



**London  
Streets**

# **Pedestrian Countdown at Traffic Signals (PCaTS) Specification**

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## **1. Introduction**

- 1.1. This specification covers the use of Pedestrian Countdown Signals (The Product) at traffic signals. The purpose of pedestrian countdown signals at traffic signals is to provide the pedestrians with additional information regarding the pedestrian blackout period, where there is no other indication given by the traffic signals.
- 1.2. This is given in the form of a numerical indicator to show the time remaining for pedestrians to complete a crossing before the illumination of the associated Red Man signal.
- 1.3. The Product use is restricted to those traffic junctions where pedestrian facilities are far-sided.

## **2. Specifications and Approvals**

- 2.1. This specification covers all the requirements for the forthcoming Highways Agency specification covering Pedestrian Countdown equipment.
- 2.2. The Highways Agency specification is currently in consultation within the UK and is not yet publically available. Once it has passed UK consultation it shall be passed to the EU for public consultation. At this point it will be available.
- 2.3. Subject to any major changes as a result of the European consultation it is expected that equipment meeting this specification will also meet all requirements for self-certification under the process described in the Highways Agency document TRG0600A.

## **3. Sequence and Appearance**

- 3.1. The Product shall be a separate aspect and not be integrated into any other pedestrian or traffic aspect.
- 3.2. The Product shall be designed to operate mounted together with existing pedestrian signals either to the left or the right of the Green Man aspect.

## 4. Operation and Timing

- 4.1. The Product shall be a learning-based system, which actively monitors the input voltages (see Section 7) to the pedestrian signals in order to deduce their state, record the activation sequence and accurately determines the time of the blackout period

### Display

- 4.2. The product shall display only during the pedestrian blackout period. Where the blackout period is defined as that part of the pedestrian signal sequence during which neither the red man nor the green man are illuminated.
- 4.3. The product shall activate at the expiry of the green pedestrian signal and shall countdown in whole seconds the Countdown Duration (Section 4.6). It shall terminate at the start of the red pedestrian signal, displaying "01", where time 0 coincides with the end of the pedestrian blackout period. Appendix 1 – Countdown Timing diagram" shows the timing chart for operation.

### System Start up

- 4.4. On application or restoration of power supply the Product shall initially display a blank face.
- 4.5. When power is applied to the Product it shall begin a learning phase to monitor the pedestrian signals for a period of 2 consistent cycles. During this learning phase the countdown display should remain blank.
- 4.6. Two cycles are considered consistent if both their sequences (as defined in 4.9) match and their measured pedestrian blackout times are within 0.5s of each other. The lowest measured value shall then be stored as the Countdown Duration.

### Timing and Sequences

- 4.7. The Product shall be connected to both the Red man and the Green man lines from the Traffic Signal Controller and use these as the input to the timing circuit.
- 4.8. The Product shall round down the displayed Countdown Duration as per Table 1 and the maximum countdown duration shall be 30s.

Measured Value [s]	Displayed Value [s]
xx.00 to xx.69	xx
xx.70 to xx.99	xx+1

**Table 1 - Rounding calculations for timing**

- 4.9. The Product shall monitor the input sequence (the order of red and green man activations discounting duration) and store this sequence. The start of the sequence shall coincide with the start of the Red Man period.
- 4.10. The Product shall provide a hardware or software mechanism to avoid picking up noise and performing incorrect timing calculations.
- 4.11. The filter system shall be designed to avoid unwanted short duration noise or other voltages at an appropriate level from masquerading as correctly received control signals and causing malfunction of the unit.

- 4.12. Because such filtering can affect the correct signal timing measurements and consequently cause unnecessarily short or long calculations of the countdown time they shall be adjusted to minimise this effect.
- 4.13. Therefore, the filter mentioned in 4.10 shall be formed in two parts. The primary filter shall have a capacity of 300ms and be used during the non-display period (Red Man and Green Man times). The second filter shall have a width of 100ms and be used during the display (Blackout) Period.
- 4.14. This ensures that the display is distinguished in as short a time as possible whilst keeping a wide enough filter during the majority of the time.
- 4.15. The foreshortening of any digit display duration, such as to deal with non integer blackout durations (e.g. 9.80s) shall only affect the first display digit.

