Luminance Measurements of InLink media screens

InLink UK

FEBRUARY 2018

REVISION A

1. Introduction

1.1 Introduction

1.1.1 Designs for Lighting Ltd were commissioned to undertake measurements of a number of InLink digital illuminated screens located within the London Borough of Wandsworth.

1.1.2 The objective is to obtain a better understanding of how the signs perform during day and night and at different brightness settings. This would enable InLink UK to be able to predict Luminance levels based on the % brightness setting on the system.

1.1.3 The luminance measurements were taken using a calibrated and high quality luminance meter and were taken in accordance with the guidance provided in the Institution of Lighting Professionals (ILP) Professional Lighting Guide (PLG) 05 “The Brightness of Illuminated Advertisements”.

1.1.4 In order to obtain the worst-case scenario for each screen, the measurements were taken on white sections of the screen as coloured sections provide much lower luminance levels. We measured luminance levels at different brightness settings (0% to 100%) and took a small number of spot measurements of different coloured screens to illustrate the differences.

1.1.5 This report will show:

- - The current light levels (day/night)
- - What the target brightness light levels should be (day/night)
- - The brightness setting on the InLink that corresponded to that target light level (day/night)

2. Methodology

2.1 Introduction

2.1.1 The measurements were undertaken on Wednesday 21st February at two locations where InLink UK digital screens had been installed but were not yet commissioned as they were awaiting full approval from the Local Planning Authority.

2.2 Sites

2.2.1 The sites were located in the following roads:

- UK-002540 - Battersea Bridge Road (OS Musgrave Court), SW11 3AN
- UK-002548 - Falcon Road (OS No.164), SW11 2NY

2.3 Luminance Meter

2.3.1 The luminance meter used for the measurements was a Minolta LS-100 luminance meter. Serial No 81813026 and calibrated on 16th August 2017 with calibration certificate No 112242/AAU

2.3.2 The Technical Specification is as follows:

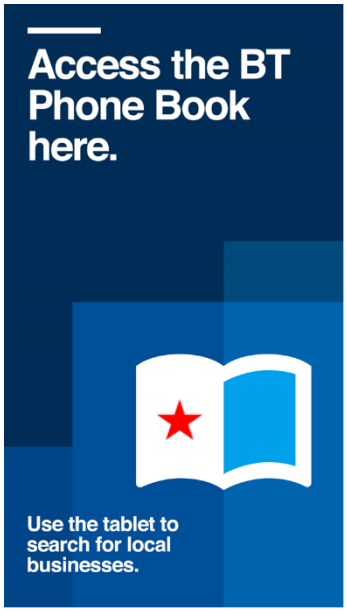
Model	**Luminance Meter LS-100**
Type	SLR spot luminance meter for measuring light-source and surface brightness
Acceptance angle	1°
Optical system	85mm f/2.8 lens; SLR viewing system; flare factor less than 1.5%
Angle of view	9°
Focusing distance	1014mm (40 in.) to infinity
Minimum measuring area	Φ14.4mm
Receptor	Silicon photocell
Relative Spectral Response*	Within 8% (f1) of the CIE spectral luminous efficiency V (λ)
Response time	FAST: Sampling time: 0.1s, time to display: 0.8 to 1.0s; SLOW: Sampling time: 0.4s, time to display: 1.4 to 1.6s
Luminance units	cd/m2 or fL (switchable)
Measuring range	FAST:0.001 to 299,900cd/m2 (0.001 to 87,530fL) SLOW: 0.001 to 49,990cd/m2 (0.001 to 14,590fL)
Accuracy	0.001 to 0.999cd/m2 (or fL): ±2% ±2 digits of displayed value 1.000cd/m2 (or fL) or greater: ±2% ±1 digit of displayed value (Illuminant A measured at ambient temperature of 20 to 30°C/68 to 86°F)
Repeatability	0.001 to 0.999cd/m2 (or fL): ±0.2% ±2 digits of displayed value 1.000cd/m2 (or fL) or greater: ±0.2% ±1 digit of displayed value (Measurement subject: Illuminant A)
Temperature/humidity drift	Within ±3% ±1 digit (of value displayed at 20°C/68°F) within operating temperature /humidity range
Measurement modes	Luminance; luminance ratio; peak luminance or luminance ratio

Table 1 Specification of Luminance Meter

2.4 Screens

2.4.1 The signs were configured to display screens in a scrolling sequence. Each screen that we measured had an area of bright white designed to emit the maximum luminance and large enough to obtain a repeatable consistent luminance measurement.

