

## **Appendix 1: Sample Particular Specification for Road Markings**

## Particular Specification for Road Markings

### **12.27 SOLID GLASS BEADS**

GS Clause 12.27 is deleted and replaced by the following: -

- (1) Drop-on glass beads shall comply with BS EN 1423: 1998. In particular, the refractive index of the glass beads shall conform to at least Class A ( $n \geq 1.5$ ) when determined in accordance with Annex A of BS EN 1423: 1998. Glass beads of different classes mixed together may be used, but the requirements on luminance and retroreflectivity stipulated in PS Clauses 12.45 (2) and (3) shall be complied with. Antiskid aggregates mixed with the glass beads may be used, but the requirement on skid resistance stipulated in PS Clause 12.45 (4) shall be complied with. The percentage of antiskid aggregates and glass beads of different classes shall be submitted to the Engineer for record.
- (2) Premixed glass beads shall comply with BS EN 1424: 1998. In particular, the refractive index of the glass beads shall conform to at least Class A when determined in accordance with Annex A of BS EN 1424: 1998.

### **12.33 PREPARATION OF SURFACES**

GS Clause 12.33 (4) is deleted and replaced by the following:

- (4) Existing road markings that are to be renewed using a similar type of material shall be roughened by a method agreed by the Engineer to assure compliance with the thickness requirement stipulated in PS Clause 12.34 (4) and proper bonding with the new road marking material.

### **12.34 LAYING HOT-APPLIED THERMOPLASTIC MATERIAL**

GS Clause 12.34 (3) is deleted and replaced by the following:

- (3) The thickness of new road markings, not including surface applied solid glass beads, shall comply with the following:
  - (a) Screed markings : 2 to 5mm
  - (b) Sprayed lines other than yellow edge lines :  $\geq 1.5$ mm
  - (c) Sprayed yellow edge lines :  $\geq 0.8$ mm

The thickness shall be measured in accordance with BS 3262: Part 3, Appendix B.

- (4) For existing road markings that are renewed using a similar type of material, the thickness of markings after renewal shall be not more than 6mm unless otherwise agreed by the Engineer.

- (5) If instructed by the Engineer, trial areas of new road markings shall be laid to demonstrate that the proposed materials and methods of laying are capable of producing road markings which comply with the requirements of the Contract. Unless otherwise stated in the Contract, the trial areas shall be constructed as part of the permanent road marking works agreed by the Engineer. The width of each trial area shall be at least one lane of carriageway and the length shall be at least 50m. Testings of road marking works and thickness shall be carried out in accordance with PS Clauses 12.45 and 12.46.

**12.37 ROAD MARKING PERFORMANCE FOR ROAD USERS**

GS Clause 12.37(c) is deleted.

**12.40 TOLERANCES**

GS Clause 12.40(a) is deleted.

**12.41 REMOVING ROAD MARKINGS**

GS Clause 12.41 is deleted and replaced by the following:

- (1) Unless otherwise instructed by the Engineer, the removal of road marking material shall be carried out by grinding. Excessive grinding that causes damage to the road surface shall be avoided.
- (2) Where existing road marking is directed by the Engineer to be removed by steel shot-blasting, the removal of road marking materials shall be carried out by a shot-blasting machine approved by the Engineer. The machine shall be self-propelled, and shall have a minimum cleaning path of 350 mm.

**12.41 REMOVING EXCESSIVE THICKNESS OF THERMOPLASTIC ROAD MARKING BY USE OF HEATING**

- (1) The existing road marking of excessive thickness shall be suitably softened by use of heating for removal of the excessive thickness without damaging the road surface.
- (2) After softening by use of heating, the excessive thickness shall be removed manually by use of hand tools unless otherwise approved by the Engineer. The road surface shall not be damaged during the process.
- (3) Thermal patcher or plant and equipment otherwise approved by the Engineer, shall be deployed for the heating process.
- (4) The residual thickness of the road marking shall not be more than 1mm from the road surface after the removal works unless otherwise approved by the Engineer.

**12.45 TESTING: ROAD MARKING PERFORMANCE**

Sampling rates for testing: luminance, retroreflectivity and skid resistance (1) Testing on luminance, retroreflectivity and skid resistance of road markings shall be conducted on batches of road marking works selected by the Engineer as detailed below. A batch of road marking works is the road markings painted within a 24-hour period counting from 08.00am to 08.00am next day. Unless otherwise instructed by the Engineer, for a set of road marking works comprising not more than 10 consecutive batches, one batch of road marking works shall be tested. For the batch selected, tests shall be conducted on not less than 10% of the testing units selected by the Engineer.\* A testing unit shall be determined according to different types of road markings as follows:

Remark \*: For capital works projects, each batch shall be tested and tests shall be conducted on not less than 10% of the testing units selected by the Engineer.

