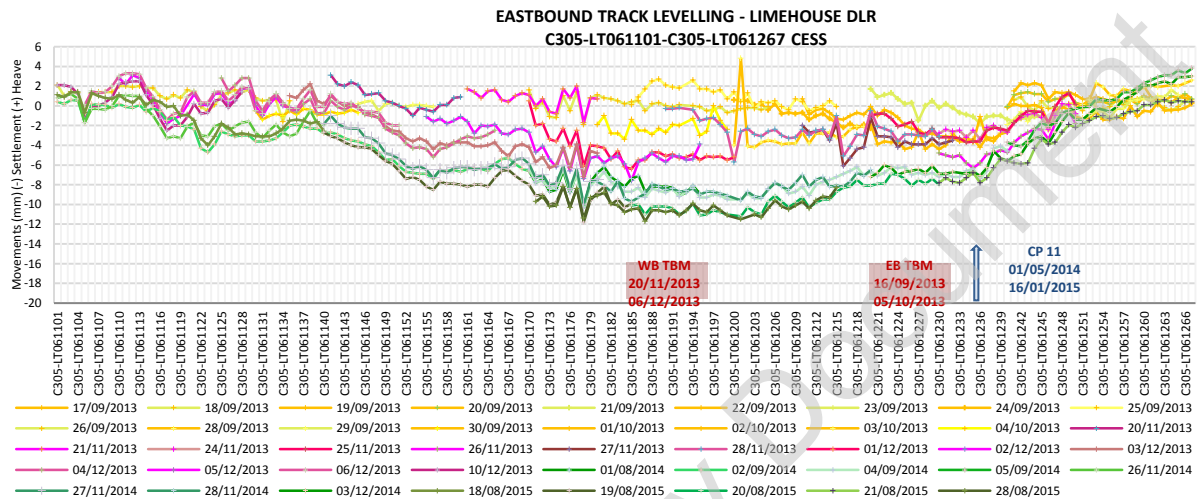
The percentage of the levelling points with a settlement rate less than 3 mm/year is 98.77%

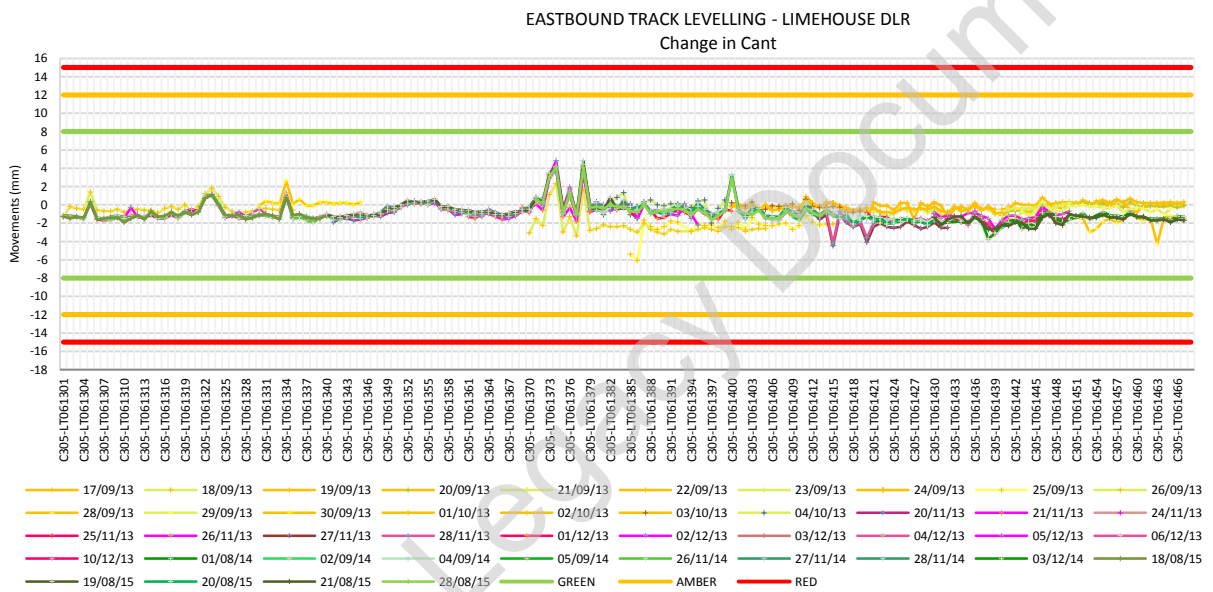
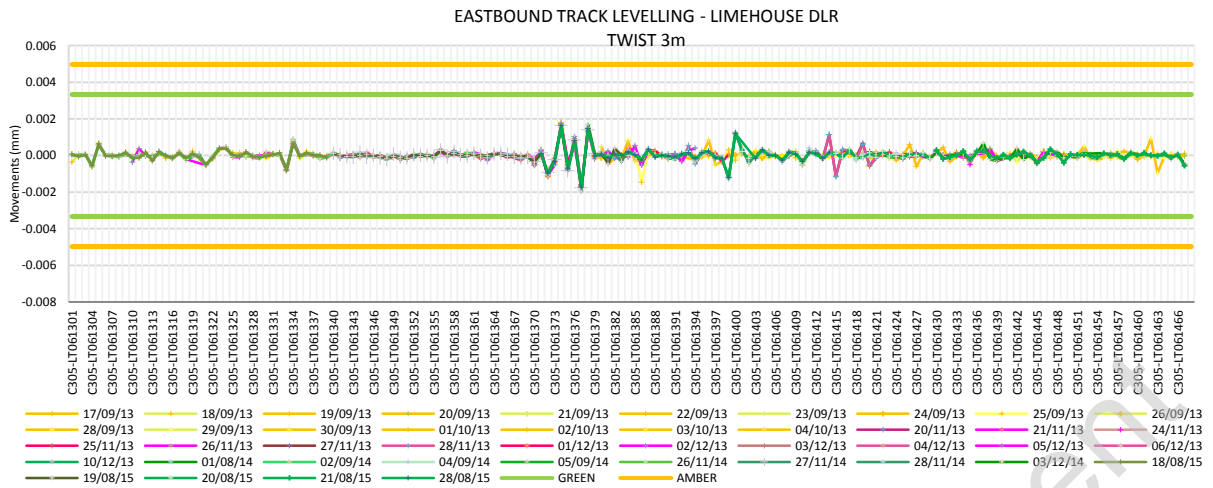


**DEFLECTION GRAPHS EASTBOUND**

Representative dates are presented in the graphs below to show the movements related to the following activities:

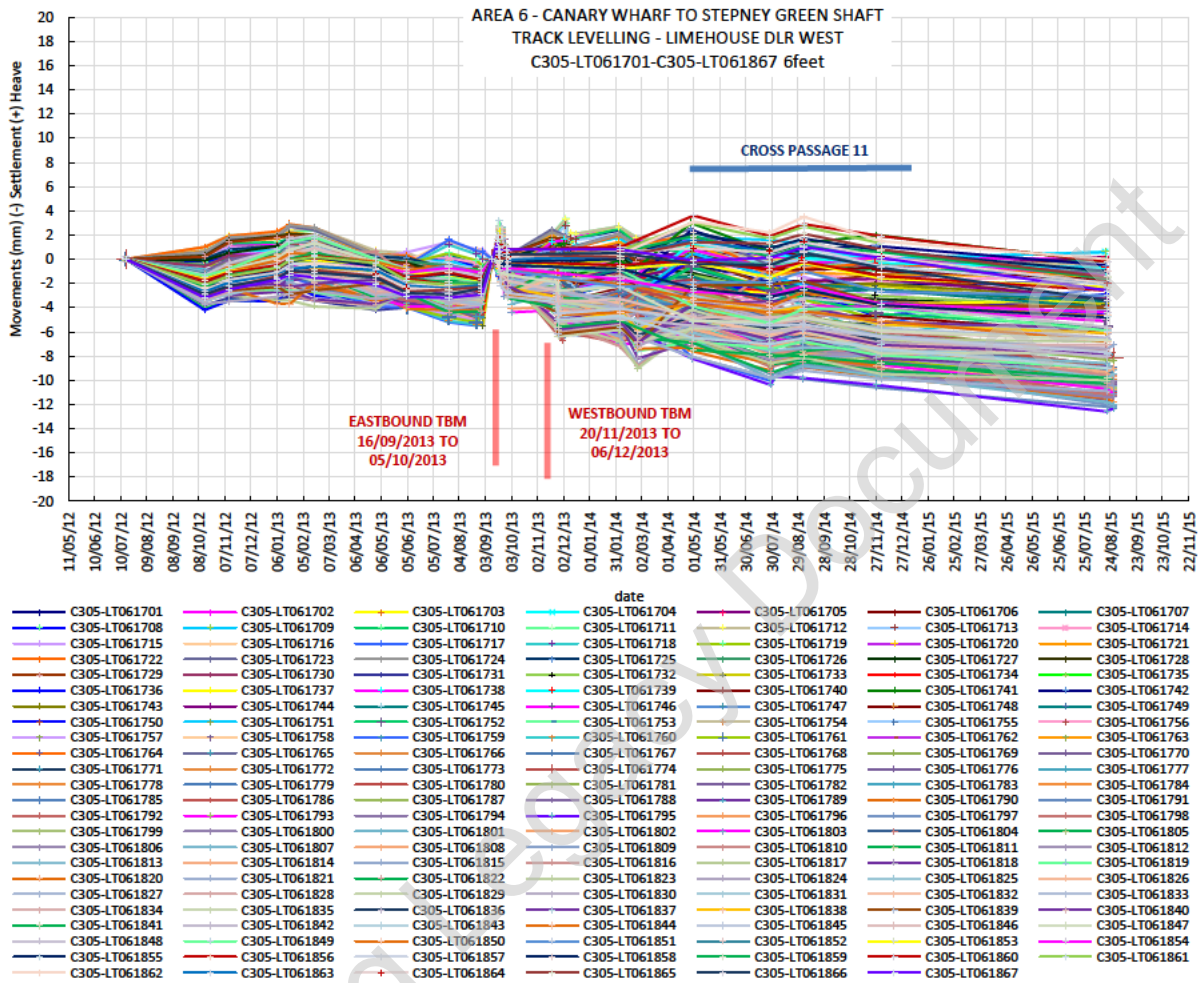
- Eastbound transit: 17/09/2013 to 04/10/2013
- Westbound transit: 20/11/2013 to 6/12/2013
- Cross Passage 11: 01/08/2014 to 28/08/2015



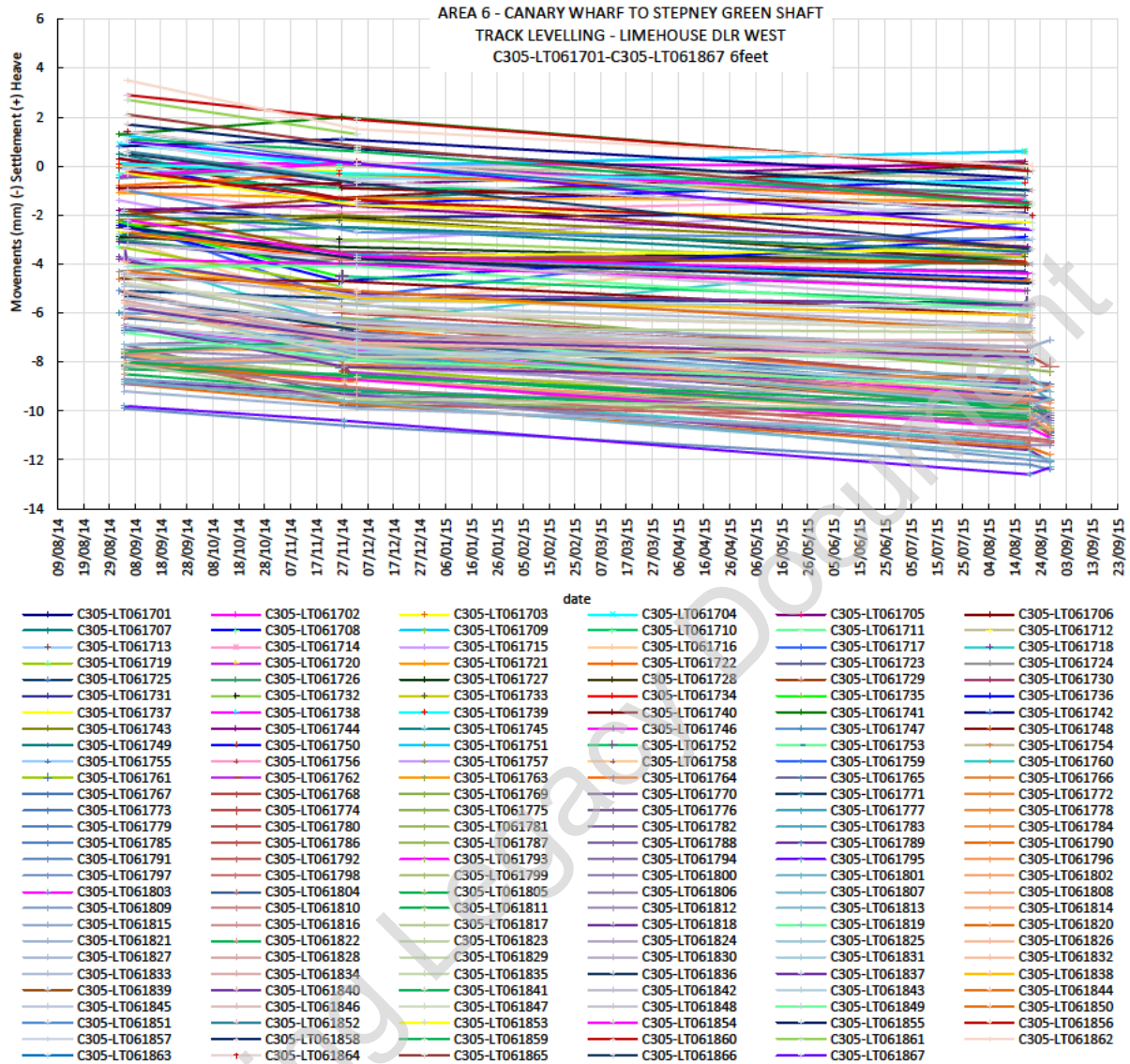


DLR WESTBOUND TRACK

The graph presented below is the track levelling for the westbound 6-Ft, and it shows a maximum settlement of -3 mm is recorded after the Eastbound TBM transit and -6 mm after Westbound TBM transit.



The next plot shows the trend line adjustment for the track levelling in westbound 6-Ft.



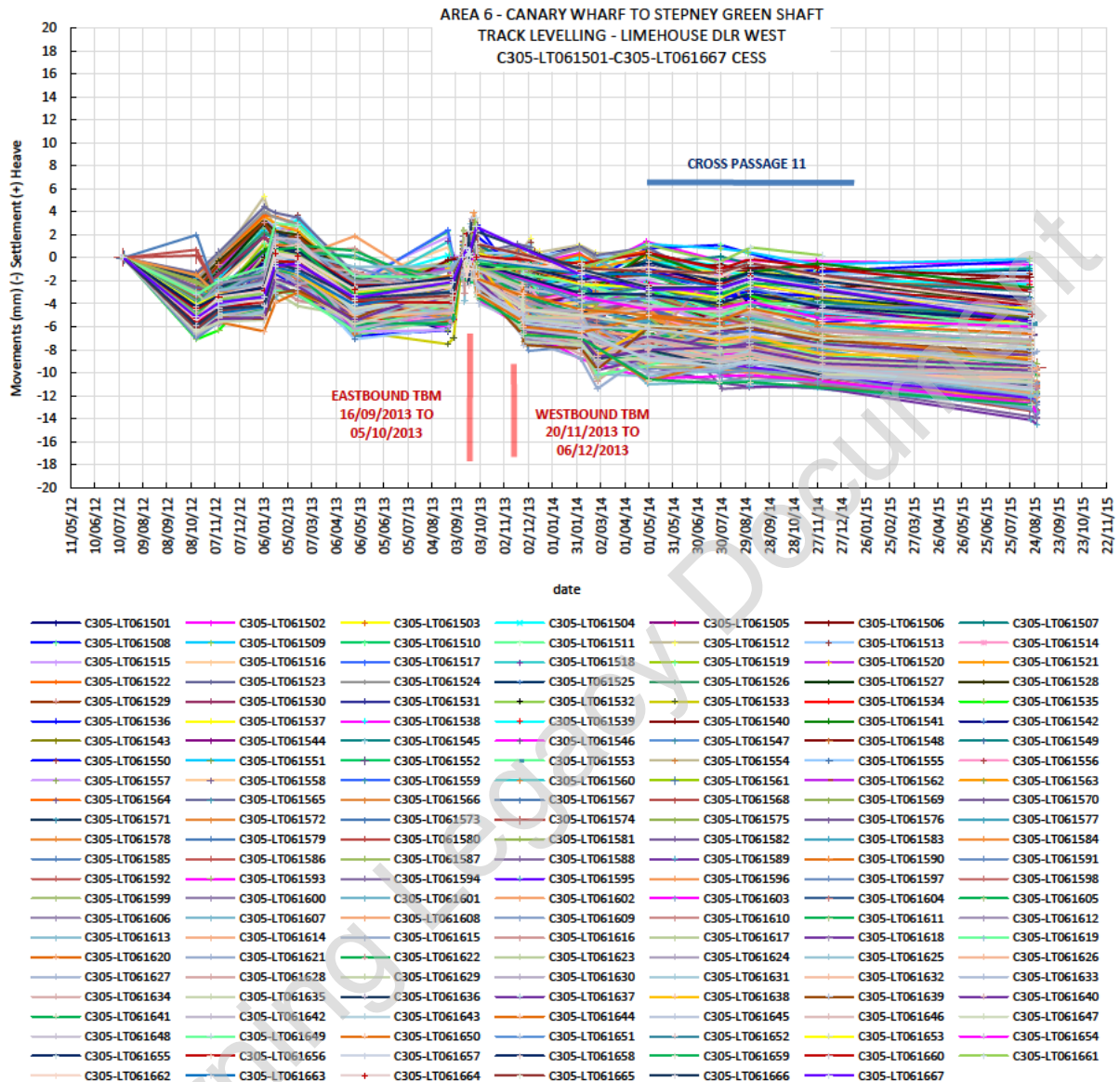


The table below shows the annual rate for the track levelling in westbound 6-Feet.

6-FEET		REGISTERED MOVEMENT FROM 02/09/2014 TO 28/05/2015			
ID-LT	RATE (mm/year)	ID-LT	RATE (mm/year)	ID-LT	RATE
C305-LT061701	-0.014	C305-LT061757	-1.653	C305-LT061813	-2.609
C305-LT061702	-0.112	C305-LT061758	-1.653	C305-LT061814	-2.660
C305-LT061703	-0.859	C305-LT061759	-	C305-LT061815	-2.147
C305-LT061704	-0.041	C305-LT061760	-2.755	C305-LT061816	-1.846
C305-LT061705	0.249	C305-LT061761	-2.892	C305-LT061817	-1.892
C305-LT061706	0.301	C305-LT061762	-2.479	C305-LT061818	-2.136
C305-LT061707	0.063	C305-LT061763	-	C305-LT061819	-2.108
C305-LT061708	-0.115	C305-LT061764	-3.030	C305-LT061820	-3.329
C305-LT061709	-0.359	C305-LT061765	-3.168	C305-LT061821	-1.691
C305-LT061710	-0.509	C305-LT061766	-0.826	C305-LT061822	-1.803
C305-LT061711	-0.978	C305-LT061767	-0.138	C305-LT061823	-1.696
C305-LT061712	-0.561	C305-LT061768	-1.653	C305-LT061824	-1.453
C305-LT061713	-0.542	C305-LT061769	-3.443	C305-LT061825	-1.683
C305-LT061714	-0.041	C305-LT061770	-3.168	C305-LT061826	-1.709
C305-LT061715	0.446	C305-LT061771	-3.197	C305-LT061827	-1.983
C305-LT061716	0.887	C305-LT061772	-3.525	C305-LT061828	-1.908
C305-LT061717	0.939	C305-LT061773	-3.319	C305-LT061829	-2.289
C305-LT061718	0.999	C305-LT061774	-2.656	C305-LT061830	-1.869
C305-LT061719	-6.871	C305-LT061775	-2.913	C305-LT061831	-1.789
C305-LT061720	-0.808	C305-LT061776	-	C305-LT061832	-1.964
C305-LT061721	-0.271	C305-LT061777	-	C305-LT061833	-1.654
C305-LT061722	-0.838	C305-LT061778	-	C305-LT061834	-1.614
C305-LT061723	-0.983	C305-LT061779	-2.643	C305-LT061835	-1.502
C305-LT061724	-1.062	C305-LT061780	-2.996	C305-LT061836	-5.678
C305-LT061725	-0.463	C305-LT061781	-2.396	C305-LT061837	-1.833
C305-LT061726	-0.457	C305-LT061782	-2.087	C305-LT061838	-1.995
C305-LT061727	-1.103	C305-LT061783	-2.515	C305-LT061839	-1.870
C305-LT061728	-1.703	C305-LT061784	-3.121	C305-LT061840	-2.043
C305-LT061729	-1.802	C305-LT061785	-2.558	C305-LT061841	-1.832
C305-LT061730	-1.117	C305-LT061786	-2.719	C305-LT061842	-2.474
C305-LT061731	-1.051	C305-LT061787	-2.147	C305-LT061843	-2.524
C305-LT061732	-1.361	C305-LT061788	-3.294	C305-LT061844	-2.555
C305-LT061733	-1.525	C305-LT061789	-3.246	C305-LT061845	-2.267
C305-LT061734	-0.986	C305-LT061790	-2.782	C305-LT061846	-1.755
C305-LT061735	-9.447	C305-LT061791	-2.426	C305-LT061847	-1.786
C305-LT061736	0.194	C305-LT061792	-3.097	C305-LT061848	-2.506
C305-LT061737	-0.457	C305-LT061793	-2.908	C305-LT061849	-2.022
C305-LT061738	-1.287	C305-LT061794	-2.516	C305-LT061850	-1.899
C305-LT061739	-0.767	C305-LT061795	-2.742	C305-LT061851	-1.709
C305-LT061740	-1.010	C305-LT061796	-	C305-LT061852	-4.921
C305-LT061741	-1.907	C305-LT061797	-3.579	C305-LT061853	-1.835
C305-LT061742	-1.553	C305-LT061798	-3.189	C305-LT061854	-1.997
C305-LT061743	-1.297	C305-LT061799	-3.090	C305-LT061855	-2.172
C305-LT061744	-1.744	C305-LT061800	-2.618	C305-LT061856	-2.316
C305-LT061745	-1.441	C305-LT061801	-3.175	C305-LT061857	-2.976
C305-LT061746	-1.390	C305-LT061802	-2.760	C305-LT061858	-2.717
C305-LT061747	-0.849	C305-LT061803	-2.993	C305-LT061859	-2.875
C305-LT061748	-1.647	C305-LT061804	-3.392	C305-LT061860	-3.166
C305-LT061749	-1.517	C305-LT061805	-2.067	C305-LT061861	-5.742
C305-LT061750	-1.377	C305-LT061806	-2.497	C305-LT061862	-3.299
C305-LT061751	-1.515	C305-LT061807	-2.196	C305-LT061863	-3.408
C305-LT061752	-1.515	C305-LT061808	-1.851	C305-LT061864	-3.440
C305-LT061753	-0.964	C305-LT061809	-2.501	C305-LT061865	-3.633
C305-LT061754	-1.653	C305-LT061810	-2.392	C305-LT061866	-4.001
C305-LT061755	-2.204	C305-LT061811	-2.916	C305-LT061867	-3.759
C305-LT061756	-1.928	C305-LT061812	-2.715		
Rate less than -2.5 mm/year		% less 2 mm/ year		65.22%	
Rate greater than -3.5 mm/year		% less 3 mm/ year		93.79%	

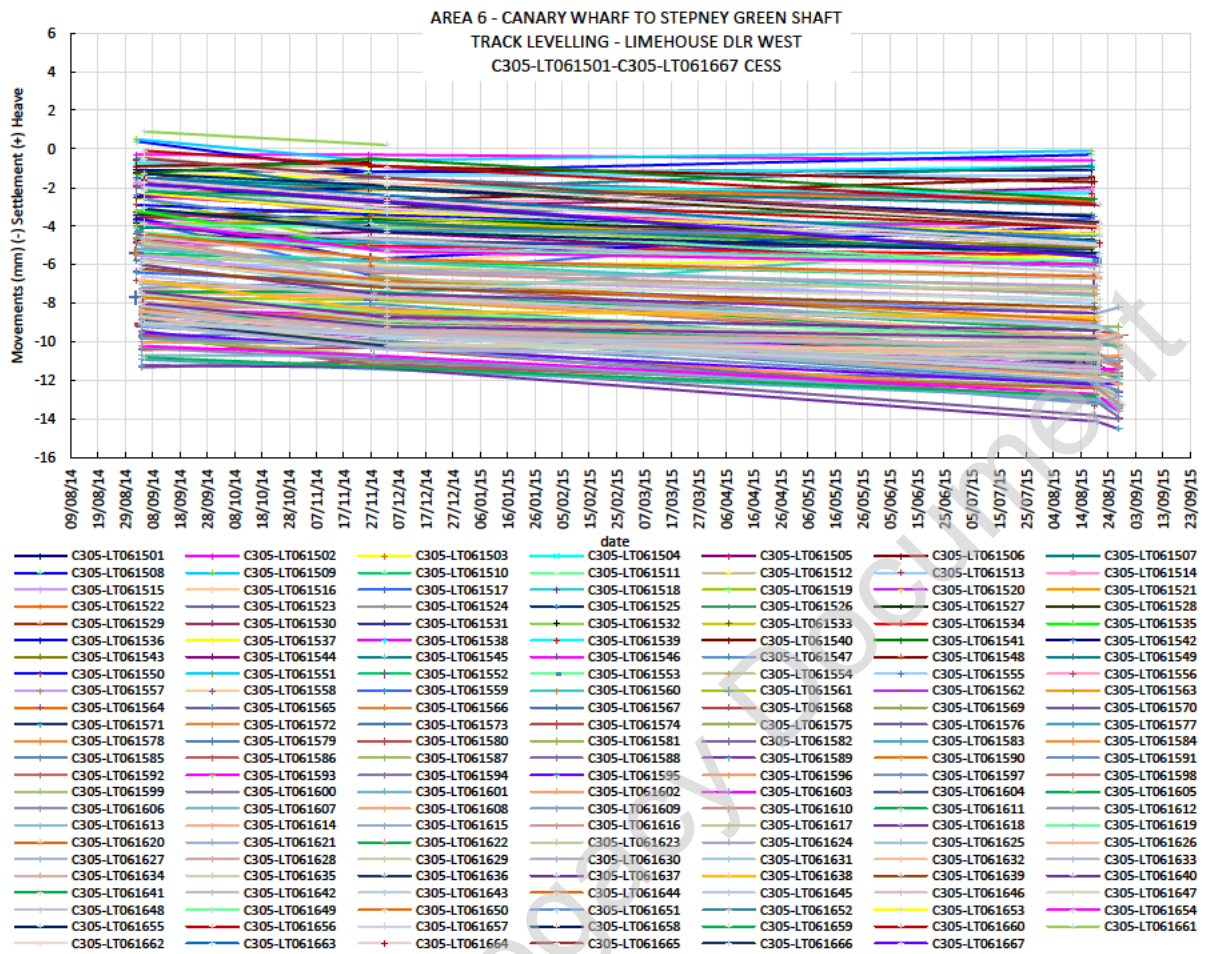
The percentage of the levelling points with a settlement rate less than 3 mm/year is 93.79%

The graph presented below is the track levelling for the westbound Cess, and it shows a maximum settlement of -3 mm is recorded after the Eastbound TBM transit and -8 mm after Westbound TBM transit.





The next plot shows the trend line adjustment for the track levelling in westbound Cess.



The table below shows the annual rate for the track levelling in westbound Cess.

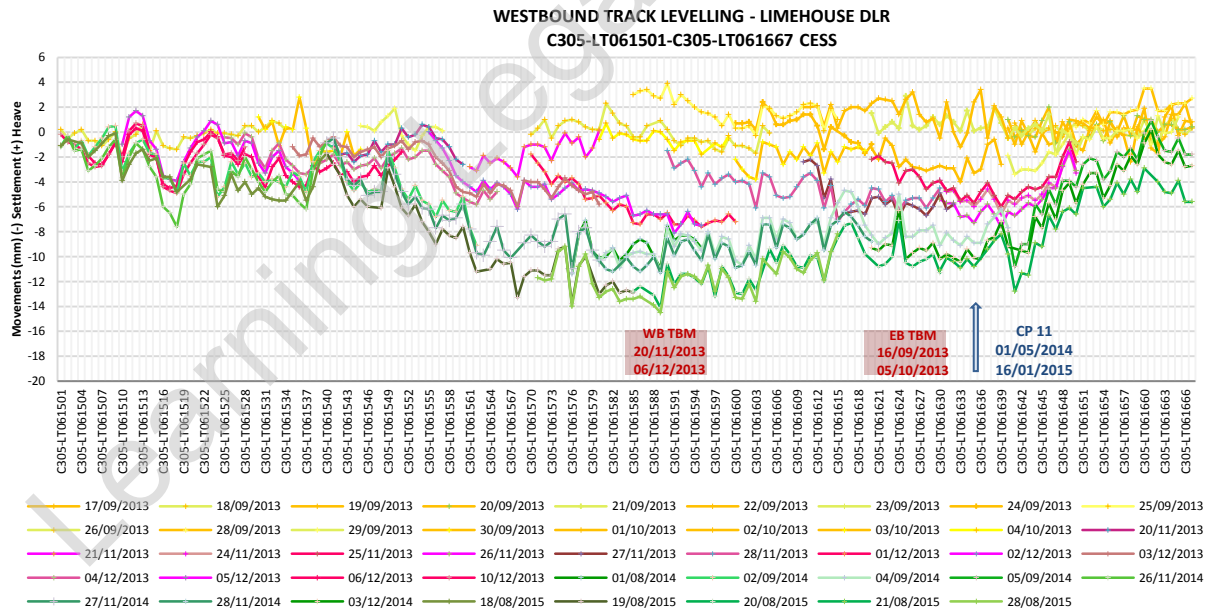
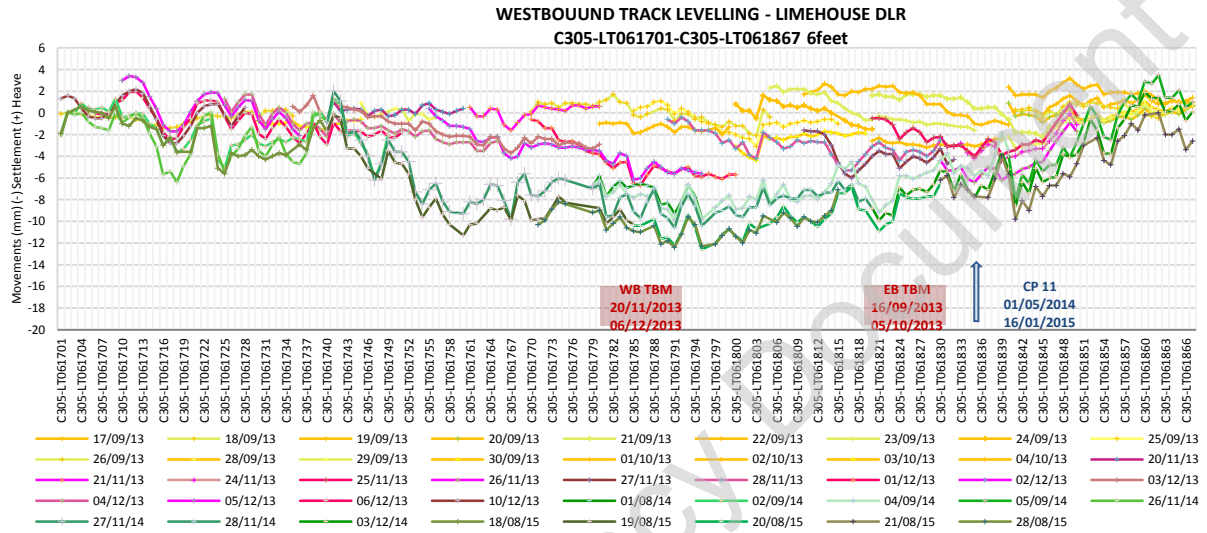
CESS		REGISTERED MOVEMENT FROM 02/09/2014 TO 28/05/2015			
ID-LT	RATE (mm/year)	ID-LT	RATE (mm/year)	ID-LT	RATE (mm/year)
C305-LT061501	0.033	C305-LT061557	-2.185	C305-LT061613	-3.125
C305-LT061502	-0.337	C305-LT061558	-1.979	C305-LT061614	-2.858
C305-LT061503	-0.859	C305-LT061559	-2.188	C305-LT061615	-2.414
C305-LT061504	0.005	C305-LT061560	-2.492	C305-LT061616	-2.585
C305-LT061505	0.282	C305-LT061561	-2.207	C305-LT061617	-2.149
C305-LT061506	0.156	C305-LT061562	-2.156	C305-LT061618	-2.314
C305-LT061507	0.077	C305-LT061563	-	C305-LT061619	-2.286
C305-LT061508	-0.260	C305-LT061564	-3.030	C305-LT061620	-3.210
C305-LT061509	-0.312	C305-LT061565	-3.581	C305-LT061621	-1.866
C305-LT061510	-0.622	C305-LT061566	-1.515	C305-LT061622	-2.203
C305-LT061511	-0.912	C305-LT061567	-0.551	C305-LT061623	-1.821
C305-LT061512	-0.898	C305-LT061568	-	C305-LT061624	-1.952
C305-LT061513	-0.635	C305-LT061569	-3.719	C305-LT061625	-1.796
C305-LT061514	-0.312	C305-LT061570	-3.857	C305-LT061626	-2.289
C305-LT061515	0.255	C305-LT061571	-3.539	C305-LT061627	-2.370
C305-LT061516	0.868	C305-LT061572	-3.397	C305-LT061628	-2.083
C305-LT061517	1.032	C305-LT061573	-3.867	C305-LT061629	-2.145
C305-LT061518	0.999	C305-LT061574	-3.390	C305-LT061630	-1.960
C305-LT061519	-10.735	C305-LT061575	-3.518	C305-LT061631	-1.708
C305-LT061520	-0.107	C305-LT061576	-3.066	C305-LT061632	-1.466
C305-LT061521	-0.323	C305-LT061577	-2.966	C305-LT061633	-1.609
C305-LT061522	-0.534	C305-LT061578	-2.698	C305-LT061634	-1.703
C305-LT061523	-1.062	C305-LT061579	-2.808	C305-LT061635	-1.753
C305-LT061524	-1.095	C305-LT061580	-3.296	C305-LT061636	-5.272
C305-LT061525	-0.654	C305-LT061581	-2.697	C305-LT061637	-1.833
C305-LT061526	-0.893	C305-LT061582	-2.550	C305-LT061638	-1.627
C305-LT061527	-1.394	C305-LT061583	-2.439	C305-LT061639	-1.927
C305-LT061528	-1.848	C305-LT061584	-3.420	C305-LT061640	-1.954
C305-LT061529	-1.769	C305-LT061585	-3.331	C305-LT061641	-2.086
C305-LT061530	-1.117	C305-LT061586	-2.969	C305-LT061642	-2.425
C305-LT061531	-1.084	C305-LT061587	-3.865	C305-LT061643	-2.587
C305-LT061532	-1.731	C305-LT061588	-4.108	C305-LT061644	-3.166
C305-LT061533	-1.848	C305-LT061589	-3.466	C305-LT061645	-2.573
C305-LT061534	-1.038	C305-LT061590	-3.294	C305-LT061646	-2.011
C305-LT061535	-8.159	C305-LT061591	-3.274	C305-LT061647	-1.867
C305-LT061536	0.241	C305-LT061592	-3.483	C305-LT061648	-2.555
C305-LT061537	-0.326	C305-LT061593	-3.378	C305-LT061649	-2.408
C305-LT061538	-2.015	C305-LT061594	-2.930	C305-LT061650	-2.060
C305-LT061539	-0.767	C305-LT061595	-2.663	C305-LT061651	-1.628
C305-LT061540	-1.010	C305-LT061596	-3.022	C305-LT061652	-4.921
C305-LT061541	-1.716	C305-LT061597	-3.444	C305-LT061653	-2.043
C305-LT061542	-1.362	C305-LT061598	-2.621	C305-LT061654	-1.997
C305-LT061543	-1.297	C305-LT061599	-3.200	C305-LT061655	-2.204
C305-LT061544	-1.586	C305-LT061600	-2.922	C305-LT061656	-2.492
C305-LT061545	-1.553	C305-LT061601	-2.829	C305-LT061657	-3.022
C305-LT061546	-1.246	C305-LT061602	-3.076	C305-LT061658	-2.618
C305-LT061547	-0.849	C305-LT061603	-3.139	C305-LT061659	-2.794
C305-LT061548	-1.535	C305-LT061604	-3.457	C305-LT061660	-2.892
C305-LT061549	-1.405	C305-LT061605	-2.642	C305-LT061661	-2.871
C305-LT061550	-1.517	C305-LT061606	-2.380	C305-LT061662	-3.601
C305-LT061551	-1.614	C305-LT061607	-2.497	C305-LT061663	-3.422
C305-LT061552	-1.325	C305-LT061608	-2.833	C305-LT061664	-3.391
C305-LT061553	-1.387	C305-LT061609	-2.600	C305-LT061665	-3.503
C305-LT061554	-1.708	C305-LT061610	-3.281	C305-LT061666	-3.952
C305-LT061555	-2.333	C305-LT061611	-3.055	C305-LT061667	-3.984
C305-LT061556	-2.170	C305-LT061612	-3.167		
		Rate less than -2.5 mm/year	% less 2 mm/ year		60.00%
		Rate greater than -3.5 mm/year	% less 3 mm/ year		90.30%