2.4.2 The screens where measurements were taken are shown below with each screen given a descriptor and number to ease measurement recording:

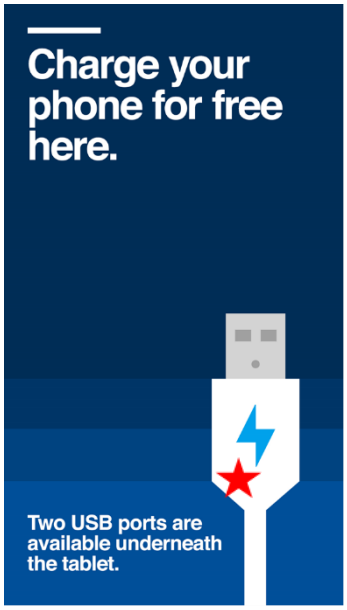


3 = Tablet

2.4.3

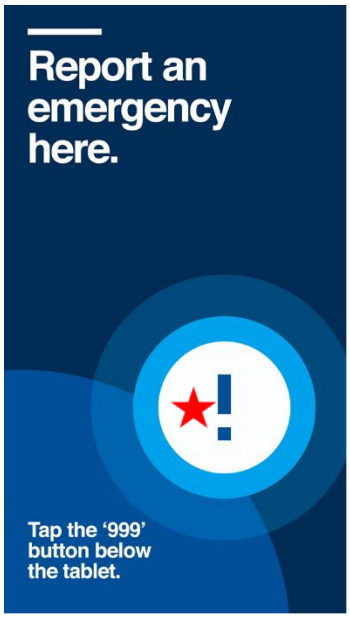


2 = Phone



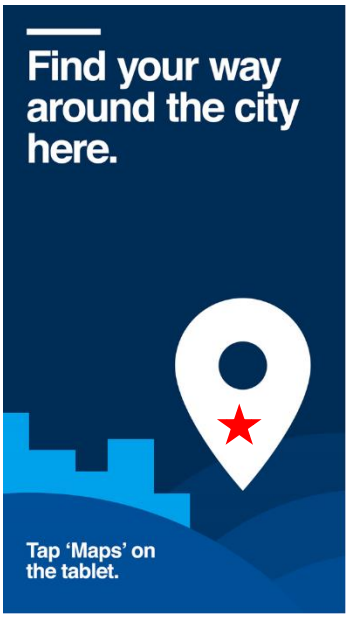
1 = USB

★ = Location within white zone that luminance measurements were taken



5 = "999"

2.4.4



4 = "maps"

2.4.5

3. Measurements

3.1 Battersea Bridge Road

3.1.1 The measurements of the screen at Battersea Road were taken during daytime at between 1545 and 1630 hours on 21st February 2018. The sky was overcast, and the weather was dry. The ambient luminance of the sky varied from 900 cd/m2 down to 326 cd/m2 dependent upon the direction of measurement and the amount and density of cloud cover.

3.1.2 Measurements were taken at a distance of 3.0m from the screen in a normal direction to the screen. The measurements recorded are shown in the table below.

