

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF :)	
)	
PROPOSED AMENDMENTS TO CLEAN)	
CONSTRUCTION OR DEMOLITION)	
DEBRIS FILL OPERATIONS (CCDD))	R12-09
AND UNCONTAMINATED SOIL)	(Rulemaking – Land)
FILL OPERATIONS)	
PROPOSED AMENDMENTS TO 35 Ill.)	
Adm. Code 1100)	

PROPOSED AMENDMENT TO AND PREFILED TESTIMONY
OF STEVEN GOBELMAN REGARDING ILLINOIS EPA'S PROPOSED
ADMENDMENTS TO SECTION 1100.212

My name is Steven Gobelman. I am currently the Geologic and Waste Assessment Specialist within the Bureau of Design and Environment of the Illinois Department of Transportation ("Department"). I have been in my current position since September 1993. Prior to being employed by the Department, I was employed by the Illinois Environmental Protection Agency from 1985 through 1993. I graduated from the University of Alaska – Fairbanks in 1985 with a M.S. in Geological Engineering and graduated from the University of Missouri-Rolla in 1983 with a B.S. in Geological Engineering. I am a licensed Professional Engineer and a licensed Professional Geologist in the State of Illinois. My resume is attached as Attachment 1.

Today I will testify in regards to the proposed changes to Section 1100.212 regarding use of painted CCDD in fill material. I have provided the Department's proposed amendment to Section 1100.212 as Attachment 2. In such amendment, the Department is requesting that broken concrete, asphalt pavement, and other roadway CCDD with pavement markings, including but not limited to striping, be allowed to be utilized as fill material in a CCDD fill operation provided the pavement markings comply with Department specifications for pavement markings. The CCDD with pavement markings must also be accompanied with a P.E. certification affirming that the pavement markings comply with the Department's specifications for pavement markings. A Board Note has also been added referencing the Department's "Standard Specifications for Road and Bridge Construction" Section 1095 is titled Pavement Markings and is included with this testimony as Attachment 3.

As part of a normal construction project, the Department routinely removes concrete and/or asphalt pavement when making improvement to the highway transportation infrastructure. The concrete and/or asphalt pavement that is removed will typically have pavement markings that are weathered by the elements and worn by vehicle traffic attached to some of the pavement or ground within the milled pavement material. The amount of pavement marking material included with the removed pavement is a de minimis quantity. Moreover, the Department routinely tests pavement marking materials for compliance with its specifications and analyzes all new pavement marking materials for conformance to the specifications.

In the Agency's testimony from Paul Purseglove, Mr. Purseglove provided a definition of "paint" as a thin, dry film of liquid mixture, usually of a solid pigment in a liquid vehicle, applied to a surface as a decorative or protective coating or as signage. The Department's pavement markings are not used as a decorative or protective coating or as signage. The Department's pavement markings consist of the following material types: Thermoplastic, Preformed Plastic, Epoxy, Preformed Thermoplastic, Tape, Polyurea, and Paint. Many pavement markings are tape or plastic material. All liquid pavement marking materials are non-toxic paints. The examples and types of painted material that the Agency wanted to prevent from going into CCDD fill operations were painted concrete, brick, and masonry blocks related to building demolition, as provided in the Agency's example of the former Busch Stadium. These types of painted material do not include pavement markings.

The Department completed a number of analytical tests of various types of pavement markings (Epoxy, Urethane, Thermoplastic, Tape, and Traffic Paint). All tests were analyzed for arsenic, cadmium, chromium, lead, mercury, and zinc utilizing the TCLP/SPLP testing methodology as proposed in Section 1100.212. The analytical results showed that the Department's pavement markings do not exceed the Class I groundwater standards. The Department's position is that the pavement markings can be safely included with CCDD and used as fill in CCDD fill operations regulated under Part 1100.

This concludes my portion of the Department's pre-filed testimony.

ATTACHMENT 1

Steven Gobelman, P.E., P.G.

