07040 Thermoplastic Pavement Markings

Index

07040-1	General	3
07040-2	Types of Markings	3
2.1	General	3
2.2	Longitudinal Markings	3
2.3	Intersection Markings	4
07040-3	Material	5
3.1	General	5
3.2	Durability	5
3.3	Colour	6
3.4	Reflectorization	6
3.5	Properties	6
3.6	Glass Beads	8
07040-4	Installation	8
4.1	General	8
4.2	Existing Pavement Markings	8
4.3	Application	9
07040-5	Traffic Control and Work Area	9
5.1	General	9
07040-6	Workmanship and Warranty	9
6.1	Adhesion to Pavement	9
6.2	Rejected Work	10
6.3	Warranty Period	10
07040-7	Payment	11

Tables

Table 1: Indentation Resistance 7
Table 2: Spheres included in the manufacture of the thermoplastic material 8

07040-1 General

This specification covers thermoplastic material suitable for use as reflecting pavement markings on bituminous pavement and method of application. The materials shall be so manufactured to be applied by extrusion onto the pavement in molten form with glass spheres mixed in and also dropped onto the material immediately after it is applied.

07040-2 Types of Markings

2.1 General

The pavement markings shown on the plans were designed, where possible, in compliance with the Uniform Traffic Control Manual for Canada. If conflict arises as to the interpretation between the plans and the Uniform Traffic Control Device Manual, precedence shall be given to the plans.

2.2 Longitudinal Markings

2.2.1 Directional Dividing Lines

Directional Dividing Lines shall be 100 mm wide, yellow in colour, solid or broken and may be a single line or two parallel lines separated by a distance of 100 mm. When broken, the directional dividing line shall consist of a line 5 metres long with an 8 metre skip distance between lines in a consecutive pattern. The depth of directional dividing line markings shall be 7 mm, 5 mm below and 2 mm above pavement surface, unless specified otherwise.

2.2.2 Lane Lines

Lane Lines shall be single line, 100 mm wide, white in colour and may be broken or solid. When broken, the lane line shall consist of a line 5 metres long with an 8 metre skip distance between lines in a consecutive pattern. The depth of lane line makings shall be 7 mm, 5 mm below and 2 mm above pavement surface, unless specified otherwise.

2.2.3 Pavement Edge Lines

Pavement Edge Lines shall be single, solid line, 100 mm wide and may be yellow or white in colour. The depth of pavement edge line markings shall be 7 mm, 5 mm below and 2 mm above pavement surface, unless specified otherwise.

2.2.4 Continuity Lines

Continuity Lines shall be a single line, 200 mm wide, white or yellow in colour and may be broken or solid. When broken, the continuity line shall consist of a line 5 metres long with a 5 metre skip distance between lines in a consecutive pattern. The depth of continuity line markings shall be 7 mm, 5 mm below and 2 mm above pavement surface, unless specified otherwise.

2.2.5 Chevrons

Chevrons shall be white or yellow 600 mm wide, bordered by a 200mm solid line and installed as per the Required Permanent Markings at Chevrons Plan No. 102-0028-009r001. The depth of chevron markings shall be 7 mm, 5 mm below and 2 mm above pavement surface, unless specified otherwise.

2.3 Intersection Markings

Intersection markings shall be installed as per the Required Permanent Markings at Intersection Plan No. 102-0028-008r001.

2.3.1 Stop Lines

Stop Lines shall be a single solid line, 600 mm wide and white in colour. The depth of stop line markings shall be 12 mm, 10 mm below and 2 mm above pavement surface, unless specified otherwise.

2.3.2 Crosswalk Lines

Crosswalk Lines shall be two parallel solid lines, 150 mm wide and white in colour. The lines shall be 3.0m apart. The depth of crosswalk line markings shall be 12 mm, 10 mm below and 2 mm above pavement surface unless specified otherwise. Crosswalk markings shall be installed as per Crosswalk Pavement Markings Plan No. 102-0028-001r002.

2.3.3 'Zebra' Crosswalk

'Zebra' Crosswalk shall be two parallel solid lines, 100 mm wide and white in colour, with alternating longitudinal lines 1000mm wide and 3.0m long, separated by 1000mm spaces across the roadway. The longitudinal lines shall be located transversely to minimize application in the established vehicle wheel path. The depth of zebra crosswalk markings shall be 10 mm, 8 mm below and 2 mm above pavement surface unless specified otherwise. Zebra crosswalk markings shall be installed as per Crosswalk Pavement Markings Plan No. 102-0028-001r002.

