

Transportation Safety Division

3M™ Stamark™ Pavement Marking Tape and Liquid Pavement Markings

Application Guidelines for Pavement Markings in Grooved Pavement Surfaces

Information Folder 5.18
September 2019

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1 Introduction

Grooving the pavement surface of a road or highway provides an alternative method for the installation of 3M Stamark Pavement Marking Tape and 3M Liquid Pavement Markings (LPM, All Weather Paint, and All Weather Thermoplastic). The benefits of grooving include enhanced protection of pavement markings and retroreflective beads from snowplow damage. Grooving extends the service lives of pavement markings.

This information folder describes the recommended procedures and application guidelines for grooving applications of the products mentioned above.

The following sections can be found in this information folder:

- Groove Specifications
- Equipment Alternatives and Surface Texture Recommendations
- Application Guidelines
- Measuring Groove Depths
- Surface Wetting Test
- Health and Safety Information
- Appendix A: Measuring Groove Depths with a Depth Plate

Follow the detailed application instructions for “Overlay Applications” found in [3M Information Folder 5.7 “3M Stamark Tapes Pavement Surface Preparation and Application Techniques”](#) when applying pavement marking tapes in grooves. All weather and climate conditions specific therein for installation of the relevant pavement marking product (liquid or tape) must be met before it is installed into the groove.

For situations not specifically covered in this information folder, or for questions regarding the installation of 3M products in grooves, it is the responsibility of the installer to contact the appropriate 3M Sales Representative or 3M pavement marking Application Engineer for guidance at 1-800-553-1380.

2 Groove Specifications

Figure 1 shows a typical section of a pavement marking in a groove with the required groove width and depth indicated for both liquid and tape pavement markings. (1000 mil = 1 inch)

Note: See Tables 1 and 2 for specific pavement marking type recommendations for tapes.

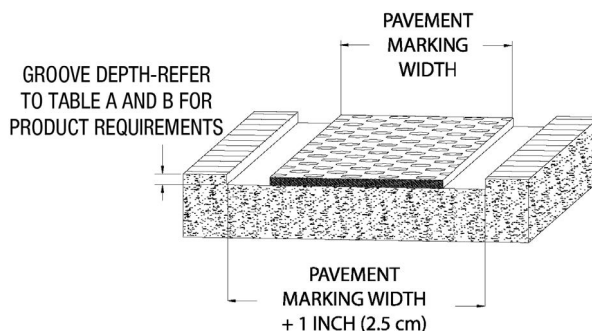


Figure 1. Geometry of a typical section of pavement marking in a groove.

2.1 Groove Depth

Grooves should be cut to depth according to the values recommended in Tables 1 and 2 below.

Table 1. Uniform groove depths for tape markings.

Pavement Marking Material	Required Groove Depth	
	Minimum	Maximum
3M Stamark Pavement Marking Tapes (Series 380I ES, 390, 270 ES, 310)	100 mils (2.54 mm)	200 mils (5.08 mm)
3M Stamark Pavement Marking Tapes Series 380AW	110 mils (2.79 mm)	200 mils (5.08 mm)

Table 2. Uniform groove depths for liquid markings.

Pavement Marking Material	Required Groove Depth
3M All Weather Paint with All Weather Elements	60 mils (1.52 mm) minimum 80 mils (2.03 mm) for max retained reflectivity.
3M Stamark Liquid Pavement Markings Series 5000 with beads and/or Connected Roads All Weather Elements	60 mils (1.52 mm) minimum 80 mils (2.03 mm) for max retained reflectivity.
3M All Weather Thermoplastic or MMA with Connected Roads All Weather Elements	Minimum 30 mils in addition to binder thickness (0.76 mm + binder thickness). For maximum retained reflectivity: 40 mils in addition to the binder thickness specification (1.02 mm + binder thickness).

Note: More aggressive traffic and harsher climates may require deeper grooves.

2.2 Groove Width – Longitudinal Markings

As shown in Figure 1, the typical groove width shall be one inch (2.5 cm) plus the width of the pavement marking. A groove that is two inches (5 cm) wider than the pavement marking width is sometimes preferred, as it facilitates a straight installation of the tape into the groove. The extra width also allows for improved tamping of the edges of the tape. Narrower grooves may provide additional protection to pavement markings, but extra care must be taken to ensure that narrow grooves are cut straight to enable straight alignment of pavement markings within grooves.