Screen display					
Brightness Setting	**Tablet cd/m²**	**Phone cd/m²**	**USB cd/m²**	**Explanation cd/m²**	**Tear Drop cd/m²**
0%	-	-	-	-	-
5%	-	-	-	-	-
10%	-	-	-	-	-
15%	637	627	640	-	-
20%	743	758	740	760	740
25%	920	892	920	900	885
30%	1005	1025	1002	1018	1010
35%	1132	1110	1131	1094	1136
40%	1215	1248	1218	1238	1219
45%	1360	1325	1340	1308	1350
50%	1460	1504	1465	1485	1470
55%	1608	1571	1603	1560	1614
60%	1681	1716	1674	1699	1673
65%	1829	1779	1819	1762	1817
70%	1915	1921	1880	1904	1867
75%	2087	2019	2055	1997	2060
80%	2094	2167	2127	2072	2146
85%	2238	2267	2204	2263	2213
90%	2327	2330	2365	2296	2363
95%	2485	2490	2430	2472	2429
100%	2530	2450	2515	2435	2511

Table 2 Luminance Readings on Battersea Bridge Rd Screen

3.1.3 The results are plotted on the following graph and it can be seen that a straight line trend is apparent and there is good consistency between luminance levels for each screen design.

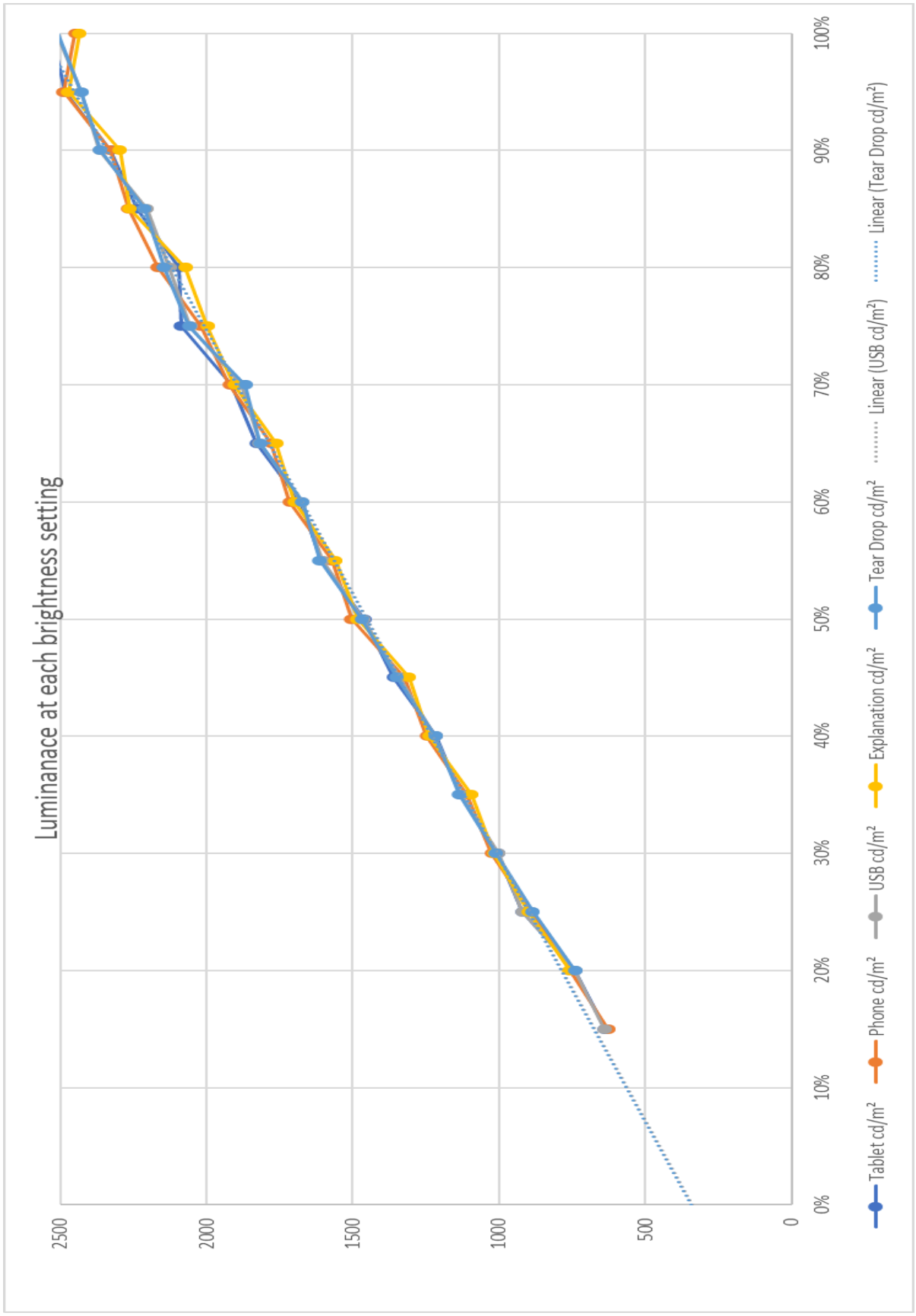


Fig. 1 Battersea Bridge Road Screen Luminance Readings

3.2 Falcon Road - Day