### ***Relearn conditions***

- 4.16. During all learning and re-learning phases the product display shall remain blank.
- 4.17. The Product shall continuously monitor all parts of the signal cycle but re-learn only when two consecutive cycles are not consistent as defined in section 4.6. The Product shall not re-learn if only the Green man or Red man times change.
- 4.18. The operation of the Product in the event that the pedestrian blackout period changes shall be the following:
  - 4.18.1. In the event that the pedestrian blackout is shorter than stored, the time taken for the unit to terminate its display shall be a maximum of the blackout filter time +10%. The unit shall then begin a re-learn phase.
  - 4.18.2. In the event that the pedestrian blackout is longer than stored the unit shall terminate display after displaying "1" for a duration of 1 second then begin a re-learn phase.
- 4.19. When there is a 48vdc power interruption of greater than 300ms the Product shall re-learn as part of the start-up sequence.

### ***Power Interruptions***

- 4.20. The Product should be designed such that it can sustain operation, including the display if appropriate, during short term power interruptions, less than 300ms.
- 4.21. For power failures of greater than 300ms the Product shall cease any display and undergo an orderly shutdown followed by a normal resumption of start up operation once power is restored.
- 4.22. The Product shall operate only in these two states (as defined in sections 4.20 and 4.21).

## 5. Fault Monitoring

The monitoring of the Product shall be defined in two distinct areas:

### **Internal Fault Monitoring**

- 5.1. The Product shall monitor its own operation and disable the display only if it detects a critical fault condition.
- 5.2. The Product shall provide a separate output, which is connected to the controller to signal a fault condition has occurred.
- 5.3. This monitoring line shall be a normally open line. Under a normal operation the Product shall force the line closed.
- 5.4. Under a fault condition the Product shall release (open) the line, signalling a fault to the Traffic Signal Controller.

### **External Fault Monitoring**

- 5.5. The Product shall be monitored by the Traffic Signal Controller via the monitoring line.
- 5.6. The Product will *not* be required to monitor the Red man \ Green Man lamps for operation and will continue to function as normal during any lamp failure of either Red man or Green man or both.
- 5.7. The monitoring line shall adhere to the requirements set out in section 7.
- 5.8. There shall be two separate fault types associated with the Product. Including but not limited to the below:

### **Non-critical faults**

- 5.9. These faults shall require reporting but do not affect the continuous operation of PCaTS:
  - A single LED String failure
  - Single Segment failure
  - Failure of unit to switch to “dim” or “bright” mode correctly
  - Failure to determine consistent cycles for longer than 60mins
- 5.10. If at any point the non-critical fault ceases to be present the Product should stop reporting the fault

### **Critical faults**

- 5.11. These faults shall cause a potential safety conflict and require reporting and the immediate shutdown of all PCaTS numerical displays.
  - Internal Timing failure – including measurement of Countdown Duration exceeding 30s
  - Loss of 2 separate numerical Segments
  - A single numerical segment or LED string permanently on
  - Total unit failure
  - Internal watchdog failure
- 5.12. All faults (critical and non-critical) shall be reported by PCaTS using the monitoring feedback line, although no distinction needs to be made between the two.

- 5.13. The Unit shall attempt to auto-recover from any non-critical fault after 60s. If the fault is still present it shall continue to attempt an auto-recover up to 10 times within 24 hours after which it should remain in a fault state and cease attempting to auto-recover.

### **On Board Diagnostics**

- 5.14. During a fault condition the Product shall provide a visual indication of which fault has occurred, using a simple LED arrangement. The table below outlines the arrangement to be used:

<b>Fault</b>	<b>Binary Code</b>
No Fault	0000
Single LED \ String failure	0001
Single Segment failure	0010
Loss of 2 separate numerical Segment	0011
A single numerical segment or LED string permanently on	0100
Failure of unit to switch to “dim” or “bright” mode correctly	0101
Failure to determine consistent cycles for longer than 60mins	0110
Internal Timing failure – including measurement of Countdown Duration exceeding 30s	1000
Internal watchdog failure	0111

**Table 2 - Fault Code Matrix**

- 5.15. The Product shall keep an historic log of all faults that have occurred including a relative timestamp.
- 5.16. In conjunction with the historic log the unit shall store on-board diagnostic information that shall provide fault diagnosis details including the last known state of all input and output ports and the fault condition causing the failure.
- 5.17. The Product shall provide a means for an Engineer to access the historic log and on-board diagnostic information to aid in fault diagnosis. Access does not need to be provided without disassembly.