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|--------------------------------|--|--|
| Professional Experience | 1993 - Present | Illinois Department of Transportation |
| | Technical Manager | <ul style="list-style-type: none">• Responsible for providing highly specialized technical expertise departmentwide, for conducting assessments and investigations of special waste, and when required remediation.• Review and prepare risk assessments, work plans, quality assurance/quality control plans, recommend further action, and coordinate various contract activities with districts, central office bureaus, and regulatory agencies. |
| | 1992 - 1993 | Illinois Environment Protection Agency |
| | Lead Worker | <ul style="list-style-type: none">• Project Manager in the Bureau of Land, Division of Remediation Management, Remedial Project Management Section, Remediation Engineering Sub-Unit. Section's Technical expert on geology, hydrogeology, and engineering.• Conduct engineering and technical research on problems associated with cleanups conducted in the Section.• Conduct public meetings and provide engineering and technical details to public information personnel for media and citizen inquiries. |
| | 1988 - 1992 | Illinois Environment Protection Agency |
| | Environment Protection Engineer | <ul style="list-style-type: none">• Project Manager in the Bureau of Land, Division of Remediation Management, Remedial Project Management Section, State Sites Unit. Unit's Technical expert on geology, hydrogeology, and engineering.• Perform duties associated with State site cleanup projects, including voluntary cleanup actions negotiated with industry, which are highly technical in nature and include complex engineering, geology, and hydrogeologic problems as well as sensitive issues concerning toxic environmental contaminants and their public health effects.• Manage contracts with engineering and cleanup firms for remedial investigations (RI), feasibility studies (FS), design, and cleanup projects. Perform RI/FS that include sampling of groundwater, soil, and hazardous waste. |
| | 1985 - 1988 | Illinois Environment Protection Agency |
| | Environmental Protection Engineer | <ul style="list-style-type: none">• Permit Reviewer in the Bureau of Land, Division of Land Pollution Control, Permit Section.• Performed a variety of geology, hydrogeologic, and engineering functions pertaining to permit review of underground injection control (UIC) permit, RCRA closure, and solid waste permit and closure applications. Determine the feasibility of the application based on technical/engineering, geology, hydrogeologic data, and financial assurance. Based on the feasibility made recommendations for approval or denial. Worked with computer modeling of pollutant transport in groundwater to determine the extent of groundwater |

contamination.

1981 - 1981 DAMES AND MOORE

Geotechnical Engineer CO-OP student

- Assisted in a project that investigated ground movements associated with an underground long wall mining operation in Southeast Ohio.

Education

1983 to 1985 University of Alaska-Fairbanks Fairbanks, Alaska
M.S./Geological Engineering

1981 to 1983 University of Missouri-Rolla Rolla, Missouri
B.S./Geological Engineering

1978 to 1981 Belleville Area College Belleville, Illinois
Undergraduate Work/Engineering

Professional License

Registered Professional Engineer – Illinois
Registered Professional Geologist - Illinois

Awards

1998 Central Office Engineer of the Year

Publications

"Sublimation of Reconstituted Frozen Silts", M.S. Thesis, University of Alaska - Fairbanks, May 1985.

ATTACHMENT 2

Section 1100.212 Use of Painted CCDD as Fill Material

a) For purposes of this Part, CCDD may include uncontaminated broken concrete without protruding metal bars, bricks, rock, stone, or reclaimed or other asphalt pavement that has been painted ("painted CCDD") if the painted CCDD is used as fill material at a CCDD fill operation. Painted CCDD may be used as fill material at a CCDD fill operation if evaluated analytically under the supervision of a PE and if all requirements of this Section are satisfied.

BOARD NOTE: Acceptance or management of painted CCDD for any purpose other than use as fill material at a CCDD fill operation must be in accordance with applicable law and may require a permit(s) or beneficial use determination(s) from the Agency. Such other purposes include, but are not limited to, processing of painted CCDD for reuse.