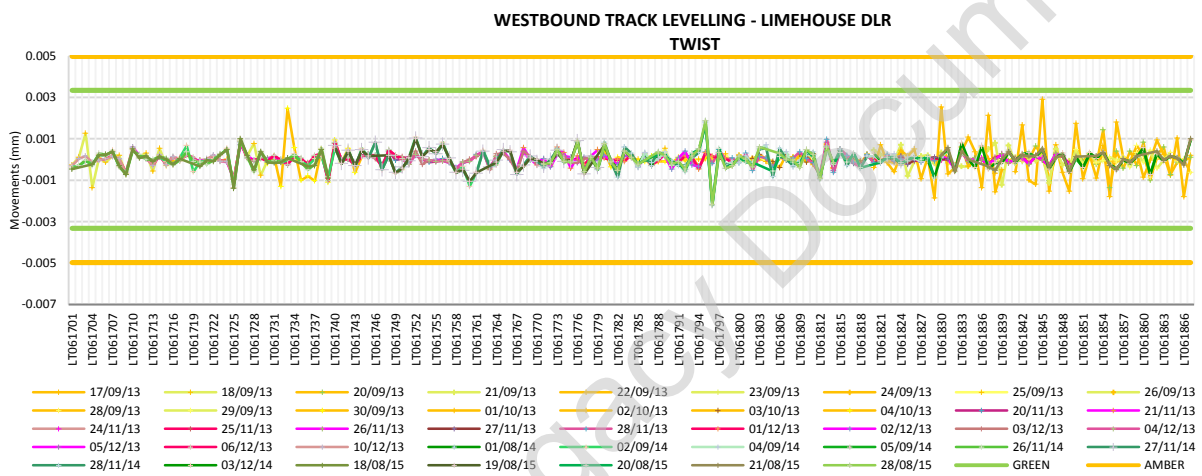
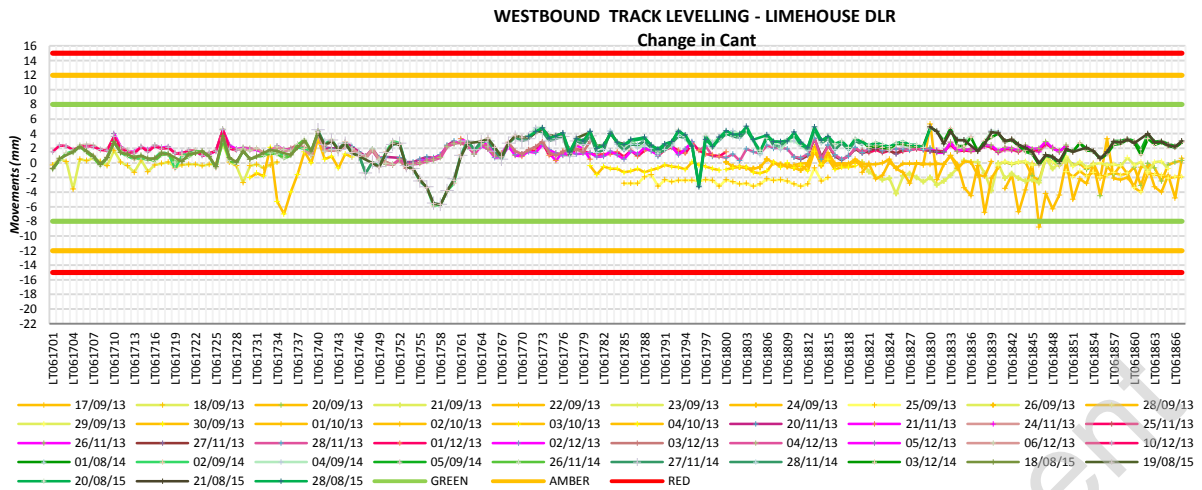
The percentage of the levelling points with a settlement rate less than 3 mm/year is 90.30 %.

### DEFLECTION GRAPHS WESTBOUND

Representative dates are presented in the graphs below to show the movements related to the following activities:

- Eastbound transit: 17/09/2013 to 04/10/2013
- Westbound transit: 20/11/2013 to 6/12/2013
- Cross Passage 11: 01/08/2014 to 28/08/2015





### 3D PRISMS

Prisms are grouped by ATS. The image below shows an overview of the location of the ATSs and the area covered by them. For details see, in the next pages, table listing prisms for each ATS and refer to drawings included in Appendix A.

The automatic readings started in September 2013.

Due to the lack of line of sight between the ATSs and some of the prisms manual readings were taken. The data of these 3D prisms have been included at the end of this section.

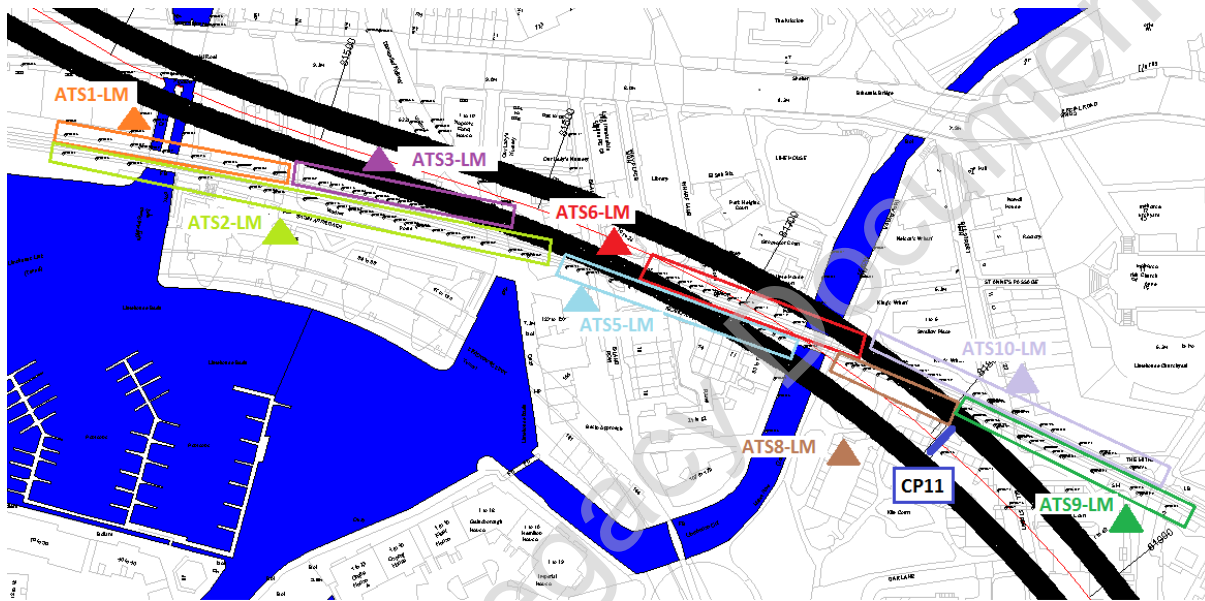


Image 1: Areas covered by Automatic Total Stations



**AUTOMATIC 3D PRISMS**

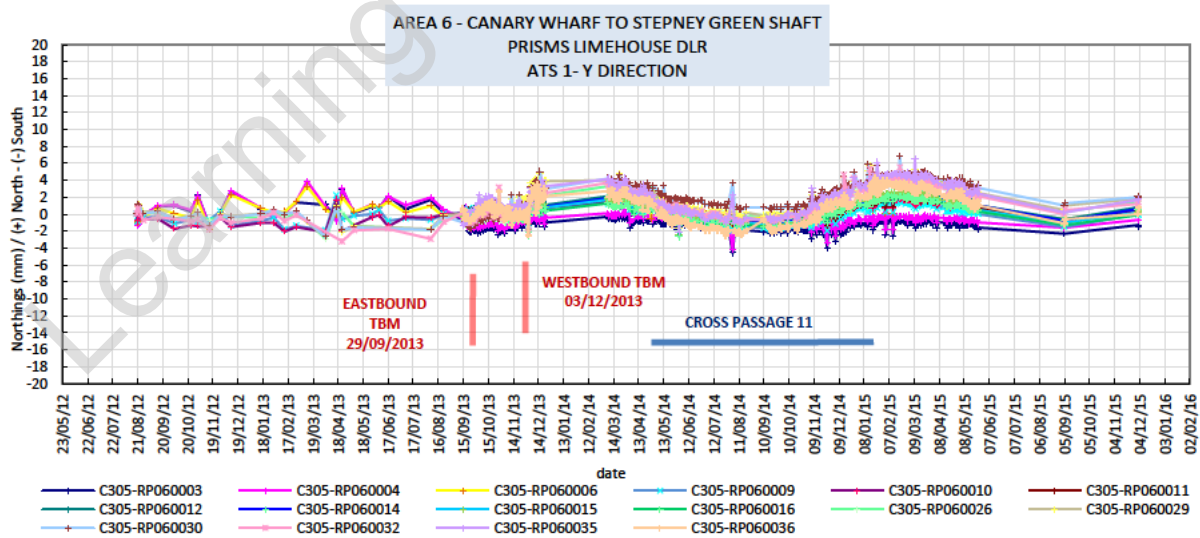
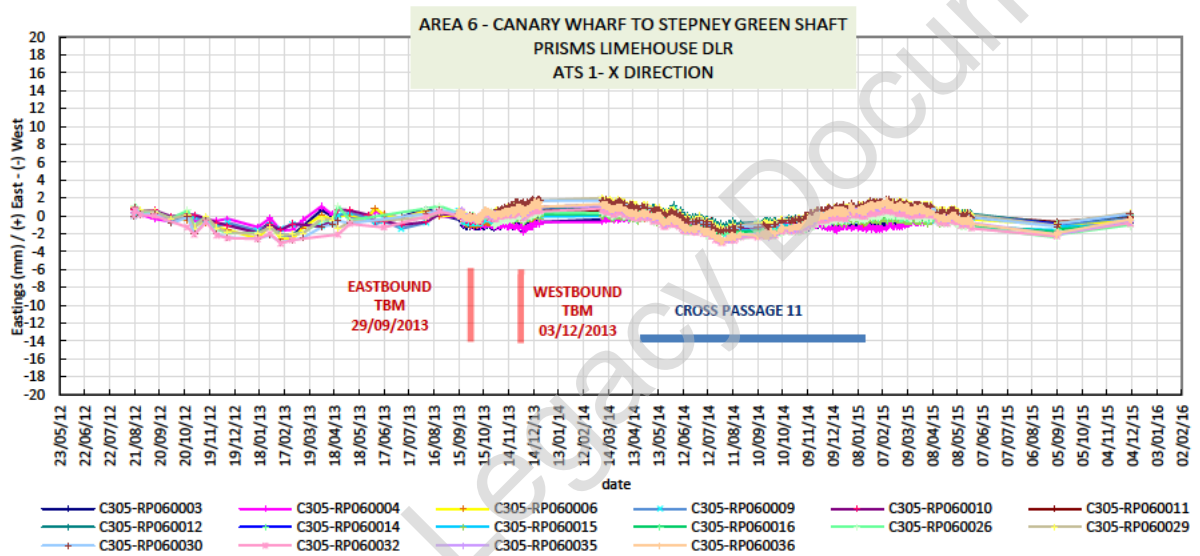
**AUTOMATIC TOTAL STATION 1**

The table below shows the prisms which readings were taken by the Automatic Total Station 1 (one data/day).

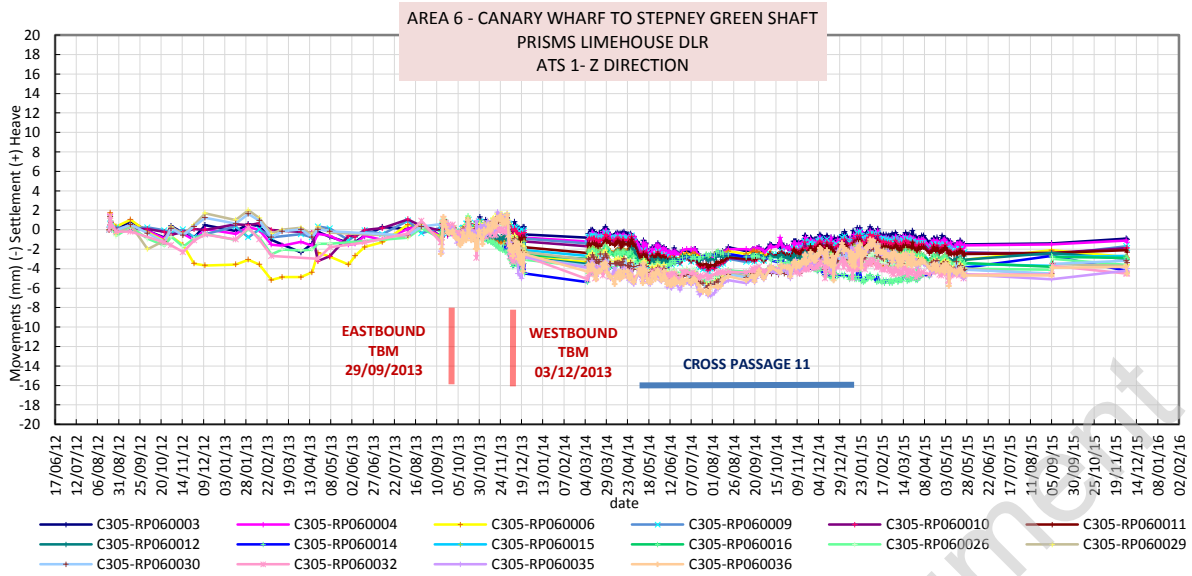
Manual readings were carried out during baseline period from 20/08/12 to 14/09/13

Automatic readings from 14/09/13 to 02/12/15

AUTOMATIC TOTAL STATION 1			
C305-RP060003	C305-RP060010	C305-RP060015	C305-RP060030
C305-RP060004	C305-RP060011	C305-RP060016	C305-RP060032
C305-RP060006	C305-RP060012	C305-RP060026	C305-RP060035
C305-RP060009	C305-RP060014	C305-RP060029	C305-RP060036







No relevant movements have been observed in X and Y axes due to any construction activity.

In Z axis a maximum settlement of -1 mm is observed after Eastbound TBM transit and -5 mm after Westbound TBM transit.

Between Dec 2012 to March 2013 some power supply issues were detected on ATS's controller; graphs show a data gap due to that problem.

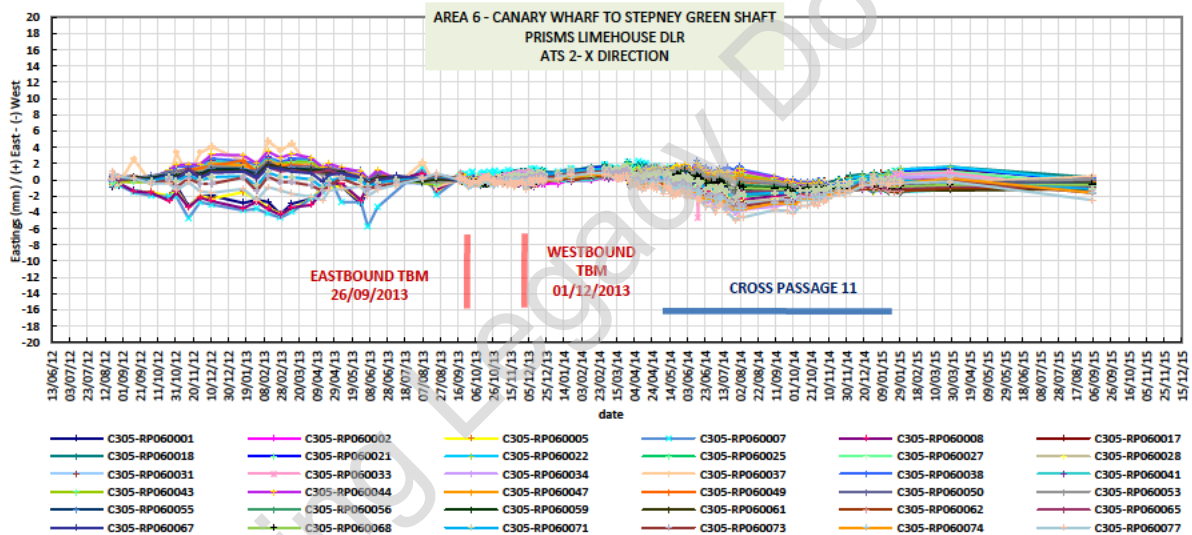
**AUTOMATIC TOTAL STATION 2**

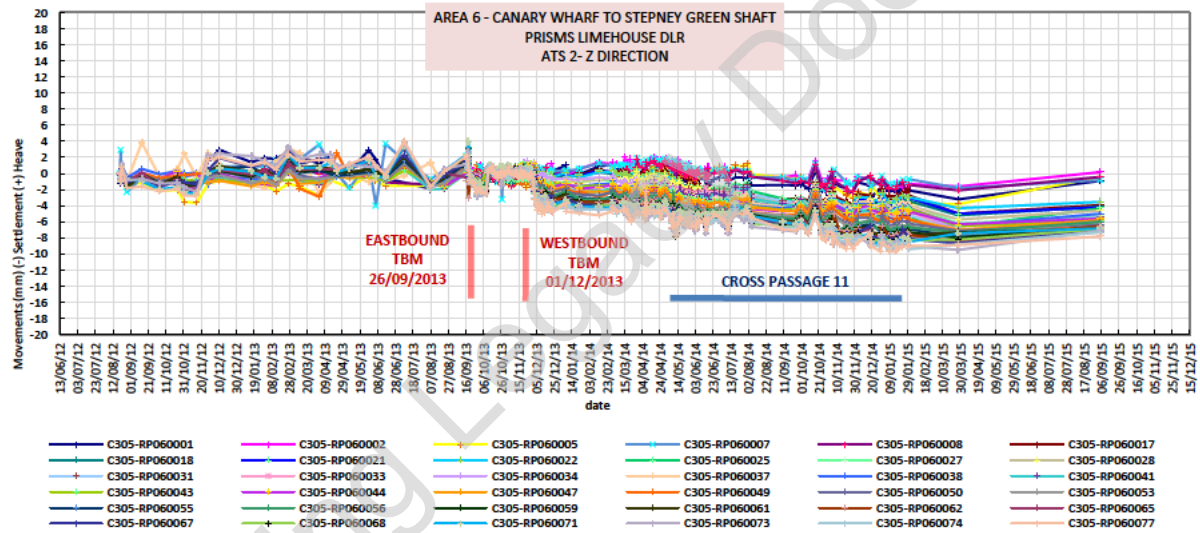
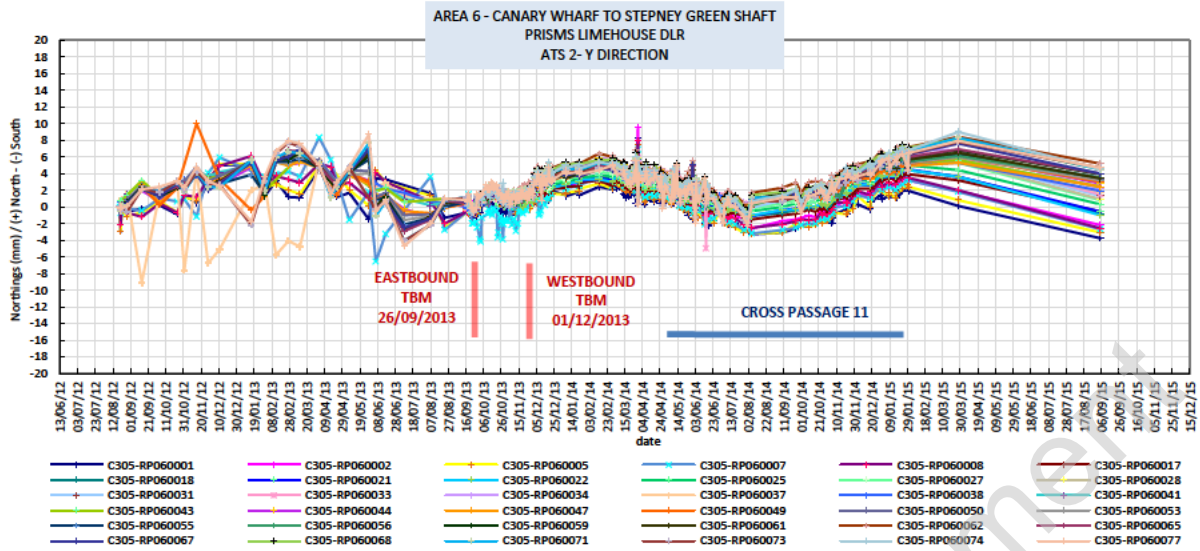
The table below shows the prisms which readings were taken by the Automatic Total Station 2. (one data/day)

Manual readings were carried out during baseline period from 20/08/12 to 16/09/13

Automatic readings from 16/09/13 to 05/09/15

AUTOMATIC TOTAL STATION 2			
C305-RP060001	C305-RP060025	C305-RP060043	C305-RP060061
C305-RP060002	C305-RP060027	C305-RP060044	C305-RP060062
C305-RP060005	C305-RP060028	C305-RP060047	C305-RP060065
C305-RP060007	C305-RP060031	C305-RP060049	C305-RP060067
C305-RP060008	C305-RP060033	C305-RP060050	C305-RP060068
C305-RP060017	C305-RP060034	C305-RP060053	C305-RP060071
C305-RP060018	C305-RP060037	C305-RP060055	C305-RP060073
C305-RP060021	C305-RP060038	C305-RP060056	C305-RP060074
C305-RP060022	C305-RP060041	C305-RP060059	C305-RP060077





No relevant movements have been observed in X and Y axes due to any construction activity.

In Z axis a maximum settlement of -2 mm is observed after Eastbound TBM transit and -5 mm after Westbound TBM transit.

Between Dec 2012 to March 2013 some power supply issues were detected on ATS's controller, graphs show a data gap due to that problem.

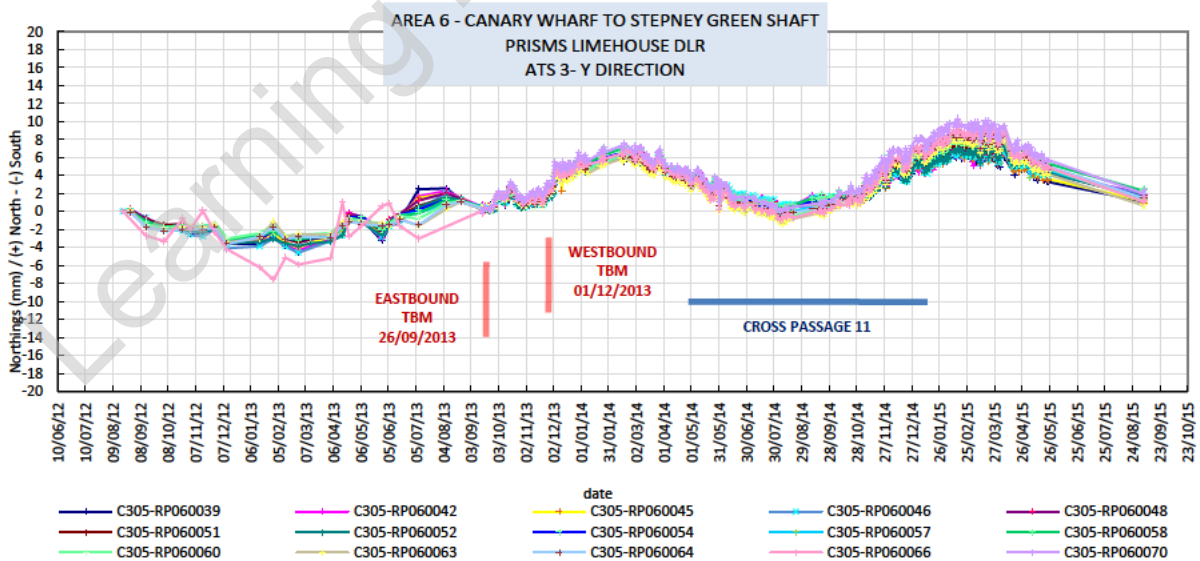
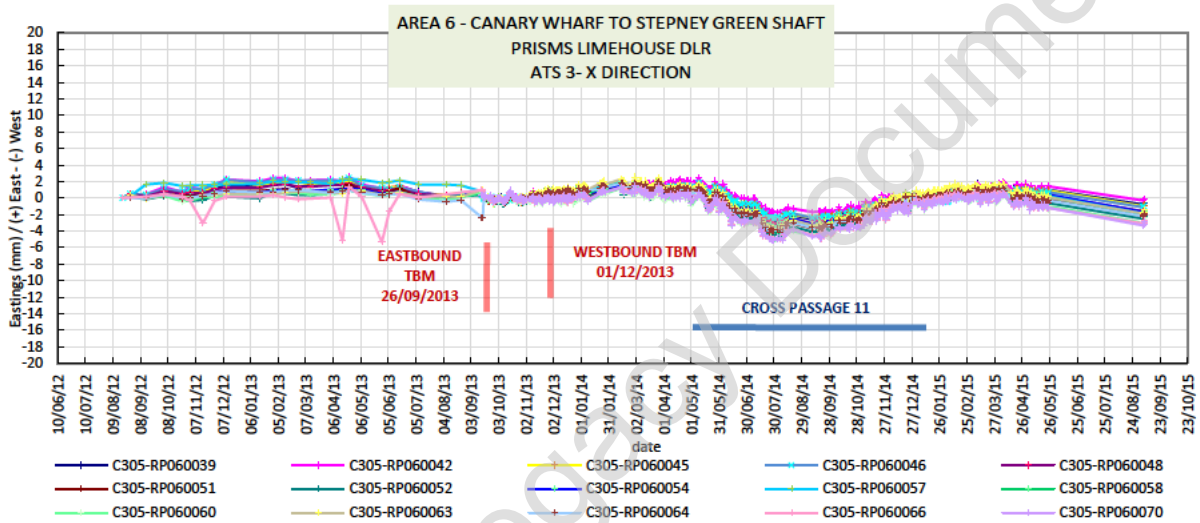
**AUTOMATIC TOTAL STATION 3**

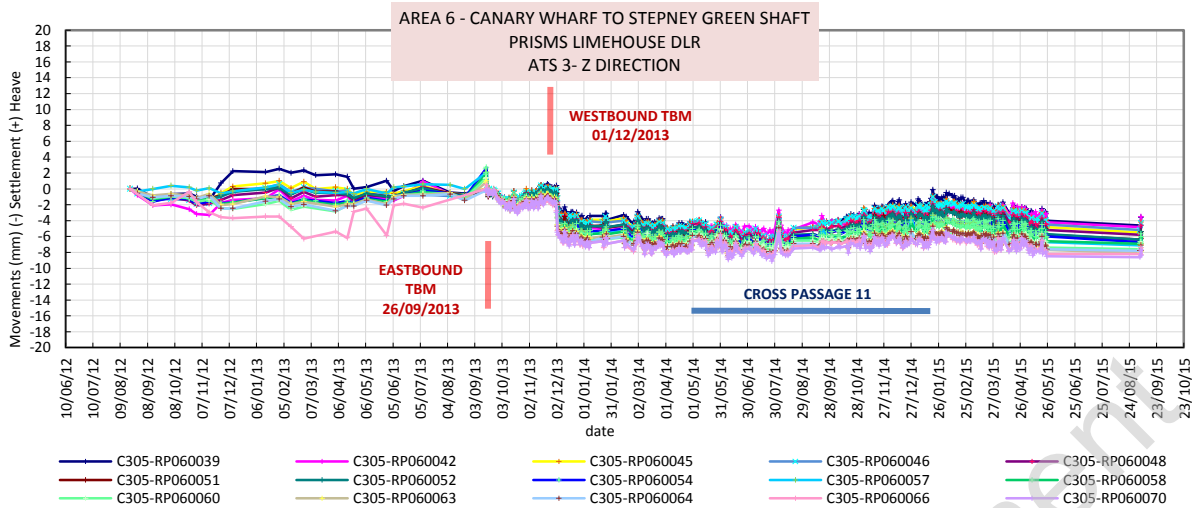
The table below shows the prisms which readings were taken by the Automatic Total Station 3. (one data/day).

Manual readings were carried out during baseline period from 20/08/12 to 14/09/13

Automatic readings from 14/09/13 to 06/09/15

AUTOMATIC TOTAL STATION 3			
C305-RP060039	C305-RP060048	C305-RP060057	C305-RP060064
C305-RP060042	C305-RP060051	C305-RP060058	C305-RP060066
C305-RP060045	C305-RP060052	C305-RP060060	C305-RP060070
C305-RP060046	C305-RP060054	C305-RP060063	





No relevant movements have been observed in X and Y axes due to any construction activity.

In Z axis a maximum settlement of -3 mm is observed after Eastbound TBM transit and -7 mm after Westbound TBM transit.

Between Dec 2012 to March 2013 some power supply issues were detected on ATS's controller, graphs show a data gap due to that problem.



