

CITY OF WHITEHORSE SERVICING STANDARDS MANUAL
PART 3 – CONSTRUCTION SPECIFICATIONS
SECTION 3.16 – PERMANENT LINE MARKING

TABLE OF CONTENTS

SECTION 3.16 – PERMANENT LINE MARKING	2
316.1 SCOPE	2
3.16.2 PLASTIC PAVEMENT MARKINGS	2
3.16.2.1 RELATED REQUIREMENTS	2
3.16.2.2 REFERENCES	2
3.16.2.3 MATERIALS	2
3.16.2.4 MIX FORMULATION	3
3.16.2.5 EQUIPMENT	3
3.16.1.6 PREPARATION	4
3.16.2.7 COLD PLASTIC APPLICATION	4
3.16.2.8 HOT THERMOPLASTIC APPLICATION	4
3.16.2.9 PROTECTION AND CLEANUP	4
3.16.2.10 THICKNESS TOLERANCE	5
3.16.2.11 WIDTH TOLERANCE	5
3.16.3 SUPPLY OF GLASS BEADS	6
3.16.3.1 REFERENCES	6
3.16.3.2 MATERIALS	6
3.16.3.3 PACKAGING	7
3.16.3.4 DELIVERY	8

SECTION 3.16 – PERMANENT LINE MARKING

316.1 SCOPE

The work described in this Section pertains to the supply and installation of permanent plastic pavement markings.

All work described in this section is to be carried out in strict accordance with manufacturer's recommendations unless otherwise noted.

3.16.2 PLASTIC PAVEMENT MARKINGS

3.16.2.1 RELATED REQUIREMENTS

Supply and application of cold plastic marking on asphalt or concrete pavement.

Supply and application of MMA spray plastic on asphalt or concrete pavement.

Supply and application of hot thermoplastic marking on asphalt pavement.

3.16.2.2 REFERENCES

ASTM D4060 – Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.

ASTM D570 - Test Method for Water Absorption of Plastics.

ASTM E28 - Test Methods for Softening Point of Resins Derived from Naval Stores by Ring and Ball Apparatus.

ASTM E1347 - Test Method for Color and Color-Difference Measurement by Tristimulus Colorimetry.

3.16.2.3 MATERIALS

3.16.2.3.1 Cold Plastic Markings: two-component, cold extruded and cold curing, having a specific gravity of 1.9 minimum at 25°C, and conforming to 3.16.1.3.3.

3.16.2.3.2 Hot Thermoplastic Marking: hot extruded, having a specific gravity of 2.0 minimum at 25°C, having a softening point of 90°C minimum according to ASTM E28, and conforming to 3.16.1.3.3.

3.16.2.3.3 Both cold and hot plastic markings are to conform to the following.

- **Water Absorption:** 0.5% maximum by mass retained water after 24-hour immersion, according to ASTM D570 Procedure A.
- **Impact Resistance:** Minimum 1.13 J at 25°C when material is cast into bar 25 mm² cross-section by 75 mm long, with 25 mm extended above vice jaws in a cantilever beam (Izod type) tester using the 2.82 J scale, according to ASTM D256 Method C.
- **Abrasion Resistance:** Maximum weight loss of 0.60 g when subjected to 200 revolutions on Taber abrader at 25°C using H-22 Calibrade wheels weighted to 500 g with sample kept continuously wet with distilled water.

CITY OF WHITEHORSE SERVICING STANDARDS MANUAL
PART 3 – CONSTRUCTION SPECIFICATIONS
SECTION 3.16 – PERMANENT LINE MARKING

- Prepare test sample with representative material placed on 100 mm square plate, 3-0.1 mm thick.
- **Chemical Resistance:** Test sample of 50 mm square, no degradation after exposure to:
 - 24 hour immersion in 5% NaCl.
 - 24 hour immersion in 5% CaCl.
 - 1 hour spot test with mineral oil.
- No deterioration when in direct contact with asphalt cement in asphalt materials, or with sodium chloride, calcium chloride or other de-icing chemicals.
- Non-toxic and not harmful to persons or property when in hardened state.
- No discoloration from sunlight ultraviolet exposure and no bond failure for warranted life of material.
- **Glass Beads:** are to conform to Section 3.16.2.
- **Pre-marking Paint:** As approved by the Engineer.
- **Groove Filler:** LRS 424 or approved equal.

3.16.2.4 MIX FORMULATION

White Colour: conforming to U.S. Federal Standard 595B Colour Number 37925 or **CGSB 1-GP-12.1C**, 70% minimum when measured with the Colour Guide Reflectometer 0,45° daylight luminous directional reflectance, with a green filter.