Group 1: Continuous road markings

For continuous road markings, including road marking nos. 1001, 1002, 1003, 1004, 1006, 1009, 1010, 1011, 1012, 1035, 1036, 1037, 1040, 1041, 1045, 1109, 1162, 1163 and 1164 as shown in drawing no. CT174/51-5(1) or CT174/51-5(2) published by the Transport Department, each 5m section is regarded as a testing unit. A remaining section shorter than 5m is also regarded as a testing unit.

Group 2: Box junction road markings

For box junction road markings, including road marking nos. 1038, 1044 and 1126, each box junction road marking or part thereof as appropriate shall be divided into 4 quarters with approximately equal areas and each quarter is regarded as a testing unit.

Group 3: Other road markings

For all other types of road markings, each entire road marking as shown in drawing nos. CT174/51-5(1) or CT174/51-5(2) is regarded as a testing unit.

Testing: luminance (2) Measurement of luminance coefficient under diffuse illumination (Qd) shall be carried out in accordance with BS EN 1436:1998. Five spots chosen by the Engineer on each of the selected testing units shall be tested. Measurement of Qd shall be carried out by an independent laboratory accredited by HOKLAS to carry out the said test. If the test cannot be carried out by a laboratory accredited by HOKLAS, the test may be carried out by others with equipment approved by the Engineer and calibrated in accordance with the manufacturer's recommendation. The test shall be carried out within 28 days after the road marking is hardened or as instructed by the Engineer, in the presence of the Engineer's Representative.

$Q_d$  measured in accordance with Annex A of BS EN 1436:1998 shall be Class Q2 and Q3 on asphaltic surface and concrete surface respectively for white markings, and shall be Class Q1 for yellow markings.  $Q_d$  of road marking on paving blocks shall follow the same requirement as on concrete surface.

The  $Q_d$  measurements of the batch shall be divided into groups each with a different  $Q_d$  requirement as mentioned above. For compliance, the average value of  $Q_d$  of every group within the batch shall meet the respective  $Q_d$  requirement.

Testing:  
retroreflectivity

- (3) Measurement of coefficient of retroreflected luminance ( $R_L$ ) shall be carried out in accordance with BS EN 1436:1998. Five spots chosen by the Engineer on each of the selected testing units shall be tested. Measurement of  $R_L$  shall be carried out by an independent laboratory accredited by HOKLAS to carry out the said test. If the test cannot be carried out by a laboratory accredited by HOKLAS, the test may be carried out by others with equipment approved by the Engineer and calibrated in accordance with the manufacturer's recommendation. The test shall be carried out within 28 days after the road marking is hardened or as instructed by the Engineer, in the presence of the Engineer's Representative.

If the marking to be measured is a center line with opposite traffic on its two sides, measurement of  $R_L$  at each spot shall be carried out with the equipment facing each traffic direction. That is, a total of 10 measurements shall be taken on the selected testing unit.

$R_L$  measured in accordance with Annex B of BS EN 1436:1998 shall be Class R2 and R1 for permanent white and yellow markings respectively, and shall be Class R3 for temporary markings.  $R_L$  of road marking on paving blocks shall follow the same requirement as on concrete surface.

The  $R_L$  measurements of the batch shall be divided into groups each with a different  $R_L$  requirement as mentioned above. For compliance, the average value of  $R_L$  of every group within the batch shall meet the respective  $R_L$  requirement.

Testing:  
skid resistance

- (4) Measurement of skid resistance shall be carried out in accordance with BS EN 1436:1998. Samples of road markings may be laid on metal plates of length not less than 300mm for off site testing as directed by the Engineer. Measurement shall be carried out on a spot chosen by the Engineer on each of the selected testing unit. Measurement of skid resistance shall be carried out by an independent laboratory accredited by HOKLAS to carry out the said test. The test shall be carried out within 28 days after the road marking is hardened or as instructed by the Engineer, in the presence of the Engineer's Representative.

For compliance, the average value of skid resistance for the batch of road markings after temperature correction shall meet the requirement of GS Clause 12.39.

Non-compliance:  
luminance,  
retroreflectivity  
,  
skid-resistance

- (5) Where there is any non-compliance in respect of the tests as required in sub-clauses (2), (3) and (4) in the batch selected for testing as per sub-clause (1), further tests shall be conducted within 56 days after the road marking is hardened or as instructed by the Engineer, on two additional batches chosen by the Engineer from the same set of works. For the avoidance of doubt, only tests with non-compliance found in the first test shall require re-testing.

If there is no non-compliance in the further testing on any testing batch, all road markings within the same set of works shall be considered as compliant with the specification. If there is any non-compliance in any of the further testing on any testing batch, the set of road markings works shall be considered as not complying with the specification and shall be rectified by the Contractor within a month after the non-compliance results of further test obtained.