3.2.1 A set of measurements were taken at the Falcon Road, Wandsworth screen from 1700 to 1730 hours during daylight. The weather was overcast and ambient luminance was measured at 122 cd/m^2. The table below details the measurements of the bright white sections of the screen and are directly comparable with those taken on the same screen during daytime.

	Screen display					
Brightness Setting	**Tablet cd/m²**	**Phone cd/m²**	**USB cd/m²**	**Explanation cd/m²**	**Tear Drop cd/m²**	**Facebook Cd/m²**
0%	334	322	340	-	336	304
5%	-	-	410	405	404	407
10%	530	520	-	518	526	522
15%	643	-	629	622	630	617
20%	-	-	-	-	-	-
25%	-	-	-	-	-	-
30%	-	-	-	-	-	-
35%	-	-	-	-	-	-
40%	-	-	-	-	-	-
45%	-	-	-	-	-	-
50%	-	-	-	-	-	-
55%	-	-	-	-	-	-
60%	-	-	-	-	-	-
65%	-	-	-	-	-	-
70%	-	-	-	-	-	-
75%	-	-	-	-	-	-
80%	-	-	-	-	-	-
85%	-	-	-	-	-	-
90%	2386	2344	2360	2322	2359	-
95%	2542	2444	2505	2358	2411	2384
100%	2567	2399	2430	2397	2485	2470

Table 3 Luminance Measurements from Falcon Road screen (Day)

3.2.2 These results show that there is good consistency between the luminance produced by the screen in Battersea Bridge Road and the one in Falcon Road. It can also be compared with the night time readings at Falcon Road to again show good consistency between daytime and nighttime luminance levels.