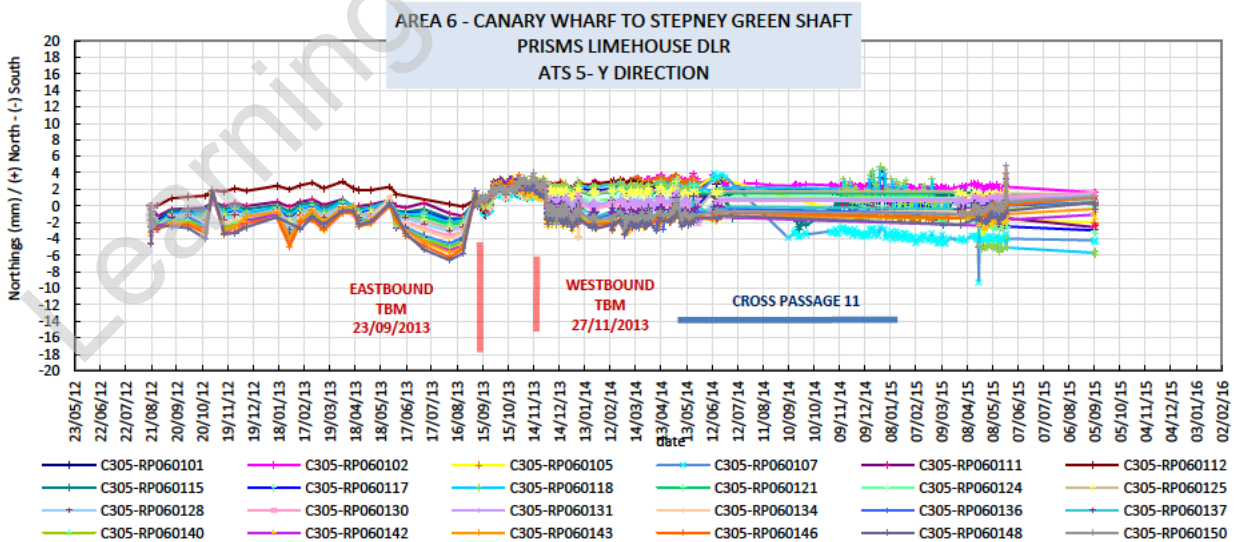
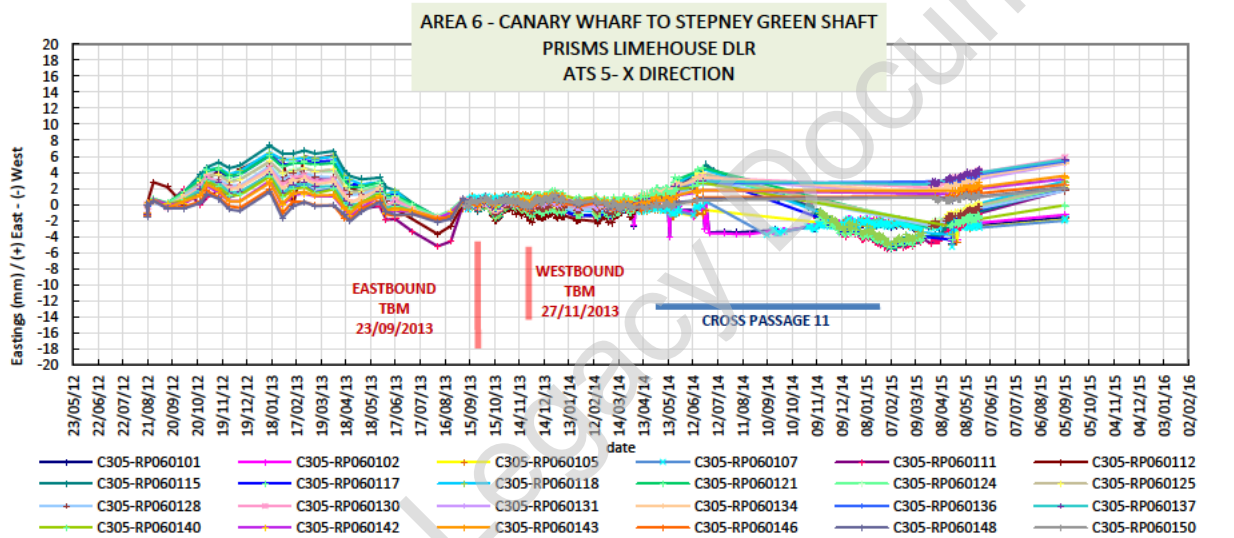
**AUTOMATIC TOTAL STATION 5**

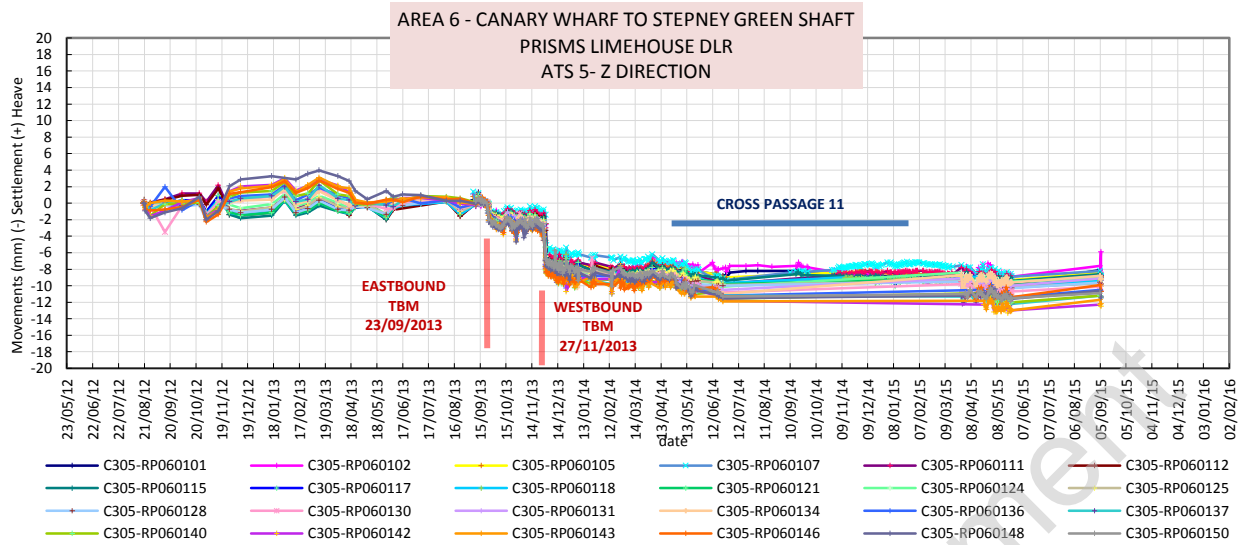
The table below shows the prisms which readings were taken by the Automatic Total Station 5. (one data/day)

Manual readings were carried out during baseline period from 20/08/12 to 9/09/13

Automatic readings from 09/09/13 to 04/09/15

AUTOMATIC TOTAL STATION 5			
C305-RP060101	C305-RP060115	C305-RP060128	C305-RP060140
C305-RP060102	C305-RP060117	C305-RP060130	C305-RP060142
C305-RP060105	C305-RP060118	C305-RP060131	C305-RP060143
C305-RP060107	C305-RP060121	C305-RP060134	C305-RP060146
C305-RP060111	C305-RP060124	C305-RP060136	C305-RP060148
C305-RP060112	C305-RP060125	C305-RP060137	C305-RP060150





A negative movement of -2 mm is observed in Y direction after the Westbound TBM transit.

In Z axis a maximum settlement of -4 mm is observed after Eastbound TBM transit and -10 mm after Westbound TBM transit.

Between Dec 2012 to March 2013 some power supply issues were detected on ATS's controller, graphs show a data gap due to that problem.

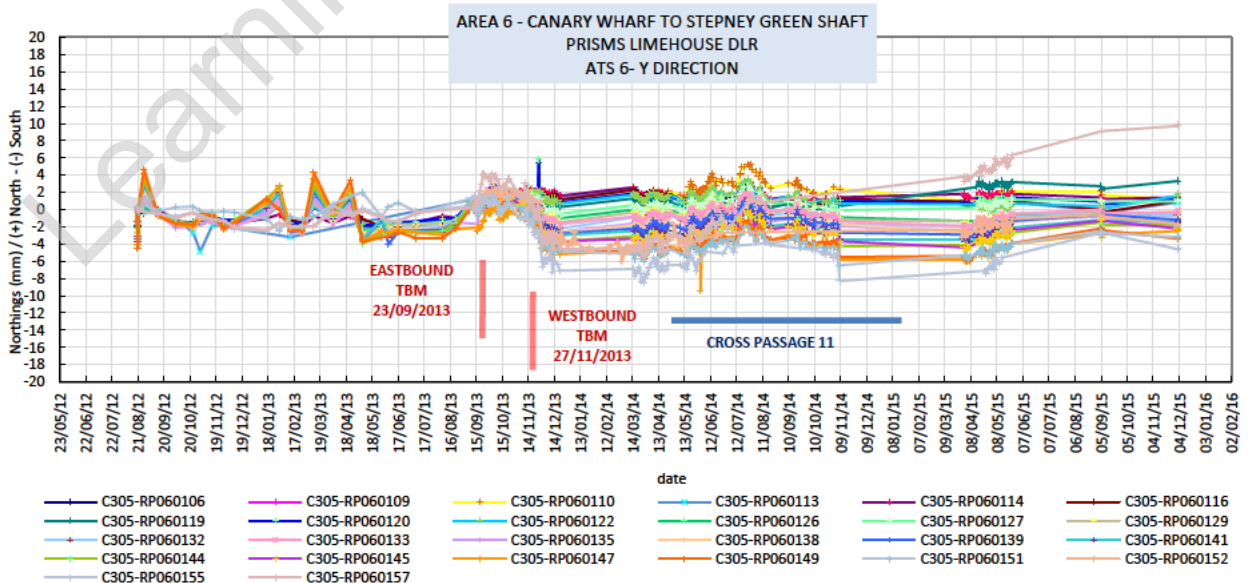
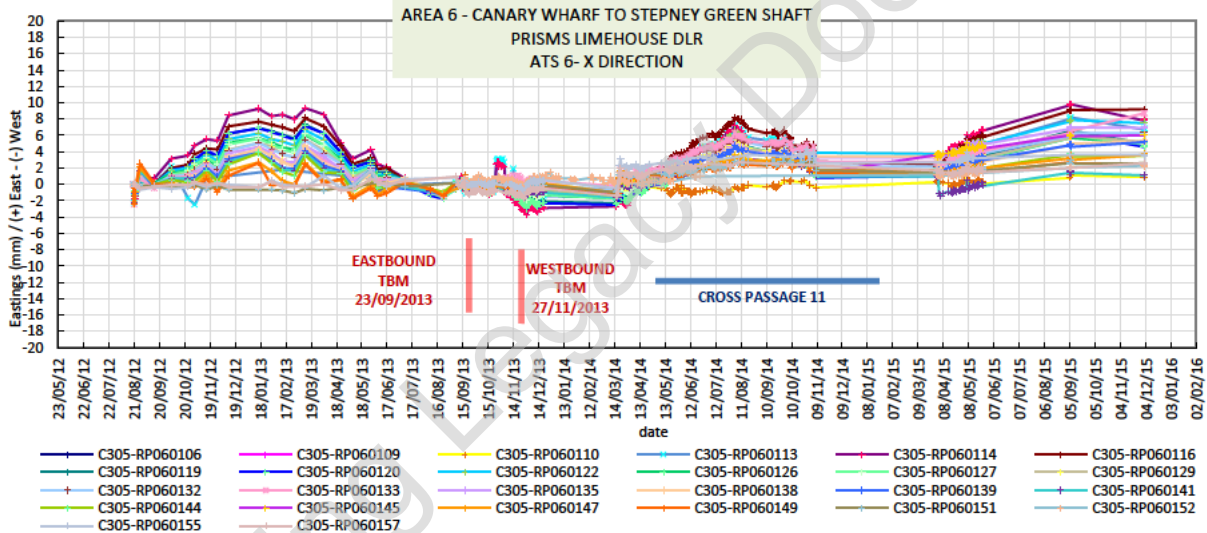
**AUTOMATIC TOTAL STATION 6**

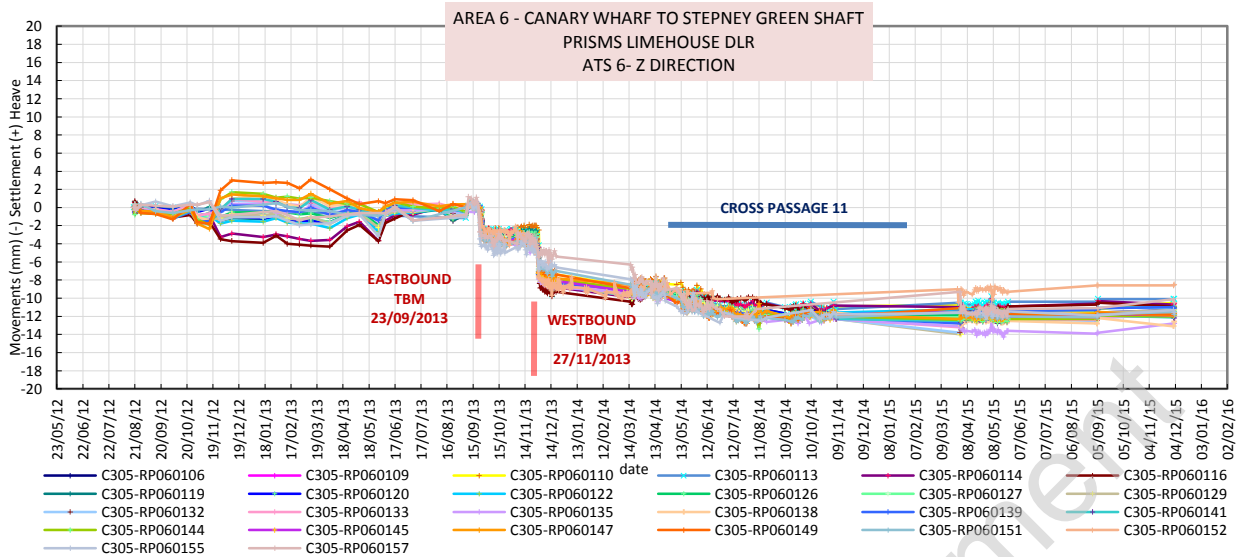
The table below shows the prisms which readings were taken by the Automatic Total Station 6. (one data/day)

Manual readings were carried out during baseline period from 20/08/12 to 06/09/13

Automatic readings from 06/09/13 to 01/12/15

AUTOMATIC TOTAL STATION 6			
C305-RP060106	C305-RP060120	C305-RP060135	C305-RP060147
C305-RP060109	C305-RP060122	C305-RP060138	C305-RP060149
C305-RP060110	C305-RP060126	C305-RP060139	C305-RP060151
C305-RP060113	C305-RP060127	C305-RP060141	C305-RP060152
C305-RP060114	C305-RP060129	C305-RP060144	C305-RP060155
C305-RP060116	C305-RP060132	C305-RP060145	C305-RP060157
C305-RP060119	C305-RP060133		





A maximum negative movement of -4 and -6 mm is registered in X and Y direction respectively, after the Westbound TBM transit.

In Z axis a maximum settlement of -5 mm is observed after Eastbound TBM transit and -10 mm after Westbound TBM transit.

Between Dec 2012 to March 2013 some power supply issues were detected on ATS's controller, graphs show a data gap due to that problem.

**AUTOMATIC TOTAL STATION 8**

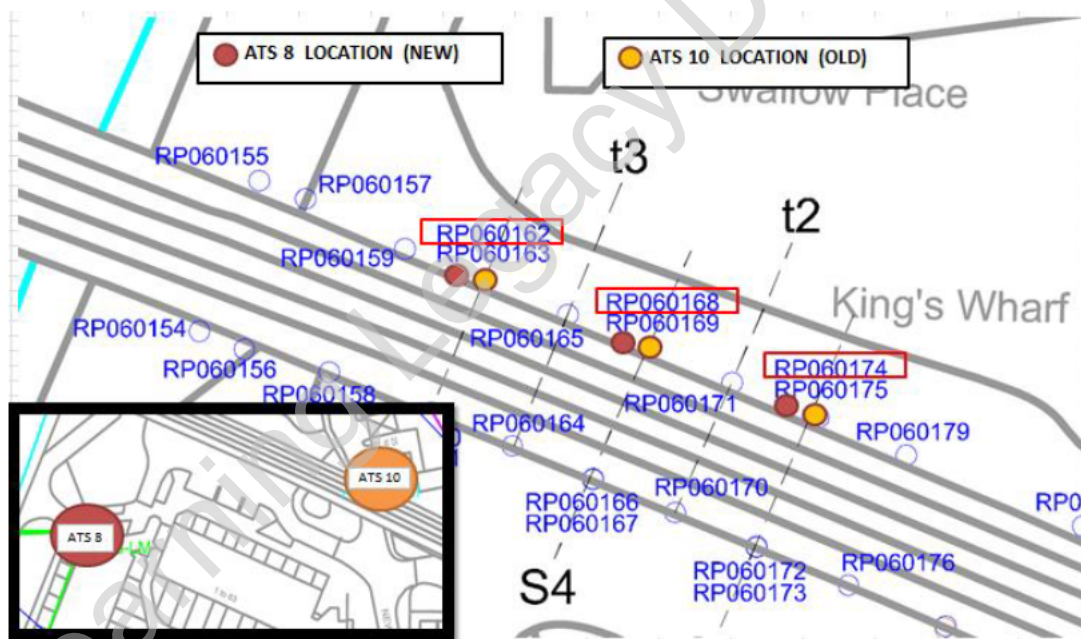
The table below shows the prisms which readings were taken by the Automatic Total Station 8. (one data/day)

Manual readings were carried out during baseline period from 20/08/12 to 10/09/13

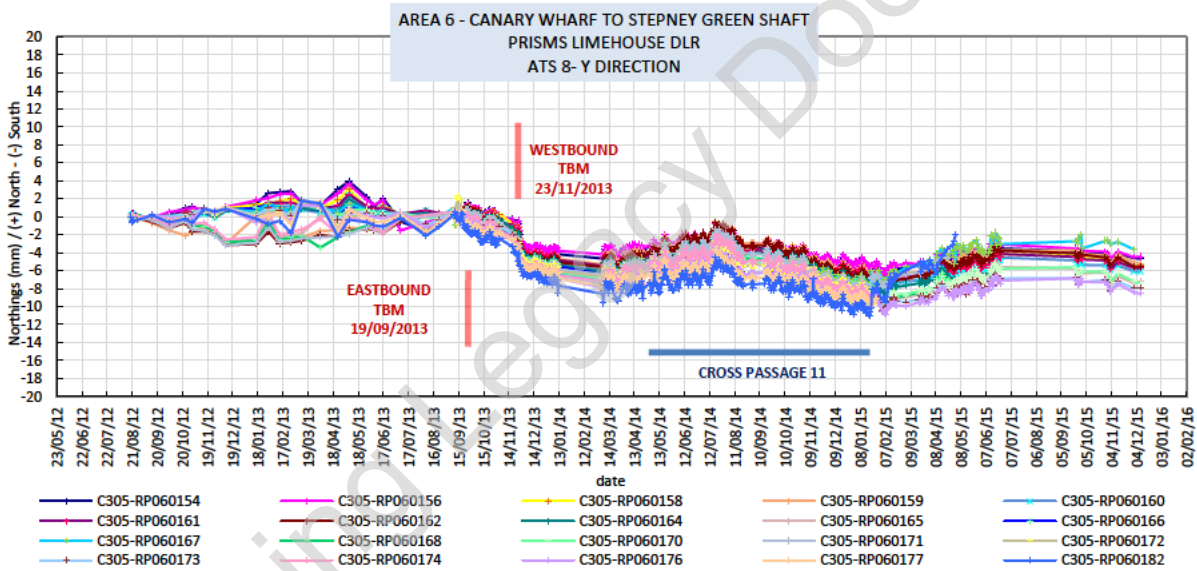
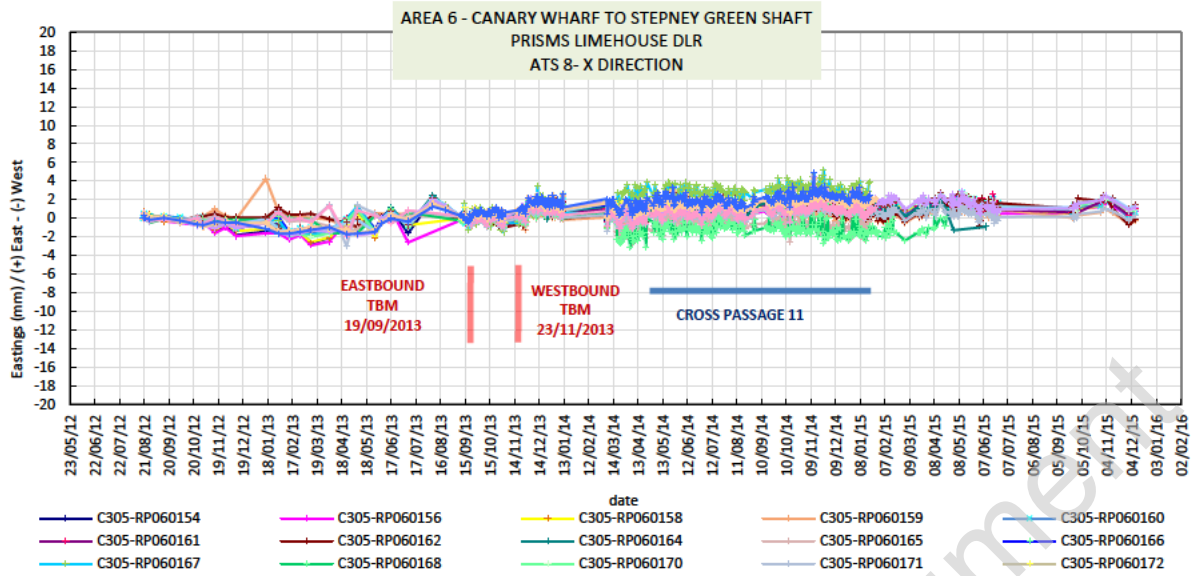
Automatic readings from 10/09/13 to 08/12/15

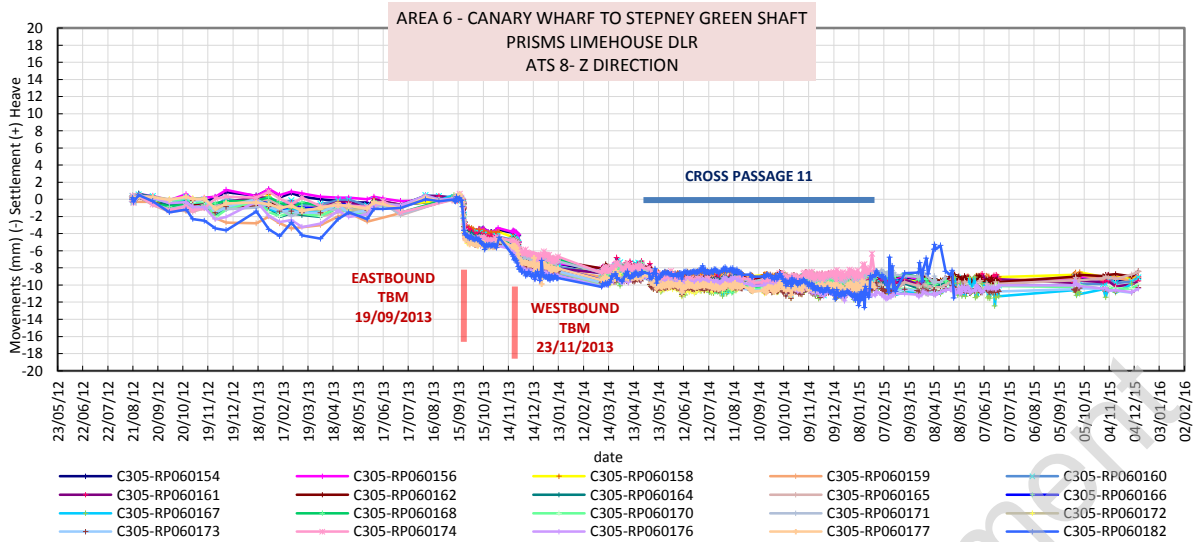
AUTOMATIC TOTAL STATION 8			
C305-RP060154	C305-RP060161	C305-RP060167	C305-RP060173
C305-RP060156	C305-RP060162*	C305-RP060168*	C305-RP060174*
C305-RP060158	C305-RP060164	C305-RP060170	C305-RP060176
C305-RP060159	C305-RP060165	C305-RP060171	C305-RP060177
C305-RP060160	C305-RP060166	C305-RP060172	C305-RP060182

Note: **C305-RP060162\***, **C305-RP060168\*** and **C305-RP060174\***, initially they were installed to be in the line of sight of ATS 10, as shown in the Installation Report no. C305-DSJ-C2-RGN-CRG03-50394. They were then relocated and re-orientated to be in the line of sight of ATS 8, due to obstructions between prisms and ATS. See sketch below for clarification.









In X and Y axes a positive movement of +2 mm and a negative movement of -2 mm respectively, have been observed after the Westbound TBM transit.

In Z axis a maximum settlement of -6 mm is observed after Eastbound TBM transit and -10 mm after Westbound TBM transit.

Between Dec 2012 to March 2013 some power supply issues were detected on ATS's controller, graphs show a data gap due to that problem.

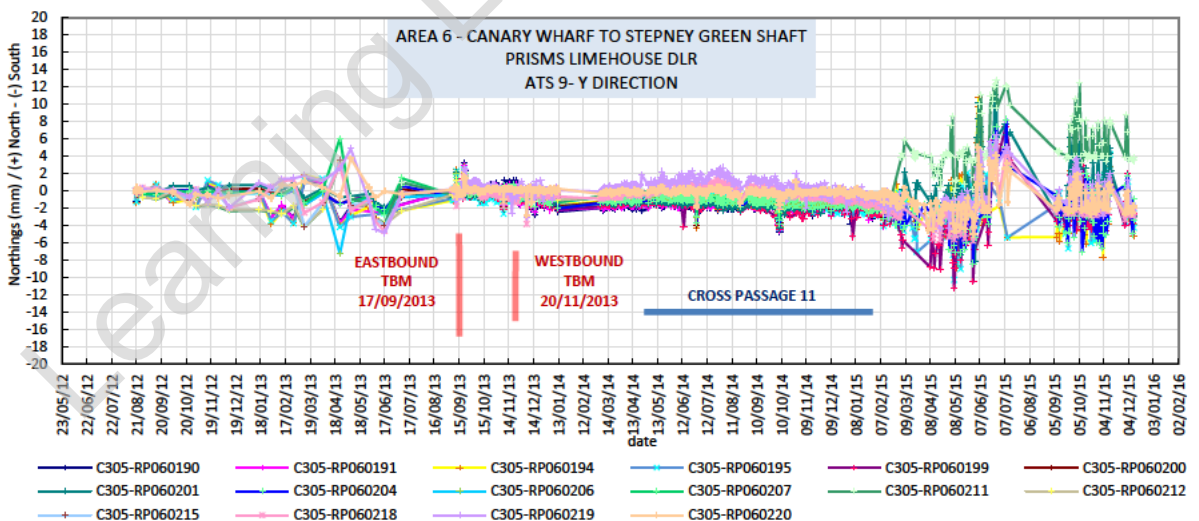
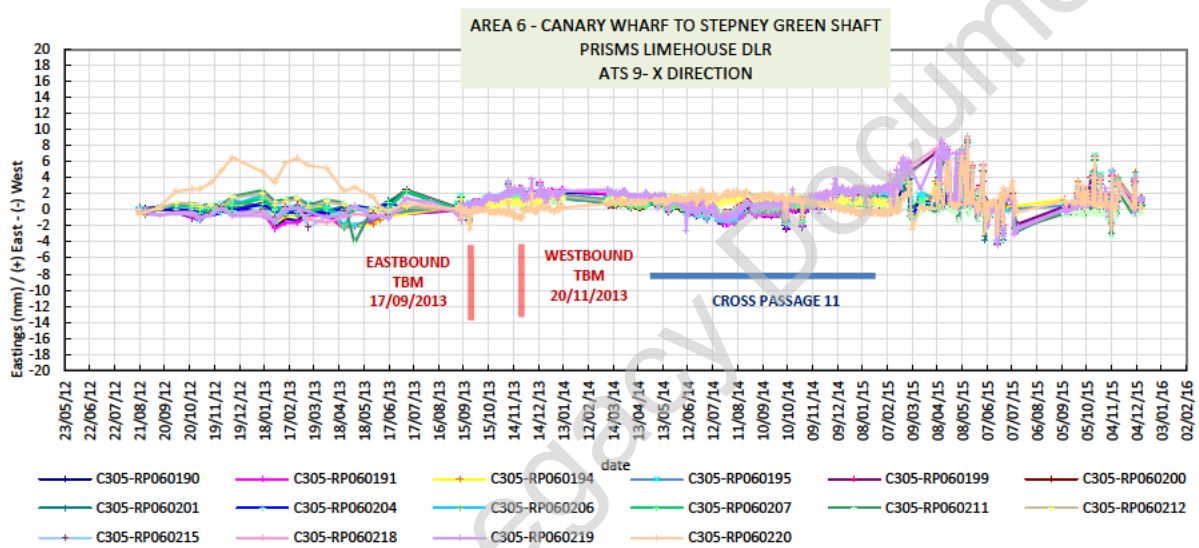
**AUTOMATIC TOTAL STATION 9**

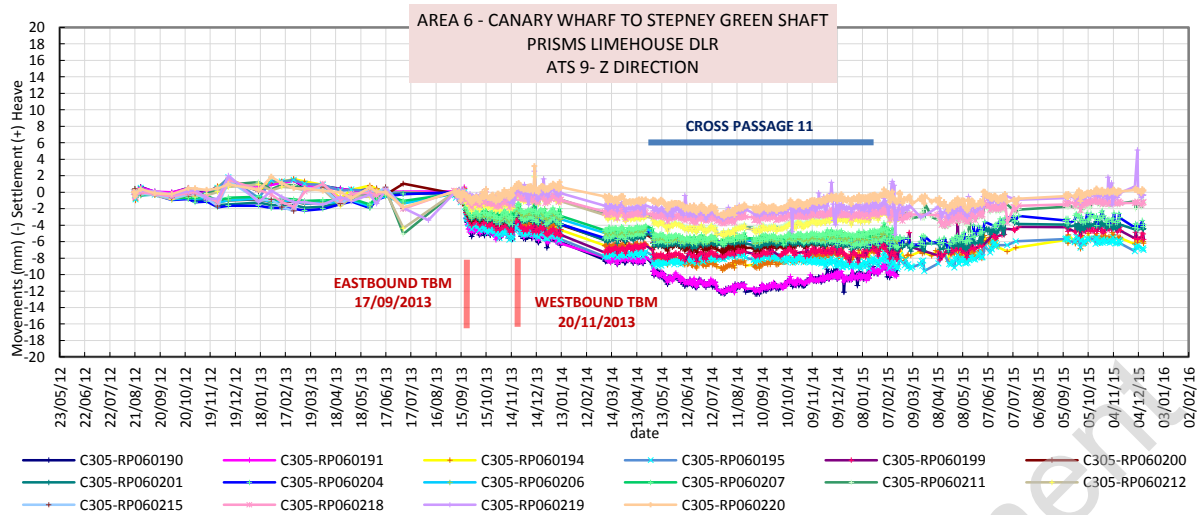
The table below shows the prisms which readings were taken by the Automatic Total Station 9. (one data/day)

Manual readings were carried out during baseline period from 20/08/12 to 06/09/13

Automatic readings from 06/09/13 to 09/12/15

AUTOMATIC TOTAL STATION 9			
C305-RP060190	C305-RP060199	C305-RP060206	C305-RP060215
C305-RP060191	C305-RP060200	C305-RP060207	C305-RP060218
C305-RP060194	C305-RP060201	C305-RP060211	C305-RP060219
C305-RP060195	C305-RP060204	C305-RP060212	C305-RP060220





No relevant movements have been observed in X and Y axes due to any construction activity.

In Z axis a maximum settlement of -6 mm is observed after Eastbound TBM transit and -7 mm after Westbound TBM transit. A settlement of -3 mm was registered due to the construction activities in Cross Passage 11.

Between Dec 2012 to March 2013 some power supply issues were detected on ATS’s controller, graphs show a data gap due to that problem.

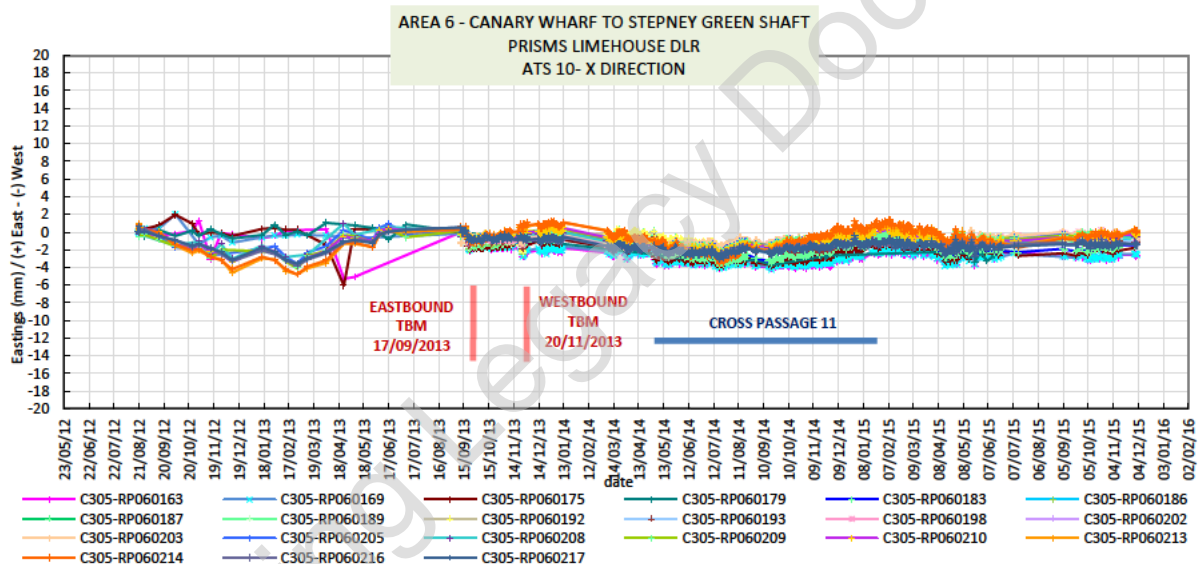
**AUTOMATIC TOTAL STATION 10**

The table below shows the prisms which readings were taken by the Automatic Total Station 10. (one data/day)

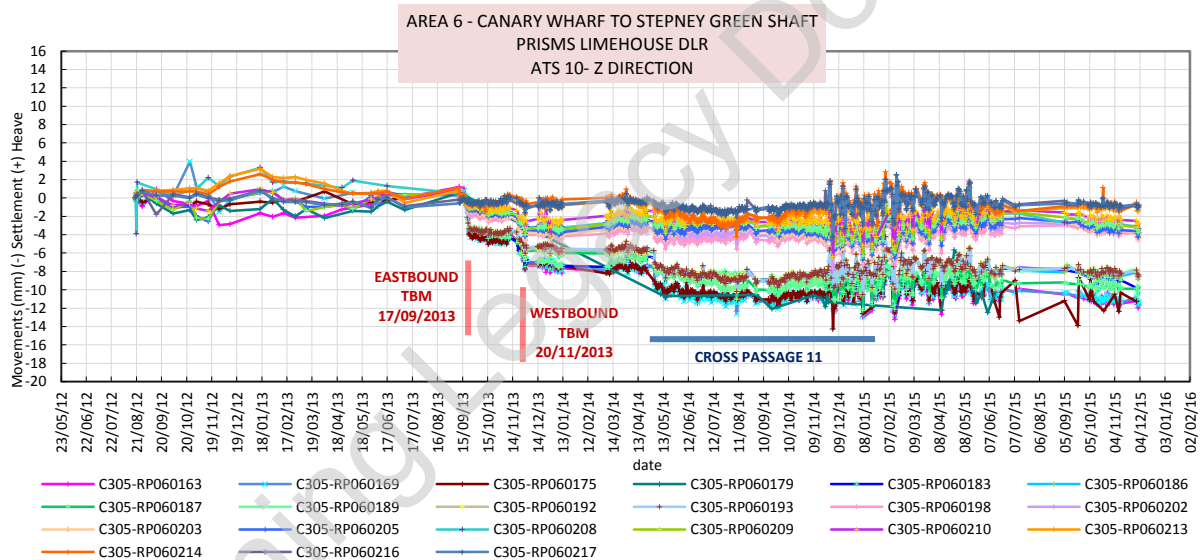
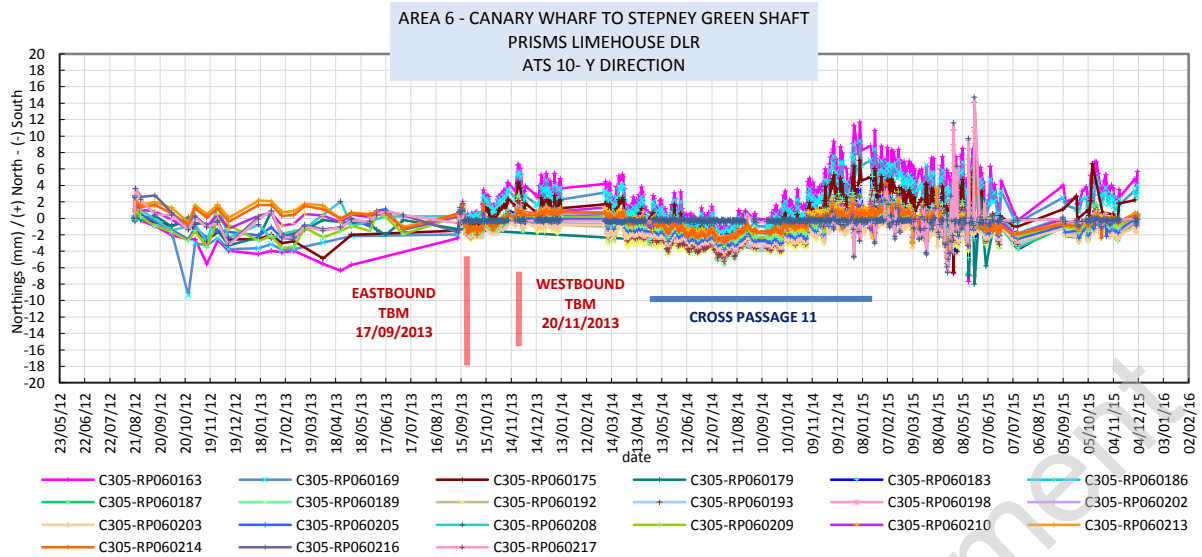
Manual readings were carried out during baseline period from 20/08/12 to 12/09/13

Automatic readings from 12/09/13 to 03/12/15

AUTOMATIC TOTAL STATION 10			
C305-RP060163	C305-RP060187	C305-RP060202	C305-RP060210
C305-RP060169	C305-RP060189	C305-RP060203	C305-RP060213
C305-RP060175	C305-RP060192	C305-RP060205	C305-RP060214
C305-RP060179	C305-RP060193	C305-RP060208	C305-RP060216
C305-RP060183	C305-RP060198	C305-RP060209	C305-RP060217
C305-RP060186			







No relevant movements have been observed in X and Y axes due to any construction activity.