## 6. Compatibility

- 6.1. The Countdown module must be compatible with Traffic signal controllers designed to TR2500A, TR2210 and TR0141C.
- 6.2. When installed the Product shall not cause by either their design or by failure, any fault condition to be detected by the Traffic Signal Controller (particularly lamp monitoring and conflict checks), other than those reported over the dedicated monitoring line.
- 6.3. The Product shall provide a CE mark to declare self-assessment against the appropriate Conformity Assessment Module(s).



## 7. Electrical

- 7.1. The Product shall interface with the existing Red and Green man lines as described in Table 3.

	<b>Low Voltage (BS7987 class A1)</b>
<b>Nominal Supply</b>	Bright: 230vac +10% -13% Dim: 160vac +10% -13%

**Table 3 - Nominal Voltages for Signal Input Lines**

- 7.2. All connections shall be electrically isolated
- 7.3. Class F1 of BS 7987 shall apply to mains frequency stability, +/-2% of the 50Hz nominal frequency in the UK.
- 7.4. The Product shall draw between 2-5mA of current from the Red \ Green Man lines whilst monitoring.
- 7.5. The Product shall operate using a dedicated permanent power line. The operating voltage range of the unit shall be 40-50vdc with a nominal 48vdc supply.
- 7.6. The Product shall ensure the timing circuit is constant and accurate, +/- 5% over the entire voltage range.
- 7.7. The circuitry shall meet the requirements of BS EN 50293 regulations regarding EMC.
- 7.8. The Product shall meet the requirements of Section 3.3 of BS 7987 as regards electrical safety.
- 7.9. The typical working power consumption should not exceed 11w during the countdown period, with an assumed "08" display in bright mode, over the entire nominal voltage and temperature ranges.

### **Monitoring line**

- 7.10. The Traffic controller requires the following impedance to be presented at its inputs:
- 7.10.1. During normal operation, when the monitoring line is closed, the traffic controller input shall be continuously presented with a resistance as in Table 4 - Monitoring line impedance setting

<b>Impedance Setting</b>	<b>Closed State Impedance (No Fault)</b>
IN	180 ohms +/- 10% and shall be able to withstand a current of at least 50mA
OUT	2 ohms +/- 10% and shall be able to withstand a current of at least 50mA

**Table 4 - Monitoring line impedance setting**

- 7.10.2. During any fault condition, when the monitoring line is open, the traffic controller input shall be continuously presented with a resistance of greater than 100 K ohms.

- 7.11. The Product's output shall be able to withstand a continuous voltage of up to 50 V dc when in the open state and capable of continuously allowing a current of 50mA to pass with a minimal volt drop.
- 7.12. In order to allow for flexible site configuration the closed state impedance must be selectable on the Product. This must be operated without disassembling the Product.
- 7.13. The selection of the closed state impedance should be provided in a manner that minimises unintentional switching.

## 8. Optical and Display

### *Digit Display*

- 8.1. Each numerical digit shall be made up of 7 separate segments, to be arranged as shown in Appendix 3.
- 8.2. Each numerical segment shall comprise a number of LEDs wired in strings. These strings shall be arranged such that a single LED failure shall not cause the total failure of the segment.
- 8.3. The display dimensions shall conform to Appendix 5 – Numerical display layout.

### *Luminance and Chromacity*

- 8.4. All segments shall be uniform with each other in respect of size, shape, layout, optical output and orientation (excluding horizontal and vertical differences) and designed to provide maximum clarity and legibility. Including during any LED string failure.
- 8.5. The colour of the Numerical display shall be yellow as per Table 2.2 of TR2516B.
- 8.6. In “Bright” mode (defined in 7.1) the luminance value of the Yellow numerical display shall be 200cd, with a maximum luminance of 800cd, when displaying the number “88”. (Table 1 of BS EN 12368, performance level 2/1).
- 8.7. In “Dim” mode (defined in 7.1) the luminance value of the Yellow numerical display shall be in line with dimming requirements of TR2206A when displaying the number “88”.
- 8.8. The Product shall voltage monitor the incoming Red \ Green Man lines to enable dimming. The Product shall use the voltage specified in Section 7.1 to determine the appropriate dimming state.

### *Viewing Angle*

- 8.9. The countdown unit shall ensure that the maximum readily readable viewing angle of 40° centred on the 0° vertical axis.
- 8.10. Further viewing angle restriction should be provided by means of a removable hood of a length of 150mm.