2.3.4 Arrows/Symbols

Arrows/Symbols shall be white and designed according to the Uniform Traffic Control Device Manual for Canada or City Standard. The depth of arrow markings shall be 7 mm, 5 mm below and 2 mm above pavement surface, unless specified otherwise.

2.3.5 Guide Lines

Guide Lines shall be white, 100 mm wide and shall be placed through intersections as extensions of lane lines 0.5 metres long spaced at 0.5 metres. The depth of guide line markings shall be 12 mm, 10 mm below and 2 mm above pavement surface, unless specified otherwise.

07040-3 Material

3.1 General

The material shall be applied to the road surface while in the liquid form and shall sufficiently set to allow traffic to drive over the material with no adverse effects to the material or vehicle. In the solid (dried) state, the material shall not give off fumes which are toxic or otherwise injurious to persons or property.

3.2 Durability

The dried material shall not deteriorate, crack, or decay during air temperature changes within -50 C to +50 C and with exposure to UV light. The material shall not deteriorate by contact with sodium chloride, calcium chloride, or other chemicals used against formation of ice on roadways; oil content of pavement materials; or motor vehicle oil or other fluids.

3.3 Colour

After setting, the colour of the white material shall be similar to standard number 37875 of the standard U.S. Federal Standard 595B, and yellow shall be similar to standard number 33538. The material shall not discolour when exposed to UV light. The material shall maintain its relative colour over the duration of the warranty period (the white marking shall not 'grey', nor shall the yellow material 'fade').

3.4 Reflectorization

During placement, glass spheres shall be mixed into the material to the extent required to achieve high levels of retroreflectivity. The pavement marking material shall bond with the beads sufficiently to ensure retention of the beads throughout the life cycle of the pavement marking. The retroreflectivity of the pavement marking shall be measured using a retroreflectometer and shall maintain a minimum reflectance value of 75 mcd/sqm/lux at the end of the warranty period for both colours.

The glass beads shall be manufactured from glass of a composition designed to be highly resistant to traffic wear and to the effects of weathering. The beads shall be transparent and colourless to prevent their imparting of any noticeable hue to the paint. Glass beads shall also be applied to surface of extruded material before it has set, at a rate of 140 to 250 g/m².

3.5 Properties

3.5.1 Drying Time

The material will be considered dried when a vehicle can drive over the material with no adverse affect to the material or vehicle. The drying time shall not exceed 20 minutes during average summer temperatures and humidity and shall be completely dry after one hour.

3.5.2 Water Absorption

The material shall have no more than 0.5 percent by weight of retained water when tested by ASTM designation D-570, "Water Absorption of Plastics" procedure (A) (24 hr. Immersion).

3.5.3 Softening Point

The material shall have a softening point of not less than 90 C, as determined by ASTM designation E-28, “Method of Test for Softening Point by Ring and Ball Apparatus”.

3.5.4 Specific Gravity

The specific gravity of the material shall be from 1.9 to 2.2 at 25 C.

3.5.5 Impact Resistance

The impact resistance of the material shall not be less than 1.13 Newton-Metres at 25 C after the material has been heated for four hours at 204 C and cast into bars of 25 mm² cross sectional area, 75 mm long and placed with 25 mm extending above the vice in a cantilever beam tester using 2.82 Newton-Metre scale. This instrument is described in ASTM designation D-246.

3.5.6 Abrasion Resistance

The material shall have a maximum weight loss of 1.0 grams when subjected to 200 revolutions on a Taber Abraider at 25 C using h-22 Calibrade wheels weighted to 500 grams. The test sample shall be prepared by forming representative lots of material of a thickness of 3.0 mm ± 0.1 mm on a 100 mm square plate. The test surface shall be kept wet during the test.