3.3 Falcon Road - Night

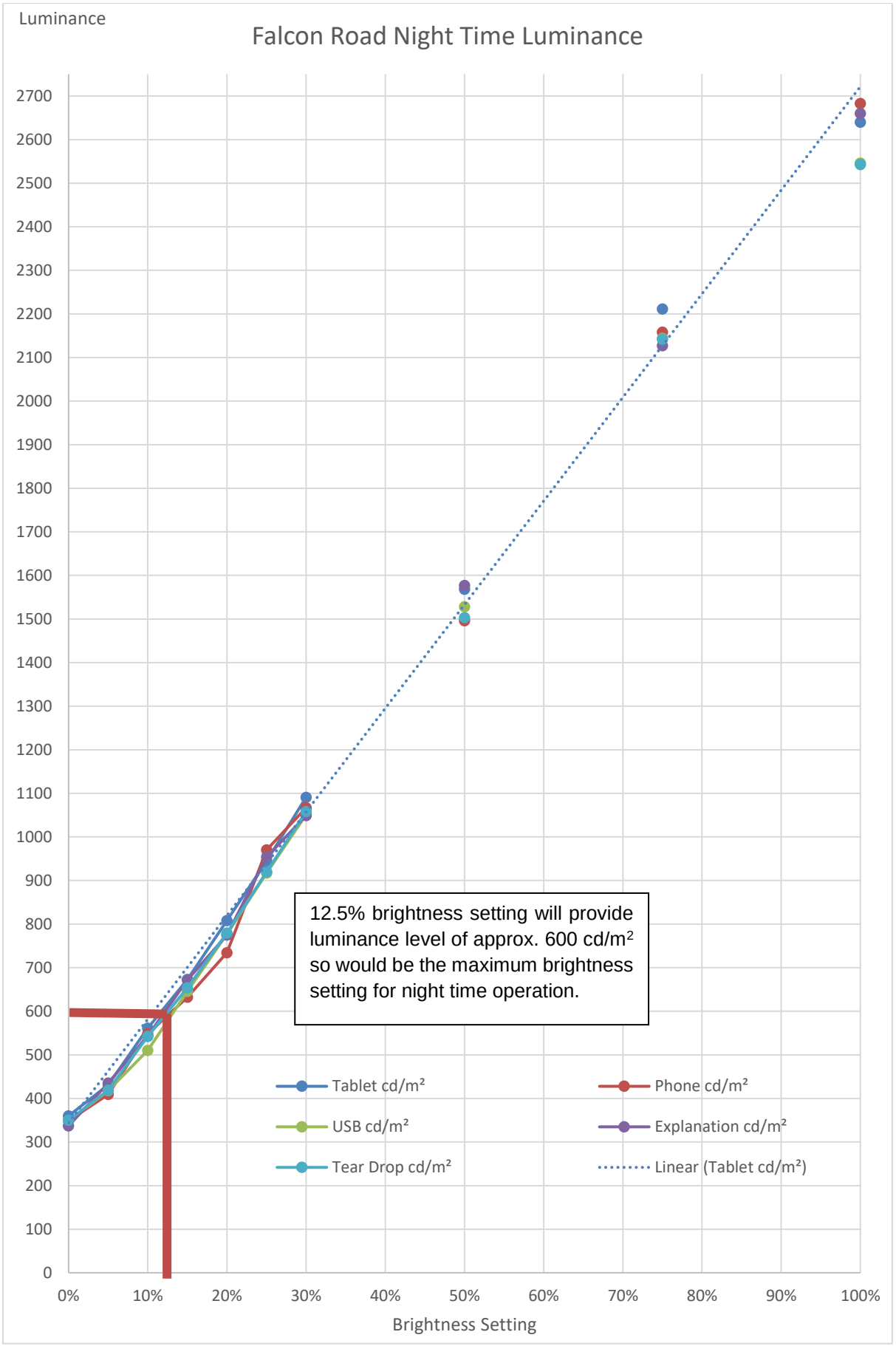
3.3.1 A set of measurements were taken at the Falcon Road, Wandsworth screen from 1930 to 2015 hours during night time. The weather was overcast and ambient luminance was measured at 122 cd/m^2. The table below details the measurements of the bright white sections of the screen and are directly comparable with those taken at Battersea Bridge Road.

Screen display					
Brightness Setting	**Tablet cd/m²**	**Phone cd/m²**	**USB cd/m²**	**Explanation cd/m²**	**Tear Drop cd/m²**
0%	360	349	348	337	350
5%	431	409	418	435	419
10%	561	548	510	543	542
15%	673	632	646	672	654
20%	808	734	777	775	779
25%	945	970	917	954	920
30%	1091	1067	1051	1049	1058
35%	-	-	-	-	-
40%	-	-	-	-	-
45%	-	-	-	-	-
50%	1568	1496	1528	1577	1503
55%	-	-	-	-	-
60%	-	-	-	-	-
65%	-	-	-	-	-
70%	-	-	-	-	-
75%	2211	2158	2144	2127	2142
80%	-	-	-	-	-
85%	-	-	-	-	-
90%	-	-	-	-	-
95%	-	-	-	-	-
100%	2640	2683	2546	2660	2543

Table 4 Luminance Measurements from Falcon Road Screen (Night)

3.3.2 The graph below shows how the luminance level is a function of the brightness setting and therefore the brightness setting is a good predictor of luminance levels.

3.3.3 The guidance limit of 600 cd/m^2 is shown on the graph with the red line which intersects the measurements line at a brightness setting of 12.5%.