- a1) The PE must determine on a site-specific basis the number and location of paint samples that will provide a representative analysis of paint from the painted CCDD to be used as fill material.
- b2) The PE must obtain paint samples consisting of representative paint chips or scrapings that include all layers of paint in the area sampled and that minimize the amount of substrate in the sample.
- e3) Paint samples must be analyzed for arsenic, cadmium, chromium (total), lead, mercury and zinc ("contaminants of concern") using the TCLP or SPLP extraction test analytical procedures in accordance with Methods 1311 and 1312 respectively in "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods," USEPA Publication No. SW-846.
 - 4A) Analytical results from paint samples must not be averaged.
 - 2B) All quantitative analyses of paint samples must be completed by an accredited laboratory in accordance with the requirements of 35 Ill. Adm. Code 186 and the scope of the accreditation.
 - 3C) Documentation of any chemical analysis must include, but is not limited to:
 - Ai) Chain of custody control;
 - Bii) A copy of the lab analysis;
 - Giii) Accreditation status of the laboratory performing the analysis; and
 - Div) Certification by an authorized agent of the laboratory that the analysis has been performed in accordance with the Agency's rules for the accreditation of environmental laboratories and the scope of the accreditation.

¶4) For painted CCDD to be used as fill material, analytical results for each paint sample must not exceed the chemical-specific Class I groundwater quality standard at 35 Ill. Adm. Code 620.410 for any contaminant of concern identified in subsection (e3) of this Section.

b) Notwithstanding subsection (a) of this Section, broken concrete, asphalt pavement, and other roadway CCDD with pavement markings, including but not limited to striping, may be used as fill material at a CCDD fill operation provided that:

- 1) The pavement markings comply with IDOT specifications for pavement markings; and
- 2) The CCDD is accompanied by a PE certification, on forms prescribed by the Agency, affirming that the pavement markings comply with IDOT specifications for pavement markings.

BOARD NOTE: The Illinois Department of Transportation (IDOT) specifications for pavement markings can be found at Section 1095 of IDOT's "Standard Specifications for Road and Bridge Construction."

ATTACHMENT 3

SECTION 1095. PAVEMENT MARKINGS

1095.01 Thermoplastic Pavement Markings. This material shall be a mixture of resins and other materials providing an essentially nonvolatile thermoplastic compound especially developed for traffic markings.

(a) Ingredient Materials.

- (1) Binder. The binder shall consist of a mixture of synthetic resins, at least one of which is solid at room temperature. The solid resin shall be a hydrocarbon or alkyd resin. The total binder content of the thermoplastic compound shall be well distributed throughout the compound. The binder shall be free from all foreign objects or ingredients that would cause bleeding, staining, or discoloration. The binder shall be 18 percent minimum by weight of the thermoplastic compound. The binder shall be characterized by an IR Spectra. Future shipments of binder will be checked by an IR Spectra to verify that the binder has not been changed.
- (2) Pigment. The pigment used for the white thermoplastic compound shall be a high-grade pure (minimum 93 percent) titanium dioxide (TiO₂). The white pigment content shall be a minimum of ten percent by weight and shall be uniformly distributed throughout the thermoplastic compound.

The pigments used for the yellow thermoplastic compound shall not contain any hazardous materials listed in the Environmental Protection Agency Code of Federal Regulations (CFR) 40, Section 261.24, Table 1. The combined total of RCRA listed heavy metals shall not exceed 100 ppm when tested by X-ray fluorescence spectroscopy. The pigments shall also be heat resistant, UV stable and color-fast yellows, golds, and oranges, which shall produce a compound which shall match Federal Standard 595 Color No. 33538. The pigment shall be uniformly distributed throughout the thermoplastic compound.

- (3) Filler. The filler to be incorporated with the resins as a binder shall be a white calcium carbonate, silica, or an approved substitute. Any filler which is insoluble in 6N hydrochloric acid shall be of such particle size as to pass a No. 100 (150 µm) sieve.
- (4) Glass Beads. The glass beads used as intermix beads with the thermoplastic pavement marking material shall meet the requirements of Article 1095.07. The glass beads shall be uniformly mixed throughout the material at the rate of not less than 30 percent by weight of the thermoplastic compound, retained on a No. 100 (150 µm) sieve.