## 9. Environmental

- 9.1. The environmental requirements for the Product are as set out in TR2130.
- 9.2. The Product shall meet the requirements of BS EN 12368: IP55.

## 10. Construction and Materials

### *Product Housing*

- 10.1. The PCaTS unit shall be provided with a housing
- 10.2. This housing shall be designed such that it is possible to mount it in the range of positions shown in Appendix 5 – Numerical display layout
- 10.3. The Housing shall be provided with a mounting mechanism designed to allow mounting onto TfL's existing signal heads
- 10.4. TfL will look to install the Unit against two distinct types of Traffic Signal Head. Details of dimensions and profiles can be found in

#### Appendix 6 – Pedestrian Signal Housings

- 10.5. Where possible a universal mounting system should be provided. Where this is not possible it is acceptable for a number of different brackets to be provided.
- 10.6. The mounting mechanism will also include a conduit to allow the PCaTS unit fly-lead to be routed into the adjacent Green Pedestrian Signal housing.
- 10.7. It is acceptable for the mounting mechanism to require some minor modification to the existing Green Pedestrian Signal housing, provided the IP rating of the Traffic Signal Housing and the Unit remain as specified (IP55).
- 10.8. The Housing should be provided with a removable masking “hood” of a length of 150mm

#### ***Countdown Display Unit***

- 10.9. The Product shall have a circular front display surface with an external diameter of 300mm +/- 5mm.
- 10.10. The front face shall be provided with an anti-reflective coating and shall be predominantly flat.
- 10.11. The Product shall be a single sealed unit, not requiring any on-site assembly for installation other than fitting to the Housing.
- 10.12. The Product shall be capable of displaying numbers “00” to “99”.

## Connection Lead

- 10.13. The Product shall be supplied with a single connection plug allowing ease of replacement. The unit shall be supplied with a fly-lead with a Bulgin Buccaneer PX0745/P plug (or equivalent).
- 10.14. The fly lead shall be 2.5m long, using multi-stranded cores and with individual cores coloured as defined in 10.15.
- 10.15. The incoming connections to the Product shall be seven wires as detailed:

Function	Wire Colour	Connector Pin
Power supply +ve	Red	1
Neutral line	Blue	2
Green Pedestrian Signal	Green	3
Monitoring line Return	Yellow	4
Monitoring Line	White	5
Power supply -ve	Black	6
Red Pedestrian Signal	Brown	7

**Table 5 - Fly-Lead connection**

- 10.16. Each unit shall be individually identified on the back with the following information:
- Serial number
  - Manufacturer name
  - Date of manufacture
  - Electrical power requirements
  - Model type
  - CE mark

## 11. Normative References

Where undated references are listed, the latest issue of the publication applies.

### **British Standards**

British Standards are published by the British Standards Institution, London.

**Contact:** +44 (0) 1344 404 429

BS 7671	Requirements for Electrical Installations
BS EN 50556	Road Traffic Signal Systems (replaces BS 5987/HD 638)
BS EN 50293	Electromagnetic Compatibility Road Traffic Signal Systems Product Standard
BS EN 60529	Specification for Degrees of Protection Provided by Enclosures (IP Code)

### **Specifications**

Specifications are published by the Highways Agency.

**Download from:** <http://www.tssplansregistry.org>

TR 2130	Environmental Tests for Motorway Communications Equipment and Portable and Permanent Road Traffic Control Equipment
TR 2500	Specification for Traffic Signal Controller
TRG 0600	Self-Certification Procedures for Statutory Approval of Traffic Control Equipment

### **Related Documents**

BS EN 12368	Traffic Signal Heads
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### **Legislation**

The Traffic Signs Regulations and General Directions 2002 (SI 2002/3113)