2.3 Groove Position

Stamark pavement marking tape is manufactured with a polymer conformance layer for durability, and a patterned surface for reflectivity. Tapes are recommended for a wide variety of uses, including intersection and longitudinal markings.

Note: See [3M Information Folder 3.2](#) for information on 3M Stamark Removable Pavement Marking Tapes.

2.4 Groove Cutting Speed

Groove cutting speed varies with groove width, application size, pavement surface (new or old asphalt or concrete), cutting equipment, and cutting blade. Groove cutting speed must be set in accordance with these and other factors to ensure that the required groove depth specifications are met.

2.5 Groove Cleaning

For some applications and equipment, it may be necessary to cool the cutting head with water. In general, long continuous groove cuts for edge line installations are more likely to require water cooling of blades. Cutting grooves for skip, dash, or other intermittent markings allows blades to cool between cutting operations and may not require water cooling. If water cooling is required, flush grooves immediately after cutting with a high pressure power washer to remove any cement dust/water slurry build-up. Grooves must also be flushed when dry grooving during rainfall. If freshly cut grooves are not flushed, slurry may harden in them and they may not meet the required specifications.

Note: If water is present during groove cutting for any reason, allow grooves to dry for, at minimum, 24 hours prior to pavement marking installation. Grooves must be clean and dry for proper pavement marking installation.

Clean grooves completely using an air compressor with an air flow of at least 185 CFM and an air pressure of at least 120 PSI, prior to pavement marking installation. A street sweeper or pick-up broom may effectively remove some debris, but a pass with an air compressor is required to completely clean the bottoms of grooves.

Note: Open grooves may be left open over night if they have been blown out or flushed out at the time of grooving. It is recommended that grooves be blown out again prior to pavement marking installation.

2.6 Grooved and Recessed Intersection Markings

Intersection markings, such as crosswalks and stop bars, can be grooved into a pavement surface and recessed by making multiple side-by-side passes with grooving equipment typically used for long line pavement markings. Making multiple side-by-side passes allows for the placement of wider intersection markings into a groove.

Cutting grooves with multiple passes can result in ridges between passes. Such ridges are due to the stops on each side of the cutting head resting on different levels of the pavement surface. The first grooving pass is completed with both stops resting on an even surface, as shown in Figure 2.

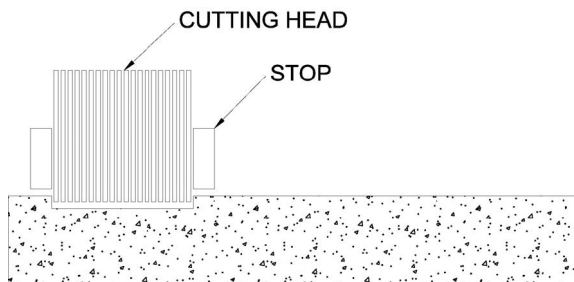


Figure 2. Position of cutting head during initial pass of a multiple-pass intersection groove cut.

After the first pass, one stop sits on the old pavement surface while the other sits slightly lower, in the newly cut groove, as illustrated in Figure 3. This produces unacceptable ridges.

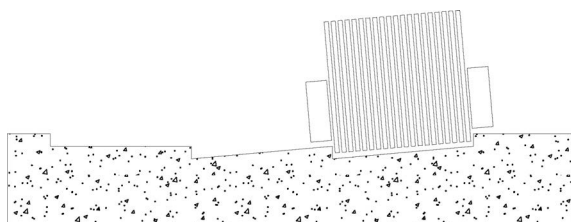


Figure 3. Position of cutting head during subsequent passes that results in ridges along the cutter head edges.

To prevent ridges, adjust the stops on either side of the cutting head after the first pass, or grind off the ridges prior to placing the pavement marking in the groove. One can also use a metal plate, with a thickness equal to the depth of the groove, to support the stop that sits on the freshly grooved surface and move the plate over for each new pass.

Legends and symbols can be grooved and recessed by grooving large square or rectangular areas that fit the pavement markings. Refer to [3M Information Folder 5.8](#) for more information.

Use wider cutting heads and more gang-stacked blades on the saw auger to reduce the number of passes needed to make wide grooves. The same can be done to reduce the number ridges formed by multiple cutting head passes.