(b) Thermoplastic Compound.

(1) Characteristic Requirements.

- a. In the plastic state, the material shall not give off fumes that are toxic or otherwise injurious to persons or property. The manufacturer shall provide material safety data sheets for the product.
- b. The temperature versus viscosity characteristic of the plastic material shall remain constant and the material shall not deteriorate in any manner during reheating processes.
- c. There shall be no obvious change in color of the material as a result of repeated heatings or from batch to batch. The maximum elapsed time after application after which normal

traffic will leave no impression or imprint on the new stripe shall be two minutes at 50 °F (10 °C) or five minutes at 90 °F (32 °C) pavement temperature. After application and proper drying, the material shall show no appreciable deformation or discoloration, shall remain free from tack, and shall not lift from the pavement under normal traffic conditions within a road temperature range of -20 to 150 °F (-29 to 66 °C). The stripe shall maintain its original color, dimensions and placement.

Cold ductility of the material shall be such as to permit normal dimensional distortion as a result of traffic impact within the temperature range specified.

- d. The material shall provide a stripe that has a uniform color and thickness throughout its cross section and has the density and character to provide a sharp edge of the line.
- e. Daylight Reflectance and Color. The thermoplastic compound after heating for four hours ± five minutes at 425 ± 3 °F (218.3 ± 2 °C) and cooled at 77 °F (25 °C) shall meet the following requirements for daylight reflectance and color, when tested, using a color spectrophotometer with 45 degree circumferential/zero degree geometry, illuminant C, and two degree observer angle. The color instrument shall measure the visible spectrum from 380 to 720 nm with a wavelength measurement interval and spectral bandpass of 10 nm.

White	Daylight Reflectance	75 % min.
Yellow *	Daylight Reflectance	75 % min.

*Shall meet the coordinates of the following color tolerance chart.

x	0.490	0.475	0.485	0.530
y	0.470	0.438	0.425	0.456

- f. Specific Gravity. After heating the thermoplastic for four hours ± five minutes at 425 ± 3 °F (218.3 ± 2 °C), the specific gravity of the thermoplastic material shall be from 1.8 to 2.4 when determined according to ASTM D 153, Method A, using kerosene as the immersion liquid.
- g. Water Absorption of Plastics. The material shall have not more than 0.5 percent by weight of retained water when tested by ASTM D 570, "Water Absorption of Plastics," Procedure (a).
- h. Softening Point. After heating the thermoplastic material for four hours ± five minutes at 425 ± 3 °F (218.3 ± 2 °C) and testing in accordance with ASTM E 28, the material shall have a softening point between 200 to 240 °F (93.3 to 115.6 °C) as measured by the ring and ball method.
- i. Tensile Bond Strength. After heating the thermoplastic material for four hours ± five minutes at 425 ± 3 °F (218.3 ± 2 °C), the tensile bond strength to unprimed, sandblasted portland cement concrete block, 0.0625 in. (1.587 mm) thick film drawn down at 425 °F (218.3 °C), tested at 75 ± 2 °F (23.9 ± 1 °C) shall exceed 150 psi (1,030 kPa) when tested according to ASTM D 4796.
- j. Yellowness Index. After heating the thermoplastic for four hours ± five minutes at 425 ± 3 °F (218.3 ± 2 °C), the white thermoplastic material shall not exceed a yellowness index of 12 when tested in accordance with ASTM D 1925.
- k. Accelerated Weathering. After heating the thermoplastic for four hours ± five minutes at 425 ± 3 °F (218.3 ± 2 °C), the thermoplastic shall be applied to a steel wool abraded aluminum alloy panel (Federal Test Std. No. 141, Method 2013) at a film thickness of 30 mils (0.75 mm) and allowed to cool for 24 hours at room temperature. The coated panel shall be subjected to accelerated weathering using the light and water exposure

apparatus (fluorescent UV - condensation type) for 75 hours according to ASTM G 53 (equipped with UVB-313 lamps).