Luminance
Falcon Road Night Time Luminance
2700
2600
2500
2400
2300
2200
2100
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Brightness Setting
12.5% brightness setting will provide luminance level of approx. 600 cd/m² so would be the maximum brightness setting for night time operation.
Tablet cd/m²
Phone cd/m²
USB cd/m²
Explanation cd/m²
Tear Drop cd/m²
Linear (Tablet cd/m²)

4. Guidance

4.1 Institution of Lighting Professionals (ILP) Professional Lighting Guide (PLG) 05 "The Brightness of Illuminated Advertisements".

4.1.1 This document has the objective of providing guidance on how to assess the impact of the signage. It provides guidance limits on luminance levels of illuminated signs based upon their size.

4.1.2 The brightness of an object is subjective and is dependent upon four factors which are:

- Luminance
- Size
- Contrast
- Observer

Environmental zones

4.1.3 The ambient luminance of an area is significant in how bright the sign will appear which is why the limit in the Table is dependent upon the Environmental Zone which is indicative of the ambient luminance of an area. Thus higher luminance levels are typically beneficial in town centres which have higher levels of ambient luminance.

4.1.4 The table is taken from the ILP Guidance Notes on Reduction of Obtrusive Light.

Environmental Zones			
Zone	Surrounding	Lighting Environment	Examples
E0	Protected	Dark	UNESCO Starlight Reserves, IDA Dark Sky Parks
E1	Natural	Intrinsically Dark	National Parks, Areas of Outstanding Natural Beauty etc
E2	Rural	Low District Brightness	Village or relatively dark outer suburban locations
E3	Suburban	Medium District Brightness	Small town centres or suburban locations
E4	Urban	High District Brightness	Town/city centres with high levels of night-time activity

Table 5 ILP Definitions of Environmental Zones

Night time luminance limits

4.1.5 The guidance levels provide limits on luminance based upon the ambient luminance of the area (rural low ambient luminance up to town centre high ambient luminance) and the size of the screen as follows:

Maximum permitted recommended luminance (cd/m^2)					
Illuminated Area (m2)	Zone E0	Zone E1	Zone E2	Zone E3	Zone E4
Up to 10	0	100	400	600	**600**
10	0	n/a	200	300	300

Table 6 ILP Guidance on screen luminance levels (night)

4.1.6 The screens are all much less than 10m^2 and would typically be located within an E4 Environmental Zone in accordance with the definitions shown in the table below.

4.1.7 Thus a recommended sign luminance maximum limit of 600 cd/m^2 should be used for night time.

Day Time luminance limits

4.1.8 During the daytime the ambient luminance is typically much higher and in order to achieve good visibility and contrast, the upper limit of luminance can be significantly higher, without causing any issues with safety or discomfort.

4.1.9 The ILP guidance states “During the daytime sign luminance should never exceed 5000 cd/m^2.”

4.1.10 Further guidance is provided within CIBSE SLL Lighting Guide 6 (LG6) - The External Environment which states “In the absence of any specific requirements, we recommend an upper limit of 3000 cd/m2”.

4.1.11 In the tests that were carried out, the maximum luminance that could be measured from a bright white screen at maximum brightness was < 2700 cd/m^2

4.1.12 On the basis of these measurements and the available guidance, the screens could be operated at 100% brightness during the day.

5. Conclusion

5.1 Summary

5.1.1 A number of tests were carried out on the two signs at Battersea Bridge Road and Falcon Road and the results provided a degree of consistency.

5.1.2 From the results a number of conclusions can be drawn.

- There is little variation in sign luminance between daytime and night time measurements
- White screens provide significantly higher luminance than coloured screen backgrounds.
- The maximum screen luminance measured at the 100% brightness setting and with a bright white screen was less than 2700cd/m^2
- The 100% brightness setting is suitable for day time use as the maximum luminance will be less than the CIBSE or ILP guidelines of 3000cd/m^2 and 5000 cd/m^2 respectively as detailed in Chapter 4.
- The night-time limit recommended in the ILP guidance document for a town or city suburban or urban location is 600cd/m^2
- This 600cd/m^2 level occurs when the brightness setting is between 15% and 10% and by interpolation would typically coincide with a 12.5% brightness setting.
- Therefore, it is recommended that a maximum brightness setting of 12.5% is used for night time screen luminance.