Directive 2004/108/EC

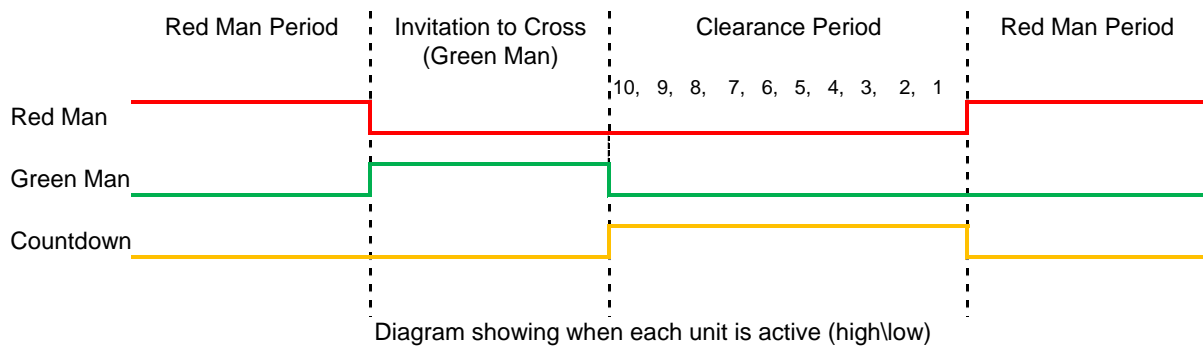
Electromagnetic Compatibility Regulations 2006 (SI 2006/3418)

Directive 2006/96/EC

The Electrical Equipment (Safety) Regulations 1994 (SI 1994/3260)

## Appendix 1 – Countdown Timing diagram

This diagram shows the status (on \ off) of each input line (Red \ Green Man), alongside the status of the countdown display (on \ off).



The countdown shall only display between the falling edge of the green man signal and the rising edge of the Red Man signal.



## **Appendix 2 – Compatibility with Traffic Controllers**

TfL has large number of traffic controller types currently in use through out London.

Siemens – ST200, ST400, ST800, ST900

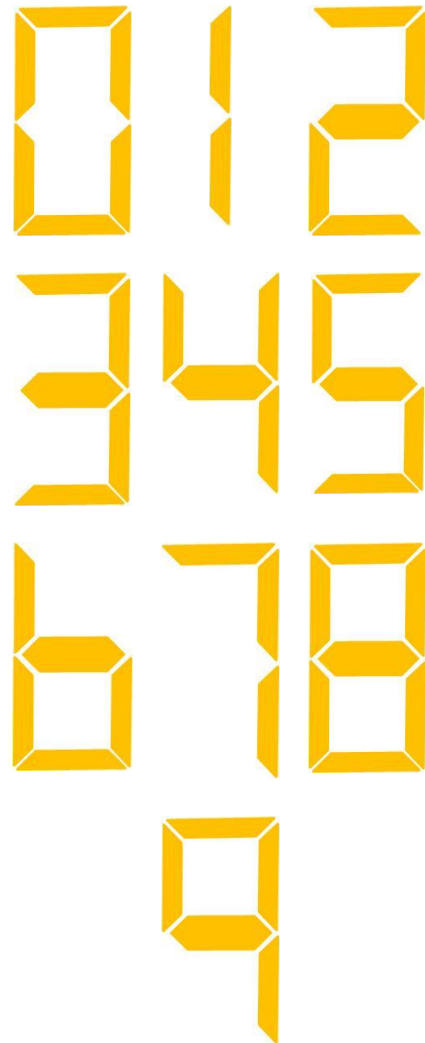
Peek - Trojan, Peek 3

Microsense - MTC

The Product should be compatible with all controllers complying with specifications: TR2500A, TR2210 and MCH141.

### Appendix 3 – Numerical appearance

The following table shows the arrangement of LED segments for all digits:



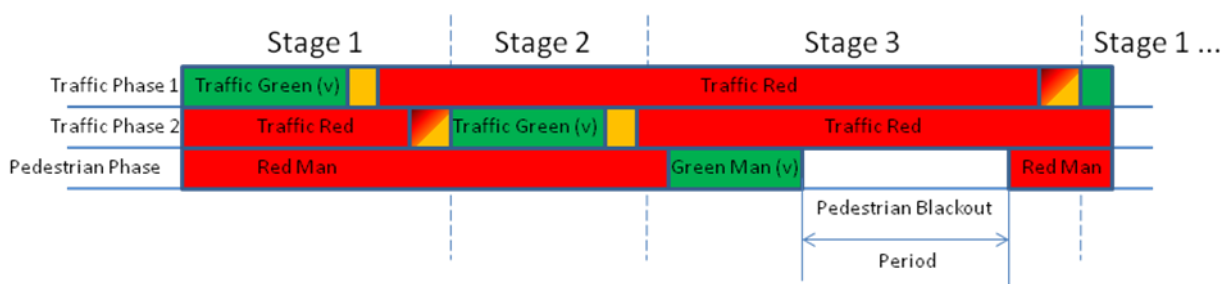
## Appendix 4 - Normal UK Traffic Signal operation

The following section details the normal operation of a UK traffic signal junction. This is detailed in order to give all parties an understanding of the traffic sequencing to be used with countdown units.