The cycle shall consist of four hours UV exposure at 122 °F (50 °C) followed by four hours of condensation at 104 °F (40 °C). UVB 313 bulbs shall be used. At the end of the exposure period, the panel shall not exceed 10 Hunter Lab Delta E units from the original material.

- (2) Packaging. The thermoplastic material shall be packaged in suitable containers which will not adhere to the product during shipment and storage. The container of thermoplastic material shall weigh approximately 50 lb (22.7 kg), and shall be delivered on pallets, 40 containers per pallet. The lot size shall be approximately 44,000 lb (20,000 kg) unless the total order is less than that amount.

Each container of material shall be stenciled with the manufacturer's name, the type of material (alkyd or hydrocarbon), color of material (white or yellow), IDOT specification number (1095.01), the month and year the material was packaged and the lot number. Lot numbers must begin with the last two digits of the year manufactured and be sequential with lot 1; i.e., the first lot manufactured in 1997 should be labeled 97-1. The letters and numbers used in the stencils shall be a minimum of 1/2 in. (12.7 mm) in height.

- (3) Storage Life. The material shall maintain a granular free-flow condition in dry storage for a minimum of one year, providing the temperature does not exceed 104 °F (40 °C). The thermoplastic must also melt uniformly with no evidence of skins or unmelted particles and meet all requirements of this specification for one year after delivery. Any material not meeting the above requirements shall be disposed of by the vendor and immediately replaced with acceptable material entirely at his expense, including handling and transportation charges.

(c) Sampling and Inspection.

- (1) The manufacturer shall forward preliminary samples of thermoplastic and ingredient materials to the Engineer of Materials and Physical Research, 126 East Ash Street, Springfield, Illinois, 62704-4766 for testing. The thermoplastic and ingredient materials shall be representative of the materials used/made and may not be changed without approval of the Department. All samples shall be provided in friction-top metal containers in the quantities specified. (Approximately 30 days are required to complete testing of the qualification samples.)

a. Ingredient Materials.

1. Glass beads. 1 qt (1 L)
2. Binder. 1 pt (0.5 L)
3. Pigments. 1 pt (0.5 L)
4. Filler. 1 pt (0.5 L)

b. Thermoplastic. 1 gal (4 L)

- (2) Sampling and Testing. Unless otherwise provided, all materials shall be sampled and tested in accordance with the latest published standard methods of the American Society for Testing and Materials, and revisions thereof, in effect on the date of the invitation for bids, where such standard methods exist. In case there are no ASTM Standards which apply, applicable standard methods of the American Association of State Highway and Transportation Officials, or the Federal Government, or of other recognized standardizing agencies shall be used. The sample(s) shall be labeled with the shipment number if applicable, lot number, date, quantity and any other pertinent information.

Thermoplastic. At least three randomly selected containers shall be obtained from each lot. A 1 gal (4 L) composite sample of the three containers shall be submitted for testing and acceptance.

- (3) Inspection. All material samples for acceptance tests shall be taken or witnessed by a representative of the Bureau of Materials and Physical Research and shall be submitted to the Engineer of Materials and Physical Research, 126 East Ash Street, Springfield, Illinois 62704-4766 at least 30 days in advance of the pavement marking operations. The right is reserved to inspect the material either at the place of manufacture or at the destination or at both places. If inspected at the place of manufacture, the manufacturer shall furnish such facilities as may be required for collecting and forwarding samples, and shall also furnish facilities for testing the material during the process of manufacture, if required. Tests will be made by and at the expense of the Department. Random check samples may be taken at the job site at the discretion of the Engineer.

(d) Manufacturer's Responsibility.