(6) Pursuant to General Conditions of Contract Clause 48(3), the Employer may agree to accept the road marking works which are not in compliance with PS Clause 12.45(1) to 12.45(5) in the manner as described below. Should the Employer so agree, the following provisions in the tables, where applicable, shall apply:

Non-compliances of the road marking works with this PS Clause: luminance coefficient	The following percentage shall be deducted from the measurement of the road marking works
Less than specified $Q_d$ but not less than 80% of specified $Q_d$	20%
Less than 80% of specified $Q_d$	rejected

Non-compliances of the road marking works with this PS Clause : retroreflectivity	The following percentage shall be deducted from the measurement of the road marking works
Less than specified $R_L$ but not less than 80% of specified $R_L$	20%
Less than 80% of specified $R_L$	rejected

Non-compliances of the road marking works with this PS Clause: skid-resistance	The following percentage shall be deducted from the measurement of the road marking works
SRT: less than 45 but not less than 36	20%
SRT: less than 36	rejected

If additional batches are selected for testing in accordance with sub-clause (5), the worst performing batch of these additional batches shall be used to determine payment reduction or rejection as appropriate.

## 12.46 **TESTING: THICKNESS**

- (1) The measurement of thickness on new thermoplastic road markings shall be conducted in accordance with BS 3262 Part 3.

Testing on thickness shall be conducted on batches of road marking works selected by the Engineer as detailed below. A batch of road marking works is the road markings painted within a 24-hour period counting from 08.00am to 08.00am next day, under the same works order. Unless otherwise instructed by the Engineer, for a set of road marking works comprising not more than 10 consecutive batches, 3 batches shall be selected by the Engineer. For the avoidance of doubt, those batches of works specified in sub-clause (2) shall be excluded from forming the set of works mentioned above. For each batch selected, at least 3 specimens shall be taken for each screed box, screeding machine and spraying machine used for the works in the said batch. The specimens shall be taken by the Contractor during the painting of road marking, in the presence of the Engineer's Representative. Measurement of thickness shall be carried out by an independent laboratory accredited by HOKLAS to carry out the said test. If the test cannot be carried out by a laboratory accredited by HOKLAS, the test may be carried out by others with equipment approved by the Engineer and calibrated in accordance with the manufacturer's recommendation. The test shall be carried out within 28 days after the road marking is hardened or as instructed by the Engineer, with the attendance of the Engineer's Representative.

Testing shall first be carried out on one of the three batches as selected by the Engineer. For compliance, the thickness of each specimen of the batch shall comply with the requirements of sub-clause 12.34(3).

Where there is any non-compliance in any specimen of the first batch which has been tested, further tests on thickness shall be conducted as soon as practicable after the first batch has been tested or as instructed by the Engineer on the specimens of the other two batches.

If there is no non-compliance in the further testing on any testing batch, all road markings within the same set of works shall be considered as compliant with the specification. If there is any non-compliance in any of the further testing on any testing batch, the set of road markings works shall be considered as not complying with the specification and shall be rectified by the Contractor within a month after the non-compliance results of further test obtained.



- (2) Pursuant to General Conditions of Contract Clause 48(3), the Employer may agree to accept the road marking works which are not in compliance with PS Clause 12.46(1) in the manner as described below. Should the Employer so agree, the following provisions, where applicable, shall apply:

Non-compliances of the road marking works with this PS Clause : thickness	The following percentage shall be deducted from the measurement of the road marking works
Greater than the specified maximum thickness but not greater than 120% of the specified maximum thickness; or less than the specified minimum thickness but not less than 80% of the specified minimum thickness.	20%
Greater than 120% of the specified maximum thickness or less than 80% of the specified minimum thickness	rejected

If additional batches are selected for testing in accordance with sub-clause (1), the worst performing batch of these additional batches shall be used to determine payment reduction or rejection as appropriate.

**12.47 SUCCESSIVE DEDUCTION FOR NON-COMPLIANCES**

Pursuant to General Conditions of Contract Clause 48(3), the Employer may agree to accept road marking works which are not in compliance with the Contract in more than one aspect as covered under Clauses 12.45(1) to 12.46(2) above. In these cases, should the Employer so agree, the measurement of the relevant road marking works shall be reduced successively by the individual deduction percentages of the failed aspects as derived from Clauses 12.45(1) to 12.46(2) above. For illustration purposes, if the measurement of a road marking works is to be reduced by A%, B%, C% and D% for failure in the aspects as covered in Clauses above, the reduced measurement for payment shall be:

$$\text{Measurement without deduction} * (1 - A\%) * (1 - B\%) * (1 - C\%) * (1 - D\%)$$