Curbs and median obstacles may not allow grooves to be cut across the entire width of an intersection marking using large, truck-mounted equipment. In such instances, use smaller equipment near obstacles to achieve grooves of required depths.

3 Equipment Alternatives and Surface Texture Recommendations

Several different cutting head configurations are available from different equipment manufacturers that specialize in cutting and grooving equipment. Different grooves will result from the use of different cutting heads and grooving equipment.

The use of groove-cutting equipment with free-floating, independent heads is recommended. Such configurations allow the cutting head to follow irregularities in pavement surfaces and produce grooves of consistent depth.

Important Note: The use of gang-stacked cutting blades is required when grooving asphalt pavement surfaces. The use of gang-stacked cutting blades is strongly recommended when grooving concrete pavement surfaces; this is especially true for older surfaces and surfaces that show visible signs of deterioration.

Special note: Diamond cutting blades produce optimal groove surfaces.

3.1 Saw Blade Cutting Heads

A single, large diameter (12-18 inch saw blades) cutting head with gang-stacked 1/8"-1/4" (0.30-0.63 cm) wide carbide or diamond tipped cutting blades (Figure 4) can be used in place of purpose-built grooving equipment. When doing so, place spacers between cutting blades to provide gaps for the wider cutting head tips and to decrease the number of blades required to fill the cutting head.



Figure 4. Saw blade cutting head

Wider blade spacings may result in heavily “ribbed” (also referred to as “ridged” or “corduroy”) patterns that are not recommended for pavement marking applications⁵. Use of gang-stacked diamond tipped cutting blades can create corduroy or ribbed patterns, as shown in Figure 5. Ribbed, or corduroy, patterns must not be irregular or large enough to prevent tape from conforming to the shapes of their lowest areas. If a tape bridges the low areas of a pattern instead of making contact with the pavement surface, moisture will penetrate the tape and result in poor adhesion..



Figure 5. Cross section illustration of a coarse tooth ribbed pattern produced by widely spaced or worn blades. Replace blades and/or change spacing to avoid such groove patterns.

Thinner spacers may be used between blades to prevent irregular groove patterns. This will result in a grooves with smoother surfaces, as illustrated in Figures 6, 7, and 8. Groove ridges should rise no more than 15 mil. above the base of the groove.



Figure 6. Cross section illustration of a smooth groove made with thin spacers and new blades.

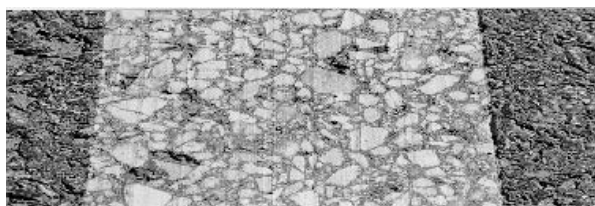


Figure 7. Photo of an asphalt cement concrete groove with a light corduroy pattern, made with properly spaced, gang-stacked cutting blades.



Figure 8. Portland cement concrete groove with a light corduroy, pattern, made with properly spaced, gang-stacked cutting blades.

3.2 Grinding Cutting Heads

A grinder-type cutting head, illustrated in Figure 9, can be used to groove ONLY newer Portland cement pavement surfaces in good repair.

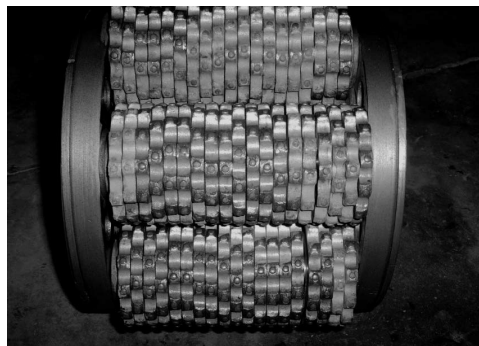


Figure 9. Grinder-type cutting head.

Grinder heads like the one shown in Figure 9 produce grooves with irregular surface textures, as illustrated in Figures 10 and 11. Such surface textures are often superior for liquid pavement marking installations.



Figure 10. Cross section illustration of the texture of a groove cut with a grinder-type cutting head.