- (1) The manufacturer shall perform tests on a minimum of one sample per 10,000 lb (4,500 kg) of thermoplastic produced. Minimum tests required shall be a softening point determination and color. Manufacturer's test results shall be submitted along with the thermoplastic sample to the Bureau of Materials and Physical Research.
- (2) The manufacturer shall retain the test sample for a minimum period of 18 months.
- (3) The manufacturer shall furnish the Bureau of Materials and Physical Research with copies of bills of lading for all material inspected. Bills of lading shall indicate the consignee and destination, date of shipment, lot numbers, quantity, type of material, name and location of source.

(e) Material Acceptance. Final acceptance of a particular lot of thermoplastic will be based on the following.

- (1) Compliance of ingredient materials with the specifications.
- (2) Compliance of thermoplastic material with the specifications.
- (3) Manufacturer's test results for each lot of thermoplastic have been received.
- (4) Identification requirements are satisfactory.

(f) Glass Beads. The glass beads used as drop on beads with the thermoplastic pavement marking material shall meet the requirements of Article 1095.07, Type B. The beads shall be applied uniformly at a minimum rate of 8 lb/100 sq ft (39 kg/100 sq m).

1095.02 Paint Pavement Markings. All materials shall meet the following paint specification unless a shortage of raw materials precludes the production of paint which will meet the materials portion of this section. If the shortage can be documented to the satisfaction of the Engineer, then an alternate formulation will be allowed. Any alternate formulation shall comply with the latest volatile organic matter (VOM) content limits published by the IEPA in Title 35, Part 223 of the Illinois Administrative Code.

The finished paint shall be formulated and manufactured from first-grade materials. It shall be free from defects and imperfections that might adversely affect the serviceability of the finished product. It shall be completely free from dirt and other foreign material and shall dry within the time specified to a good, tough, serviceable film. The paint shall show no evidence of excessive settling, gelling, skinning, spoilage or livering upon storage in the sealed shipping containers under normal above freezing temperatures within twelve months of delivery. Any settled portion shall be easily brought back into suspension by hand mixing. When the settled portion is brought back into suspension in the vehicle, the paint shall be homogeneous and

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shall not show a viscosity change of more than 5 KU from the original viscosity. Any paint that has settled within the period of twelve months after delivery to the degree that the settled portion cannot be easily brought into suspension by hand mixing shall be disposed of by the vendor and immediately replaced with acceptable material entirely at his expense, including handling and transportation charges. The paint, when applied by spraying methods to a hot-mix asphalt pavement, shall not be discolored due to the solvent action of the paint on the surface.

(a) Ingredient Materials.

- (1) Titanium Dioxide. This material shall comply with the latest revision of the Specification for Titanium Dioxide Pigments, ASTM D 476, Type II, Rutile. A notarized certificate of compliance from the pigment manufacturer shall be required.
- (2) Yellow Pigment. This material shall be a non-toxic organic pigment, Yellow 65: Engelhard 1244 or equivalent.
- (3) Calcium Carbonate. This material shall comply with the latest revision of the Specification for Calcium Carbonate Pigments, ASTM D 1199, Type GC, Grade I, with minimum of 95 percent Calcium Carbonate or Type PC, minimum 98 percent Calcium Carbonate.
- (4) Acrylic Emulsion Polymer. This material shall be Rohm and Haas 2706 or Dow Chemical DT-211.
- (5) Methyl Alcohol. This material shall comply with the latest revision of the Specification for Methyl Alcohol, ASTM D 1152.

(6) Miscellaneous Materials.

- a. Water: Potable
- b. Dispersant: Tamol 850 (Rohm and Haas) or equivalent
- c. Surfactant: Triton CF-10 (Union Carbide) or equivalent
- d. Defoamer: Colloids 654 (Rhone-Poulenc) or equivalent
- e. Rheology Modifier: Natrasol 250 HBR (Aqualon Company) or equivalent
- f. Coalescent: Texanol (Eastman Chemical)
- g. Preservative: Troy 192 (Troy Chemical) or equivalent

- (b) Manufacture. All ingredient materials shall be delivered in the original containers and shall be used without adulteration. The containers shall be marked with type of material, name of manufacturer and lot number.