Yellow Colour: conforming to U.S. Federal Standard 595B Colour Number 33538 or **CGSB colour #505-308**, 40% minimum when measured with the Colour Guide Reflectometer 0,45° daylight luminous directional reflectance, with a green filter. The tolerance in colour allowed is as follows in the CIE L*, a*, b* Uniform Color Space and Color Difference Equation when calculated from instrumentally measured colour differences conforming to ASTM D2244:

- White
- Yellow – MTO
- L* = +2 and -1.5 max
- a* = +1.5 and -1 max
- b* = +4 and -4 max
- L* = +2 and -1.5 max
- a* = +1.5 and -1 max
- b* = +4 and -4 max
- Yellow - U.S. L* = -2 and +4 max
- a* = -6 and +4 max
- b* = -9 and +10 max
- No formulation change unless approved by the Engineer. Any significant change will be subject to field trials.

3.16.2.5 EQUIPMENT

Grooving Machine, Applicators: Subject to the Engineer's approval.

CITY OF WHITEHORSE SERVICING STANDARDS MANUAL
PART 3 – CONSTRUCTION SPECIFICATIONS
SECTION 3.16 – PERMANENT LINE MARKING

3.16.1.6 PREPARATION

Follow safe practices in the Procedures Manual for On-Street Construction Safety.

Sweep or airblow pavement surface clean and dry.

Remove conflicting markings.

Do not apply plastic marking until premarkings have passed inspection by the Engineer.

3.16.2.7 COLD PLASTIC APPLICATION

Cut groove into pavement surface to designated width and depth. Remove grindings and haul to a designated location. Sweep or airblast groove clean and dry. Grind width and length must meet specification.

Mix components and apply cold plastic marking according to manufacturer's surface application procedure, to a thickness of 2.0 mm minimum and 3.0 mm maximum.

Apply plastic markings in accordance with manufacturer's instructions and procedures.

Fill groove with material. Completely fill the groove, rising 2-3mm above the surface.

Apply glass beads to surface of extruded material before it has set, at a rate of 140 to 250 g/m².

Do not permit traffic over applied markings until they have adequately hardened.

3.16.2.8 HOT THERMOPLASTIC APPLICATION

Cut groove into pavement surface to designated width and depth. Remove grindings and haul to a designated location. Sweep or airblast groove clean and dry. Grind width and length must meet specification.

Heat material and apply according to manufacturer's hot extrusion process.

Apply plastic markings in accordance with manufacturer's instructions and procedures.

Fill groove with hot molten material. Do not overfill more than 3.0 mm above pavement surface. Completely fill the groove, rising 2-3mm above the surface.

Apply glass beads to surface of extruded material while it is still molten at a rate of 140 to 250 g/m².

Trim surplus material to give clean straight edges.

Do not permit traffic over applied markings until they have adequately hardened.

3.16.2.9 PROTECTION AND CLEANUP

Protect surrounding areas and structures from disfiguration and damage. Repair any damage as directed by the Engineer.

CITY OF WHITEHORSE SERVICING STANDARDS MANUAL
PART 3 – CONSTRUCTION SPECIFICATIONS
SECTION 3.16 – PERMANENT LINE MARKING

On completion of work and prior to opening to traffic, clean up and leave site free of debris and waste matter.

3.16.2.10 THICKNESS TOLERANCE

Cold Plastic Marking:

- **Measurement:** The quality assurance laboratory will measure suspect markings with a surface micrometer. The average of five measurements will represent 300 m of marking, or one job site, whichever is less.
- **Thickness Deficiencies:** Where a significant number of deficiencies occur in the work, involving average thicknesses greater than 3.0 mm or less than 1.8 mm, the Engineer may order removal and replacement or application of additional material.
- **Groove Thickness Deficiencies:** Where a significant number of deficiencies occur, involving average groove thicknesses less than 70% of that specified, the Engineer may order removal and replacement. Groove to be 2-3mm deep for all markings.
- If surface dishing deeper than 0.5 mm occurs, the Engineer may order removal and replacement. Variations in asphalt surface profile may be taken into consideration.

Thermoplastic Marking:

- **Measurement:** The quality assurance laboratory will core suspect markings. The average thickness of three cores will represent 300 m of marking, or one job site, whichever is less.
- **Overfill Thickness:** That portion of marking above pavement surface will receive no additional payment. If overfill exceeds 3.0 mm, the Engineer may order removal and replacement of marking.
- **Groove Thickness Deficiencies:** Where a significant number of deficiencies occur, involving average groove thicknesses less than 70% of that specified, the Engineer may order removal and replacement. Groove to be 5mm for lane lines and centrelines, crosswalk stop bars and arrows to be 10mm deep.
- If surface dishing deeper than 0.5 mm occurs, the Engineer may order removal and replacement. Variations in asphalt surface profile may be taken into consideration.

3.16.2.11 WIDTH TOLERANCE

Cold Plastic Marking:

- The quality assurance laboratory will determine the width of suspect markings by the average of five measurements representing 300 m of marking, or one job site, whichever is less.

Hot Thermoplastic Marking:

- The quality assurance laboratory will determine the groove width of suspect markings by the average measurements of three cores representing 300 m of marking, or one job site, whichever is less.