In Z axis a maximum settlement of -5 mm is observed after Eastbound TBM transit and -8 mm after Westbound TBM transit. A settlement of -3 mm was registered due to the construction activities in Cross Passage 11.

Between Dec 2012 to March 2013 some power supply issues were detected on ATS’s controller; graphs show a data gap due to that problem

## PRISMS SUMMARY TABLE

The table below presents a summary of movements detected by the prisms installed on the viaduct (maximum, minimum and final). The movements are compared to trigger values defined in the Specific Action Plan C305-DSJ-C2-STP-CRG03-50037. For reference, the calculation method and sign convention are shown in the sketch presented at page 50.

TYPE STRUCTURE PIER/ABUTMENT	Movement type	PRISMS C305- 060XXX	Max. from Historical Values (mm)	Min. from Historical Values (mm)	Final Values	Green Level (mm)	Amber Level (mm)	Red Level (mm)	COMMENTS	
EAST ABUTMENT	Differential Settlement	211-212-216-217	3.50	-2.50	18/02/2015	2.42	±3	±5	±10	
	Longitudinal Displacement		1.00	-1.30		-0.48	±3	±5	±10	
	Total Settlement		0.00	-3.84		-1.67	±3	±5	±10	
	Transversal Displacement		1.00	-2.00		-0.92	±3	±5	±10	
The Mitre bridge	Differential Settlements between pier/abutment		0.30	-1.50		±3	±5	±10		
WEST ABUTMENT	Differential Settlement	206-207-213-214	5.00	-1.54	19/02/2015	4.66	±3	±5	±10	
	Longitudinal Displacement		1.50	-2.34		0.82	±3	±5	±10	
	Total Settlement		0.00	-5.00		-2.54	±3	±5	±10	
	Transversal Displacement		1.97	-3.00		-0.36	±3	±5	±10	
ABUTMENT	Differential Settlement	206-207-208-209	4.81	-1.78	08/02/2015	3.48	±3	±5	±10	
	Longitudinal Displacement		0.97	-1.67		0.19	±3	±5	±10	
	Total Settlement		-0.49	-5.50		-3.75	-8	-10	-15	
	Transversal Displacement		0.68	-3.11		0.56	±3	±5	±10	
ARCH 287	Differential Settlements between pier/abutment		0.00	-1.20		±3	±5	±10		
PIER	Differential Settlement	200-201-202-203	3.00	-0.10	26/12/2014	3.00	±3	±5	±10	
	Longitudinal Displacement		1.50	-1.55		0.32	±3	±5	±10	
	Total Settlement		0.10	-6.50		-6.16	-8	-10	-15	
	Transversal Displacement		0.54	-2.75		-0.95	±3	±5	±10	
ARCH 286	Differential Settlements between pier/abutment		N/A	N/A		±3	±5	±10	Data unavailable for the calculation	
ABUTMENT	Differential Settlement	N/A-N/A-195-194	N/A	N/A	N/A	N/A	±3	±5	±10	
	Longitudinal Displacement		N/A	N/A	N/A	N/A	±3	±5	±10	
	Total Settlement		N/A	N/A	N/A	N/A	-8	-10	-15	
	Transversal Displacement		N/A	N/A	N/A	N/A	±3	±5	±10	
EAST ABUTMENT	Differential Settlement	197-196-195-194 (manual prisms)	N/A	N/A	N/A	N/A	±3	±5	±10	
	Longitudinal Displacement		N/A	N/A	N/A	N/A	±3	±5	±10	
	Total Settlement		N/A	N/A	N/A	N/A	-8	-10	-15	
	Transversal Displacement		N/A	N/A	N/A	N/A	±3	±5	±10	
Newell Street Bridge	Differential Settlements between pier/abutment		N/A	N/A		±3	±5	±10	Data unavailable for the calculation	
WEST ABUTMENT	Differential Settlement	190-191-192-193	4.50	-1.45	16/02/2015	1.07	±3	±5	±10	
	Longitudinal Displacement		1.00	-2.30		0.34	±3	±5	±10	
	Total Settlement		0.00	-10.50		-9.57	SAP CP11 Alert value -16 mm settlement			TBM triggers values superseded. SAP CP11 Alert value -16 mm (C305-DSJ-C2-STP-CRG03-50020 Rev 3.0)
	Transversal Displacement		1.00	-4.50		-0.68	±3	±5	±10	
ABUTMENT	Differential Settlement	184-185-186-187 (manual prisms)	#N/A	#N/A	03/12/2015	#N/A	±3	±5	±10	
	Longitudinal Displacement		1.00	-2.50		-0.95	±3	±5	±10	
	Total Settlement		0.00	-10.00		-6.50	±8	±10	±15	
	Transversal Displacement		-2.00	-5.70		-0.63	±3	±5	±10	
ARCH 285	Differential Settlements between pier/abutment		N/A	N/A		±3	±5	±10	Data unavailable for the calculation	
PIER		N/A-N/A-178-177 (manual prisms)	N/A	N/A	N/A	N/A	±3	±5	±10	
			N/A	N/A	N/A	N/A	±3	±5	±10	
			N/A	N/A	N/A	N/A	-8	-10	-15	
			N/A	N/A	N/A	N/A	±3	±5	±10	
ARCH 284	Differential Settlements between pier/abutment		N/A	N/A		±3	±5	±10	Data unavailable for the calculation	

TYPE STRUCTURE PIER/ABUTMENT	Movement type	PRISMS C305- 060XXX	Max. from Historical Values (mm)	Min. from Historical Values (mm)	Final Values	Green Level (mm)	Amber Level (mm)	Red Level (mm)	COMMENTS	
PIER	Differential Settlement	172-173-174-175	2.00	0.00	27/01/2015	1.31	±3	±5	±10	TBM triggers values superseded. SAP CP11 Alert value -16 mm (C305-DSJ-C2-STP-CRG03-50020 Rev 3.0) Trigger value reached during CP11 works. However the trend shown in the graph at page 49 illustrates trigger breach due to temperature seasonal effect. ERP (06/02/2015)
	Longitudinal Displacement		1.30	-1.00		0.77	±3	±5	±10	
	Total Settlement		0.42	-10.00		-9.71	SAP CP11 Alert value -16 mm settlement			
	Transversal Displacement		0.00	-5.70		-5.56	±3	±5	±10	
ARCH 283	Differential Settlements between pier/abutment		0.50	-0.50		±3	±5	±10		
PIER	Differential Settlement	166-167-168-169	1.50	-1.17	18/01/2015	0.18	±3	±5	±10	TBM triggers values superseded. SAP CP11 Alert value -16 mm (C305-DSJ-C2-STP-CRG03-50020 Rev 3.0)
	Longitudinal Displacement		0.50	-1.00		0.16	±3	±5	±10	
	Total Settlement		0.00	-10.00		-9.66	SAP CP11 Alert value -16 mm settlement			
	Transversal Displacement		0.00	-4.80		-4.37	±3	±5	±10	
ARCH 282	Differential Settlements between pier/abutment		0.00	-0.70		±3	±5	±10		
PIER	Differential Settlement	160-161-162-163	1.20	-1.00	23/04/2015	0.10	±3	±5	±10	TBM triggers values superseded. SAP CP11 Alert value -16 mm (C305-DSJ-C2-STP-CRG03-50020 Rev 3.0)
	Longitudinal Displacement		0.54	-1.00		-0.11	±3	±5	±10	
	Total Settlement		0.00	-10.00		-9.48	SAP CP11 Alert value -16 mm settlement			
	Transversal Displacement		1.11	-4.00		-3.27	±3	±5	±10	
ARCH 281	Differential Settlements between pier/abutment		1.00	-1.00		±3	±5	±10		
EAST ABUTMENT	Differential Settlement	154-155-156-157	1.73	-2.50	18/05/2015	-1.31	±3	±5	±10	TBM triggers values superseded. SAP CP11 Alert value -16 mm (C305-DSJ-C2-STP-CRG03-50020 Rev 3.0) Trigger value reached during CP11 works. However the trend shown in the graph at page 49 illustrates trigger breach due to temperature seasonal effect.
	Longitudinal Displacement		1.99	-2.64		-2.21	±3	±5	±10	
	Total Settlement		0.00	-10.90		-10.65	SAP CP11 Alert value -16 mm settlement			
	Transversal Displacement		2.00	-5.90		-5.06	±3	±5	±10	
Limehouse Cut Bridge 280	Differential Settlements between pier/abutment		#N/A	#N/A		±3	±5	±10	Data unavailable for the calculation	
WEST ABUTMENT	Differential Settlement	148-149-150-151	1.00	-2.00	04/07/2014	0	±3	±5	±10	TBM triggers values superseded. SAP CP11 Alert value -16 mm (C305-DSJ-C2-STP-CRG03-50020 Rev 3.0)
	Longitudinal Displacement		1.50	-1.00		1	±3	±5	±10	
	Total Settlement		0.00	-11.50		-11	SAP CP11 Alert value -16 mm settlement			
	Transversal Displacement		2.00	-4.50		-3	±3	±5	±10	
ARCH 279	Differential Settlements between pier/abutment		0.50	-1.00		±3	±5	±10		
PIER	Differential Settlement	142-143-144-145	1.00	-2.00	04/07/2014	0.20	±3	±5	±10	
	Longitudinal Displacement		2.00	-1.00		2.00	±3	±5	±10	
	Total Settlement		0.00	-11.90		-11.00	-12	-15	-20	
	Transversal Displacement		2.50	-3.50		-2.30	±3	±5	±10	
ARCH 278	Differential Settlements between pier/abutment		0.50	-0.50		±3	±5	±10		
PIER	Differential Settlement	136-137-138-139	1.00	-2.00	07/07/2014	-0.40	±3	±5	±10	
	Longitudinal Displacement		3.00	-1.50		3.00	±3	±5	±10	
	Total Settlement		0.00	-11.80		-11.05	-12	-15	-20	
	Transversal Displacement		2.50	-2.50		-0.57	±3	±5	±10	
ARCH 277	Differential Settlements between pier/abutment		0.50	-0.30		±3	±5	±10		
PIER	Differential Settlement	130-131-132-133	0.65	-2.00	08/07/2014	-0.75	±3	±5	±10	
	Longitudinal Displacement		3.80	0.00		3.63	±3	±5	±10	
	Total Settlement		0.00	-11.60		-10.78	-12	-15	-20	
	Transversal Displacement		3.00	-2.00		2.35	±3	±5	±10	
ARCH 276	Differential Settlements between pier/abutment		0.75	0.00		±3	±5	±10		
PIER	Differential Settlement	124-125-126-127	1.50	-4.50	06/07/2014	-0.45	±3	±5	±10	#
	Longitudinal Displacement		4.00	-1.50		3.95	±3	±5	±10	
	Total Settlement		0.00	-10.70		-10.47	-12	-15	-20	
	Transversal Displacement		2.00	-1.50		0.98	±3	±5	±10	

TYPE STRUCTURE PIER/ABUTMENT	Movement type	PRISMS C305- 060XXX	Max. from Historical Values (mm)	Min. from Historical Values (mm)	Final Values		Green Level (mm)	Amber Level (mm)	Red Level (mm)	COMMENTS
ARCH 275	Differential Settlements between pier/abutment		1.00	-0.50			±3	±5	±10	
PIER	Differential Settlement	117-118-119-120	1.09	-2.50	30/07/2014	-2.10	±3	±5	±10	
	Longitudinal Displacement		4.00	-2.00		4.17	±3	±5	±10	
	Total Settlement		0.00	-10.50		-10.25	-12	-15	-20	
	Transversal Displacement		2.00	-2.58		-2.58	±3	±5	±10	
ARCH 274	Differential Settlements between pier/abutment		0.50	0.00			±3	±5	±10	
EAST ABUTMENT	Differential Settlement	111-112-113-114	0.60	-2.50	07/05/2014	-1.55	±3	±5	±10	
	Longitudinal Displacement		1.00	-1.70		0.88	±3	±5	±10	
	Total Settlement		0.88	-9.28		-8.57	-8	-10	-15	
	Transversal Displacement		2.50	-1.18		1.27	±3	±5	±10	
Island Row Bridge 273	Differential Settlements between pier/abutment		1.00	-0.50			±3	±5	±10	
WEST ABUTMENT	Differential Settlement	105-107-N/A-110	0.50	-2.50	10/09/2014	-2.40	±3	±5	±10	
	Longitudinal Displacement		1.13	-2.00		-1.63	±3	±5	±10	
	Total Settlement		0.00	-9.80		-9.20	±8	±10	±15	
	Transversal Displacement		4.00	-2.00		1.13	±3	±5	±10	
ARCH 272	Differential Settlements between pier/abutment		N/A	N/A			±3	±5	±10	Data unavailable for the calculation
PIER	Differential Settlement	N/A-N/A-N/A-N/A	N/A	N/A	N/A	N/A	±3	±5	±10	Data unavailable for the calculation
	Longitudinal Displacement		N/A	N/A	N/A	N/A	±3	±5	±10	
	Total Settlement		N/A	N/A	N/A	N/A	±8	±10	±15	
	Transversal Displacement		N/A	N/A	N/A	N/A	±3	±5	±10	
ARCH 271	Differential Settlements between pier/abutment		N/A	N/A			±3	±5	±10	Data unavailable for the calculation
PIER	Differential Settlement	N/A-N/A-N/A-N/A	N/A	N/A	N/A	N/A	±3	±5	±10	Data unavailable for the calculation
	Longitudinal Displacement		N/A	N/A	N/A	N/A	±3	±5	±10	
	Total Settlement		N/A	N/A	N/A	N/A	±8	±10	±15	
	Transversal Displacement		N/A	N/A	N/A	N/A	±3	±5	±10	
ARCH 270	Differential Settlements between pier/abutment		N/A	N/A			±3	±5	±10	Data unavailable for the calculation
EAST ABUTMENT	Differential Settlement	083-084-085-086 (manual prisms)	0.00	-3.00	05/12/2013	0.15	±3	±5	±10	Movement values relate only to TBM passage.
	Longitudinal Displacement		2.50	0.00		0.98	±3	±5	±10	
	Total Settlement		0.00	-7.70		-7.78	±8	±10	±15	
	Transversal Displacement		4.50	0.00		3.38	±3	±5	±10	
Mill Place Bridge 269	Differential Settlements between pier/abutment		0.80	-0.40						
WEST ABUTMENT	Differential Settlement	079-080-081-082 (manual prisms)	2.00	3.00	05/12/2013	-1.05	±3	±5	±10	Movement values relate only to TBM passage.
	Longitudinal Displacement		2.00	-0.50		-0.65	±3	±5	±10	
	Total Settlement		0.00	-7.60		-7.68	±8	±10	±15	
	Transversal Displacement		4.20	-0.73		4.20	±3	±5	±10	
ARCH 268	Differential Settlements between pier/abutment		N/A	N/A			±3	±5	±10	Data unavailable for the calculation
PIER	Differential Settlement	N/A-N/A-074-073	N/A	N/A	N/A	N/A	±3	±5	±10	Data unavailable for the calculation
	Longitudinal Displacement		N/A	N/A	N/A	N/A	±3	±5	±10	
	Total Settlement		N/A	N/A	N/A	N/A	±8	±10	±15	
	Transversal Displacement		N/A	N/A	N/A	N/A	±3	±5	±10	
ARCH 267	Differential Settlements between pier/abutment		N/A	N/A			±3	±5	±10	Data unavailable for the calculation
PIER	Differential Settlement	067-068-N/A-070	2.00	-4.50	19/12/2014	1.10	±3	±5	±10	Values based on 3No prisms.
	Longitudinal Displacement		1.33	-2.83		-0.97	±3	±5	±10	
	Total Settlement		0.00	-7.60		-7.63	±8	±10	±15	
	Transversal Displacement		5.00	-1.00		4.90	±3	±5	±10	
ARCH 266	Differential Settlements between pier/abutment		1.00	0.50			±3	±5	±10	

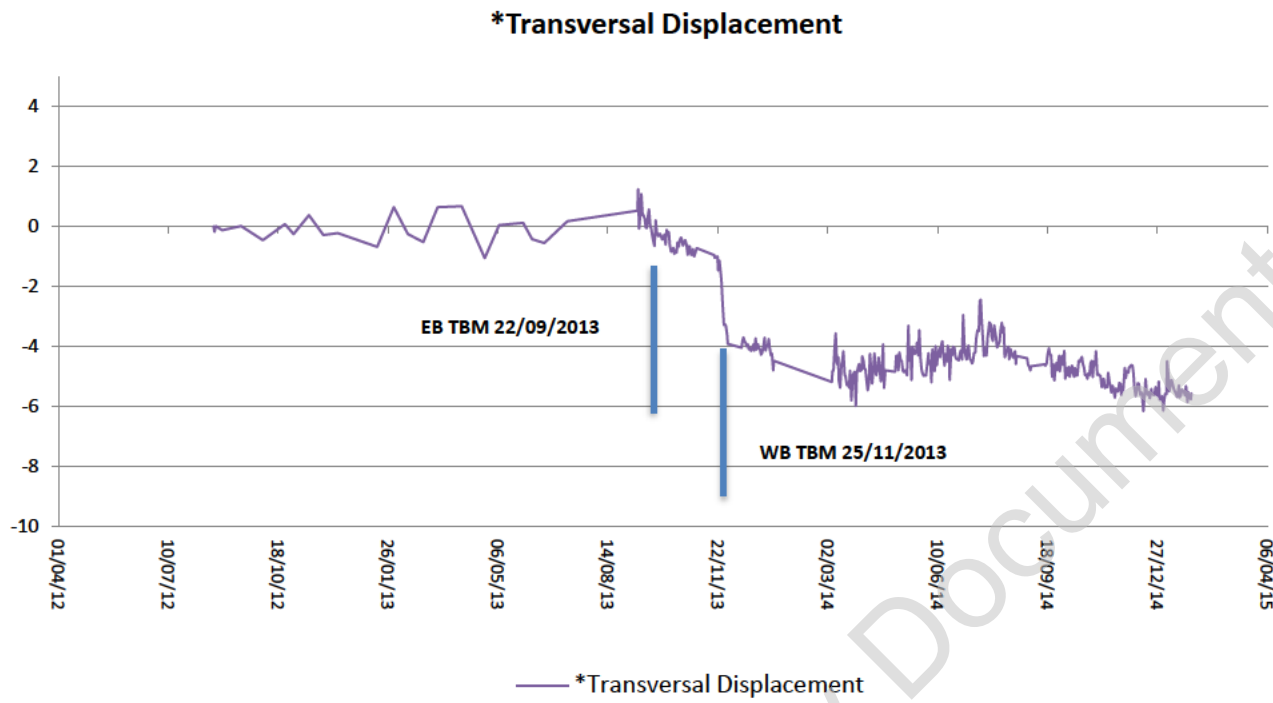


TYPE STRUCTURE PIER/ABUTMENT	Movement type	PRISMS C305- 060XXX	Max. from Historical Values (mm)	Min. from Historical Values (mm)	Final Values	Green Level (mm)	Amber Level (mm)	Red Level (mm)	COMMENTS
PIER	Differential Settlement	061-062-063-064	1.20	-3.70	11/04/2014	-2.05	±3	±5	±10
	Longitudinal Displacement		1.38	-0.95		0.60	±3	±5	±10
	Total Settlement		0.00	-6.08		-6.08	-8	-10	-15
	Transversal Displacement		4.00	-0.65		3.42	±3	±5	±10
ARCH 265	Differential Settlements between pier/abutment		1.00	0.00		±3	±5	±10	
PIER	Differential Settlement	055-056-057-058	2.00	-3.85	20/03/2014	-2.60	±3	±5	±10
	Longitudinal Displacement		1.57	-1.05		1.00	±3	±5	±10
	Total Settlement		0.00	-4.50		-4.25	-8	-10	-15
	Transversal Displacement		4.00	-0.48		3.88	±3	±5	±10
ARCH 264	Differential Settlements between pier/abutment		0.75	0.00		±3	±5	±10	
PIER	Differential Settlement	049-050-051-052	1.55	-3.50	27/03/2014	-1.95	±3	±5	±10
	Longitudinal Displacement		1.49	-1.02		1.14	±3	±5	±10
	Total Settlement		0.00	-4.38		-3.42	-8	-10	-15
	Transversal Displacement		4.50	-0.45		4.78	±3	±5	±10
ARCH 263	Differential Settlements between pier/abutment		0.80	0.00		±3	±5	±10	
PIER	Differential Settlement	043-044-045-046	1.92	-3.50	26/03/2014	-2.50	±3	±5	±10
	Longitudinal Displacement		2.23	-0.70		1.05	±3	±5	±10
	Total Settlement		0.98	-3.52		-3.00	-8	-10	-15
	Transversal Displacement		4.50	-0.43		4.50	±3	±5	±10
ARCH 263	Differential Settlements between pier/abutment		1.00	-0.50		±3	±5	±10	
EAST ABUTMENT	Differential Settlement	N/A-037-038-039	2.50	-3.20	19/12/2014	2.00	±3	±5	±10
	Longitudinal Displacement		1.20	-1.00		-0.37	±3	±5	±10
	Total Settlement		0.00	-4.50		-3.53	±8	±10	±15
	Transversal Displacement		4.50	-0.50		3.43	±3	±5	±10
Warehouse Yard Bridge 261	Differential Settlements between pier/abutment		1.00	-1.00		±3	±5	±10	
WEST ABUTMENT	Differential Settlement	033-034-035-036	1.00	-4.00	18/12/2014	0.35	±3	±5	±10
	Longitudinal Displacement		1.00	-2.50		0.33	±3	±5	±10
	Total Settlement		0.00	-4.70		-3.73	±8	±10	±15
	Transversal Displacement		4.50	-1.00		3.53	±3	±5	±10
ARCH 260	Differential Settlements between pier/abutment		1.00	-1.00		±3	±5	±10	
PIER	Differential Settlement	027-028-029-030	0.85	-2.45	27/03/2014	-1.90	±3	±5	±10
	Longitudinal Displacement		1.25	-0.30		1.18	±3	±5	±10
	Total Settlement		0.00	-2.23		-1.65	-8	-10	-15
	Transversal Displacement		3.75	-1.15		3.35	±3	±5	±10
ARCH 259	Differential Settlements between pier/abutment		1.00	-0.50		±3	±5	±10	
EAST ABUTMENT	Differential Settlement	015-016-017-018	1.25	-2.70	26/03/2014	-2.05	±3	±5	±10
	Longitudinal Displacement		0.60	-0.35		0.80	±3	±5	±10
	Total Settlement		0.00	-1.57		-0.98	-3	-5	-10
	Transversal Displacement		2.50	-1.48		0.95	±3	±5	±10
Regent Cannal Bridge 258	Differential Settlements between pier/abutment		1.50	-1.00		±3	±5	±10	
WEST ABUTMENT	Differential Settlement	007-008-009-010	1.50	-2.00	11/04/2014	-0.45	±3	±5	±10
	Longitudinal Displacement		1.00	-0.50		0.88	±3	±5	±10
	Total Settlement		0.00	-0.75		-0.63	-3	-5	-10
	Transversal Displacement		2.00	-1.00		1.52	±3	±5	±10
ARCH 257	Differential Settlements between pier/abutment		0.50	-1.00		±3	±5	±10	

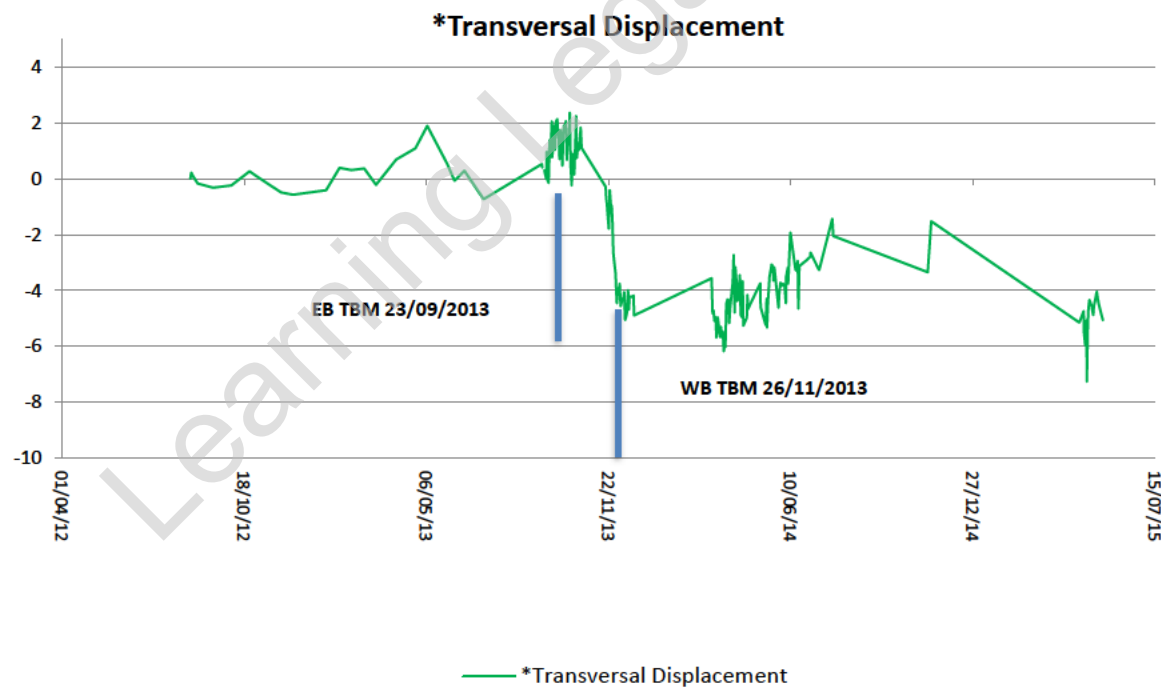


TYPE STRUCTURE PIER/ABUTMENT	Movement type	PRISMS C305- 060XXX	Max. from Historical Values (mm)	Min. from Historical Values (mm)	Final Values		Green Level (mm)	Amber Level (mm)	Red Level (mm)	COMMENTS
PIER	Differential Settlement	001-002-003-004	1.50	-2.00	22/05/2014	-0.40	±3	±5	±10	
	Longitudinal Displacement		0.50	-1.00		0	±3	±5	±10	
	Total Settlement		0.00	-1.50		-1.50	-3	-5	-10	
	Transversal Displacement		1.00	-1.50		-0.95	±3	±5	±10	

\*Transversal Displacement. pier (PRISMS C305-060172-173-174-175)



\*Transversal Displacement. pier (PRISMS C305-060154-155-156-157)



RELATIVE DIFFERENTIAL MOVEMENTS BETWEEN PIER/ABUTMENT

Sketch below shows a description of movements calculated for reference to trigger values.

Longitudinal and transverse movements are relative to the viaduct alignment.

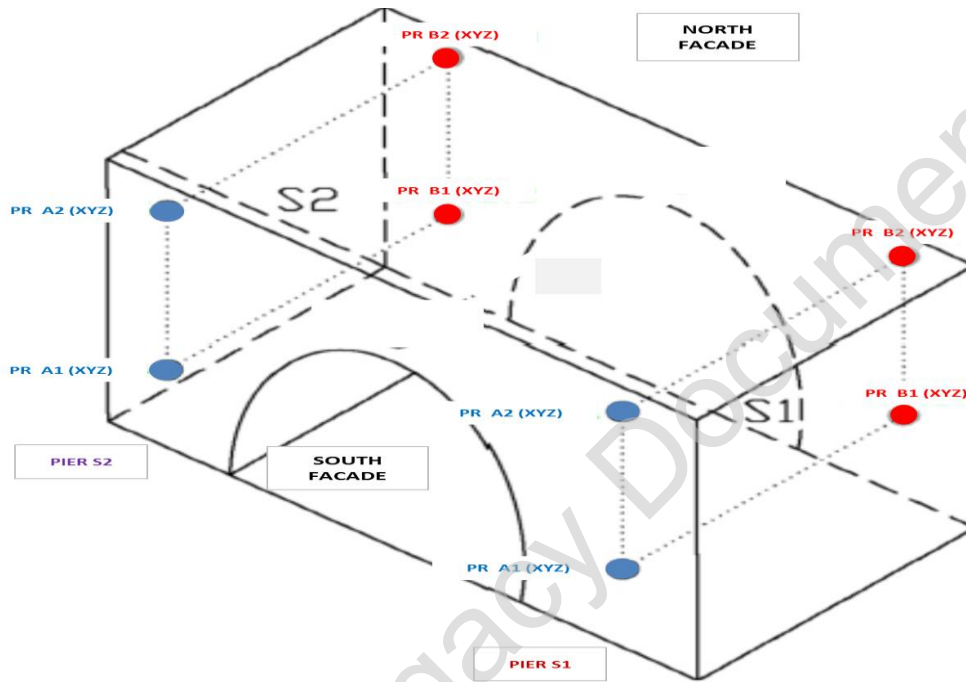


Table below shows calculation method for each movement.

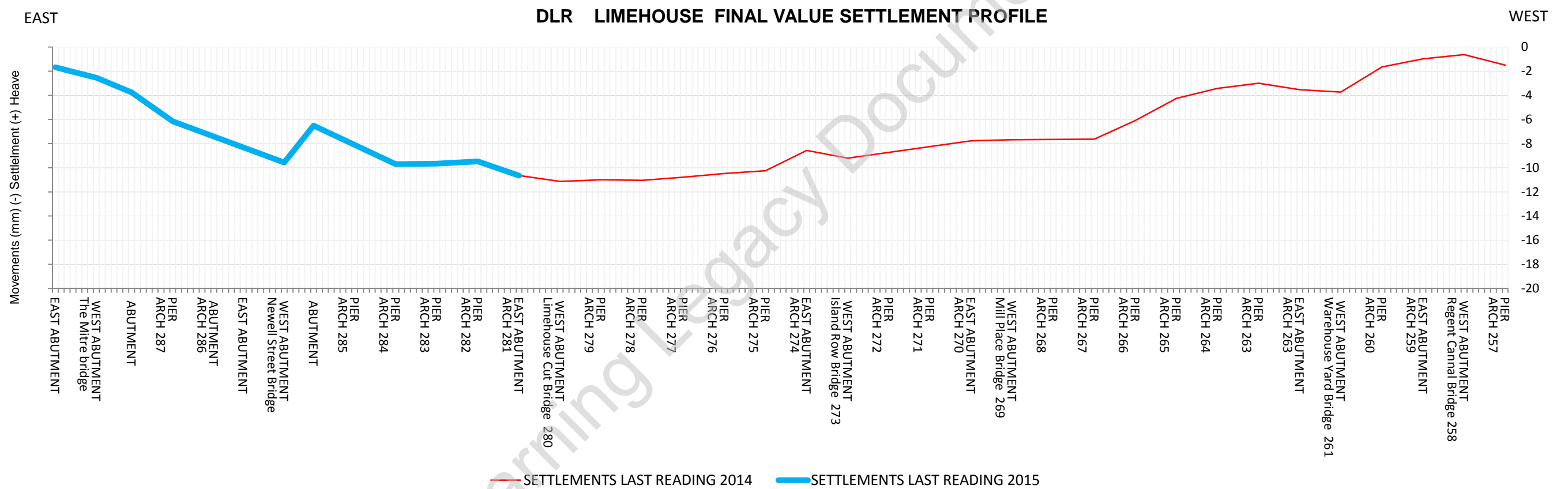
DESCRIPTION OF MOVEMENTS	CALCULATION	COMMENTS
PIER DIFFERENTIAL SETTLEMENT	$\frac{((\text{PRISM B1Z} + \text{PRISM B2Z}) / 2) - ((\text{PRISM A1Z} + \text{PRISM A2Z}) / 2)}$	Difference between the south and north facades per pier location. Use average of facade prisms, (2no). Positive (+ve) relative movement is south façade moving down relative to north façade at a pier/abutment location
PIER LONGITUDINAL DISPLACEMENT	$\frac{(\text{PRISM A1X} + \text{PRISM A2X} + \text{PRISM B1X} + \text{PRISM B2X})}{4}$	Average of prisms (4no) longitudinal horizontal movement per pier location. Positive (+ve) movement is Westwards.
PIER TOTAL SETTLEMENT	$\frac{(\text{PRISM A1Z} + \text{PRISM A2Z} + \text{PRISM B1Z} + \text{PRISM B2Z})}{4}$	Average of prisms at pier location, (4no). Positive (+ve) movement is upwards.
PIER TRANSVERSAL DISPLACEMENT	$\frac{(\text{PRISM A1Y} + \text{PRISM A2Y} + \text{PRISM B1Y} + \text{PRISM B2Y})}{4}$	Average of prisms (4no) transverse horizontal movement per pier location. Positive (+ve) movement is Northwards.
DIFFERENTIAL SETTLEMENTS BETWEEN PIER / ABUTMENT	TOTAL SETTLEMENT PIER S2 - TOTAL SETTLEMENT PIER S1	Difference between two adjacent piers. Average settlement for each pier. Positive (+ve) relative movement is east pier(S1) moving down relative to adjacent west pier (S2)

### LIMEHOUSE SETTLEMENTS PROFILE

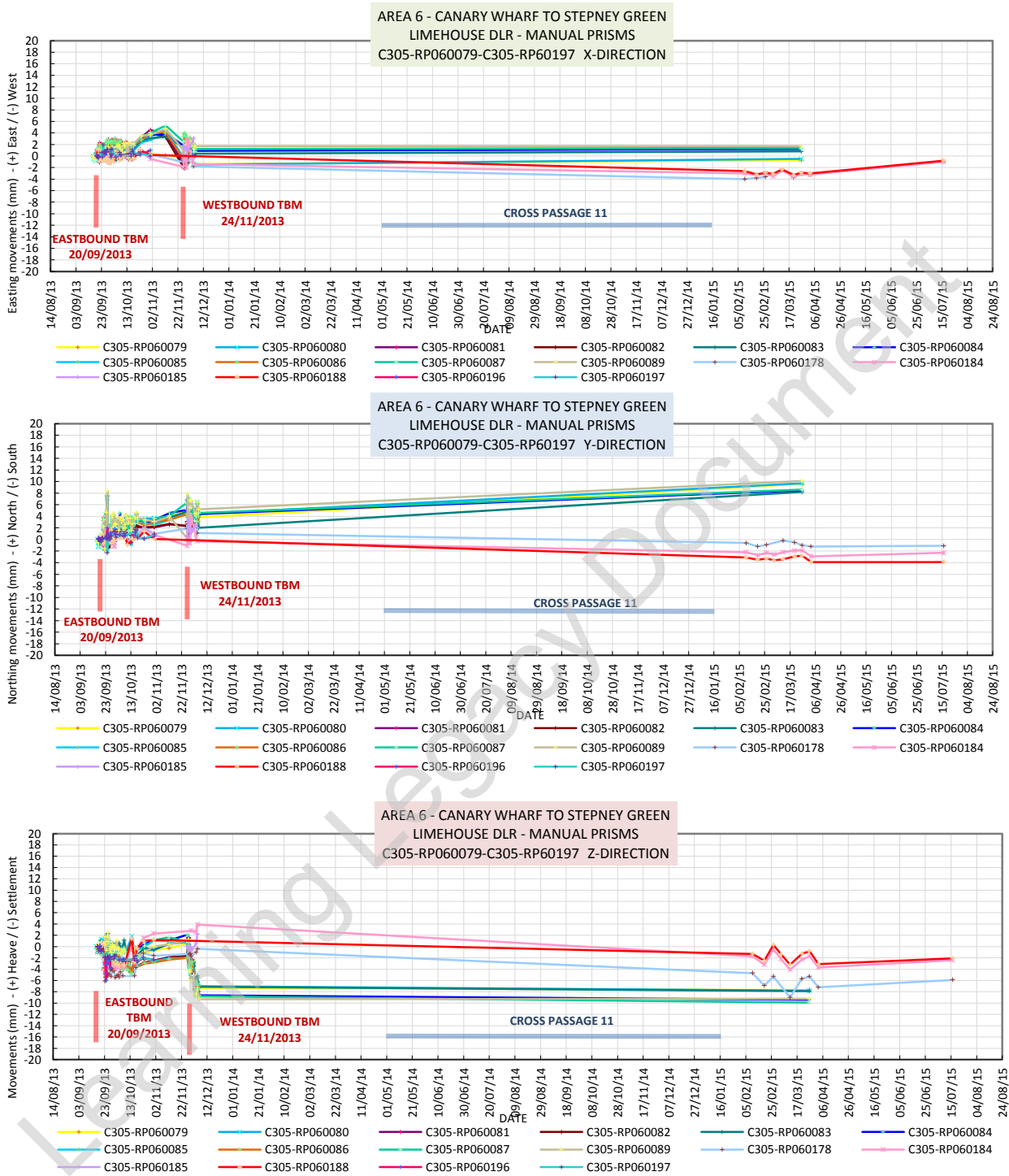
The graph presented below is the settlement profile along DLR Limehouse structure. A maximum of -11.9 mm settlement has been recorded after TBMs transit and CP11 works.