The manufacturer shall furnish to the Department the batch formula which will be used in manufacturing the paint.

No change shall be made in this formula without prior approval by the Department and no change will be approved that adversely affects the quality or serviceability of the paint.

The following Standard Formulas shall be the basis for the paint. The finished products shall conform on a weight basis to the composition requirements of these formulas. No variations will be permitted, except for the replacement of volatile lost in processing. Amounts are shown in pounds (kilograms) of material.

	White	Yellow
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	lb (kg)	lb (kg)
C.I. Pigment Yellow 65	---	32 (14.52)
Titanium Dioxide, Rutile, Type II	100 (45.36)	21 (9.53)
Calcium Carbonate, Type PC	150 (68.04)	150 (68.04)
Calcium Carbonate, Type GC	430 (195.05)	465 (210.92)
Rheology Modifier	0.5 (0.23)	0.5 (0.23)
Acrylic Emulsion, 50% Solids	541 (245.40)	535 (242.68)
Coalescent	24 (10.89)	23 (10.43)
Defoamer	5 (2.27)	5 (2.27)
Dispersant	8 (3.63)	9 (4.08)
Surfactant	2 (0.91)	2 (0.91)
Methyl Alcohol	29 (13.15)	28 (12.70)
Preservative	1.5 (0.68)	1.5 (0.68)
Water	10 (4.54)	10 (4.54)
Total	1301 (590.15)	1282 (581.53)

(c) Paint Properties. The finished paint shall be according to the following.

(1) Pigment. Analysis of the extracted pigment shall be according to the following.

	White	Yellow
Organic Yellow 65 (%)	---	Min. 4.8
Titanium Dioxide (%)	Min. 13.4	Min. 2.8
Calcium Carbonate (%)	Max. 86	Max. 93

The percent pigment by weight of the finished product shall not be less than 50 percent nor more than 54 percent.

- (2) Vehicle. The non-volatile portion of the vehicle shall be composed of a 100 percent acrylic polymer and shall not be less than 44 percent by weight.
- (3) Organic Volatiles. The finished paint shall contain less than 150 grams of volatile organic matter per liter of total paint. (ASTM D 3960)
- (4) Total Solids. The finished paint shall not be less than 73 percent total non-volatile by weight. (ASTM D 2369)
- (5) Unit Weight. The unit weight at 77 °F (25 °C) of the production batches shall not vary more than plus or minus 0.20 lb/gal (0.024 kg/L) from the weight of the qualification samples.
- (6) Viscosity. The consistency of the paint shall not be less than 83 nor more than 98 Krieb units at 77 °F (25 °C).
- (7) Dry Opacity. The minimum contrast ratio shall be 0.97 when tested in accordance with Federal Specification, Method 141 a, No. 4121, Procedure B when applied at a wet film thickness of 15 mils (0.38 mm).
- (8) Color And Directional Reflectance. The paint, applied at a wet film thickness of 15 mils (0.38 mm) and allowed to dry 24 hours, shall meet the following requirements for daylight reflectance and color, when tested, using a color spectrophotometer with 45 degrees circumferential/zero degree geometry, illuminant C, and two degree observer angle. The color instrument shall measure the visible spectrum from 380 to 720 nm with a wavelength measurement interval and spectral bandpass of 10 nm.

White	Daylight Reflectance (Y)	85 % min.
Yellow *	Daylight Reflectance (Y)	50 % min.