3.5.7 Indentation Resistance

The indentation resistance of the material shall be measured by a Shore Durometer Type A2 as described in ASTM designation, D-1706. The reading of the Shore Durometer after 15 seconds and using a 0.907 Kilogram weight shall not be less than the amounts specified below when the material is tested for temperature:

Table 1: Indentation Resistance

Temperature	Reading
46 C	65 ± 2
25 C	95 ± 2

3.5.8 Chemical Resistance

Material test sections, 5 cm x 5 cm should show no signs of degradation after exposure to:

- 5% NaCl (24 hr. Immersion)
- 5% CaCl (24 hr. Immersion)

3.6 Glass Beads

The surface of the spheres shall be smooth and free from film, scratches and pits. At least 80 percent shall be of true spherical shape and free from milkiness, dark or air inclusions and other defects.

The liquid immersion method of 25 C may be used to determine the refractive index of the glass spheres. A refractive index of 1.50 to 1.60 is required.

The glass spheres shall meet the following gradation requirements when tested in accordance with ASTM designation D-12214.

Table 2: Spheres included in the manufacture of the thermoplastic material

Standard Sieve	% Passing
Passing #900 µm	90 – 100
Passing #300 µm	20 – 50
Passing #200 µm	0 – 10

07040-4 Installation

4.1 General

The thermoplastic material shall be installed in a groove ground into the pavement surface. The material shall completely fill the groove and extend not less than 2.0 mm above the pavement surface. The depths of the groove vary for different markings and are specified in Section 07040-6.

4.2 Existing Pavement Markings

Where the location of the new thermoplastic markings conflict with existing pavement markings, such as paint, the new marking shall be installed in the same line as the

existing marking, ensuring that the routed groove completely removes the previous marking material.

4.3 Application

4.3.1 Longitudinal Joints

The thermoplastic markings shall not be installed over a longitudinal joint or seam except transverse markings such as stop lines and crosswalk lines.

4.3.2 Road Surface

All work must be done on a clean dry road surface. All grooves must be clean and dry before the material is installed.

4.3.3 Application Temperature

To ensure the best possible adhesion, the material shall be applied in a melted state at a minimum temperature of 190 C for white markings and 165 C for yellow markings.

No material is to be laid when the air temperatures is below 5 C.

07040-5 Traffic Control and Work Area

5.1 General

Work zone traffic controls shall be set up in accordance with the City of Saskatoon Traffic Control Manual.

The Contractor shall at all times keep traffic congestion to a minimum. The work zone shall be limited to maintain one lane of traffic in all directions at all times. The work shall be carried out as quickly as possible to prevent excessive delay and inconvenience to traffic.

07040-6 Workmanship and Warranty

6.1 Adhesion to Pavement

The Contractor shall make all tests and take all samples necessary to assure adequate adhesion between the pavement marking material and the roadway surfaces used by

the City. Surface preparation is at the discretion of the Contractor and any markings installed over existing markings is covered by the warranty period even if the old marking bond is deemed to be the failed portion of the application.

6.2 Rejected Work

Poor workmanship such as insufficient material, wrong location, wavy lines, too much overflow, non-uniform lengths, shall be removed by the Contractor and replaced within seven calendar days. Surplus material shall be trimmed to give clean straight edges. The Engineer will give the Contractor written notice of any markings that have been rejected.

6.3 Warranty Period

The Engineer will issue a Completion Certificate for each month the Contractor performs work. The Contractor shall remedy all defects in the work due to faulty material, workmanship or everyday wear for a period of three (3) years from the date of installation.

The maintenance of the markings during the warranty period shall be the Contractor's responsibility and shall be carried on until expiration of the warranty period of which time the Contractor's responsibility shall cease, unless there is an outstanding order from the Engineer requiring the Contractor to correct some of the maintenance that has not been completed.

The Contractor shall supply the Owner with a written three (3) year warranty for retention of at least ninety (90) percent of the longitudinal markings and eighty (80) percent of the transverse markings.

The Engineer shall give the Contractor written notice of all defects observed within the warranty period.

In the event that the above minimum retention is not met, the Contractor will, at the option of the Engineer, either:

1. Replace the missing sections to the satisfaction of the Engineer at no expense to the City or;
2. Reimburse the City at the same rate the Contract was awarded, for the quantity of line failing to meet the minimum criteria.

07040-7 Payment

Payment is to be made on the basis of the number of lineal metres of material installed as measured by the Engineer in the field for lines, and per unit for arrows/symbols as counted.

The unit prices are to include the complete cost of supplying and installing the material, surface preparation, and traffic accommodation (except traffic control on freeways). All costs associated with travel to and from the worksite shall be included in the unit prices.

End of Specification 07040