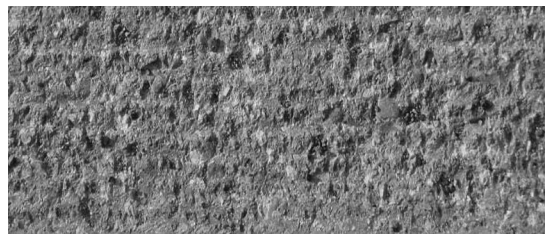


Figure 11. Photo of the surface texture of a groove cut with a grinder-type cutting head.

3.3 Achieving a Textured Surface with Saw Blades

The bottom surface of a groove is a “textured groove surface” if it has an irregular pattern and does not show the ribbed or corduroy groove patterns common to grooves newly cut with saw blades.

A textured groove surface can be achieved using the saw blade configuration shown in Figure 4 if a slow moving shot blaster, grinder, or sand blaster is used to knock down the resulting ridges and texture the groove surface following the initial groove cutting. Hydroblasting can also be used to remove ridges and texture the surface, but the groove must be allowed to dry following hydroblasting for at least 24 hours prior to pavement marking installation.

New concrete surfaces may contain more fine cement dust after cutting. This dust and all other cement residues must be removed and blown clean from groove prior to pavement marking installation.

3.4 Asphalt Cement Concrete (ACC) Surfaces

Important Note: Gang-stacked cutting blades must be used to groove asphalt pavement surfaces.

Special Note: Diamond cutting blades produce optimum groove surfaces.

Existing asphalt surfaces should possess the strength necessary to withstand groove cutting. Inspect surfaces for obvious signs of distress before cutting grooves. Refer to the [3M Road Surface Guide](#) for more details. Always inspect grooves at start-up for signs of channel or groove wall weakness. Lightly scratching a channel or groove wall with a pointed object can help determine the integrity of a cut.

Groove cutting older asphalt surfaces can sometimes weaken the aggregate/asphalt bond near the pavement surface. The structural integrity of a groove bottom should be checked after grooving and prior to pavement marking installation.

In general, newly paved asphalt surfaces should not be grooved within 10 days of placement of the final course of pavement. During the first 10 days following final placement, asphalt may be too soft to support grooving operations, especially during periods of hot weather. New asphalt surfaces must be opened to traffic for at least 10 days prior to pavement marking installation.

Some asphalt mixes require 30 days to achieve sufficient strength to support grooving operations. Prior to grooving new asphalt mixes, perform a field test on a small localized area of the new asphalt to verify that proper surface strength has been achieved.

Inlay techniques (rolling tape into fresh hot asphalt) should be utilized when installing Stamark tapes on new asphalt surfaces whenever possible. See [3M Information Folder 5.7](#) for additional information on inlay techniques.

4 Application Guidelines

The following are specific guidelines for installing Stamark tapes in grooves. They should be followed in conjunction with the detailed installation instructions presented in [3M Information Folder 5.7](#), “Pavement Surface Preparation and Application Techniques for 3M Stamark Tapes,” as well as the climate and weather recommendations made therein, to produce reliable, durable pavement markings.

4.1 Clean the Groove

Prior to installing pavement markings, clean grooves completely using an air compressor with at least 185 CFM of air flow and 120 PSI of air pressure. There should be no more than 50 feet of ¾-inch (inside diameter) hose between the compressor and the air nozzle, and the air nozzle should have an inside diameter of no less than ½-inch. The compressor should also be equipped with a moisture and oil trap. When cleaning the groove, it is recommended that the air nozzle be no more than two feet from the ground. A street sweeper or pick-up broom may also be used to clean effectively, but a pass with an air compressor is still required to completely clean the bottoms of grooves.

4.2 Apply the Tape

Apply Stamark tape in the groove according to the detailed instructions presented in [3M Information Folder 5.7](#) for “Overlay Applications.”

4.3 Tamp the Tape

When newly laid in the groove, tamp the tape thoroughly with a minimum of six (6) passes (three passes back and forth), using an RTC-2 Tamper Cart with a 200-pound (90 kg) load.

Tamping the edges of the tape is very important. To do so, tape installed in a groove requires tamping with a tamper cart roller that has been cut to fit the groove. A vehicle tire may tamp the center of the tape but not the edges near the sides of the groove. Use a modified tamper cart roller if necessary (See Figure 12). A typical modified roller is 4-inches wide and ¼-inch deep. Contact your 3M Application Engineer for further for information regarding tamping cart and roller procurement.

