

Liquid membrane-forming compounds will be tested in accordance with the requirements of *VTM-2* and shall conform to the following:

1. Liquid membrane-forming compounds shall contain an easily dispersed opaque, white, finely ground pigment or a fugitive dye. They shall not react with the components of concrete and shall not contain oils, waxes, or other materials that would prevent bonding of traffic paints. The resulting film shall be continuous, uniform, and free from pinholes, bubbles, or blisters and shall not darken the hardened concrete. The dye shall have sufficient color to be distinctly visible for at least 30 minutes after application and to disappear within 7 days.
 2. The membrane shall not peel. It shall disappear by gradual disintegration from exposure to the elements over a period of at least 30 days but not more than 1 year. Within 60 days after application, the membrane shall be capable of being readily removed by means of steel wire brushes or another abrasive that will not damage the concrete surface.
 3. When applied by pressure spray to a troweled, vertical, damp concrete surface at the rate specified, material shall adhere to the surface in a continuous, tenacious film without running off or sagging appreciably.
 4. Shipping containers shall identify the trade name of the material and a lot or batch number except for small, locally repackaged containers bearing the Department's seal.
 5. The average moisture loss at 24 hours shall be not more than 0.0116 grams per square centimeter of exposed surface. At 72 hours, it shall be not more than 0.0232 grams.
 6. When applied to the test specimen, white pigmented material shall have a daylight reflectance of at least 60 percent of that of magnesium oxide.
- (e) **Water** used for curing concrete shall be clean, clear, and free from oil and other deleterious substances and shall have a pH of at least 4.5.

SECTION 221—GUARDRAIL

221.01—Description.

These specifications cover material requirements for components of guardrail systems.

221.02—Detail Requirements.

Guardrail shall consist of rail or cable elements and fastenings fabricated to develop continuous beam or cable strength when installed.

- (a) **Steel beam guardrail** shall conform to the requirements of AASHTO M180, Class A, Type 1. Where guardrail is to be constructed on curves that have a radius of 150 feet or less, rail elements shall be shop curved to the proper radius, with the roadside of the rail either concave or convex as required.
- (b) **Wire rope (cable)** shall conform to the requirements of AASHTO M30, Type I, Class A.
- (c) **Brackets, turnbuckles, compensating assemblies, and attachment hardware** shall be of sufficient design and section to develop the full strength of the cable guardrail and shall be galvanized in accordance with the requirements of ASTM A153. The spring compensating device shall have a spring constant of 450 ± 50 pounds and shall permit a travel of 6 ± 1 inches.
- (d) **Concrete for precast reinforced concrete posts** shall conform to the requirements of Section 217 for Class A3 except that Type I cement and a smaller size of aggregate may be used.
- (e) **Steel posts** shall be galvanized in accordance with the requirements of AASHTO M111.
 - 1. **Structural rolled shapes** shall conform to the requirements of ASTM A709 Grade 36.
 - 2. **Sheet steel for fabricated shapes** shall conform to the requirements of ASTM A570, Grade 36.
 - 3. **Weld-fabricated shapes** shall conform to the requirements of ASTM A769.
- (f) **Wood posts** shall conform to the requirements of Section 236 and shall be pressure treated.
- (g) **Anchor bolts** shall conform to the requirements of Section 226.02(c)2. for high-strength bolts.
- (h) **Offset block** shall conform to either of the following:
 - 1. **Wood** conforming to the requirements of Section 236 and shall be pressure treated.
 - 2. **Recycled material** – Offset blocks shall be made from a minimum of 40 percent recycled plastic waste. Such plastic shall be accumulated from post consumer and post industry waste. The material for these blocks shall have a minimum specific gravity of 0.950. The minimum compressive strength of these blocks in the lateral dimen-

sion shall be 1600 pounds per square inch. The maximum water absorption allowed over the theoretical lifetime of the block shall not exceed 5 percent by weight, when tested in accordance with ASTM D1037. Block attachment shall be in accordance with the Standard Drawings for wooden posts, standard GR-2, 2A W-Beam guardrail. The size tolerance in the direction of the bolt hole shall not be more than 1/4-inch. The blocks shall present a neat appearance and have plane surfaces. The blocks shall conform to the dimensions and tolerances listed on the Standard Drawings.

The manufacturer of the recycled plastic blocks must provide independent test results showing the material meets the velocity, acceleration and post-impact trajectory requirements of National Cooperative Highway Research Program (NCHRP) Report 350.

The manufacturer shall also certify that the material components of the completed blocks are resistant to the Subterranean Termites during its theoretical lifetime when tested in accordance with ASTM D3345. The theoretical lifetime is considered to be at least 20 years.

SECTION 222—MASONRY UNITS

222.01—Description.

These specifications cover masonry units manufactured of regular or lightweight concrete or brick made from clay or shale in a plant specifically designed for such a purpose.

222.02—Detail Requirements.

(a) **Wall Units:**

1. **Hollow load bearing units** shall conform to the requirements of ASTM C90, Grade N-I.
2. **Hollow non-load bearing units** shall conform to the requirements of ASTM C129, Type I.
3. **Solid load bearing units** shall conform to the requirements of ASTM C145, Grade N-I.
4. **Building bricks** shall conform to the requirements of AASHTO M114, Grade SW, or ASTM C55, Grade N-I.