The graph shows two series, the blue line correspond to the last set of readings taken after CP11 works in 2015, the red line correspond to the last set of long term readings taken in 2014 after TBMs transit.

Profile based on average movement at pier/abutment location.



**MANUAL 3D PRISMS**



In X direction, there is no relevant movement during the Eastbound TBM transit and a positive movement of +6 mm is observed prior to the Westbound TBM transit.

In Y axis a maximum positive movement of +4 mm is observed after Eastbound TBM transit and +6 mm after Westbound TBM transit.

In Z axis a maximum settlement of -6 mm is observed after Eastbound TBM transit and -10 mm after Westbound TBM transit.

## 8 SUMMARY STATEMENT

It has been agreed between the Project Manager, the Designer, the Contractor and the Sub Contractor that the instrumentation covered herein, for monitoring ground movement effects of Crossrail works, including long term effects, can be closed out for decommissioning a trends of the monitoring points were approaching or had achieved the specified 2 mm/year settlement rate.

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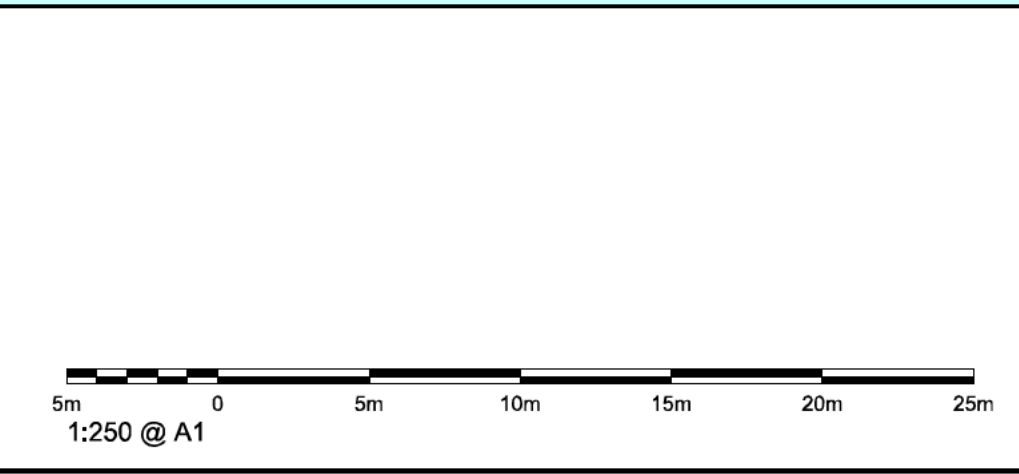
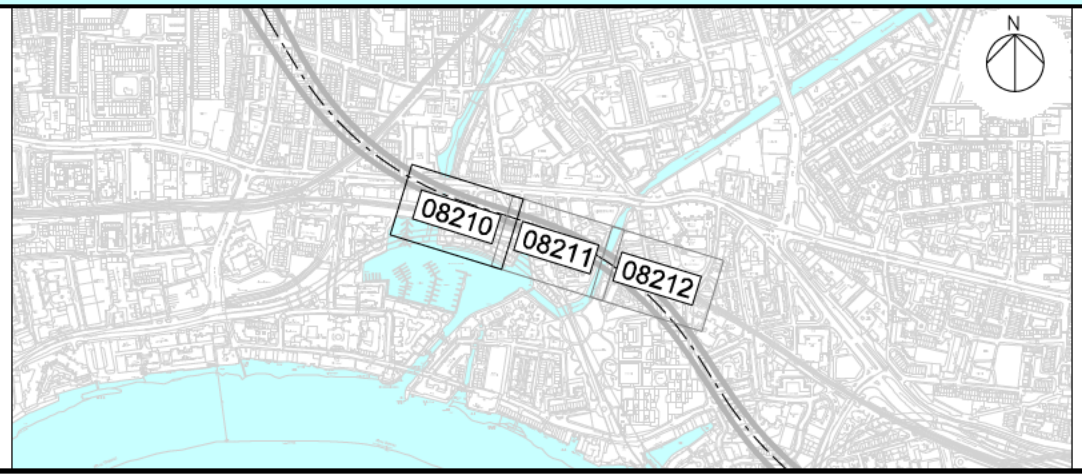
## APPENDIX A: INSTRUMENT LOCATION





Rev.	Date	Description	By	Chkd	App	Auth
P01	25/02/2016	First Issue	MD	MD	MD	-

- Notes**
- 3D Prisms
  - ⊠ Automatic Total Station
  - Sockets



	Contract:	Tunnels East - Drive Y LIM to FAR & Drive Z SGJ to PML & Drive G
	Originator:	Dragados Sisk Joint Venture
Crossrail Limited 25 Canada Square London E14 5LQ	Location:	Crossrail Tunnels - Drive Y (Limmo Peninsula to Farringdon Stn)
	Title:	Instrumentation & Monitoring I&M Installation Report for Limehouse DLR Viaduct - 3D Prisms, ATS and Sockets (Drive Y) C305-DSJ-C2-RGN-CRG03-50394
© Crossrail	Scale:	1:250 @ A1
www.crossrail.co.uk	Drawing and CAD No:	C305-DSJ-C2-DDA-CRT00_ST006_1-08210
	Rev:	P01
	Suitability:	S4

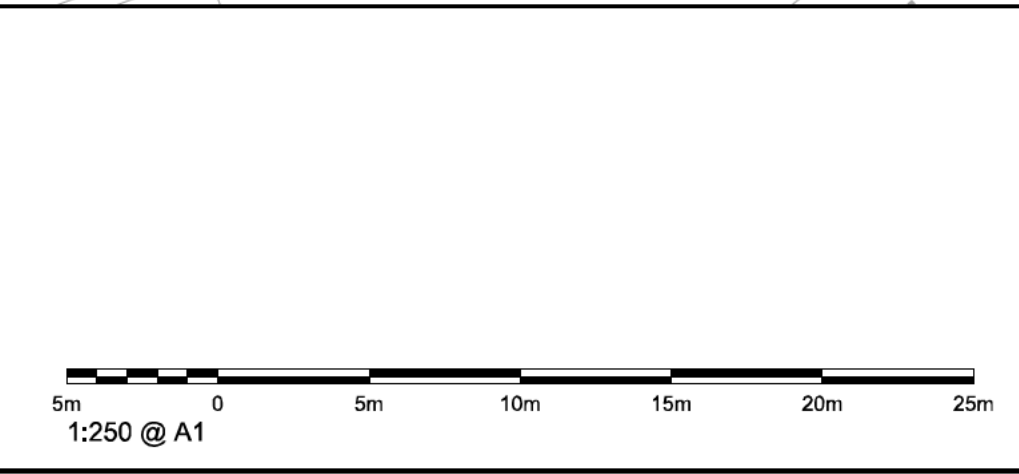
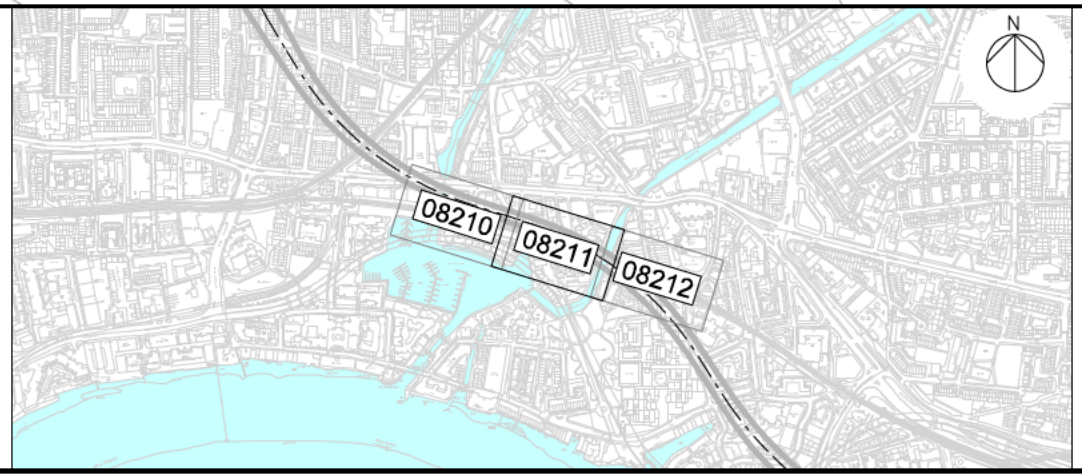
FIT for authorisation





Rev.	Date	Description	By	Chkd	App	Auth
P01	25/02/2016	First Issue	MD	MD	MD	-

- Notes**
- 3D Prisms
  - ⊗ Automatic Total Station
  - Sockets



**Crossrail Limited**  
25 Canada Square  
Canary Wharf  
London  
E14 6LQ

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Contract: Tunnels East - Drive Y LIM to FAR & Drive Z SGJ to PML & Drive G  
 Originator: Dragados Sisk Joint Venture  
 Location: Crossrail Tunnels - Drive Y (Limmo Peninsula to Farringdon Stn)

Title: Instrumentation & Monitoring  
 I&M Installation Report for Limehouse DLR  
 Viaduct - 3D Prisms, ATS and Sockets (Drive Y)  
 C305-DSJ-C2-RGN-CRG03-50394

By: M.DAVIS  
 CHK: M.DAVIS  
 App: M.DAVIS  
 Auth: -

Scale: 1:250 @ A1  
 Drawing and CAD No: C305-DSJ-C2-DDA-CRT00\_ST006\_1-08211  
 Rev: P01  
 Suitability: S4

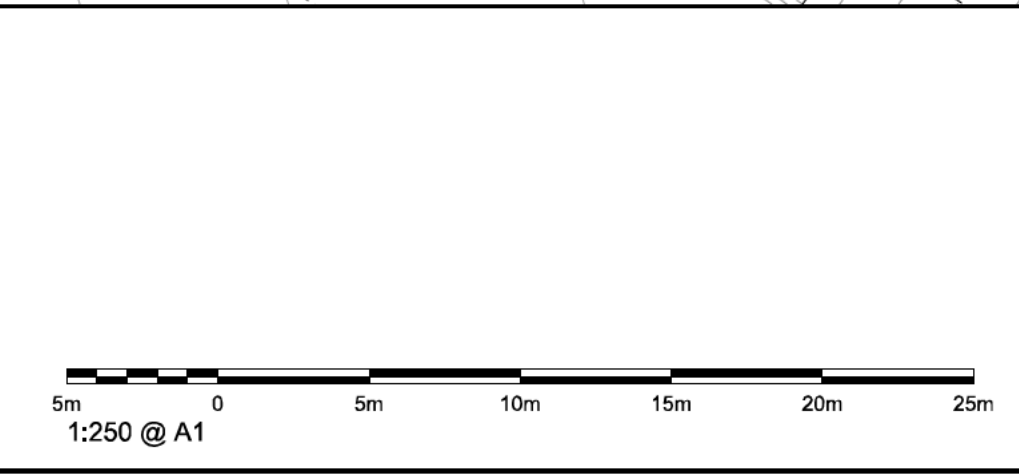
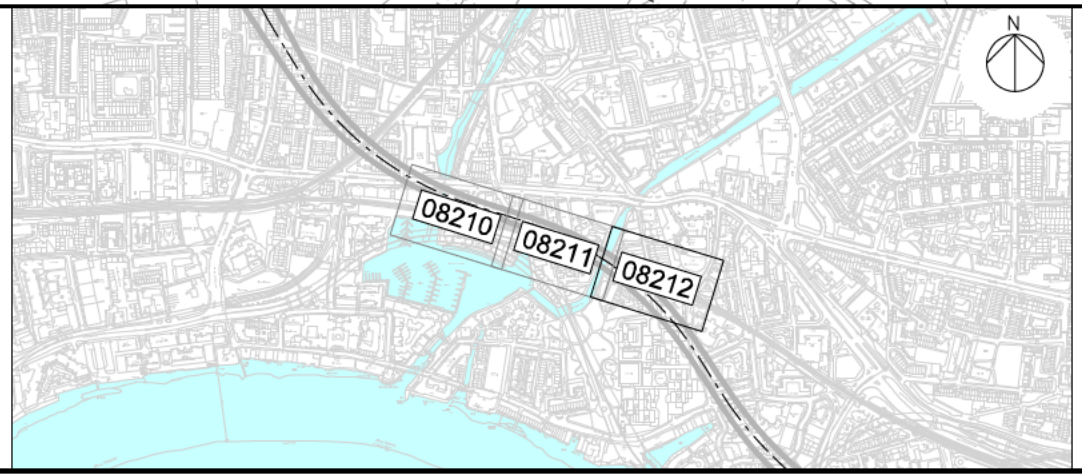
RESTRICTED





Rev.	Date	Description	By	Chkd	App	Auth
P01	25/02/2016	First Issue	MD	MD	MD	-

- Notes**
- 3D Prisms
  - ⊗ Automatic Total Station
  - Sockets



 Crossrail Limited 25 Canada Square London E14 6LQ		Contract: <b>Tunnels East - Drive Y LIM to FAR &amp; Drive Z SGJ to PML &amp; Drive G</b> Originator: <b>Dragados Sisk Joint Venture</b> Location: <b>Crossrail Tunnels - Drive Y (Limmo Peninsula to Farringdon Stn)</b>	
Title: <b>Instrumentation &amp; Monitoring          I&amp;M Installation Report for Limehouse DLR          Viaduct - 3D Prisms, ATS and Sockets (Drive Y)          C305-DSJ-C2-RGN-CRG03-50394</b>		By: M.DAVIS Chk: M.DAVIS App: M.DAVIS Auth: -	
Scale: <b>1:250 @ A1</b>		Drawing and CAD No: <b>C305-DSJ-C2-DDA-CRT00_ST006_1-08212</b>	
www.crossrail.co.uk		Rev: P01	Suitability: S4

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**APPENDIX B: SUMMARY OF INSTRUMENTATION INSTALLED ON SITE**

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IRS Installation Record Sheets - 3D Prisms/Retro Targets											
Sensor Type	Sensor ID	Date Installation	Status	SENSOR Location			Commissioning Reading				
				Eastings X (m)	Northings Y (m)	Elevation Z (mATD)		Eastings X (m)	Northings Y (m)	Elevation Z (mATD)	
3D Prism	C305-RP060001	12/07/2012	Installed	86631.12435	35679.3173	109.2684	AVERAGE	86631.1244	35679.3173	109.2684	
								20/08/2012	86631.1238	35679.3175	109.2688
								20/08/2012	86631.1247	35679.3167	109.2680
								20/08/2012	86631.1247	35679.3177	109.2684
3D Prism	C305-RP060002	13/07/2012	Installed	86631.0875	35679.2707	112.6166	AVERAGE	86631.0875	35679.2707	112.6166	
								20/08/2012	86631.0881	35679.2709	112.6164
								20/08/2012	86631.0869	35679.2705	112.6170
								20/08/2012	86631.0875	35679.2707	112.6164
3D Prism	C305-RP060003	12/07/2012	Installed	86631.8684	35687.4792	109.355	AVERAGE	86631.8684	35687.5152	109.3550	
								20/08/2012	86631.8689	35687.5154	109.3549
								20/08/2012	86631.8682	35687.5146	109.3556
								20/08/2012	86631.8681	35687.5156	109.3545
3D Prism	C305-RP060004	13/07/2012	Installed	86631.9214	35687.4792	112.5287	AVERAGE	86631.9214	35687.4792	112.5287	
								20/08/2012	86631.9210	35687.4795	112.5286
								20/08/2012	86631.9215	35687.4791	112.5289
								20/08/2012	86631.9217	35687.4790	112.5286
3D Prism	C305-RP060005	13/07/2012	Installed	86645.7762	35676.9732	111.7886	AVERAGE	86645.7762	35676.9732	111.7886	
								20/08/2012	86645.7761	35676.9734	111.7882
								20/08/2012	86645.7763	35676.9728	111.7888
								20/08/2012	86645.7762	35676.9734	111.7888
3D Prism	C305-RP060006	13/07/2012	Installed	86647.0981	35685.1081	111.8396	AVERAGE	86647.0981	35685.1081	111.8396	
								20/08/2012	86647.0976	35685.1086	111.8400
								20/08/2012	86647.0982	35685.1075	111.8392
								20/08/2012	86647.0985	35685.1082	111.8396
3D Prism	C305-RP060007	12/07/2012	Installed	86660.047	35674.6673	109.3633	AVERAGE	86660.0470	35674.6673	109.3633	
								20/08/2012	86660.0476	35674.6668	109.3631
								20/08/2012	86660.0466	35674.6676	109.3634
								20/08/2012	86660.0468	35674.6675	109.3634
3D Prism	C305-RP060008	13/07/2012	Installed	86659.9741	35674.6484	112.6931	AVERAGE	86659.9741	35674.6484	112.6931	
								20/08/2012	86659.9747	35674.6480	112.6936
								20/08/2012	86659.9737	35674.6488	112.6927
								20/08/2012	86659.9739	35674.6484	112.6930
3D Prism	C305-RP060009	12/07/2012	Installed	86661.1843	35682.8415	108.9251	AVERAGE	86661.1843	35682.8415	108.9251	
								20/08/2012	86661.1839	35682.8420	108.9246
								20/08/2012	86661.1846	35682.8412	108.9255
								20/08/2012	86661.1844	35682.8413	108.9252
3D Prism	C305-RP060010	12/07/2012	Installed	86661.204	35682.7917	112.7368	AVERAGE	86661.2040	35682.7917	112.7368	
								20/08/2012	86661.2042	35682.7916	112.7372
								20/08/2012	86661.2035	35682.7921	112.7362
								20/08/2012	86661.2043	35682.7914	112.7370
3D Prism	C305-RP060011	17/04/2013	Installed	86664.9257	35682.1591	112.6538	AVERAGE	86664.9257	35682.1591	112.6538	
								14/09/2013	86664.9255	35682.1592	112.6539
								14/09/2013	86664.9260	35682.1588	112.6532
								14/09/2013	86664.9256	35682.1593	112.6543
3D Prism	C305-RP060012	17/04/2013	Installed	86669.1686	35681.3982	112.6505	AVERAGE	86669.1686	35681.3982	112.6505	
								14/09/2013	86669.1692	35681.3978	112.6504
								14/09/2013	86669.1684	35681.3987	112.6507
								14/09/2013	86669.1682	35681.3981	112.6504
3D Prism	C305-RP060014	17/04/2013	Installed	86675.1624	35680.3129	112.2894	AVERAGE	86675.1624	35680.3129	112.2894	
								14/09/2013	86675.1622	35680.3128	112.2900
								14/09/2013	86675.1628	35680.3133	112.2890
								14/09/2013	86675.1622	35680.3126	112.2892
3D Prism	C305-RP060015	17/04/2013	Installed	86688.0449	35677.9752	108.3357	AVERAGE	86688.0449	35677.9752	108.3357	
								14/09/2013	86688.0454	35677.9754	108.3356
								14/09/2013	86688.0448	35677.9746	108.3363
								14/09/2013	86688.0445	35677.9756	108.3352
3D Prism	C305-RP060016	17/04/2013	Installed	86687.9485	35677.9955	110.4713	AVERAGE	86687.9485	35677.9955	110.4713	
								14/09/2013	86687.9479	35677.9949	110.4717
								14/09/2013	86687.9490	35677.9959	110.4711
								14/09/2013	86687.9486	35677.9957	110.4711
3D Prism	C305-RP060017	17/04/2013	Installed	86690.9606	35668.4266	108.2835	AVERAGE	86690.9606	35668.4266	108.2835	
								16/09/2013	86690.9604	35668.4268	108.2841
								16/09/2013	86690.9607	35668.4263	108.2834
								16/09/2013	86690.9607	35668.4267	108.2830

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Sensor Type	Sensor ID	Date Installation	Status	SENSOR Location			Commissioning Reading				
				Eastings X (m)	Northings Y (m)	Elevation Z (mATD)		Eastings X (m)	Northings Y (m)	Elevation Z (mATD)	
3D Prism	C305-RP060018	17/04/2013	Installed	86690.9322	35668.4119	110.3975	AVERAGE	86690.9322	35668.4119	110.3975	
								16/09/2013	86690.9320	35668.4122	110.3970
								16/09/2013	86690.9327	35668.4117	110.3978
								16/09/2013	86690.9319	35668.4118	110.3977
3D Prism	C305-RP060021	04/04/2013	Installed	86693.9244	35668.395	111.069	AVERAGE	86693.9281	35668.3904	111.0771	
								16/09/2013	86693.9283	35668.3909	111.0769
								16/09/2013	86693.9275	35668.3898	111.0776
								16/09/2013	86693.9285	35668.3905	111.0768
3D Prism	C305-RP060022	04/04/2013	Installed	86693.976	35668.309	113.114	AVERAGE	86693.9808	35668.3047	113.1215	
								16/09/2013	86693.9804	35668.3050	113.1209
								16/09/2013	86693.9812	35668.3041	113.1220
								16/09/2013	86693.9808	35668.3050	113.1216
3D Prism	C305-RP060025	04/04/2013	Installed	86700.221	35667.151	112.629	AVERAGE	86700.2254	35667.1466	112.6406	
								16/09/2013	86700.2259	35667.1460	112.6408
								16/09/2013	86700.2250	35667.1472	112.6400
								16/09/2013	86700.2253	35667.1466	112.6410
3D Prism	C305-RP060026	07/08/2012	Installed	86701.8699	35675.2493	112.7726	AVERAGE	86701.8699	35675.2493	112.7726	
								20/08/2012	86701.8693	35675.2487	112.7731
								20/08/2012	86701.8703	35675.2499	112.7724
								20/08/2012	86701.8701	35675.2493	112.7723
3D Prism	C305-RP060027	07/08/2012	Installed	86706.9283	35665.8471	111.7172	AVERAGE	86706.9283	35665.8471	111.7172	
								16/09/2013	86706.9280	35665.8472	111.7177
								16/09/2013	86706.9287	35665.8465	111.7170
								16/09/2013	86706.9282	35665.8476	111.7169
3D Prism	C305-RP060028	07/08/2012	Installed	86706.6614	35665.7622	113.667	AVERAGE	86706.6614	35665.7622	113.6670	
								16/09/2013	86706.6610	35665.7623	113.6669
								16/09/2013	86706.6618	35665.7620	113.6675
								16/09/2013	86706.6614	35665.7623	113.6666
3D Prism	C305-RP060029	07/08/2012	Installed	86708.0285	35673.9838	112.2391	AVERAGE	86708.1029	35673.9838	112.2391	
								20/08/2012	86708.1035	35673.9835	112.2397
								20/08/2012	86708.1026	35673.9844	112.2388
								20/08/2012	86708.1026	35673.9835	112.2388
3D Prism	C305-RP060030	07/08/2012	Installed	86707.8154	35674.0667	114.1319	AVERAGE	86707.8154	35674.0667	114.1319	
								20/08/2012	86707.8150	35674.0666	114.1322
								20/08/2012	86707.8160	35674.0670	114.1315
								20/08/2012	86707.8152	35674.0665	114.1320
3D Prism	C305-RP060031	04/04/2013	Installed	86713.113	35664.517	112.552	AVERAGE	86713.1180	35664.5094	112.5672	
								16/09/2013	86713.1179	35664.5093	112.5676
								16/09/2013	86713.1186	35664.5095	112.5669
								16/09/2013	86713.1175	35664.5094	112.5671
3D Prism	C305-RP060032	08/07/2012	Installed	86715.1371	35672.523	112.7621	AVERAGE	86715.1374	35672.5230	112.7621	
								20/08/2012	86715.1379	35672.5228	112.7619
								20/08/2012	86715.1370	35672.5236	112.7623
								20/08/2012	86715.1373	35672.5226	112.7621
3D Prism	C305-RP060033	04/04/2013	Installed	86719.779	35662.992	113.563	AVERAGE	86719.7772	35662.9827	113.5787	
								16/09/2013	86719.7769	35662.9831	113.5783
								16/09/2013	86719.7778	35662.9824	113.5793
								16/09/2013	86719.7769	35662.9826	113.5785
3D Prism	C305-RP060034	04/04/2013	Installed	86723.598	35662.332	112.366	AVERAGE	86723.5947	35662.3229	112.3820	
								16/09/2013	86723.5951	35662.3224	112.3824
								16/09/2013	86723.5942	35662.3231	112.3817
								16/09/2013	86723.5948	35662.3232	112.3819
3D Prism	C305-RP060035	07/08/2012	Installed	86724.4996	35670.5732	112.3055	AVERAGE	86724.4996	35670.5732	112.3055	
								14/09/2013	86724.4997	35670.5729	112.3059
								14/09/2013	86724.4994	35670.5737	112.3051
								14/09/2013	86724.4997	35670.5730	112.3055
3D Prism	C305-RP060036	07/08/2012	Installed	86723.6696	35670.7319	112.5289	AVERAGE	86723.6696	35670.7319	112.5289	
								14/09/2013	86723.6698	35670.7324	112.5294
								14/09/2013	86723.6692	35670.7316	112.5283
								14/09/2013	86723.6698	35670.7317	112.5290
3D Prism	C305-RP060037	16/07/2012	Installed	86737.0097	35659.3528	112.38	AVERAGE	86737.0097	35659.3528	112.3800	
								20/08/2012	86737.0101	35659.3526	112.3805
								20/08/2012	86737.0093	35659.3529	112.3795
								20/08/2012	86737.0097	35659.3529	112.3800

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				Eastings X (m)	Northings Y (m)	Elevation Z (mATD)		Eastings X (m)	Northings Y (m)	Elevation Z (mATD)	
3D Prism	C305-RP060038	16/07/2012	Installed	86737.301	35659.279	113.2412	AVERAGE	86737.3010	35659.2790	113.2412	
								20/08/2012	86737.3011	35659.2791	113.2406
								20/08/2012	86737.3005	35659.2785	113.2413
								20/08/2012	86737.3014	35659.2794	113.2417
3D Prism	C305-RP060039	07/08/2012	Installed	86736.7391	35667.843	112.1601	AVERAGE	86736.7391	35667.8430	112.1601	
								20/08/2012	86736.7397	35667.8429	112.1596
								20/08/2012	86736.7387	35667.8432	112.1603
								20/08/2012	86736.7389	35667.8429	112.1604
3D Prism	C305-RP060041	16/07/2012	Installed	86741.9667	35658.1802	112.358	AVERAGE	86741.9667	35658.1802	112.3580	
								16/09/2013	86741.9662	35658.1807	112.3578
								16/09/2013	86741.9673	35658.1798	112.3584
								16/09/2013	86741.9666	35658.1801	112.3578
3D Prism	C305-RP060042	17/07/2012	Installed	86743.7422	35666.2002	112.5327	AVERAGE	86743.7422	35666.2002	112.5327	
								20/08/2012	86743.7420	35666.2006	112.5326
								20/08/2012	86743.7428	35666.2000	112.5328
								20/08/2012	86743.7418	35666.2000	112.5327
3D Prism	C305-RP060043	16/07/2012	Installed	86746.9	35657.0369	111.6421	AVERAGE	86746.9000	35657.0369	111.6421	
								20/08/2012	86746.9003	35657.0364	111.6418
								20/08/2012	86746.8998	35657.0370	111.6425
								20/08/2012	86746.8999	35657.0373	111.6420
3D Prism	C305-RP060044	16/07/2012	Installed	86746.881	35656.9143	113.4973	AVERAGE	86746.8810	35656.9143	113.4973	
								20/08/2012	86746.8812	35656.9142	113.4974
								20/08/2012	86746.8804	35656.9149	113.4967
								20/08/2012	86746.8814	35656.9138	113.4978
3D Prism	C305-RP060045	17/07/2012	Installed	86748.6769	35665.0622	111.437	AVERAGE	86748.6769	35665.0622	111.4370	
								20/08/2012	86748.6768	35665.0616	111.4371
								20/08/2012	86748.6775	35665.0624	111.4369
								20/08/2012	86748.6764	35665.0626	111.4370
3D Prism	C305-RP060046	17/07/2012	Installed	86748.7936	35665.1129	113.6171	AVERAGE	86748.7936	35665.1129	113.6171	
								20/08/2012	86748.7931	35665.1128	113.6169
								20/08/2012	86748.7939	35665.1132	113.6174
								20/08/2012	86748.7938	35665.1127	113.6170
3D Prism	C305-RP060047	16/07/2012	Installed	86751.9483	35655.8302	112.3251	AVERAGE	86751.9483	35655.8302	112.3251	
								20/08/2012	86751.9485	35655.8305	112.3257
								20/08/2012	86751.9478	35655.8301	112.3248
								20/08/2012	86751.9486	35655.8300	112.3248
3D Prism	C305-RP060048	17/07/2012	Installed	86753.7192	35663.8458	112.453	AVERAGE	86753.7192	35663.8458	112.4530	
								20/08/2012	86753.7188	35663.8457	112.4532
								20/08/2012	86753.7197	35663.8461	112.4530
								20/08/2012	86753.7191	35663.8456	112.4528
3D Prism	C305-RP060049	16/07/2012	Installed	86756.8579	35654.692	110.9861	AVERAGE	86756.8579	35654.6920	110.9861	
								20/08/2012	86756.8581	35654.6914	110.9867
								20/08/2012	86756.8573	35654.6924	110.9855
								20/08/2012	86756.8583	35654.6922	110.9861
3D Prism	C305-RP060050	16/07/2012	Installed	86756.8499	35654.548	113.4145	AVERAGE	86756.8499	35654.5480	113.4145	
								20/08/2012	86756.8504	35654.5475	113.4150
								20/08/2012	86756.8497	35654.5485	113.4143
								20/08/2012	86756.8496	35654.5480	113.4142
3D Prism	C305-RP060051	17/07/2012	Installed	86758.6731	35662.7024	111.2516	AVERAGE	86758.6731	35662.7024	111.2516	
								20/08/2012	86758.6730	35662.7029	111.2517
								20/08/2012	86758.6735	35662.7018	111.2512
								20/08/2012	86758.6728	35662.7025	111.2519
3D Prism	C305-RP060052	17/07/2012	Installed	86758.707	35662.7488	113.5473	AVERAGE	86758.7070	35662.7488	113.5473	
								20/08/2012	86758.7074	35662.7493	113.5470
								20/08/2012	86758.7069	35662.7483	113.5477
								20/08/2012	86758.7067	35662.7488	113.5472
3D Prism	C305-RP060053	16/07/2012	Installed	86761.8755	35653.474	112.237	AVERAGE	86761.8755	35653.4740	112.2370	
								20/08/2012	86761.8756	35653.4734	112.2373
								20/08/2012	86761.8754	35653.4740	112.2364
								20/08/2012	86761.8755	35653.4746	112.2373
3D Prism	C305-RP060054	17/07/2012	Installed	86763.7323	35661.4698	112.456	AVERAGE	86763.7323	35661.4698	112.4560	
								20/08/2012	86763.7318	35661.4701	112.4566
								20/08/2012	86763.7326	35661.4694	112.4554
								20/08/2012	86763.7325	35661.4699	112.4560