Important Note: A vehicle tire can be used to tamp grooved-in long line pavement marking applications of waffle pattern tapes (380I-ES, 270ES, 310, 390, and 380AW). Refer to [3M Information Folder 5.7](#) for further information.

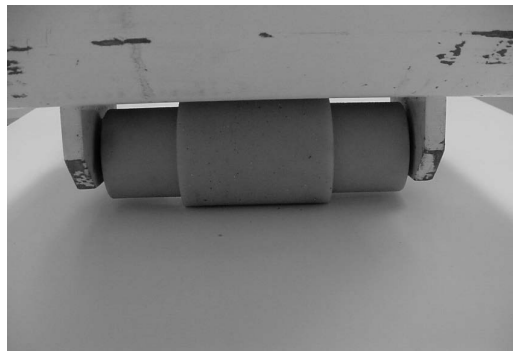


Figure 12. Tamper cart roller cut for groove tamping.

4.4 3M Liquid Pavement Markings

Properly applying liquid pavement marking products to grooves increases durability and improves long-term retroreflective performance. Grooving-in liquid pavement markings is especially effective for extending the service lives of liquid pavement markings in northern climates where snow removal equipment is used.

Refer to [3M Information Folder 5.28](#) (Liquid Pavement Markings), [3M Information Folder 5.22](#) (All Weather Paint), and [3M Information Folder 5.24](#) (All Weather Thermoplastic) for proper surface preparation methods and application requirements.

A liquid pavement marking must be fully contained within a groove to be considered successfully applied and to receive the full benefit of the groove. A wider groove (up to two inches wider than the marketing) may be needed to allow for the proper placement of the liquid marking material into the groove.

5 Measuring Uniform Groove Depths

A micrometer or depth gage can be used to verify the depth uniformities of new grooves. Another method for testing groove depth is through the use of depth plates (see Appendix).

Grooves should be checked frequently following groove cutter alignment changes to verify that proper and stable adjustments have been made and avoid improper grooving. For example, check groove depths at 10-foot intervals for 50 feet immediately following any groove cutter adjustments. Each measurement should fall within the range indicated in Table 1. Calculate the average of the five depths measured – the average should also fall within the depth range indicated in Table 1. If the average does not fall within the range indicated in Table 1, adjust the cutting equipment and check groove depth for the next 50 feet in the same way. Continue to adjust groove cutting equipment until a groove with an appropriate average depth is achieved.

6 Surface Wetting Test

Measure the wetability of the grooved surface. Use an eye dropper to apply a drop of water to the surface. The water drop should wet out on the groove surface. If not, the groove needs to be cleaned out, ground, or shot blasted.

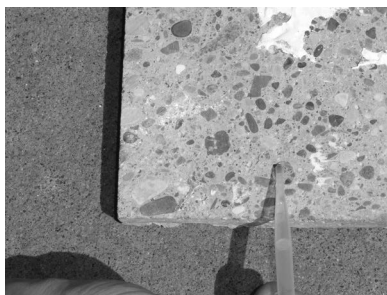


Figure 13. Place a drop of clean drinking or distilled water on the pavement surface.

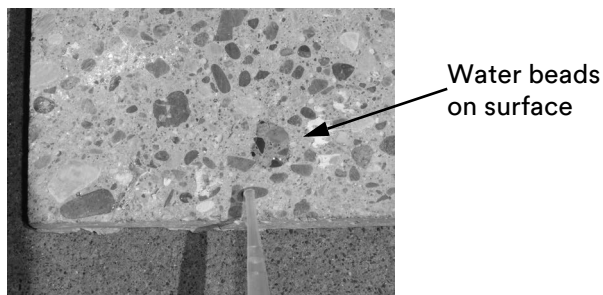


Figure 14. Water does not wet groove surface. Instead, it beads on the groove surface.

If the drop of water does not spread (if it beads on the surface instead), the surface may be contaminated and requires additional surface preparation or re-cleaning with high pressure air.