Traffic signals in the UK use a number of control methods including Vehicle Actuated (VA) and UTC SCOOT. Both of these control methods are capable of dynamically changing the duration of traffic and pedestrian stages.

PCaTS shall be designed to run only during the pedestrian blackout period. This time is not dynamically variable but can be changed by an engineer on site, although these changes are infrequent.

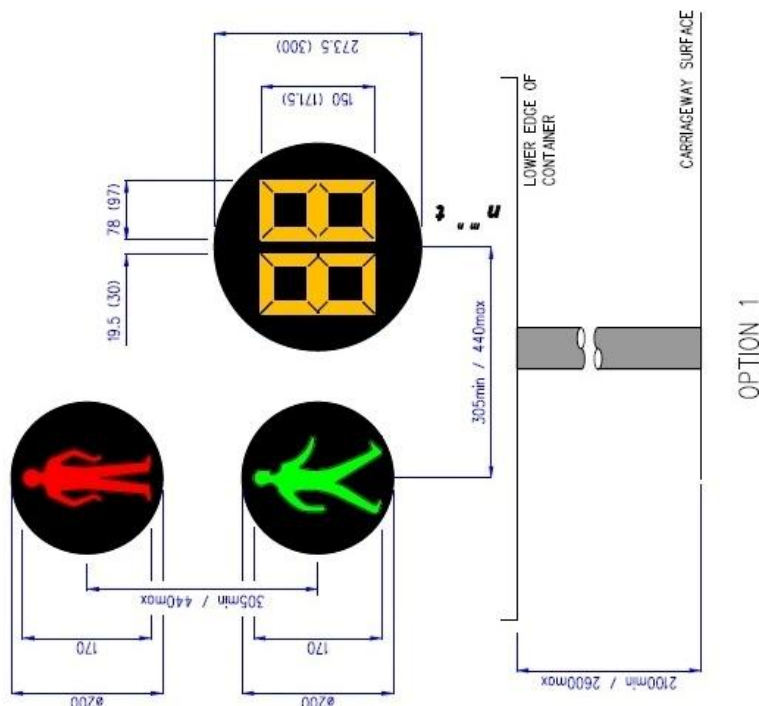
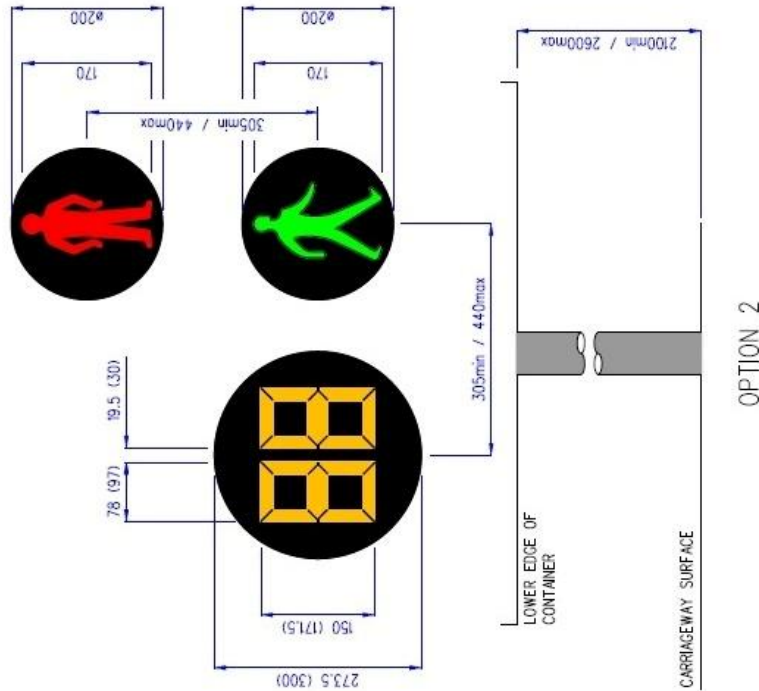
The below diagram shows the typical stages in a traffic cycle



Typical Traffic sequence  
(v) indicates a dynamically variable time

## Appendix 5 – Numerical display layout

The numerical layout of the Product is subject to DfT approval. Nationwide approval for a standard layout is expected in the near future. In lieu of this formal approval the below diagram is based on a previous DfT approved countdown unit.