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				Eastings X (m)	Northings Y (m)	Elevation Z (mATD)		Eastings X (m)	Northings Y (m)	Elevation Z (mATD)	
3D Prism	C305-RP060055	16/07/2012	Installed	86766.8539	35652.3055	110.7623	AVERAGE	86766.8539	35652.3055	110.7623	
								20/08/2012	86766.8533	35652.3049	110.7627
								20/08/2012	86766.8542	35652.3061	110.7617
								20/08/2012	86766.8542	35652.3055	110.7625
3D Prism	C305-RP060056	04/04/2013	Installed	86766.714	35652.158	113.303	AVERAGE	86766.6989	35652.1550	113.3092	
								16/09/2013	86766.6993	35652.1554	113.3097
								16/09/2013	86766.6986	35652.1544	113.3091
								16/09/2013	86766.6988	35652.1552	113.3088
3D Prism	C305-RP060057	17/07/2012	Installed	86768.7119	35660.3018	110.5976	AVERAGE	86768.7119	35660.3018	110.5976	
								20/08/2012	86768.7117	35660.3019	110.5970
								20/08/2012	86768.7125	35660.3014	110.5982
								20/08/2012	86768.7115	35660.3021	110.5976
3D Prism	C305-RP060058	17/07/2012	Installed	86768.6244	35660.3361	113.4625	AVERAGE	86768.6244	35660.3361	113.4625	
								20/08/2012	86768.6240	35660.3363	113.4628
								20/08/2012	86768.6247	35660.3355	113.4622
								20/08/2012	86768.6245	35660.3365	113.4625
3D Prism	C305-RP060059	16/07/2012	Installed	86771.783	35651.0556	112.1313	AVERAGE	86771.7830	35651.0556	112.1313	
								20/08/2012	86771.7832	35651.0557	112.1317
								20/08/2012	86771.7825	35651.0554	112.1310
								20/08/2012	86771.7833	35651.0557	112.1312
3D Prism	C305-RP060060	17/07/2012	Installed	86773.6708	35659.0378	112.3725	AVERAGE	86773.6708	35659.0378	112.3725	
								20/08/2012	86773.6703	35659.0373	112.3723
								20/08/2012	86773.6709	35659.0382	112.3726
								20/08/2012	86773.6712	35659.0379	112.3726
3D Prism	C305-RP060061	16/07/2012	Installed	86776.6796	35649.8327	110.436	AVERAGE	86776.6796	35649.8327	110.4360	
								20/08/2012	86776.6791	35649.8325	110.4358
								20/08/2012	86776.6797	35649.8332	110.4365
								20/08/2012	86776.6800	35649.8324	110.4357
3D Prism	C305-RP060062	04/04/2013	Installed	86776.705	35649.671	113.237	AVERAGE	86776.6901	35649.6689	113.2420	
								16/09/2013	86776.6899	35649.6683	113.2417
								16/09/2013	86776.6907	35649.6694	113.2425
								16/09/2013	86776.6897	35649.6690	113.2418
3D Prism	C305-RP060063	17/07/2012	Installed	86778.5735	35657.8248	110.5833	AVERAGE	86778.5735	35657.8248	110.5833	
								20/08/2012	86778.5738	35657.8242	110.5829
								20/08/2012	86778.5730	35657.8252	110.5835
								20/08/2012	86778.5737	35657.8250	110.5835
3D Prism	C305-RP060064	17/07/2012	Installed	86778.6614	35657.8584	113.382	AVERAGE	86778.6614	35657.8584	113.3820	
								20/08/2012	86778.6612	35657.8583	113.3815
								20/08/2012	86778.6618	35657.8589	113.3824
								20/08/2012	86778.6612	35657.8580	113.3821
3D Prism	C305-RP060065	16/07/2012	Installed	86781.634	35648.5638	112.0798	AVERAGE	86781.6340	35648.5638	112.0798	
								20/08/2012	86781.6343	35648.5644	112.0793
								20/08/2012	86781.6337	35648.5634	112.0802
								20/08/2012	86781.6340	35648.5636	112.0799
3D Prism	C305-RP060066	17/07/2012	Installed	86783.5596	35656.5568	112.2776	AVERAGE	86783.5596	35656.5568	112.2776	
								20/08/2012	86783.5601	35656.5573	112.2782
								20/08/2012	86783.5591	35656.5564	112.2773
								20/08/2012	86783.5596	35656.5567	112.2773
3D Prism	C305-RP060067	17/07/2012	Installed	86786.3774	35647.3689	110.2715	AVERAGE	86786.3774	35647.3689	110.2715	
								20/08/2012	86786.3770	35647.3695	110.2719
								20/08/2012	86786.3780	35647.3685	110.2712
								20/08/2012	86786.3772	35647.3687	110.2714
3D Prism	C305-RP060068	04/04/2013	Installed	86786.587	35647.191	113.135	AVERAGE	86786.5726	35647.1888	113.1373	
								16/09/2013	86786.5727	35647.1883	113.1367
								16/09/2013	86786.5721	35647.1893	113.1374
								16/09/2013	86786.5730	35647.1888	113.1378
3D Prism	C305-RP060070	17/07/2012	Installed	86788.3942	35655.3929	113.3082	AVERAGE	86788.3942	35655.3929	113.3082	
								14/09/2013	86788.3947	35655.3927	113.3085
								14/09/2013	86788.3937	35655.3931	113.3081
								14/09/2013	86788.3942	35655.3929	113.3080
3D Prism	C305-RP060071	17/07/2012	Installed	86793.506	35645.4904	111.8827	AVERAGE	86793.5060	35645.4904	111.8827	
								20/08/2012	86793.5056	35645.4903	111.8822
								20/08/2012	86793.5062	35645.4909	111.8832
								20/08/2012	86793.5062	35645.4900	111.8827

IRS Installation Record Sheets - 3D Prisms/Retro Targets											
Sensor Type	Sensor ID	Date Installation	Status	SENSOR Location			Commissioning Reading				
				Eastings X (m)	Northings Y (m)	Elevation Z (mATD)		Eastings X (m)	Northings Y (m)	Elevation Z (mATD)	
3D Prism	C305-RP060073	17/07/2012	Installed	86799.9893	35643.8104	110.2738	AVERAGE	86799.9893	35643.8104	110.2738	
								20/08/2012	86799.9895	35643.8098	110.2735
								20/08/2012	86799.9887	35643.8107	110.2741
								20/08/2012	86799.9897	35643.8107	110.2738
3D Prism	C305-RP060074	04/04/2013	Installed	86799.89	35643.75	113.086	AVERAGE	86799.8771	35643.7479	113.0877	
								16/09/2013	86799.8769	35643.7477	113.0876
								16/09/2013	86799.8774	35643.7482	113.0883
								16/09/2013	86799.8770	35643.7478	113.0872
3D Prism	C305-RP060077	17/07/2012	Installed	86806.9601	35641.9813	111.914	AVERAGE	86806.9601	35641.9813	111.9140	
								20/08/2012	86806.9605	35641.9819	111.9136
								20/08/2012	86806.9596	35641.9812	111.9145
								20/08/2012	86806.9602	35641.9808	111.9139
3D Prism	C305-RP060079	16/07/2012	Installed	86815.1694	35639.8629	110.1693	AVERAGE	86815.1694	35639.8629	110.1693	
								20/08/2012	86815.1688	35639.8630	110.1690
								20/08/2012	86815.1698	35639.8624	110.1699
								20/08/2012	86815.1696	35639.8633	110.1690
3D Prism	C305-RP060080	16/07/2012	Installed	86815.4054	35639.8649	113.8537	AVERAGE	86815.4054	35639.8649	113.8537	
								16/07/2012	86815.4059	35639.8645	113.8538
								16/07/2012	86815.4051	35639.8651	113.8535
								16/07/2012	86815.4052	35639.8651	113.8538
3D Prism	C305-RP060081	16/04/2013	Installed	86816.6968	35647.4459	111.5775	AVERAGE	86816.6968	35647.4459	111.5775	
								16/04/2013	86816.6965	35647.4465	111.5780
								16/04/2013	86816.6970	35647.4457	111.5773
								16/04/2013	86816.6969	35647.4455	111.5772
3D Prism	C305-RP060082	16/04/2013	Installed	86815.4071	35648.358	113.4103	AVERAGE	86815.4071	35648.3580	113.4103	
								16/04/2013	86815.4066	35648.3582	113.4108
								16/04/2013	86815.4077	35648.3577	113.4102
								16/04/2013	86815.4070	35648.3581	113.4099
3D Prism	C305-RP060083	04/04/2013	Installed	86827.31765	35636.56727	112.755	AVERAGE	86827.3177	35636.5673	112.7550	
								04/04/2013	86827.3174	35636.5675	112.7553
								04/04/2013	86827.3179	35636.5670	112.7547
								04/04/2013	86827.3178	35636.5674	112.7550
3D Prism	C305-RP060084	17/07/2012	Installed	86827.3232	35636.5942	112.7651	AVERAGE	86827.3232	35636.5942	112.7651	
								17/07/2012	86827.3231	35636.5940	112.7646
								17/07/2012	86827.3234	35636.5946	112.7653
								17/07/2012	86827.3231	35636.5940	112.7654
3D Prism	C305-RP060085	16/04/2013	Installed	86825.6532	35645.4574	111.1378	AVERAGE	86825.6532	35645.4574	111.1378	
								16/04/2013	86825.6529	35645.4576	111.1377
								16/04/2013	86825.6537	35645.4573	111.1380
								16/04/2013	86825.6530	35645.4573	111.1377
3D Prism	C305-RP060086	16/04/2013	Installed	86825.5898	35645.7945	113.0644	AVERAGE	86825.5898	35645.7945	113.0644	
								16/04/2013	86825.5897	35645.7948	113.0640
								16/04/2013	86825.5903	35645.7939	113.0649
								16/04/2013	86825.5894	35645.7948	113.0643
3D Prism	C305-RP060087	17/07/2012	Installed	86832.808	35635.0716	111.866	AVERAGE	86832.8080	35635.0716	111.8660	
								17/07/2012	86832.8077	35635.0715	111.8658
								17/07/2012	86832.8084	35635.0722	111.8665
								17/07/2012	86832.8079	35635.0711	111.8657
3D Prism	C305-RP060089	04/04/2013	Installed	86835.526	35634.291	113.946	AVERAGE	86835.5260	35634.2910	113.9460	
								04/04/2013	86835.5263	35634.2906	113.9456
								04/04/2013	86835.5259	35634.2914	113.9462
								04/04/2013	86835.5258	35634.2910	113.9462
3D Prism	C305-RP060101	04/04/2013	Installed	86852.2183	35629.4434	111.7276	AVERAGE	86852.2183	35629.4434	111.7276	
								06/09/2013	86852.2180	35629.4429	111.7271
								06/09/2013	86852.2187	35629.4437	111.7282
								06/09/2013	86852.2182	35629.4436	111.7275
3D Prism	C305-RP060102	04/04/2013	Installed	86852.0773	35629.5137	113.4128	AVERAGE	86852.0773	35629.5137	113.4128	
								06/09/2013	86852.0779	35629.5132	113.4123
								06/09/2013	86852.0768	35629.5139	113.4134
								06/09/2013	86852.0772	35629.5140	113.4127
3D Prism	C305-RP060105	04/04/2013	Installed	86857.1745	35628.0154	113.0878	AVERAGE	86857.1745	35628.0154	113.0878	
								06/09/2013	86857.1746	35628.0158	113.0877
								06/09/2013	86857.1743	35628.0150	113.0882
								06/09/2013	86857.1746	35628.0154	113.0875



IRS Installation Record Sheets - 3D Prisms/Retro Targets											
Sensor Type	Sensor ID	Date Installation	Status	SENSOR Location			Commissioning Reading				
				Eastings X (m)	Northings Y (m)	Elevation Z (mATD)		Eastings X (m)	Northings Y (m)	Elevation Z (mATD)	
3D Prism	C305-RP060106	19/07/2013	Installed	86858.6106	35637.9607	112.9819	AVERAGE	86858.6106	35637.9607	112.9819	
								16/09/2013	86858.6105	35637.9602	112.9824
								16/09/2013	86858.6112	35637.9613	112.9818
								16/09/2013	86858.6101	35637.9606	112.9815
3D Prism	C305-RP060107	19/07/2013	Installed	86861.1651	35626.8004	110.1377	AVERAGE	86861.1651	35626.8004	110.1377	
								06/09/2013	86861.1650	35626.8008	110.1380
								06/09/2013	86861.1655	35626.8001	110.1371
								06/09/2013	86861.1648	35626.8003	110.1380
3D Prism	C305-RP060109	19/07/2013	Installed	86860.0814	35637.0637	111.5565	AVERAGE	86860.0814	35637.0637	111.5565	
								16/09/2013	86860.0818	35637.0633	111.5560
								16/09/2013	86860.0808	35637.0643	111.5566
								16/09/2013	86860.0816	35637.0635	111.5569
3D Prism	C305-RP060110	19/07/2013	Installed	86860.0985	35637.0628	113.5641	AVERAGE	86860.0985	35637.0628	113.5641	
								16/09/2013	86860.0982	35637.0630	113.5640
								16/09/2013	86860.0987	35637.0622	113.5643
								16/09/2013	86860.0986	35637.0632	113.5640
3D Prism	C305-RP060111	19/07/2012	Installed	86871.5289	35623.5904	110.1984	AVERAGE	86871.5289	35623.5904	110.1984	
								20/08/2012	86871.5283	35623.5898	110.1980
								20/08/2012	86871.5290	35623.5908	110.1990
								20/08/2012	86871.5294	35623.5906	110.1982
3D Prism	C305-RP060112	19/07/2012	Installed	86871.4366	35623.656	112.7167	AVERAGE	86871.4366	35623.6560	112.7167	
								20/08/2012	86871.4360	35623.6564	112.7161
								20/08/2012	86871.4370	35623.6559	112.7170
								20/08/2012	86871.4368	35623.6557	112.7170
3D Prism	C305-RP060113	19/07/2012	Installed	86872.0014	35632.0801	110.5273	AVERAGE	86872.0014	35632.0801	110.5273	
								20/08/2012	86872.0020	35632.0798	110.5272
								20/08/2012	86872.0013	35632.0805	110.5274
								20/08/2012	86872.0009	35632.0800	110.5273
3D Prism	C305-RP060114	19/07/2012	Installed	86871.9043	35632.0984	113.0515	AVERAGE	86871.9043	35632.0984	113.0515	
								20/08/2012	86871.9040	35632.0986	113.0518
								20/08/2012	86871.9045	35632.0978	113.0513
								20/08/2012	86871.9044	35632.0988	113.0514
3D Prism	C305-RP060115	19/07/2012	Installed	86879.905	35620.9222	111.2344	AVERAGE	86879.9050	35620.9222	111.2344	
								20/08/2012	86879.9054	35620.9219	111.2338
								20/08/2012	86879.9046	35620.9224	111.2350
								20/08/2012	86879.9050	35620.9223	111.2344
3D Prism	C305-RP060116	19/07/2012	Installed	86877.7795	35630.3088	111.1882	AVERAGE	86877.7795	35630.3088	111.1882	
								20/08/2012	86877.7798	35630.3087	111.1880
								20/08/2012	86877.7792	35630.3091	111.1887
								20/08/2012	86877.7795	35630.3086	111.1879
3D Prism	C305-RP060117	19/07/2012	Installed	86885.7207	35619.1143	109.9403	AVERAGE	86885.7207	35619.1143	109.9403	
								20/08/2012	86885.7206	35619.1145	109.9408
								20/08/2012	86885.7209	35619.1137	109.9399
								20/08/2012	86885.7206	35619.1147	109.9402
3D Prism	C305-RP060118	19/07/2012	Installed	86885.3663	35619.1532	112.7122	AVERAGE	86885.3663	35619.1532	112.7122	
								20/08/2012	86885.3669	35619.1534	112.7123
								20/08/2012	86885.3659	35619.1529	112.7118
								20/08/2012	86885.3661	35619.1533	112.7125
3D Prism	C305-RP060119	19/07/2012	Installed	86884.4776	35628.2209	110.18	AVERAGE	86884.4776	35628.2209	110.1800	
								20/08/2012	86884.4780	35628.2210	110.1806
								20/08/2012	86884.4772	35628.2205	110.1797
								20/08/2012	86884.4776	35628.2212	110.1797
3D Prism	C305-RP060120	19/07/2012	Installed	86884.4384	35628.1657	112.8195	AVERAGE	86884.4384	35628.1657	112.8195	
								20/08/2012	86884.4379	35628.1653	112.8200
								20/08/2012	86884.4390	35628.1660	112.8194
								20/08/2012	86884.4383	35628.1658	112.8191
3D Prism	C305-RP060121	19/07/2012	Installed	86891.7463	35617.1081	110.9872	AVERAGE	86891.7463	35617.1091	110.9872	
								20/08/2012	86891.7459	35617.1095	110.9874
								20/08/2012	86891.7466	35617.1087	110.9870
								20/08/2012	86891.7464	35617.1091	110.9872
3D Prism	C305-RP060122	19/07/2012	Installed	86891.0385	35626.1446	111.0512	AVERAGE	86891.0383	35626.1446	111.0514	
								20/08/2012	86891.0381	35626.1441	111.0520
								20/08/2012	86891.0386	35626.1452	111.0511
								20/08/2012	86891.0382	35626.1445	111.0511

IRS Installation Record Sheets - 3D Prisms/Retro Targets											
Sensor Type	Sensor ID	Date Installation	Status	SENSOR Location			Commissioning Reading				
				Eastings X (m)	Northings Y (m)	Elevation Z (mATD)		Eastings X (m)	Northings Y (m)	Elevation Z (mATD)	
3D Prism	C305-RP060124	19/07/2012	Installed	86897.5237	35615.2536	109.6516	AVERAGE	86897.5312	35615.2596	109.6600	
								20/08/2012	86897.5313	35615.2600	109.6604
								20/08/2012	86897.5306	35615.2592	109.6598
								20/08/2012	86897.5317	35615.2596	109.6598
3D Prism	C305-RP060125	19/07/2012	Installed	86897.2621	35615.2344	112.5429	AVERAGE	86897.2621	35615.2344	112.5429	
								20/08/2012	86897.2624	35615.2346	112.5425
								20/08/2012	86897.2619	35615.2342	112.5432
								20/08/2012	86897.2620	35615.2344	112.5430
3D Prism	C305-RP060126	19/07/2012	Installed	86896.2793	35624.4088	110.2142	AVERAGE	86896.2793	35624.4088	110.2142	
								20/08/2012	86896.2797	35624.4082	110.2143
								20/08/2012	86896.2790	35624.4089	110.2137
								20/08/2012	86896.2792	35624.4093	110.2146
3D Prism	C305-RP060127	19/07/2012	Installed	86896.3758	35624.2908	112.873	AVERAGE	86896.3758	35624.2908	112.8730	
								20/08/2012	86896.3763	35624.2912	112.8733
								20/08/2012	86896.3754	35624.2904	112.8726
								20/08/2012	86896.3757	35624.2908	112.8731
3D Prism	C305-RP060128	19/07/2012	Installed	86902.7498	35613.5458	110.9482	AVERAGE	86902.7498	35613.5458	110.9482	
								20/08/2012	86902.7497	35613.5455	110.9488
								20/08/2012	86902.7502	35613.5459	110.9477
								20/08/2012	86902.7495	35613.5460	110.9481
3D Prism	C305-RP060129	19/07/2012	Installed	86901.609	35622.7015	110.9333	AVERAGE	86901.6090	35622.7015	110.9333	
								20/08/2012	86901.6094	35622.7013	110.9335
								20/08/2012	86901.6085	35622.7020	110.9329
								20/08/2012	86901.6091	35622.7012	110.9335
3D Prism	C305-RP060130	19/07/2014	Installed	86907.9847	35611.8664	109.5545	AVERAGE	86907.9924	35611.8731	109.5632	
								20/08/2012	86907.9920	35611.8725	109.5629
								20/08/2012	86907.9925	35611.8732	109.5633
								20/08/2012	86907.9927	35611.8736	109.5634
3D Prism	C305-RP060131	16/04/2013	Installed	86907.9245	35611.7432	112.2999	AVERAGE	86907.9245	35611.7432	112.2999	
								06/09/2013	86907.9248	35611.7435	112.3003
								06/09/2013	86907.9241	35611.7426	112.2997
								06/09/2013	86907.9246	35611.7435	112.2997
3D Prism	C305-RP060132	19/07/2012	Installed	86906.6577	35620.9888	110.15	AVERAGE	86906.6577	35620.9888	110.1500	
								20/08/2012	86906.6581	35620.9893	110.1498
								20/08/2012	86906.6576	35620.9883	110.1503
								20/08/2012	86906.6574	35620.9888	110.1499
3D Prism	C305-RP060133	19/07/2012	Installed	86906.5882	35620.9309	112.7088	AVERAGE	86906.5882	35620.9309	112.7088	
								20/08/2012	86906.5883	35620.9311	112.7093
								20/08/2012	86906.5879	35620.9308	112.7087
								20/08/2012	86906.5884	35620.9308	112.7084
3D Prism	C305-RP060134	19/07/2012	Installed	86913.4946	35609.9714	110.754	AVERAGE	86913.4946	35609.9714	110.7540	
								20/08/2012	86913.4945	35609.9711	110.7544
								20/08/2012	86913.4949	35609.9717	110.7536
								20/08/2012	86913.4944	35609.9714	110.7540
3D Prism	C305-RP060135	19/07/2012	Installed	86912.6552	35618.9841	110.5271	AVERAGE	86912.6552	35618.9841	110.8104	
								20/08/2012	86912.6556	35618.9836	110.8106
								20/08/2012	86912.6551	35618.9844	110.8099
								20/08/2012	86912.6549	35618.9843	110.8107
3D Prism	C305-RP060136	19/07/2012	Installed	86919.3105	35608.0011	109.5018	AVERAGE	86919.3105	35608.0011	109.5018	
								20/08/2012	86919.3108	35608.0006	109.5014
								20/08/2012	86919.3104	35608.0017	109.5019
								20/08/2012	86919.3103	35608.0010	109.5021
3D Prism	C305-RP060137	19/07/2012	Installed	86919.2815	35607.9708	112.1717	AVERAGE	86919.2915	35607.9708	112.1717	
								20/08/2012	86919.2914	35607.9703	112.1718
								20/08/2012	86919.2917	35607.9709	112.1712
								20/08/2012	86919.2914	35607.9712	112.1721
3D Prism	C305-RP060138	19/07/2012	Installed	86918.2566	35617.0433	109.7839	AVERAGE	86918.2566	35617.0433	109.7839	
								20/08/2012	86918.2572	35617.0428	109.7836
								20/08/2012	86918.2562	35617.0434	109.7840
								20/08/2012	86918.2564	35617.0437	109.7841
3D Prism	C305-RP060139	19/07/2012	Installed	86918.2665	35616.9853	112.4476	AVERAGE	86918.2665	35616.9853	112.4476	
								20/08/2012	86918.2666	35616.9851	112.4478
								20/08/2012	86918.2663	35616.9858	112.4472
								20/08/2012	86918.2666	35616.9850	112.4478

IRS Installation Record Sheets - 3D Prisms/Retro Targets											
Sensor Type	Sensor ID	Date Installation	Status	SENSOR Location			Commissioning Reading				
				Eastings X (m)	Northings Y (m)	Elevation Z (mATD)		Eastings X (m)	Northings Y (m)	Elevation Z (mATD)	
3D Prism	C305-RP060140	19/07/2012	Installed	86924.4221	35606.2328	110.673	AVERAGE	86924.4221	35606.2328	110.6730	
								20/08/2012	86924.4217	35606.2324	110.6736
								20/08/2012	86924.4222	35606.2334	110.6725
								20/08/2012	86924.4224	35606.2326	110.6729
3D Prism	C305-RP060141	19/07/2012	Installed	86923.7158	35615.1773	110.6163	AVERAGE	86923.7158	35615.1773	110.6163	
								20/08/2012	86923.7152	35615.1771	110.6161
								20/08/2012	86923.7161	35615.1775	110.6168
								20/08/2012	86923.7161	35615.1773	110.6160
3D Prism	C305-RP060142	19/07/2012	Installed	86929.5976	35604.4483	109.4217	AVERAGE	86929.5976	35604.4483	109.4217	
								20/08/2012	86929.5980	35604.4479	109.4223
								20/08/2012	86929.5972	35604.4488	109.4212
								20/08/2012	86929.5976	35604.4482	109.4216
3D Prism	C305-RP060143	19/07/2012	Installed	86929.6513	35604.3611	112.063	AVERAGE	86929.6513	35604.3611	112.0630	
								20/08/2012	86929.6509	35604.3610	112.0626
								20/08/2012	86929.6517	35604.3613	112.0632
								20/08/2012	86929.6513	35604.3610	112.0632
3D Prism	C305-RP060144	19/07/2012	Installed	86928.3471	35613.5862	109.4512	AVERAGE	86928.3471	35613.5862	109.4512	
								20/08/2012	86928.3466	35613.5864	109.4507
								20/08/2012	86928.3472	35613.5857	109.4517
								20/08/2012	86928.3475	35613.5865	109.4512
3D Prism	C305-RP060145	19/07/2012	Installed	86928.6552	35613.5579	111.9714	AVERAGE	86928.6552	35613.5579	111.9714	
								06/09/2013	86928.6548	35613.5574	111.9720
								06/09/2013	86928.6558	35613.5581	111.9708
								06/09/2013	86928.6550	35613.5582	111.9714
3D Prism	C305-RP060146	19/07/2012	Installed	86936.5212	35601.9264	110.5529	AVERAGE	86936.5212	35601.9264	110.5529	
								20/08/2012	86936.5211	35601.9261	110.5528
								20/08/2012	86936.5215	35601.9267	110.5532
								20/08/2012	86936.5210	35601.9264	110.5527
3D Prism	C305-RP060147	19/07/2012	Installed	86935.4177	35611.182	110.8118	AVERAGE	86935.4177	35611.1820	110.8118	
								16/09/2013	86935.4175	35611.1825	110.8119
								16/09/2013	86935.4183	35611.1815	110.8112
								16/09/2013	86935.4173	35611.1820	110.8123
3D Prism	C305-RP060148	19/07/2012	Installed	86942.9777	35599.7167	109.4351	AVERAGE	86942.9777	35599.7167	109.4351	
								20/08/2012	86942.9782	35599.7173	109.4348
								20/08/2012	86942.9771	35599.7164	109.4356
								20/08/2012	86942.9778	35599.7164	109.4349
3D Prism	C305-RP060149	19/07/2012	Installed	86943.9025	35608.1544	110.0371	AVERAGE	86943.9025	35608.1544	110.0371	
								20/08/2012	86943.9031	35608.1538	110.0367
								20/08/2012	86943.9020	35608.1546	110.0376
								20/08/2012	86943.9024	35608.1548	110.0370
3D Prism	C305-RP060150	19/07/2012	Installed	86945.8713	35598.0137	109.3111	AVERAGE	86945.8713	35598.0137	109.3111	
								06/09/2013	86945.8719	35598.0139	109.3109
								06/09/2013	86945.8710	35598.0131	109.3117
								06/09/2013	86945.8710	35598.0141	109.3107
3D Prism	C305-RP060151	19/07/2012	Installed	86948.8051	35606.9289	109.3167	AVERAGE	86948.8051	35606.9289	109.3167	
								06/09/2013	86948.8048	35606.9286	109.3166
								06/09/2013	86948.8055	35606.9291	109.3168
								06/09/2013	86948.8050	35606.9290	109.3167
3D Prism	C305-RP060152	19/07/2012	Installed	86956.829	35594.4942	109.8499	AVERAGE	86956.8290	35594.4942	109.8499	
								06/09/2013	86956.8292	35594.4944	109.8498
								06/09/2013	86956.8288	35594.4938	109.8501
								06/09/2013	86956.8290	35594.4944	109.8498
3D Prism	C305-RP060154	31/07/2012	Installed	86975.36	35586.7526	109.655	AVERAGE	86975.3600	35586.7526	109.6550	
								20/08/2012	86975.3602	35586.7521	109.6553
								20/08/2012	86975.3599	35586.7532	109.6544
								20/08/2012	86975.3599	35586.7525	109.6553
3D Prism	C305-RP060155	30/07/2012	Installed	86978.8044	35595.542	110.5649	AVERAGE	86978.8044	35595.5420	110.5649	
								06/09/2013	86978.8047	35595.5416	110.5647
								06/09/2013	86978.8040	35595.5426	110.5654
								06/09/2013	86978.8045	35595.5418	110.5646
3D Prism	C305-RP060156	31/07/2012	Installed	86977.9677	35585.7135	109.7395	AVERAGE	86977.9677	35585.7135	109.7395	
								20/08/2012	86977.9674	35585.7133	109.7398
								20/08/2012	86977.9680	35585.7139	109.7393
								20/08/2012	86977.9677	35585.7133	109.7394

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				Eastings X (m)	Northings Y (m)	Elevation Z (mATD)		Eastings X (m)	Northings Y (m)	Elevation Z (mATD)	
3D Prism	C305-RP060157	30/07/2012	Installed	86980.9669	35594.7055	110.217	AVERAGE	86980.9669	35594.7055	110.2170	
								06/09/2013	86980.9671	35594.7057	110.2165
								06/09/2013	86980.9666	35594.7053	110.2171
								06/09/2013	86980.9670	35594.7055	110.2174
3D Prism	C305-RP060158	31/07/2012	Installed	86982.8674	35584.3933	110.3487	AVERAGE	86982.8674	35584.3933	110.3487	
								20/08/2012	86982.8670	35584.3937	110.3487
								20/08/2012	86982.8676	35584.3928	110.3483
								20/08/2012	86982.8676	35584.3934	110.3491
3D Prism	C305-RP060159	30/07/2012	Installed	86986.9634	35590.9409	109.9633	AVERAGE	86986.9634	35590.9409	109.9633	
								09/09/2013	86986.9640	35590.9415	109.9629
								09/09/2013	86986.9629	35590.9403	109.9639
								09/09/2013	86986.9633	35590.9409	109.9631
3D Prism	C305-RP060160	31/07/2012	Installed	86988.7535	35582.067	108.7572	AVERAGE	86988.7535	35582.0670	108.7572	
								20/08/2012	86988.7537	35582.0671	108.7574
								20/08/2012	86988.7531	35582.0669	108.7570
								20/08/2012	86988.7537	35582.0670	108.7572
3D Prism	C305-RP060161	01/08/2012	Installed	86988.754	35581.9926	111.5288	AVERAGE	86988.7540	35581.9926	111.5288	
								20/08/2012	86988.7541	35581.9923	111.5286
								20/08/2012	86988.7538	35581.9930	111.5290
								20/08/2012	86988.7541	35581.9925	111.5288
3D Prism	C305-RP060162	30/07/2012	Installed	86990.2201	35590.0195	109.0643	AVERAGE	86990.2201	35590.0195	109.0643	
								09/09/2013	86990.2204	35590.0196	109.0637
								09/09/2013	86990.2198	35590.0194	109.0648
								09/09/2013	86990.2201	35590.0195	109.0644
3D Prism	C305-RP060163	01/08/2012	Installed	86991.8456	35589.5971	111.6107	AVERAGE	86991.8707	35589.6834	111.6135	
								20/08/2012	86991.8704	35589.6831	111.6137
								20/08/2012	86991.8711	35589.6838	111.6131
								20/08/2012	86991.8706	35589.6833	111.6137
3D Prism	C305-RP060164	01/08/2012	Installed	86993.4491	35580.141	110.5811	AVERAGE	86993.4491	35580.1410	110.5811	
								20/08/2012	86993.4490	35580.1415	110.5806
								20/08/2012	86993.4496	35580.1409	110.5813
								20/08/2012	86993.4487	35580.1406	110.5814
3D Prism	C305-RP060165	30/07/2012	Installed	86997.3657	35586.9538	109.7567	AVERAGE	86997.3657	35586.9538	109.7567	
								09/09/2013	86997.3652	35586.9544	109.7571
								09/09/2013	86997.3659	35586.9537	109.7561
								09/09/2013	86997.3660	35586.9533	109.7569
3D Prism	C305-RP060166	31/07/2012	Installed	86998.1239	35578.2442	108.6022	AVERAGE	86998.1239	35578.2442	108.6022	
								20/08/2012	86998.1234	35578.2445	108.6016
								20/08/2012	86998.1244	35578.2436	108.6025
								20/08/2012	86998.1239	35578.2445	108.6025
3D Prism	C305-RP060167	01/08/2012	Installed	86998.1087	35578.1857	111.437	AVERAGE	86998.1087	35578.1857	111.4370	
								20/08/2012	86998.1082	35578.1851	111.4374
								20/08/2012	86998.1088	35578.1863	111.4366
								20/08/2012	86998.1091	35578.1857	111.4370
3D Prism	C305-RP060168	30/07/2012	Installed	86999.7392	35586.2514	109.0744	AVERAGE	86999.7392	35586.2514	109.0744	
								09/09/2013	86999.7391	35586.2508	109.0748
								09/09/2013	86999.7394	35586.2516	109.0742
								09/09/2013	86999.7391	35586.2518	109.0742
3D Prism	C305-RP060169	01/08/2012	Installed	87001.4037	35585.79	111.4699	AVERAGE	87001.4037	35585.7900	111.4699	
								20/08/2012	87001.4032	35585.7897	111.4705
								20/08/2012	87001.4038	35585.7905	111.4695
								20/08/2012	87001.4041	35585.7897	111.4697
3D Prism	C305-RP060170	01/08/2012	Installed	87002.8695	35576.2767	110.2577	AVERAGE	87002.8695	35576.2767	110.2577	
								20/08/2012	87002.8700	35576.2771	110.2575
								20/08/2012	87002.8693	35576.2763	110.2582
								20/08/2012	87002.8692	35576.2767	110.2574
3D Prism	C305-RP060171	30/07/2012	Installed	87008.4483	35582.6905	109.4996	AVERAGE	87008.4483	35582.6905	109.4996	
								09/09/2013	87008.4480	35582.6906	109.4997
								09/09/2013	87008.4485	35582.6901	109.4995
								09/09/2013	87008.4484	35582.6908	109.4996
3D Prism	C305-RP060172	31/07/2012	Installed	87007.5604	35574.3268	108.8233	AVERAGE	87007.5604	35574.3268	108.8232	
								20/08/2012	87007.5598	35574.3265	108.8230
								20/08/2012	87007.5610	35574.3271	108.8235
								20/08/2012	87007.5604	35574.3268	108.8231