CITY OF WHITEHORSE SERVICING STANDARDS MANUAL
PART 3 – CONSTRUCTION SPECIFICATIONS
SECTION 3.16 – PERMANENT LINE MARKING

Width Deficiencies: Where a significant number of deficiencies occur greater than 10 mm in average widths of cold plastic, or in average groove widths of hot thermoplastic, the Engineer may order removal and replacement.

3.16.3 SUPPLY OF GLASS BEADS

Requirements for the supply only of glass beads for traffic marking.

3.16.3.1 REFERENCES

ASTM D1155 –Test Method for Roundness of Glass Spheres

ASTM D1214 - Test Method for Sieve Analysis for Glass Spheres.

ASTM E11 – Specification for Woven Wire Sieve Cloth and Test Sieves

CGSB 1-GP-71 Method 49.1 - Test Method for Index of Refraction on Glass Beads.

3.16.3.2 MATERIALS

Glass Beads: Are to be manufactured from glass of a composition designed to be highly resistant to the effects of traffic wear and weathering. Glass beads are not to contain lead or be manufactured from materials containing lead.

Color: The glass is to be colourless to a degree that the resulting beads, when added to white paint, do not impart a noticeable hue.

Bead type and Grade: Beads supplied are to be treated in such a manner as to overcome the effects of water, as vapour or liquid, on the beads before the beads are added to the paint stripe.

Roundness: A minimum of 80% by mass of the glass beads are to be true spheres.

Gradation: The glass beads for mixing with and for surface application on thermoplastic material are to meet the following gradation requirements when tested in accordance with ASTM D1214:

Sieve Size (um) % Passing by Mass	% Passing By
850	90-100
300	12-50
180	0-10

Index of Refraction: 1.5 minimum when tested in liquid immersion at 25° C according to CGSB 1-GP-71 Method 49.1.

Imperfections: The surface of the beads are to be smooth, lustrous and free from film, scratches and pits. Not more than 25% by mass of the true spheres are to have imperfections such as milkiness, dark

CITY OF WHITEHORSE SERVICING STANDARDS MANUAL
PART 3 – CONSTRUCTION SPECIFICATIONS
SECTION 3.16 – PERMANENT LINE MARKING

specks, incipient fractures, and air inclusions in the form of bubbles greater than 10% of the volume of the spheres.

Quality Assurance Sampling and Testing: Sampling and testing of the glass beads supplied to the project will be carried out by the Quality Assurance laboratory. A maximum of 10% but no less than 1% of the total number of packages in each batch will be taken at random for test purposes. The contents of each random package will be riffled until a representative sample of approximately 1000 g (or 500 ml) of beads is obtained. The 1000 g samples will be combined to form a composite sample of about 4 kg (about 4 L in volume) representing a batch of 25,000 kg of beads. The composite sample will be riffled in the laboratory until about a 150 g sample is obtained for the following testing.

Roundness Testing: The percentage true spheres are to be determined by one of the following methods:

- By counting the beads under 50X and 100X magnification as follows:
 - Glass beads larger than #50 sieve size inclusive, are to be counted using 50X magnification (see gradation requirements).
 - Glass beads smaller than #50 sieve size are to be counted using 100X magnification.
 - Approximately 1,000 beads contained loosely in a culture dish are to be counted under reflected light for each sieve specified to determine the percentage by mass of perfectly round spheres.
- By ASTM D1155

Imperfections Testing: Imperfections are to be evaluated by observation using 50X and 100X magnification.

Water Resistance Testing: One hundred grams of glass beads will be placed in a 500 ml beaker and an equivalent volume of distilled water will be flowed into the beaker on top of the glass beads. The beaker will be permitted to stand for 5 min. At the end of this period, the water is to be poured off and the glass beads will be transferred to a clean, dry beaker and permitted to stand for 5 min. The spheres will then be introduced into a standard 125 mm diameter glass funnel having a stem of 125 mm length. The beads are to flow through the funnel without stoppage. (Slight initial agitation to start the flow through the funnel at the beginning of the test will be permissible.)

3.16.3.3 PACKAGING

Beads in bags are to be free of clusters, lumps, moisture and foreign matter.

Glass beads are to be packaged in bags of 25 kg net capacity, and each bag is to be marked to show clearly the following information:

"Overlay Type Glass Beads"

"Moisture Proof Grade"

CITY OF WHITEHORSE SERVICING STANDARDS MANUAL
PART 3 – CONSTRUCTION SPECIFICATIONS
SECTION 3.16 – PERMANENT LINE MARKING

"MTC"

"Batch number" (marked in 25 mm

"Manufacturer's name" high letters)

Bags are to be paper-lined burlap with 50 µm polyethylene inserts. The burlap liner, all seams and top closures are to be waterproof and leak-proof and are to be capable of maintaining these properties during transportation and numerous handlings. Bags are to be approximately 0.35 m x 0.66 m with the 50 µm polyethylene insert being 0.35 m x 0.96 m.

3.16.3.4 DELIVERY

Deliver Glass Beads to designated location in pallets for unloading by forklift.

Pick up rejected shipment and replace with glass beads from another production batch.