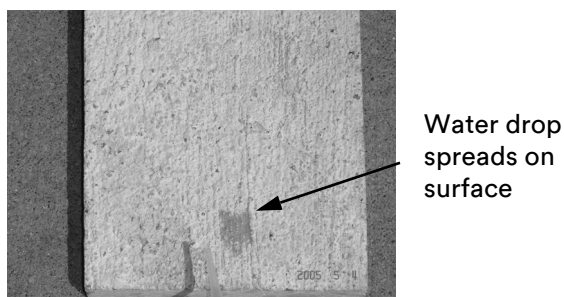


Figure 15. Water wets grooves surface, spreading out.

If the water drop spreads (wets), the surface is ready for pavement marking application.

7 Health and Safety Information

Dry pavement preparation techniques, dry grooving methods, and dry groove cleaning methods are recommended because they optimize pavement marking tape adhesive performance and facilitate immediate pavement marking application without the need for a 24-hour drying period.

Always follow applicable temporary traffic control procedures and safe work zone practices. For example, eye, ear, respiratory, or other protection may be appropriate during grooving, surface preparation, or removal of existing pavement markings. For respiratory protection requirements, please refer to the OSHA Respirable Crystalline Silica Standard and the Small Entity Compliance Guide for Respirable Crystalline Silica Standard for Construction, which can be found at www.osha.gov. If wet grinding or grooving procedures are used, including those listed in Table 1 of the referenced OSHA standards, grooves must be cleaned immediately with high pressure water spray to prevent the resulting cement dust/water slurry from hardening in the groove. Cleaning with must be followed by a 24 hour drying period prior to pavement marking installation.

Read all health hazard, precautionary, and first aid statements found in the Safety Data Sheets (SDS), Article Information Sheets, and products labels of any materials for important health, safety, and environmental information prior to handling or use. Also refer to SDSs for information regarding the volatile organic compound (VOC) contents of chemical products. Consult local regulations and authorities for possible restrictions on product VOC contents and/or VOC emissions. To obtain SDSs and Article Information Sheets for 3M products, go to 3M.com/SDS, contact 3M by mail, or for urgent requests call 1-800-364-3577.

8 Other Product Information

Always confirm that you have the most current version of the applicable product bulletin, information folder, or other product information from 3M's Website at <http://www.3M.com/roadsafety>.

9 Literature Reference

For additional information on 3M Stamark Pavement Marking Tapes, application recommendations, or 3M application equipment, refer to the following publications:

3M IF 3.2	3M™ Stamark™ Removable Tapes Pavement Surface Preparation and Application Procedures
3M IF 5.7	Pavement Surface Preparation and Application Techniques for 3M™ Stamark™ Tapes
3M IF 5.8	Instructions for Precut Symbols and Legends
3M IF 5.20	Application Guidelines for Liquid Pavement Markings
3M IF 5.22	3M™ All Weather Paint Application Guidelines
3M IF 5.23	3M™ Connected Roads All Weather Elements Application Guidelines for 3M Connected Roads All Weather Elements
3M IF 5.24	3M All Weather Thermoplastic application guidelines
3M IF 5.28	Liquid Pavement Marking Application Guidelines Series 5000
3M PB 270 ES	3M™ Stamark™ Pavement Marking Tape Series 270 ES
3M PB 310	3M™ Stamark™ Pavement Marking Tape Series 310
3M PB 380I ES	3M™ Stamark™ High Performance Tape Series 380I ES
3M PB 380AW	3M™ Stamark™ High Performance All Weather Tape Series 380AW
3M PB 390	3M™ Stamark™ High Performance Pavement Marking Tape Series 390
3M PB 1000	3M™ Stamark™ Liquid Pavement Marking Series 1000
3M PB 1400	All Weather Liquid Pavement Marking Series 1400
3M PB AWT	All Weather Thermoplastic
3M PB CR AWE	3M™ Connected Roads All Weather Elements
3M PSD	Personal Safety Division's Tips for New OSHA Silica Regulations
3M Road Surface Guide	3M™ Road Surface Guide for 3M™ Stamark™ Pavement Marking Tapes

Appendix A:

Measuring Groove Depth with a Depth Plate

Use a depth plate of thickness equal to the desired groove depth.



Drop depth plate into groove.



Use a straight edge to check if depth plate fits into groove.



Put straight edge across the groove, over the top of depth plat.



Slide the depth plate back and forth to see if groove depth is correct.

For Information or Assistance

Call: 1-800-553-1380

In Canada Call:

1-800-3M HELPS (1-800-364-3577)

Internet:

<http://www.3M.com/roadsafety>

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