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				Eastings X (m)	Northings Y (m)	Elevation Z (mATD)		Eastings X (m)	Northings Y (m)	Elevation Z (mATD)	
3D Prism	C305-RP060173	01/08/2012	Installed	87007.5663	35574.2645	111.3021	AVERAGE	87007.5663	35574.2645	111.3021	
								20/08/2012	87007.5661	35574.2651	111.3019
								20/08/2012	87007.5665	35574.2643	111.3027
								20/08/2012	87007.5663	35574.2641	111.3017
3D Prism	C305-RP060174	30/07/2012	Installed	87009.3694	35582.2346	108.8261	AVERAGE	87009.3694	35582.2346	108.8261	
								09/09/2013	87009.3693	35582.2348	108.8264
								09/09/2013	87009.3700	35582.2344	108.8255
								09/09/2013	87009.3689	35582.2346	108.8264
3D Prism	C305-RP060175	01/08/2012	Installed	87011.1565	35581.7619	111.358	AVERAGE	87011.1565	35581.7619	111.3580	
								20/08/2012	87011.1571	35581.7618	111.3578
								20/08/2012	87011.1563	35581.7621	111.3586
								20/08/2012	87011.1561	35581.7618	111.3576
3D Prism	C305-RP060176	01/08/2012	Installed	87012.8775	35572.0797	110.2373	AVERAGE	87012.8775	35572.0797	110.2376	
								20/08/2012	87012.8781	35572.0796	110.2374
								20/08/2012	87012.8773	35572.0801	110.2377
								20/08/2012	87012.8771	35572.0794	110.2377
3D Prism	C305-RP060177	30/07/2012	Installed	87018.5082	35569.7182	108.5778	AVERAGE	87018.5082	35569.7182	108.5778	
								20/08/2012	87018.5078	35569.7185	108.5772
								20/08/2012	87018.5086	35569.7176	108.5779
								20/08/2012	87018.5082	35569.7185	108.5783
3D Prism	C305-RP060178	31/07/2012	Installed	87018.444	35569.6267	111.3353	AVERAGE	87018.4440	35569.6267	111.3353	
								31/07/2012	87018.4441	35569.6271	111.3354
								31/07/2012	87018.4435	35569.6266	111.3348
								31/07/2012	87018.4444	35569.6264	111.3357
3D Prism	C305-RP060179	01/08/2012	Installed	87015.6522	35579.7842	111.5902	AVERAGE	87015.6522	35579.7842	111.5902	
								10/09/2013	87015.6527	35579.7844	111.5897
								10/09/2013	87015.6516	35579.7840	111.5908
								10/09/2013	87015.6523	35579.7842	111.5901
3D Prism	C305-RP060182	01/08/2012	Installed	87024.8944	35566.9494	110.0084	AVERAGE	87024.8944	35566.9494	110.0084	
								20/08/2012	87024.8945	35566.9490	110.0083
								20/08/2012	87024.8939	35566.9498	110.0089
								20/08/2012	87024.8948	35566.9494	110.0080
3D Prism	C305-RP060183	30/07/2012	Installed	87031.0978	35573.4197	109.9105	AVERAGE	87031.0978	35573.4197	109.9105	
								10/09/2013	87031.0974	35573.4201	109.9099
								10/09/2013	87031.0981	35573.4196	109.9107
								10/09/2013	87031.0979	35573.4194	109.9109
3D Prism	C305-RP060184	01/08/2012	Installed	87031.244	35564.1928	108.5621	AVERAGE	87031.2440	35564.1928	108.5621	
								20/08/2012	87031.2439	35564.1929	108.5622
								20/08/2012	87031.2443	35564.1927	108.5617
								20/08/2012	87031.2438	35564.1928	108.5624
3D Prism	C305-RP060185	01/08/2012	Installed	87031.1866	35564.1036	111.1302	AVERAGE	87031.1866	35564.1036	111.1302	
								20/08/2012	87031.1861	35564.1037	111.1305
								20/08/2012	87031.1870	35564.1030	111.1296
								20/08/2012	87031.1867	35564.1041	111.1305
3D Prism	C305-RP060186	30/07/2012	Installed	87037.4644	35570.7298	109.2547	AVERAGE	87037.4644	35570.7298	109.2547	
								10/09/2013	87037.4638	35570.7294	109.2548
								10/09/2013	87037.4649	35570.7303	109.2543
								10/09/2013	87037.4645	35570.7297	109.2550
3D Prism	C305-RP060187	12/04/2013	Installed	87037.3053	35570.8348	110.9713	AVERAGE	87037.3053	35570.8348	110.9713	
								10/09/2013	87037.3048	35570.8346	110.9715
								10/09/2013	87037.3055	35570.8354	110.9712
								10/09/2013	87037.3056	35570.8344	110.9712
3D Prism	C305-RP060188	01/08/2012	Installed	87036.7144	35561.7493	110.0026	AVERAGE	87036.7144	35561.7493	110.0026	
								20/08/2012	87036.7143	35561.7488	110.0022
								20/08/2012	87036.7147	35561.7494	110.0029
								20/08/2012	87036.7142	35561.7497	110.0027
3D Prism	C305-RP060189	30/07/2012	Installed	87038.1249	35570.4767	109.745	AVERAGE	87038.1249	35570.4767	109.7450	
								10/09/2013	87038.1245	35570.4773	109.7445
								10/09/2013	87038.1250	35570.4766	109.7455
								10/09/2013	87038.1252	35570.4762	109.7450
3D Prism	C305-RP060190	31/07/2012	Installed	87040.2561	35559.7929	108.5408	AVERAGE	87040.2561	35559.7929	108.5408	
								20/08/2012	87040.2558	35559.7926	108.5413
								20/08/2012	87040.2565	35559.7934	108.5405
								20/08/2012	87040.2560	35559.7927	108.5406



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				Eastings X (m)	Northings Y (m)	Elevation Z (mATD)		Eastings X (m)	Northings Y (m)	Elevation Z (mATD)	
3D Prism	C305-RP060191	31/07/2012	Installed	87041.606	35559.1796	108.5283	AVERAGE	87041.6060	35559.1796	108.5283	
								20/08/2012	87041.6059	35559.1792	108.5284
								20/08/2012	87041.6063	35559.1800	108.5278
								20/08/2012	87041.6058	35559.1796	108.5287
3D Prism	C305-RP060192	30/07/2012	Installed	87038.1864	35570.4633	111.5731	AVERAGE	87038.1864	35570.4633	111.5731	
								10/09/2013	87038.1867	35570.4628	111.5725
								10/09/2013	87038.1861	35570.4637	111.5737
								10/09/2013	87038.1864	35570.4634	111.5731
3D Prism	C305-RP060193	12/04/2013	Installed	87039.1037	35570.0316	109.5905	AVERAGE	87039.1037	35570.0316	109.5905	
								10/09/2013	87039.1038	35570.0310	109.5902
								10/09/2013	87039.1031	35570.0317	109.5906
								10/09/2013	87039.1042	35570.0321	109.5907
3D Prism	C305-RP060194	31/07/2012	Installed	87050.6213	35555.0253	108.8766	AVERAGE	87050.6213	35555.0253	108.8766	
								20/08/2012	87050.6218	35555.0251	108.8768
								20/08/2012	87050.6209	35555.0254	108.8765
								20/08/2012	87050.6212	35555.0254	108.8765
3D Prism	C305-RP060195	31/07/2012	Installed	87050.81	35555.0602	111.1024	AVERAGE	87050.8100	35555.0602	111.1024	
								06/09/2013	87050.8095	35555.0599	111.1030
								06/09/2013	87050.8103	35555.0606	111.1023
								06/09/2013	87050.8102	35555.0601	111.1019
3D Prism	C305-RP060196	06/08/2012	Installed	87048.4397	35565.8646	110.1371	AVERAGE	87048.4397	35565.8646	110.1371	
								20/08/2012	87048.4396	35565.8648	110.1374
								20/08/2012	87048.4400	35565.8645	110.1369
								20/08/2012	87048.4395	35565.8645	110.1370
3D Prism	C305-RP060197	06/08/2012	Installed	87049.8671	35565.251	110.2198	AVERAGE	87049.8671	35565.2510	110.2198	
								20/08/2012	87049.8665	35565.2509	110.2200
								20/08/2012	87049.8674	35565.2514	110.2193
								20/08/2012	87049.8674	35565.2507	110.2201
3D Prism	C305-RP060198	12/04/2013	Installed	87060.5245	35559.9536	109.8051	AVERAGE	87060.5245	35559.9536	109.8051	
								10/09/2013	87060.5239	35559.9534	109.8057
								10/09/2013	87060.5247	35559.9539	109.8050
								10/09/2013	87060.5249	35559.9535	109.8046
3D Prism	C305-RP060199	06/08/2012	Installed	87056.204	35552.8612	110.9702	AVERAGE	87056.2040	35552.8612	110.9702	
								12/09/2013	87056.2044	35552.8617	110.9707
								12/09/2013	87056.2035	35552.8606	110.9700
								12/09/2013	87056.2041	35552.8613	110.9699
3D Prism	C305-RP060200	03/08/2012	Installed	87062.5137	35550.0425	108.8695	AVERAGE	87062.5137	35550.0425	108.8695	
								20/08/2012	87062.5139	35550.0419	108.8697
								20/08/2012	87062.5135	35550.0427	108.8690
								20/08/2012	87062.5137	35550.0429	108.8698
3D Prism	C305-RP060201	03/08/2012	Installed	87062.5576	35549.9698	110.9591	AVERAGE	87062.5576	35549.9698	110.9591	
								20/08/2012	87062.5574	35549.9702	110.9588
								20/08/2012	87062.5579	35549.9695	110.9594
								20/08/2012	87062.5575	35549.9697	110.9591
3D Prism	C305-RP060202	06/08/2012	Installed	87065.5867	35557.6309	109.205	AVERAGE	87065.5867	35557.6309	109.2050	
								10/09/2013	87065.5864	35557.6312	109.2049
								10/09/2013	87065.5869	35557.6305	109.2055
								10/09/2013	87065.5868	35557.6310	109.2046
3D Prism	C305-RP060203	06/08/2012	Installed	87065.5766	35557.5975	111.1598	AVERAGE	87065.5766	35557.5975	111.1598	
								10/09/2013	87065.5762	35557.5971	111.1600
								10/09/2013	87065.5771	35557.5977	111.1597
								10/09/2013	87065.5765	35557.5977	111.1597
3D Prism	C305-RP060204	03/08/2012	Installed	87066.0422	35548.3898	109.9466	AVERAGE	87066.0422	35548.3898	109.9466	
								20/08/2012	87066.0423	35548.3896	109.9465
								20/08/2012	87066.0420	35548.3902	109.9471
								20/08/2012	87066.0423	35548.3896	109.9462
3D Prism	C305-RP060205	06/08/2012	Installed	87069.2805	35556.0626	109.705	AVERAGE	87069.2805	35556.0626	109.7050	
								10/09/2013	87069.2800	35556.0623	109.7054
								10/09/2013	87069.2811	35556.0627	109.7044
								10/09/2013	87069.2804	35556.0628	109.7052
3D Prism	C305-RP060206	03/08/2012	Installed	87069.3261	35546.4397	109.5523	AVERAGE	87069.3261	35546.4397	109.5523	
								20/08/2012	87069.3257	35546.4393	109.5526
								20/08/2012	87069.3264	35546.4398	109.5521
								20/08/2012	87069.3262	35546.4400	109.5522

IRS Installation Record Sheets - 3D Prisms/Retro Targets											
Sensor Type	Sensor ID	Date Installation	Status	SENSOR Location			Commissioning Reading				
				Eastings X (m)	Northings Y (m)	Elevation Z (mATD)		Eastings X (m)	Northings Y (m)	Elevation Z (mATD)	
3D Prism	C305-RP060207	03/08/2012	Installed	87070.6508	35545.8296	109.5409	AVERAGE	87070.6508	35545.8296	109.5409	
								20/08/2012	87070.6509	35545.8290	109.5411
								20/08/2012	87070.6502	35545.8301	109.5408
								20/08/2012	87070.6513	35545.8297	109.5408
3D Prism	C305-RP060208	06/08/2012	Installed	87073.0692	35554.1789	109.3192	AVERAGE	87073.0692	35554.1789	109.3192	
								10/09/2013	87073.0687	35554.1792	109.3198
								10/09/2013	87073.0698	35554.1784	109.3190
								10/09/2013	87073.0691	35554.1791	109.3188
3D Prism	C305-RP060209	06/08/2012	Installed	87072.9938	35554.1449	111.1198	AVERAGE	87072.9938	35554.1449	111.1198	
								10/09/2013	87072.9936	35554.1446	111.1199
								10/09/2013	87072.9939	35554.1454	111.1196
								10/09/2013	87072.9939	35554.1447	111.1199
3D Prism	C305-RP060210	06/08/2012	Installed	87077.9218	35551.9124	109.7433	AVERAGE	87077.9218	35551.9124	109.7433	
								20/08/2012	87077.9212	35551.9126	109.7439
								20/08/2012	87077.9223	35551.9123	109.7428
								20/08/2012	87077.9219	35551.9123	109.7432
3D Prism	C305-RP060211	03/08/2012	Installed	87082.683	35540.1084	109.2998	AVERAGE	87082.6830	35540.1094	109.2998	
								20/08/2012	87082.6827	35540.1090	109.2994
								20/08/2012	87082.6835	35540.1098	109.3004
								20/08/2012	87082.6828	35540.1094	109.2996
3D Prism	C305-RP060212	03/08/2012	Installed	87083.8804	35539.5458	109.2959	AVERAGE	87083.8804	35539.5458	109.2959	
								20/08/2012	87083.8810	35539.5464	109.2963
								20/08/2012	87083.8798	35539.5457	109.2955
								20/08/2012	87083.8804	35539.5453	109.2959
3D Prism	C305-RP060213	06/08/2012	Installed	87086.7405	35548.1313	109.869	AVERAGE	87086.7446	35548.1254	109.8753	
								20/08/2012	87086.7448	35548.1250	109.8754
								20/08/2012	87086.7441	35548.1259	109.8751
								20/08/2012	87086.7449	35548.1253	109.8754
3D Prism	C305-RP060214	06/08/2012	Installed	87088.364	35547.3929	109.852	AVERAGE	87088.3818	35547.3782	110.0153	
								20/08/2012	87088.3814	35547.3778	110.0154
								20/08/2012	87088.3819	35547.3788	110.0151
								20/08/2012	87088.3821	35547.3780	110.0154
3D Prism	C305-RP060215	06/08/2012	Installed	87099.9395	35532.0732	109.8708	AVERAGE	87099.9395	35532.0732	109.8708	
								20/08/2012	87099.9389	35532.0727	109.8703
								20/08/2012	87099.9397	35532.0738	109.8710
								20/08/2012	87099.9399	35532.0731	109.8711
3D Prism	C305-RP060216	06/08/2012	Installed	87100.2597	35541.5531	109.7206	AVERAGE	87100.2575	35541.5351	109.7272	
								20/08/2012	87100.2570	35541.5349	109.7273
								20/08/2012	87100.2579	35541.5354	109.7269
								20/08/2012	87100.2576	35541.5350	109.7274
3D Prism	C305-RP060217	06/08/2012	Installed	87101.6194	35540.8675	109.4049	AVERAGE	87101.5366	35540.8925	109.8055	
								20/08/2012	87101.5363	35540.8926	109.8050
								20/08/2012	87101.5372	35540.8924	109.8056
								20/08/2012	87101.5363	35540.8925	109.8059
3D Prism	C305-RP060218	06/08/2012	Installed	87102.9673	35530.189	110.3771	AVERAGE	87102.9673	35530.1890	110.3771	
								20/08/2012	87102.9677	35530.1884	110.3774
								20/08/2012	87102.9671	35530.1894	110.3768
								20/08/2012	87102.9671	35530.1892	110.3771
3D Prism	C305-RP060219	06/08/2012	Installed	87104.4657	35529.4485	109.9826	AVERAGE	87104.4657	35529.4485	109.9826	
								20/08/2012	87104.4663	35529.4484	109.9831
								20/08/2012	87104.4655	35529.4486	109.9825
								20/08/2012	87104.4653	35529.4485	109.9822
3D Prism	C305-RP060220	06/08/2012	Installed	87115.5386	35524.2739	109.7165	AVERAGE	87115.5521	35524.2739	109.7165	
								20/08/2012	87115.5516	35524.2737	109.7166
								20/08/2012	87115.5526	35524.2741	109.7163
								20/08/2012	87115.5521	35524.2739	109.7166

NOTE: INSTRUMENT CO-ORDINATES (see tables above)

Sensors installation location co-ordinates were taken during installation using GPS or Total Station (with reference to the London Grid Network). Commissioning readings of the system were then taken using ATS reading of the same Sensors resulting in negligible differences in co-ordinates due to accuracy of instrument type.

IRS Installation Record Sheets - Automatic Total Station							
Sensor Type	Sensor ID	Date Installation	Status	SENSOR			Commissioning Reading
				Eastings X (m)	Northings Y (m)	Elevation Z (mATD)	
ATS	C305-ATS1LM	11/09/2013	Installed	86662.6274	35688.0881	113.7469	N/A
ATS	C305-ATS2LM	17/09/2013	Installed	86722.8985	35646.7033	117.9317	N/A
ATS	C305-ATS3LM	12/09/2013	Installed	86791.3794	35658.13	117.2249	N/A
ATS	C305-ATS5LM	09/06/2013	Installed	86849.9763	35625.3869	113.4189	N/A
ATS	C305-ATS6LM	15/07/2013	Installed	86871.6791	35637.2939	116.8542	N/A
ATS	C305-ATS8LM	11/06/2013	Installed	86973.5103	35554.6878	111.151	N/A
ATS	C305-ATS9LM	11/07/2013	Installed	87097.131	35529.1227	115.7595	N/A
ATS	C305-ATS10LM	29/08/2013	Installed	87047.8744	35567.2265	114.1173	N/A

Learning Legacy Document

IRS Installation Record Sheets - 3D Prisms/Retro Targets											
Sensor Type	Sensor ID	Date Installation	Status	SENSOR Location			Commissioning Reading				
				Eastings X (m)	Northings Y (m)	Elevation Z (mATD)					
Socket	C305-LB060001	12/09/2013	Installed	86725.2862	35663.6152	110.3768	AVERAGE	13/09/2013	13/09/2013	13/09/2013	13/09/2013
							110.3768	110.3769	110.3764	110.3769	110.3769
Socket	C305-LB060002	12/09/2013	Installed	86735.9754	35661.2226	110.4619	AVERAGE	13/09/2013	13/09/2013	13/09/2013	13/09/2013
							110.4619	110.4620	110.4617	110.4620	110.4620
Socket	C305-LB060003	12/09/2013	Installed	86861.2913	35630.2075	108.8633	AVERAGE	11/09/2013	11/09/2013	11/09/2013	11/09/2013
							108.8633	108.8630	108.8629	108.8638	108.8638
Socket	C305-LB060004	12/09/2013	Installed	86869.5823	35627.7317	108.9253	AVERAGE	11/09/2013	11/09/2013	11/09/2013	11/09/2013
							108.9253	108.9255	108.9256	108.9250	108.9250
Socket	C305-LB060005	12/09/2013	Installed	86862.429	35627.6676	108.8181	AVERAGE	11/09/2013	11/09/2013	11/09/2013	11/09/2013
							108.8181	108.8179	108.8181	180.8182	180.8182
Socket	C305-LB060006	12/09/2013	Installed	86870.0104	35627.7192	108.7111	AVERAGE	11/09/2013	11/09/2013	11/09/2013	11/09/2013
							108.7110	108.7111	108.7114	108.7106	108.7106
Socket	C305-LB064804	28/05/2013	Installed	87109.449	35536.24	106.653	AVERAGE	11/07/2013	11/07/2013	11/07/2013	11/07/2013
							106.6533	106.6538	106.6527	106.6534	106.6534
Socket	C305-LB064805	28/05/2013	Installed	87100.018	35540.545	106.483	AVERAGE	11/07/2013	11/07/2013	11/07/2013	11/07/2013
							106.4826	106.4827	106.4822	106.4829	106.4829
Socket	C305-LB064806	28/05/2013	Installed	87050.478	35556.617	106.618	AVERAGE	11/07/2013	11/07/2013	11/07/2013	11/07/2013
							106.6182	106.6187	106.6179	106.6180	106.6180
Socket	C305-LB064807	28/05/2013	Installed	87041.79	35560.443	106.669	AVERAGE	11/07/2013	11/07/2013	11/07/2013	11/07/2013
							106.6692	106.6688	106.6698	106.6690	106.6690
Socket	C305-LB067605	17/09/2013	Installed	86689.073	35677.763	107.2915	AVERAGE	29/09/2013	29/09/2013	29/09/2013	29/09/2013
							106.6233	106.6235	106.6230	106.6234	106.6234
Socket	C305-LB067606	17/09/2013	Installed	86662.894	35682.529	107.2931	AVERAGE	30/09/2013	30/09/2013	30/09/2013	30/09/2013
							106.6242	106.6240	106.6245	106.6241	106.6241

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Instrumentation summary –Track levelling Eastbound Cess

The first levelling track point C305-LT061101, located approximately 38 meters away from C305 WB tunnel centre line (Project chainage 81400 aprox). All other points follow Eastwards at 3m centre.

Sensor Type	Sensor ID	SENSOR Location - GPS reading (m)		
		Eastings X	Northings Y	Elevation Z (mATD)
Levelling point	C305-LT061101	86628.526	35685.856	113.797
Levelling point	C305-LT061102	86631.494	35685.425	113.795
Levelling point	C305-LT061103	86634.463	35684.995	113.792
Levelling point	C305-LT061104	86637.432	35684.564	113.793
Levelling point	C305-LT061105	86640.401	35684.133	113.793
Levelling point	C305-LT061106	86643.38	35683.674	113.793
Levelling point	C305-LT061107	86646.34	35683.186	113.793
Levelling point	C305-LT061108	86649.3	35682.697	113.792
Levelling point	C305-LT061109	86652.26	35682.209	113.790
Levelling point	C305-LT061110	86655.22	35681.721	113.792
Levelling point	C305-LT061111	86658.18	35681.232	113.790
Levelling point	C305-LT061112	86661.14	35680.744	113.791
Levelling point	C305-LT061113	86664.1	35680.256	113.798
Levelling point	C305-LT061114	86667.06	35679.767	113.801
Levelling point	C305-LT061115	86670.025	35679.224	113.809
Levelling point	C305-LT061116	86672.975	35678.676	113.815
Levelling point	C305-LT061117	86675.9240	35678.1280	113.825
Levelling point	C305-LT061118	86678.874	35677.579	113.828
Levelling point	C305-LT061119	86681.823	35677.031	113.831
Levelling point	C305-LT061120	86684.773	35676.483	113.832
Levelling point	C305-LT061121	86687.722	35675.935	113.835
Levelling point	C305-LT061122	86690.671	35675.387	113.840
Levelling point	C305-LT061123	86693.628	35674.834	113.843
Levelling point	C305-LT061124	86696.571	35674.255	113.846
Levelling point	C305-LT061125	86699.515	35673.676	113.854
Levelling point	C305-LT061126	86702.459	35673.097	113.859
Levelling point	C305-LT061127	86705.402	35672.518	113.863
Levelling point	C305-LT061128	86708.346	35671.94	113.867
Levelling point	C305-LT061129	86711.29	35671.361	113.873
Levelling point	C305-LT061130	86714.233	35670.782	113.883
Levelling point	C305-LT061131	86717.177	35670.203	113.894
Levelling point	C305-LT061132	86720.12	35669.624	113.899
Levelling point	C305-LT061133	86723.068	35669	113.906
Levelling point	C305-LT061134	86726.001	35668.369	113.920
Levelling point	C305-LT061135	86728.934	35667.737	113.931
Levelling point	C305-LT061136	86731.866	35667.106	113.939
Levelling point	C305-LT061137	86734.799	35666.474	113.947
Levelling point	C305-LT061138	86737.732	35665.843	113.954
Levelling point	C305-LT061139	86740.665	35665.211	113.963
Levelling point	C305-LT061140	86743.597	35664.58	113.972
Levelling point	C305-LT061141	86746.53	35663.948	113.985
Levelling point	C305-LT061142	86749.468	35663.265	113.995
Levelling point	C305-LT061143	86752.386	35662.57	114.008
Levelling point	C305-LT061144	86755.304	35661.874	114.019
Levelling point	C305-LT061145	86758.222	35661.179	114.033
Levelling point	C305-LT061146	86761.141	35660.483	114.046
Levelling point	C305-LT061147	86764.069	35659.767	114.060
Levelling point	C305-LT061148	86766.972	35659.01	114.074
Levelling point	C305-LT061149	86769.8750	35658.2530	114.087
Levelling point	C305-LT061150	86772.778	35657.496	114.094
Levelling point	C305-LT061151	86775.679	35656.743	114.106
Levelling point	C305-LT061152	86778.585	35656	114.115
Levelling point	C305-LT061153	86781.492	35655.257	114.129
Levelling point	C305-LT061154	86784.398	35654.513	114.146
Levelling point	C305-LT061155	86787.305	35653.77	114.163



Sensor Type	Sensor ID	SENSOR Location - GPS reading (m)		
		Eastings X	Northings Y	Elevation Z (mATD)
Levelling point	C305-LT061156	86790.211	35653.027	114.182
Levelling point	C305-LT061157	86793.118	35652.283	114.197
Levelling point	C305-LT061158	86796.024	35651.54	114.210
Levelling point	C305-LT061159	86798.93	35650.797	114.219
Levelling point	C305-LT061160	86801.837	35650.053	114.227
Levelling point	C305-LT061161	86804.756	35649.304	114.234
Levelling point	C305-LT061162	86807.648	35648.506	114.243
Levelling point	C305-LT061163	86810.54	35647.708	114.254
Levelling point	C305-LT061164	86813.432	35646.909	114.260
Levelling point	C305-LT061165	86816.323	35646.111	114.274
Levelling point	C305-LT061166	86819.2150	35645.3130	114.270
Levelling point	C305-LT061167	86822.107	35644.514	114.263
Levelling point	C305-LT061168	86824.999	35643.716	114.253
Levelling point	C305-LT061169	86827.891	35642.918	114.239
Levelling point	C305-LT061170	86830.782	35642.119	114.220
Levelling point	C305-LT061171	86833.674	35641.321	114.198
Levelling point	C305-LT061172	86836.566	35640.456	114.173
Levelling point	C305-LT061173	86839.437	35639.584	114.142
Levelling point	C305-LT061174	86842.295	35638.732	114.106
Levelling point	C305-LT061175	86845.185	35637.929	114.067
Levelling point	C305-LT061176	86848.076	35637.125	114.028
Levelling point	C305-LT061177	86850.966	35636.322	113.987
Levelling point	C305-LT061178	86853.857	35635.519	113.945
Levelling point	C305-LT061179	86856.748	35634.672	113.906
Levelling point	C305-LT061180	86859.624	35633.816	113.870
Levelling point	C305-LT061181	86862.499	35632.96	113.831
Levelling point	C305-LT061182	86865.374	35632.105	113.789
Levelling point	C305-LT061183	86868.25	35631.249	113.748
Levelling point	C305-LT061184	86871.129	35630.385	113.704
Levelling point	C305-LT061185	86873.997	35629.507	113.663
Levelling point	C305-LT061186	86876.866	35628.628	113.620
Levelling point	C305-LT061187	86879.734	35627.75	113.579
Levelling point	C305-LT061188	86882.603	35626.872	113.539
Levelling point	C305-LT061189	86885.466	35625.939	113.497
Levelling point	C305-LT061190	86888.321	35625.017	113.458
Levelling point	C305-LT061191	86891.175	35624.094	113.414
Levelling point	C305-LT061192	86894.03	35623.171	113.371
Levelling point	C305-LT061193	86896.884	35622.248	113.332
Levelling point	C305-LT061194	86899.739	35621.325	113.292
Levelling point	C305-LT061195	86902.606	35620.394	113.251
Levelling point	C305-LT061196	86905.441	35619.412	113.208
Levelling point	C305-LT061197	86908.276	35618.43	113.169
Levelling point	C305-LT061198	86911.11	35617.448	113.127
Levelling point	C305-LT061199	86913.945	35616.466	113.083
Levelling point	C305-LT061200	86916.78	35615.484	113.041
Levelling point	C305-LT061201	86919.615	35614.502	113.002
Levelling point	C305-LT061202	86922.449	35613.52	112.963
Levelling point	C305-LT061203	86925.284	35612.538	112.923
Levelling point	C305-LT061204	86928.121	35611.54	112.882
Levelling point	C305-LT061205	86930.946	35610.529	112.842
Levelling point	C305-LT061206	86933.77	35609.517	112.801
Levelling point	C305-LT061207	86936.594	35608.506	112.761
Levelling point	C305-LT061208	86939.419	35607.494	112.719
Levelling point	C305-LT061209	86942.243	35606.483	112.673
Levelling point	C305-LT061210	86945.067	35605.471	112.633
Levelling point	C305-LT061211	86947.895	35604.433	112.590
Levelling point	C305-LT061212	86950.702	35603.374	112.548
Levelling point	C305-LT061213	86953.509	35602.316	112.506
Levelling point	C305-LT061214	86956.316	35601.258	112.463
Levelling point	C305-LT061215	86959.123	35600.199	112.425
Levelling point	C305-LT061216	86961.93	35599.141	112.387
Levelling point	C305-LT061217	86964.741	35598.071	112.346

Sensor Type	Sensor ID	SENSOR Location - GPS reading (m)		
		Eastings X	Northings Y	Elevation Z (mATD)
Levelling point	C305-LT061218	86967.537	35596.986	112.311
Levelling point	C305-LT061219	86970.334	35595.9	112.274
Levelling point	C305-LT061220	86973.131	35594.814	112.237
Levelling point	C305-LT061221	86975.859	35593.754	112.206
Levelling point	C305-LT061222	86978.778	35592.777	112.174
Levelling point	C305-LT061223	86981.559	35591.65	112.146
Levelling point	C305-LT061224	86984.339	35590.523	112.115
Levelling point	C305-LT061225	86987.119	35589.396	112.087
Levelling point	C305-LT061226	86989.9	35588.27	112.066
Levelling point	C305-LT061227	86992.68	35587.143	112.043
Levelling point	C305-LT061228	86995.458	35586.001	112.024
Levelling point	C305-LT061229	86998.233	35584.859	112.009
Levelling point	C305-LT061230	87001.007	35583.718	111.994
Levelling point	C305-LT061231	87003.781	35582.576	111.980
Levelling point	C305-LT061232	87006.556	35581.435	111.961
Levelling point	C305-LT061233	87009.33	35580.293	111.949
Levelling point	C305-LT061234	87012.109	35579.138	111.938
Levelling point	C305-LT061235	87014.868	35577.96	111.923
Levelling point	C305-LT061236	87017.627	35576.783	111.905
Levelling point	C305-LT061237	87020.386	35575.605	111.890
Levelling point	C305-LT061238	87023.145	35574.427	111.882
Levelling point	C305-LT061239	87025.905	35573.249	111.871
Levelling point	C305-LT061240	87028.663	35572.061	111.853
Levelling point	C305-LT061241	87031.417	35570.871	111.838
Levelling point	C305-LT061242	87034.171	35569.681	111.827
Levelling point	C305-LT061243	87036.924	35568.49	111.812
Levelling point	C305-LT061244	87039.678	35567.3	111.805
Levelling point	C305-LT061245	87042.433	35566.099	111.795
Levelling point	C305-LT061246	87045.178	35564.889	111.782
Levelling point	C305-LT061247	87047.923	35563.678	111.764
Levelling point	C305-LT061248	87050.668	35562.468	111.750
Levelling point	C305-LT061249	87053.413	35561.258	111.740
Levelling point	C305-LT061250	87056.158	35560.047	111.725
Levelling point	C305-LT061251	87058.901	35558.804	111.712
Levelling point	C305-LT061252	87061.626	35557.549	111.696
Levelling point	C305-LT061253	87064.351	35556.294	111.680
Levelling point	C305-LT061254	87067.076	35555.039	111.665
Levelling point	C305-LT061255	87069.8	35553.784	111.647
Levelling point	C305-LT061256	87072.525	35552.529	111.632
Levelling point	C305-LT061257	87075.25	35551.273	111.618
Levelling point	C305-LT061258	87077.974	35550.008	111.602
Levelling point	C305-LT061259	87080.693	35548.74	111.590
Levelling point	C305-LT061260	87083.412	35547.472	111.579
Levelling point	C305-LT061261	87086.131	35546.204	111.566
Levelling point	C305-LT061262	87088.849	35544.936	111.553
Levelling point	C305-LT061263	87091.568	35543.668	111.540
Levelling point	C305-LT061264	87094.287	35542.4	111.523
Levelling point	C305-LT061265	87097.002	35541.104	111.509
Levelling point	C305-LT061266	87099.706	35539.804	111.493

Instrumentation summary –Track levelling Eastbound 6 feet

The first levelling track point C305-LT061301, located approximately 38 meters away from C305 WB tunnel centre line (Project chainage 81400 aprox). All other points follow Eastwards at 3m centre.