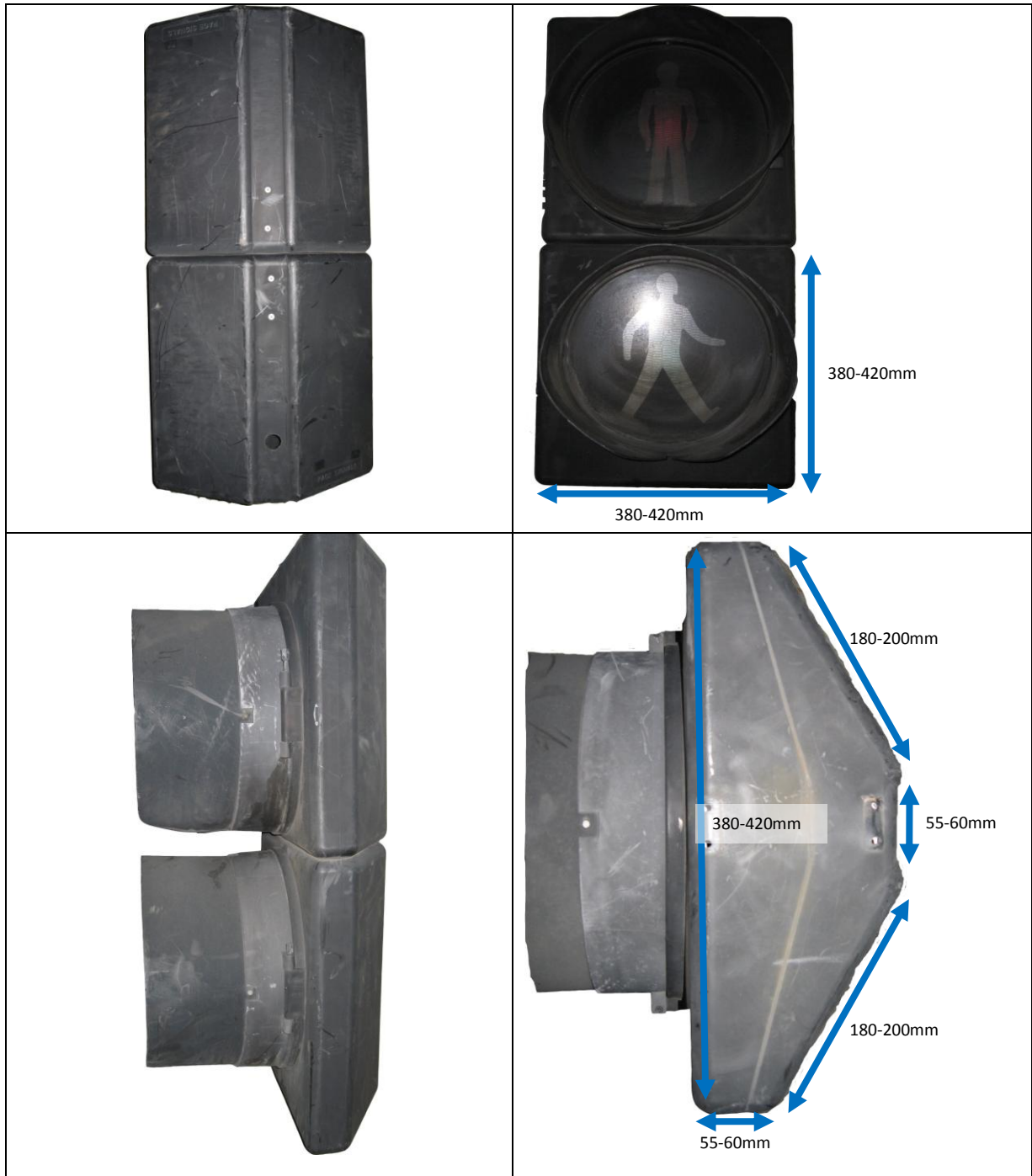


NOTES  
1 ALL DIMENSIONS IN MILLIMETRES

## Appendix 6 – Pedestrian Signal Housings

TfL will be installing the Product alongside two distinct types of Pedestrian Signal Head. Both types are shown below. The photos and dimensions do represent the actual signal heads to be used but should be treated as indicative, subject to final confirmation.

Type 1 – This a mixture of three legacy manufacturer’s similar designs



Type 2 – Single manufacturer’s design of current signal heads