Sensor Type	Sensor ID	SENSOR Location - GPS reading (m)		
		Eastings X	Northings Y	Elevation Z (mATD)
Levelling point	C305-LT061301	86628.317	35684.421	113.772
Levelling point	C305-LT061302	86631.286	35683.991	113.768
Levelling point	C305-LT061303	86634.255	35683.56	113.766
Levelling point	C305-LT061304	86637.224	35683.129	113.766
Levelling point	C305-LT061305	86640.193	35682.698	113.766
Levelling point	C305-LT061306	86643.144	35682.243	113.768
Levelling point	C305-LT061307	86646.104	35681.755	113.767
Levelling point	C305-LT061308	86649.064	35681.267	113.766
Levelling point	C305-LT061309	86652.024	35680.778	113.765
Levelling point	C305-LT061310	86654.984	35680.29	113.765
Levelling point	C305-LT061311	86657.944	35679.802	113.765
Levelling point	C305-LT061312	86660.904	35679.313	113.766
Levelling point	C305-LT061313	86663.864	35678.825	113.772
Levelling point	C305-LT061314	86666.824	35678.337	113.775
Levelling point	C305-LT061315	86669.76	35677.798	113.781
Levelling point	C305-LT061316	86672.71	35677.25	113.788
Levelling point	C305-LT061317	86675.6590	35676.7020	113.798
Levelling point	C305-LT061318	86678.609	35676.154	113.801
Levelling point	C305-LT061319	86681.558	35675.606	113.806
Levelling point	C305-LT061320	86684.508	35675.058	113.808
Levelling point	C305-LT061321	86687.457	35674.509	113.810
Levelling point	C305-LT061322	86690.407	35673.961	113.813
Levelling point	C305-LT061323	86693.348	35673.411	113.816
Levelling point	C305-LT061324	86696.292	35672.832	113.821
Levelling point	C305-LT061325	86699.235	35672.253	113.828
Levelling point	C305-LT061326	86702.179	35671.674	113.833
Levelling point	C305-LT061327	86705.122	35671.096	113.837
Levelling point	C305-LT061328	86708.066	35670.517	113.841
Levelling point	C305-LT061329	86711.01	35669.938	113.847
Levelling point	C305-LT061330	86713.953	35669.359	113.856
Levelling point	C305-LT061331	86716.897	35668.78	113.868
Levelling point	C305-LT061332	86719.841	35668.202	113.874
Levelling point	C305-LT061333	86722.763	35667.583	113.882
Levelling point	C305-LT061334	86725.696	35666.951	113.894
Levelling point	C305-LT061335	86728.628	35666.32	113.904
Levelling point	C305-LT061336	86731.561	35665.688	113.913
Levelling point	C305-LT061337	86734.494	35665.057	113.922
Levelling point	C305-LT061338	86737.427	35664.425	113.927
Levelling point	C305-LT061339	86740.359	35663.794	113.936
Levelling point	C305-LT061340	86743.292	35663.162	113.947
Levelling point	C305-LT061341	86746.225	35662.531	113.959
Levelling point	C305-LT061342	86749.131	35661.855	113.968
Levelling point	C305-LT061343	86752.05	35661.159	113.982
Levelling point	C305-LT061344	86754.968	35660.464	113.996
Levelling point	C305-LT061345	86757.886	35659.768	114.008
Levelling point	C305-LT061346	86760.805	35659.073	114.022
Levelling point	C305-LT061347	86763.704	35658.364	114.037
Levelling point	C305-LT061348	86766.607	35657.607	114.051
Levelling point	C305-LT061349	86769.5090	35656.8500	114.066
Levelling point	C305-LT061350	86772.412	35656.093	114.079
Levelling point	C305-LT061351	86775.32	35655.339	114.096
Levelling point	C305-LT061352	86778.226	35654.595	114.110
Levelling point	C305-LT061353	86781.132	35653.852	114.126
Levelling point	C305-LT061354	86784.039	35653.109	114.143

Sensor Type	Sensor ID	SENSOR Location - GPS reading (m)		
		Eastings X	Northings Y	Elevation Z (mATD)
Levelling point	C305-LT061355	86786.945	35652.365	114.157
Levelling point	C305-LT061356	86789.852	35651.622	114.172
Levelling point	C305-LT061357	86792.758	35650.879	114.183
Levelling point	C305-LT061358	86795.665	35650.135	114.192
Levelling point	C305-LT061359	86798.571	35649.392	114.197
Levelling point	C305-LT061360	86801.478	35648.649	114.203
Levelling point	C305-LT061361	86804.37	35647.907	114.211
Levelling point	C305-LT061362	86807.262	35647.108	114.219
Levelling point	C305-LT061363	86810.154	35646.31	114.230
Levelling point	C305-LT061364	86813.046	35645.512	114.238
Levelling point	C305-LT061365	86815.937	35644.713	114.243
Levelling point	C305-LT061366	86818.8290	35643.9150	114.243
Levelling point	C305-LT061367	86821.721	35643.117	114.238
Levelling point	C305-LT061368	86824.613	35642.318	114.229
Levelling point	C305-LT061369	86827.505	35641.52	114.214
Levelling point	C305-LT061370	86830.397	35640.721	114.196
Levelling point	C305-LT061371	86833.2880	35639.9230	114.174
Levelling point	C305-LT061372	86836.1450	35639.0680	114.148
Levelling point	C305-LT061373	86839.0150	35638.1970	114.117
Levelling point	C305-LT061374	86841.9070	35637.3350	114.082
Levelling point	C305-LT061375	86844.7970	35636.5320	114.043
Levelling point	C305-LT061376	86847.6880	35635.7280	114.002
Levelling point	C305-LT061377	86850.5780	35634.9250	113.961
Levelling point	C305-LT061378	86853.4690	35634.1220	113.921
Levelling point	C305-LT061379	86856.3350	35633.2820	113.883
Levelling point	C305-LT061380	86859.2100	35632.4270	113.847
Levelling point	C305-LT061381	86862.0850	35631.5710	113.808
Levelling point	C305-LT061382	86864.9610	35630.7150	113.767
Levelling point	C305-LT061383	86867.8360	35629.8590	113.723
Levelling point	C305-LT061384	86870.7040	35628.9990	113.680
Levelling point	C305-LT061385	86873.5730	35628.1200	113.638
Levelling point	C305-LT061386	86876.4410	35627.2420	113.596
Levelling point	C305-LT061387	86879.3100	35626.3640	113.555
Levelling point	C305-LT061388	86882.1780	35625.4850	113.512
Levelling point	C305-LT061389	86885.0200	35624.5600	113.472
Levelling point	C305-LT061390	86887.8750	35623.6370	113.431
Levelling point	C305-LT061391	86890.7290	35622.7140	113.391
Levelling point	C305-LT061392	86893.5840	35621.7910	113.349
Levelling point	C305-LT061393	86896.4380	35620.8680	113.309
Levelling point	C305-LT061394	86899.2930	35619.9460	113.268
Levelling point	C305-LT061395	86902.1320	35619.0240	113.227
Levelling point	C305-LT061396	86904.9660	35618.0420	113.185
Levelling point	C305-LT061397	86907.8010	35617.0600	113.144
Levelling point	C305-LT061398	86910.6360	35616.0780	113.103
Levelling point	C305-LT061399	86913.4710	35615.0960	113.060
Levelling point	C305-LT061400	86916.3050	35614.1140	113.019
Levelling point	C305-LT061401	86919.1400	35613.1320	112.978
Levelling point	C305-LT061402	86921.9750	35612.1500	112.938
Levelling point	C305-LT061403	86924.8090	35611.1680	112.899
Levelling point	C305-LT061404	86927.6320	35610.1750	112.858
Levelling point	C305-LT061405	86930.4570	35609.1630	112.818
Levelling point	C305-LT061406	86933.2810	35608.1520	112.777
Levelling point	C305-LT061407	86936.1050	35607.1400	112.737
Levelling point	C305-LT061408	86938.9300	35606.1290	112.693
Levelling point	C305-LT061409	86941.7540	35605.1170	112.649
Levelling point	C305-LT061410	86944.5780	35604.1060	112.608
Levelling point	C305-LT061411	86947.3830	35603.0760	112.566
Levelling point	C305-LT061412	86950.1900	35602.0180	112.524
Levelling point	C305-LT061413	86952.9970	35600.9590	112.481
Levelling point	C305-LT061414	86955.8040	35599.9010	112.440
Levelling point	C305-LT061415	86958.6110	35598.8420	112.400

Sensor Type	Sensor ID	SENSOR Location - GPS reading (m)		
		Eastings X	Northings Y	Elevation Z (mATD)
Levelling point	C305-LT061416	86961.4190	35597.7840	112.361
Levelling point	C305-LT061417	86964.2160	35596.7200	112.323
Levelling point	C305-LT061418	86967.0130	35595.6340	112.284
Levelling point	C305-LT061419	86969.8090	35594.5480	112.248
Levelling point	C305-LT061420	86972.6060	35593.4630	112.212
Levelling point	C305-LT061421	86975.4720	35592.3560	112.181
Levelling point	C305-LT061422	86978.2340	35591.4330	112.149
Levelling point	C305-LT061423	86981.0140	35590.3060	112.118
Levelling point	C305-LT061424	86983.7940	35589.1790	112.091
Levelling point	C305-LT061425	86986.5750	35588.0530	112.063
Levelling point	C305-LT061426	86989.3550	35586.9260	112.040
Levelling point	C305-LT061427	86992.1360	35585.7990	112.020
Levelling point	C305-LT061428	86994.9070	35584.6600	112.000
Levelling point	C305-LT061429	86997.6810	35583.5190	111.982
Levelling point	C305-LT061430	87000.4550	35582.3770	111.967
Levelling point	C305-LT061431	87003.2300	35581.2350	111.953
Levelling point	C305-LT061432	87006.0040	35580.0940	111.938
Levelling point	C305-LT061433	87008.7780	35578.9520	111.925
Levelling point	C305-LT061434	87011.5400	35577.8050	111.909
Levelling point	C305-LT061435	87014.2990	35576.6270	111.894
Levelling point	C305-LT061436	87017.0580	35575.4490	111.882
Levelling point	C305-LT061437	87019.8170	35574.2710	111.867
Levelling point	C305-LT061438	87022.5760	35573.0930	111.854
Levelling point	C305-LT061439	87025.3350	35571.9150	111.842
Levelling point	C305-LT061440	87028.0880	35570.7310	111.829
Levelling point	C305-LT061441	87030.8410	35569.5400	111.814
Levelling point	C305-LT061442	87033.5950	35568.3500	111.801
Levelling point	C305-LT061443	87036.3490	35567.1590	111.789
Levelling point	C305-LT061444	87039.1030	35565.9690	111.780
Levelling point	C305-LT061445	87041.8480	35564.7720	111.769
Levelling point	C305-LT061446	87044.5930	35563.5620	111.756
Levelling point	C305-LT061447	87047.3380	35562.3520	111.740
Levelling point	C305-LT061448	87050.0830	35561.1410	111.725
Levelling point	C305-LT061449	87052.8280	35559.9310	111.714
Levelling point	C305-LT061450	87055.5730	35558.7200	111.701
Levelling point	C305-LT061451	87058.2940	35557.4870	111.687
Levelling point	C305-LT061452	87061.0190	35556.2320	111.671
Levelling point	C305-LT061453	87063.7440	35554.9770	111.656
Levelling point	C305-LT061454	87066.4690	35553.7220	111.640
Levelling point	C305-LT061455	87069.1940	35552.4670	111.622
Levelling point	C305-LT061456	87071.9190	35551.2120	111.607
Levelling point	C305-LT061457	87074.6430	35549.9560	111.593
Levelling point	C305-LT061458	87077.3610	35548.6940	111.578
Levelling point	C305-LT061459	87080.0800	35547.4260	111.567
Levelling point	C305-LT061460	87082.7990	35546.1580	111.555
Levelling point	C305-LT061461	87085.5180	35544.8900	111.541
Levelling point	C305-LT061462	87088.2370	35543.6220	111.527
Levelling point	C305-LT061463	87090.9550	35542.3540	111.513
Levelling point	C305-LT061464	87093.6740	35541.0860	111.499
Levelling point	C305-LT061465	87096.3740	35539.7980	111.483
Levelling point	C305-LT061466	87099.0770	35538.4970	111.468



Instrumentation summary –Track levelling Westbound 6 feet

The first levelling track point C305-LT061701, located approximately 38 meters away from C305 WB tunnel centre line (Project chainage 81400 aprox). All other points follow Eastwards at 3m centre.

Sensor Type	Sensor ID	SENSOR Location - GPS reading (m)		
		Eastings X	Northings Y	Elevation Z (mATD)
Levelling point	C305-LT061701	86628.084	35682.807	113.793
Levelling point	C305-LT061702	86631.052	35682.375	113.791
Levelling point	C305-LT061703	86634.033	35681.933	113.792
Levelling point	C305-LT061704	86636.993	35681.445	113.790
Levelling point	C305-LT061705	86639.953	35680.958	113.791
Levelling point	C305-LT061706	86642.913	35680.47	113.791
Levelling point	C305-LT061707	86645.873	35679.982	113.792
Levelling point	C305-LT061708	86648.834	35679.494	113.794
Levelling point	C305-LT061709	86651.794	35679.006	113.794
Levelling point	C305-LT061710	86654.754	35678.519	113.797
Levelling point	C305-LT061711	86657.714	35678.031	113.799
Levelling point	C305-LT061712	86660.674	35677.543	113.800
Levelling point	C305-LT061713	86663.618	35677.063	113.803
Levelling point	C305-LT061714	86666.605	35676.563	113.806
Levelling point	C305-LT061715	86669.557	35676.025	113.810
Levelling point	C305-LT061716	86672.508	35675.487	113.818
Levelling point	C305-LT061717	86675.4590	35674.9490	113.821
Levelling point	C305-LT061718	86678.411	35674.41	113.824
Levelling point	C305-LT061719	86681.362	35673.872	113.827
Levelling point	C305-LT061720	86684.313	35673.334	113.828
Levelling point	C305-LT061721	86687.264	35672.796	113.830
Levelling point	C305-LT061722	86690.216	35672.257	113.835
Levelling point	C305-LT061723	86693.178	35671.702	113.838
Levelling point	C305-LT061724	86696.118	35671.108	113.846
Levelling point	C305-LT061725	86699.059	35670.513	113.852
Levelling point	C305-LT061726	86701.999	35669.919	113.854
Levelling point	C305-LT061727	86704.94	35669.324	113.857
Levelling point	C305-LT061728	86707.88	35668.73	113.860
Levelling point	C305-LT061729	86710.821	35668.135	113.867
Levelling point	C305-LT061730	86713.761	35667.541	113.876
Levelling point	C305-LT061731	86716.702	35666.946	113.887
Levelling point	C305-LT061732	86719.644	35666.334	113.895
Levelling point	C305-LT061733	86722.588	35665.705	113.903
Levelling point	C305-LT061734	86725.515	35665.05	113.914
Levelling point	C305-LT061735	86728.443	35664.394	113.925
Levelling point	C305-LT061736	86731.37	35663.739	113.933
Levelling point	C305-LT061737	86734.298	35663.083	113.941
Levelling point	C305-LT061738	86737.225	35662.428	113.945
Levelling point	C305-LT061739	86740.153	35661.772	113.955
Levelling point	C305-LT061740	86743.08	35661.117	113.965
Levelling point	C305-LT061741	86746.008	35660.461	113.974
Levelling point	C305-LT061742	86748.935	35659.806	113.986
Levelling point	C305-LT061743	86751.864	35659.148	114.003
Levelling point	C305-LT061744	86754.79	35658.445	114.017
Levelling point	C305-LT061745	86757.707	35657.744	114.032
Levelling point	C305-LT061746	86760.624	35657.043	114.048
Levelling point	C305-LT061747	86763.541	35656.342	114.062
Levelling point	C305-LT061748	86766.458	35655.642	114.072
Levelling point	C305-LT061749	86769.3750	35654.9410	114.080
Levelling point	C305-LT061750	86772.292	35654.24	114.090
Levelling point	C305-LT061751	86775.209	35653.539	114.102
Levelling point	C305-LT061752	86778.126	35652.838	114.116
Levelling point	C305-LT061753	86781.052	35652.116	114.131
Levelling point	C305-LT061754	86783.955	35651.362	114.146
Levelling point	C305-LT061755	86786.859	35650.608	114.163
Levelling point	C305-LT061756	86789.762	35649.854	114.182
Levelling point	C305-LT061757	86792.666	35649.1	114.198
Levelling point	C305-LT061758	86795.57	35648.345	114.212
Levelling point	C305-LT061759	86798.473	35647.591	114.223

Sensor Type	Sensor ID	SENSOR Location - GPS reading (m)		
		Eastings X	Northings Y	Elevation Z (mATD)
Levelling point	C305-LT061760	86801.377	35646.837	114.232
Levelling point	C305-LT061761	86804.282	35646.057	114.241
Levelling point	C305-LT061762	86807.177	35645.271	114.249
Levelling point	C305-LT061763	86810.072	35644.485	114.259
Levelling point	C305-LT061764	86812.968	35643.699	114.264
Levelling point	C305-LT061765	86815.863	35642.914	114.266
Levelling point	C305-LT061766	86818.7580	35642.1280	114.267
Levelling point	C305-LT061767	86821.654	35641.342	114.265
Levelling point	C305-LT061768	86824.549	35640.556	114.256
Levelling point	C305-LT061769	86827.444	35639.746	114.240
Levelling point	C305-LT061770	86830.332	35638.935	114.222
Levelling point	C305-LT061771	86833.2200	35638.1230	114.200
Levelling point	C305-LT061772	86836.0480	35637.2540	114.172
Levelling point	C305-LT061773	86838.9420	35636.4650	114.141
Levelling point	C305-LT061774	86841.8360	35635.6760	114.107
Levelling point	C305-LT061775	86844.7300	35634.8860	114.069
Levelling point	C305-LT061776	86847.6250	35634.0970	114.032
Levelling point	C305-LT061777	86850.5190	35633.3080	113.997
Levelling point	C305-LT061778	86853.4200	35632.5010	113.957
Levelling point	C305-LT061779	86856.3020	35631.6680	113.922
Levelling point	C305-LT061780	86859.1890	35630.8290	113.882
Levelling point	C305-LT061781	86862.0630	35629.9700	113.847
Levelling point	C305-LT061782	86864.9380	35629.1120	113.808
Levelling point	C305-LT061783	86867.8120	35628.2530	113.766
Levelling point	C305-LT061784	86870.6870	35627.3950	113.721
Levelling point	C305-LT061785	86873.5610	35626.5360	113.680
Levelling point	C305-LT061786	86876.4360	35625.6770	113.637
Levelling point	C305-LT061787	86879.3070	35624.7490	113.594
Levelling point	C305-LT061788	86882.1600	35623.8210	113.550
Levelling point	C305-LT061789	86885.0130	35622.8920	113.511
Levelling point	C305-LT061790	86887.8650	35621.9640	113.469
Levelling point	C305-LT061791	86890.7180	35621.0350	113.426
Levelling point	C305-LT061792	86893.5710	35620.1070	113.382
Levelling point	C305-LT061793	86896.4240	35619.1790	113.340
Levelling point	C305-LT061794	86899.2760	35618.2500	113.299
Levelling point	C305-LT061795	86902.1290	35617.3220	113.260
Levelling point	C305-LT061796	86904.9840	35616.3870	113.222
Levelling point	C305-LT061797	86907.8380	35615.4370	113.175
Levelling point	C305-LT061798	86910.6750	35614.4630	113.133
Levelling point	C305-LT061799	86913.5120	35613.4890	113.092
Levelling point	C305-LT061800	86916.3500	35612.5150	113.050
Levelling point	C305-LT061801	86919.1870	35611.5410	113.009
Levelling point	C305-LT061802	86922.0250	35610.5660	112.966
Levelling point	C305-LT061803	86924.8620	35609.5920	112.924
Levelling point	C305-LT061804	86927.7000	35608.6180	112.882
Levelling point	C305-LT061805	86930.5380	35607.6190	112.840
Levelling point	C305-LT061806	86933.3630	35606.6070	112.799
Levelling point	C305-LT061807	86936.1860	35605.5780	112.756
Levelling point	C305-LT061808	86939.0030	35604.5480	112.714
Levelling point	C305-LT061809	86941.8210	35603.5180	112.672
Levelling point	C305-LT061810	86944.6390	35602.4880	112.630
Levelling point	C305-LT061811	86947.4560	35601.4580	112.589
Levelling point	C305-LT061812	86950.2740	35600.4280	112.546
Levelling point	C305-LT061813	86953.0850	35599.3410	112.506
Levelling point	C305-LT061814	86955.8820	35598.2550	112.466
Levelling point	C305-LT061815	86958.6790	35597.1700	112.425
Levelling point	C305-LT061816	86961.4760	35596.0850	112.387
Levelling point	C305-LT061817	86964.2700	35595.0110	112.349
Levelling point	C305-LT061818	86967.0760	35593.9490	112.312
Levelling point	C305-LT061819	86969.8820	35592.8880	112.275
Levelling point	C305-LT061820	86972.6880	35591.8260	112.243
Levelling point	C305-LT061821	86975.4940	35590.7640	112.213
Levelling point	C305-LT061822	86978.2990	35589.7020	112.182
Levelling point	C305-LT061823	86981.1050	35588.6400	112.153
Levelling point	C305-LT061824	86983.9110	35587.5790	112.125

Sensor Type	Sensor ID	SENSOR Location - GPS reading (m)		
		Eastings X	Northings Y	Elevation Z (mATD)
Levelling point	C305-LT061825	86986.7170	35586.5170	112.099
Levelling point	C305-LT061826	86989.5150	35585.3780	112.074
Levelling point	C305-LT061827	86992.2890	35584.2370	112.052
Levelling point	C305-LT061828	86995.0630	35583.0960	112.032
Levelling point	C305-LT061829	86997.8380	35581.9540	112.013
Levelling point	C305-LT061830	87000.6120	35580.8130	111.995
Levelling point	C305-LT061831	87003.3930	35579.6680	111.979
Levelling point	C305-LT061832	87006.1560	35578.5000	111.964
Levelling point	C305-LT061833	87008.9190	35577.3330	111.949
Levelling point	C305-LT061834	87011.6830	35576.1650	111.937
Levelling point	C305-LT061835	87014.4460	35574.9970	111.924
Levelling point	C305-LT061836	87017.2100	35573.8300	111.909
Levelling point	C305-LT061837	87019.9750	35572.6570	111.895
Levelling point	C305-LT061838	87022.7320	35571.4740	111.882
Levelling point	C305-LT061839	87025.4900	35570.2920	111.869
Levelling point	C305-LT061840	87028.2470	35569.1100	111.859
Levelling point	C305-LT061841	87031.0040	35567.9270	111.848
Levelling point	C305-LT061842	87033.7610	35566.7450	111.832
Levelling point	C305-LT061843	87036.5140	35565.5240	111.818
Levelling point	C305-LT061844	87039.2520	35564.2990	111.800
Levelling point	C305-LT061845	87041.9910	35563.0740	111.789
Levelling point	C305-LT061846	87044.7290	35561.8490	111.780
Levelling point	C305-LT061847	87047.4670	35560.6240	111.768
Levelling point	C305-LT061848	87050.2080	35559.3940	111.754
Levelling point	C305-LT061849	87052.9410	35558.1570	111.742
Levelling point	C305-LT061850	87055.6740	35556.9200	111.730
Levelling point	C305-LT061851	87058.4060	35555.6820	111.717
Levelling point	C305-LT061852	87061.1390	35554.4450	111.702
Levelling point	C305-LT061853	87063.8720	35553.2080	111.690
Levelling point	C305-LT061854	87066.6050	35551.9700	111.680
Levelling point	C305-LT061855	87069.3380	35550.7070	111.668
Levelling point	C305-LT061856	87072.0530	35549.4300	111.654
Levelling point	C305-LT061857	87074.7670	35548.1530	111.639
Levelling point	C305-LT061858	87077.4820	35546.8760	111.625
Levelling point	C305-LT061859	87080.1970	35545.5990	111.613
Levelling point	C305-LT061860	87082.9110	35544.3220	111.598
Levelling point	C305-LT061861	87085.6250	35543.0380	111.585
Levelling point	C305-LT061862	87088.3350	35541.7510	111.573
Levelling point	C305-LT061863	87091.0450	35540.4640	111.562
Levelling point	C305-LT061864	87093.7550	35539.1770	111.552
Levelling point	C305-LT061865	87096.4650	35537.8900	111.538

## Instrumentation summary –Track levelling Westbound Cess

The first levelling track point C305-LT061501, located approximately 38 meters away from C305 WB tunnel centre line (Project chainage 81400 aprox). All other points follow Eastwards at 3m centre.

Sensor Type	Sensor ID	SENSOR Location - GPS reading (m)		
		Eastings X	Northings Y	Elevation Z (mATD)
Levelling point	C305-LT061501	86627.874	35681.372	113.774
Levelling point	C305-LT061502	86630.843	35680.94	113.769
Levelling point	C305-LT061503	86633.797	35680.502	113.769
Levelling point	C305-LT061504	86636.757	35680.015	113.766
Levelling point	C305-LT061505	86639.718	35679.527	113.770
Levelling point	C305-LT061506	86642.678	35679.039	113.768
Levelling point	C305-LT061507	86645.638	35678.551	113.768
Levelling point	C305-LT061508	86648.598	35678.064	113.771
Levelling point	C305-LT061509	86651.558	35677.576	113.771
Levelling point	C305-LT061510	86654.518	35677.088	113.774
Levelling point	C305-LT061511	86657.478	35676.6	113.776
Levelling point	C305-LT061512	86660.438	35676.112	113.776
Levelling point	C305-LT061513	86663.416	35675.627	113.779
Levelling point	C305-LT061514	86666.345	35675.137	113.782
Levelling point	C305-LT061515	86669.296	35674.599	113.785
Levelling point	C305-LT061516	86672.248	35674.06	113.792
Levelling point	C305-LT061517	86675.1990	35673.5220	113.797
Levelling point	C305-LT061518	86678.15	35672.984	113.801
Levelling point	C305-LT061519	86681.102	35672.446	113.804
Levelling point	C305-LT061520	86684.053	35671.907	113.804
Levelling point	C305-LT061521	86687.004	35671.369	113.807
Levelling point	C305-LT061522	86689.956	35670.831	113.812
Levelling point	C305-LT061523	86692.891	35670.281	113.816
Levelling point	C305-LT061524	86695.831	35669.687	113.824
Levelling point	C305-LT061525	86698.772	35669.092	113.827
Levelling point	C305-LT061526	86701.712	35668.498	113.830
Levelling point	C305-LT061527	86704.653	35667.903	113.833
Levelling point	C305-LT061528	86707.593	35667.309	113.836
Levelling point	C305-LT061529	86710.534	35666.714	113.844
Levelling point	C305-LT061530	86713.474	35666.119	113.852
Levelling point	C305-LT061531	86716.415	35665.525	113.863
Levelling point	C305-LT061532	86719.347	35664.914	113.871
Levelling point	C305-LT061533	86722.271	35664.29	113.881
Levelling point	C305-LT061534	86725.198	35663.635	113.891
Levelling point	C305-LT061535	86728.126	35662.979	113.902
Levelling point	C305-LT061536	86731.053	35662.324	113.910
Levelling point	C305-LT061537	86733.981	35661.668	113.918
Levelling point	C305-LT061538	86736.908	35661.013	113.923
Levelling point	C305-LT061539	86739.836	35660.357	113.932
Levelling point	C305-LT061540	86742.763	35659.702	113.941
Levelling point	C305-LT061541	86745.691	35659.046	113.951
Levelling point	C305-LT061542	86748.618	35658.391	113.964
Levelling point	C305-LT061543	86751.544	35657.733	113.980
Levelling point	C305-LT061544	86754.451	35657.035	113.994
Levelling point	C305-LT061545	86757.368	35656.334	114.009
Levelling point	C305-LT061546	86760.285	35655.633	114.025
Levelling point	C305-LT061547	86763.202	35654.933	114.039
Levelling point	C305-LT061548	86766.119	35654.232	114.053
Levelling point	C305-LT061549	86769.0360	35653.5310	114.066
Levelling point	C305-LT061550	86771.953	35652.83	114.082
Levelling point	C305-LT061551	86774.87	35652.129	114.098
Levelling point	C305-LT061552	86777.787	35651.428	114.114
Levelling point	C305-LT061553	86780.687	35650.713	114.129
Levelling point	C305-LT061554	86783.591	35649.959	114.145
Levelling point	C305-LT061555	86786.494	35649.205	114.160
Levelling point	C305-LT061556	86789.398	35648.45	114.172
Levelling point	C305-LT061557	86792.302	35647.696	114.183
Levelling point	C305-LT061558	86795.205	35646.942	114.191
Levelling point	C305-LT061559	86798.109	35646.188	114.200
Levelling point	C305-LT061560	86801.013	35645.434	114.208
Levelling point	C305-LT061561	86803.902	35644.657	114.218
Levelling point	C305-LT061562	86806.797	35643.871	114.227

Sensor Type	Sensor ID	SENSOR Location - GPS reading (m)		
		Eastings X	Northings Y	Elevation Z (mATD)
Levelling point	C305-LT061563	86809.693	35643.086	114.237
Levelling point	C305-LT061564	86812.588	35642.3	114.241
Levelling point	C305-LT061565	86815.483	35641.514	114.242
Levelling point	C305-LT061566	86818.3780	35640.7280	114.243
Levelling point	C305-LT061567	86821.274	35639.943	114.241
Levelling point	C305-LT061568	86824.169	35639.157	114.232
Levelling point	C305-LT061569	86827.052	35638.35	114.217
Levelling point	C305-LT061570	86829.94	35637.539	114.199
Levelling point	C305-LT061571	86832.8280	35636.7270	114.176
Levelling point	C305-LT061572	86835.6660	35635.8550	114.150
Levelling point	C305-LT061573	86838.5600	35635.0660	114.118
Levelling point	C305-LT061574	86841.4550	35634.2770	114.083
Levelling point	C305-LT061575	86844.3490	35633.4870	114.047
Levelling point	C305-LT061576	86847.2430	35632.6980	114.011
Levelling point	C305-LT061577	86850.1380	35631.9090	113.972
Levelling point	C305-LT061578	86853.0170	35631.1080	113.933
Levelling point	C305-LT061579	86855.8990	35630.2750	113.899
Levelling point	C305-LT061580	86858.7740	35629.4400	113.860
Levelling point	C305-LT061581	86861.6480	35628.5810	113.824
Levelling point	C305-LT061582	86864.5230	35627.7220	113.786
Levelling point	C305-LT061583	86867.3970	35626.8640	113.745
Levelling point	C305-LT061584	86870.2720	35626.0050	113.699
Levelling point	C305-LT061585	86873.1460	35625.1470	113.657
Levelling point	C305-LT061586	86876.0210	35624.2880	113.615
Levelling point	C305-LT061587	86878.8590	35623.3700	113.572
Levelling point	C305-LT061588	86881.7110	35622.4420	113.529
Levelling point	C305-LT061589	86884.5640	35621.5140	113.488
Levelling point	C305-LT061590	86887.4170	35620.5850	113.445
Levelling point	C305-LT061591	86890.2690	35619.6570	113.404
Levelling point	C305-LT061592	86893.1220	35618.7280	113.359
Levelling point	C305-LT061593	86895.9750	35617.8000	113.318
Levelling point	C305-LT061594	86898.8280	35616.8710	113.276
Levelling point	C305-LT061595	86901.6800	35615.9430	113.236
Levelling point	C305-LT061596	86904.5270	35615.0110	113.193
Levelling point	C305-LT061597	86907.3670	35614.0660	113.153
Levelling point	C305-LT061598	86910.2040	35613.0920	113.112
Levelling point	C305-LT061599	86913.0420	35612.1170	113.070
Levelling point	C305-LT061600	86915.8790	35611.1430	113.029
Levelling point	C305-LT061601	86918.7160	35610.1690	112.988
Levelling point	C305-LT061602	86921.5540	35609.1950	112.944
Levelling point	C305-LT061603	86924.3910	35608.2210	112.902
Levelling point	C305-LT061604	86927.2290	35607.2470	112.859
Levelling point	C305-LT061605	86930.0500	35606.2540	112.816
Levelling point	C305-LT061606	86932.8740	35605.2420	112.775
Levelling point	C305-LT061607	86935.6880	35604.2160	112.734
Levelling point	C305-LT061608	86938.5050	35603.1860	112.691
Levelling point	C305-LT061609	86941.3230	35602.1560	112.650
Levelling point	C305-LT061610	86944.1410	35601.1260	112.608
Levelling point	C305-LT061611	86946.9580	35600.0960	112.564
Levelling point	C305-LT061612	86949.7760	35599.0660	112.523
Levelling point	C305-LT061613	86952.5610	35597.9890	112.482
Levelling point	C305-LT061614	86955.3570	35596.9040	112.443
Levelling point	C305-LT061615	86958.1540	35595.8180	112.401
Levelling point	C305-LT061616	86960.9510	35594.7330	112.364
Levelling point	C305-LT061617	86963.7570	35593.6550	112.326
Levelling point	C305-LT061618	86966.5630	35592.5930	112.288
Levelling point	C305-LT061619	86969.3690	35591.5310	112.252
Levelling point	C305-LT061620	86972.1750	35590.4700	112.220
Levelling point	C305-LT061621	86974.9800	35589.4080	112.189
Levelling point	C305-LT061622	86977.7860	35588.3460	112.159
Levelling point	C305-LT061623	86980.5920	35587.2840	112.130
Levelling point	C305-LT061624	86983.3980	35586.2230	112.100
Levelling point	C305-LT061625	86986.2040	35585.1610	112.075
Levelling point	C305-LT061626	86988.9630	35584.0370	112.051
Levelling point	C305-LT061627	86991.7370	35582.8960	112.029
Levelling point	C305-LT061628	86994.5120	35581.7550	112.008
Levelling point	C305-LT061629	86997.2860	35580.6130	111.989
Levelling point	C305-LT061630	87000.0610	35579.4720	111.974

Sensor Type	Sensor ID	SENSOR Location - GPS reading (m)		
		Eastings X	Northings Y	Elevation Z (mATD)
Levelling point	C305-LT061631	87002.8280	35578.3320	111.957
Levelling point	C305-LT061632	87005.5920	35577.1650	111.942
Levelling point	C305-LT061633	87008.3550	35575.9970	111.926
Levelling point	C305-LT061634	87011.1190	35574.8290	111.914
Levelling point	C305-LT061635	87013.8820	35573.6620	111.902
Levelling point	C305-LT061636	87016.6450	35572.4940	111.887
Levelling point	C305-LT061637	87019.4040	35571.3240	111.872
Levelling point	C305-LT061638	87022.1610	35570.1420	111.859
Levelling point	C305-LT061639	87024.9180	35568.9590	111.847
Levelling point	C305-LT061640	87027.6750	35567.7770	111.838
Levelling point	C305-LT061641	87030.4320	35566.5950	111.825
Levelling point	C305-LT061642	87033.1900	35565.4120	111.809
Levelling point	C305-LT061643	87035.9210	35564.2000	111.796
Levelling point	C305-LT061644	87038.6600	35562.9750	111.776
Levelling point	C305-LT061645	87041.3980	35561.7500	111.766
Levelling point	C305-LT061646	87044.1370	35560.5250	111.755
Levelling point	C305-LT061647	87046.8750	35559.3000	111.746
Levelling point	C305-LT061648	87049.6100	35558.0740	111.732
Levelling point	C305-LT061649	87052.3430	35556.8360	111.718
Levelling point	C305-LT061650	87055.0750	35555.5990	111.707
Levelling point	C305-LT061651	87057.8080	35554.3610	111.693
Levelling point	C305-LT061652	87060.5410	35553.1240	111.679
Levelling point	C305-LT061653	87063.2740	35551.8870	111.667
Levelling point	C305-LT061654	87066.0070	35550.6490	111.657
Levelling point	C305-LT061655	87068.7210	35549.3950	111.643
Levelling point	C305-LT061656	87071.4350	35548.1180	111.629
Levelling point	C305-LT061657	87074.1500	35546.8410	111.616
Levelling point	C305-LT061658	87076.8650	35545.5640	111.601
Levelling point	C305-LT061659	87079.5790	35544.2870	111.590
Levelling point	C305-LT061660	87082.2940	35543.0100	111.577
Levelling point	C305-LT061661	87085.0030	35541.7280	111.562
Levelling point	C305-LT061662	87087.7130	35540.4410	111.552
Levelling point	C305-LT061663	87090.4230	35539.1540	111.541
Levelling point	C305-LT061664	87093.1330	35537.8670	111.529
Levelling point	C305-LT061665	87095.8430	35536.5800	111.516
Levelling point	C305-LT061666	87098.5530	35535.2930	111.504
Levelling point	C305-LT061667	87101.2400	35533.9880	111.492