*Shall match Federal 595 Color No. 33538 and chromaticity limits as follows.

x	0.490	0.475	0.485	0.530
y	0.470	0.438	0.425	0.456

- (9) Water Resistance. The paint shall be according to Federal Specification TT-P-1952D, Section 3.2.5.
- (10) Freeze-Thaw Stability. The paint shall show no coagulation or change in consistency greater than 10 Kreb Units, when tested according to Federal Specification TT-P-1952D, Section 4.3.8.
- (11) Accelerated Package Stability. The paint shall show no coagulation, discoloration, or change in consistency greater than 10 Kreb Units when tested according to Federal Specification TT-P-1952D, Section 4.3.4.
- (12) Dilution Test. The paint shall be capable of dilution with water at all levels without curdling or precipitation such that the wet paint can be readily cleaned up with water only.
- (13) Storage Stability. After 30 days storage in a three-quarters filled, closed container, the paint shall show no caking that cannot be readily remixed to a smooth, homogenous state, no skinning, livering, curdling or hard settling. The viscosity shall not change more than 5 Kreb units from the viscosity of the original sample.
- (14) No Pick-Up Time. The no pick-up time shall be less than 10 minutes. The test shall follow the requirements of ASTM D 711 with a wet film thickness of 15 mils (0.38 mm).
- (15) Grind. The paint shall have a grind of not less than 3 on a Hegman Grind Gauge.
- (16) Flexibility. The paint shall show no cracking or flaking when tested according to Federal Specification TT-P-1952D, Section 4.3.5.
- (17) Dry Through Time. The paint, when applied to a non-absorbent substrate at a wet film thickness of 15 mils (0.38 mm) and placed in a humidity chamber controlled at 90 ± 5 percent R.H. and 72.5 ± 2.5 °F (22.5 ± 1.4 °C) shall have a "dry through time" not greater than 15 minutes of the IDOT standard formula. The dry through time shall be determined according to ASTM D 1640, except that the pressure exerted shall be the minimum needed to maintain contact with the thumb and film.
- (18) No-Tracking Time Field Test. The paint shall dry to a no-tracking condition under traffic in three minutes maximum when applied at 15 ± 1 mil (0.38 ± 0.03 mm) wet film thickness at $130 - 150$ °F ($54.4 - 65.6$ °C), and from three to ten minutes when applied at ambient temperatures with 6 lb (0.72 kg) of glass beads per gal (L) of paint. "No-tracking" shall be the time in minutes required for the line to withstand the running of a standard automobile over the line at a speed of approximately 40 mph (65 km/hr), simulating a passing procedure without tracking of the reflectorized line when viewed from a distance of 50 ft (15 m).
- (d) Sampling and Inspection.
- (1) Sample. The manufacturer shall forward to the Engineer of Materials and Physical Research, 126 East Ash Street, Springfield, Illinois 62704-4766, for test purposes, three 1 pt (1/2 L) qualification samples of material representative of that which he/she proposes to produce.

Along with the samples, the paint manufacturer shall furnish a copy of his/her batching formula and a list of the trade names and manufacturers of the ingredient materials proposed for use. Product data sheets shall be provided as verification of the ingredient materials conformity with the specification requirements. No changes shall be made without prior approval by the Department.

- (2) Sampling and Testing. Unless otherwise provided, all materials shall be sampled and tested in accordance with the latest published standard methods of the American Society for Testing and Materials, and revisions thereof, in effect on the date of manufacture, where such standard methods exist. In case there are no ASTM Standards which apply, applicable standard methods of the American Association of State Highway and Transportation Officials, or of the Federal Government, or of other recognized standardizing agencies shall be used.
- (3) Inspection. The right is reserved to inspect the paint either at the place of manufacture or after its arrival at destination. If inspected at the place of manufacture, the manufacturer shall furnish such facilities as may be required for collecting and forwarding samples of ingredient materials and finished paint and for performing the inspection of the paint during the process of manufacture. Before manufacture of the paint is started, the ingredient materials shall be set aside at the manufacturer's plant and shall be sampled by an authorized representative of the Department. All materials represented by these samples shall be held until tests have been made and the materials found to comply with the requirements of the specifications. Approximately 30 days are required to test the ingredient materials. The Department has the option to waive inspection of ingredient materials. During the manufacturing operations, the Department's representative shall have free entry at all times to such parts of the plant as concern the manufacture of the paint. All tests will be made by and at the expense of the Department.

All material samples for acceptance tests shall be taken or witnessed by a representative of the Bureau of Materials and Physical Research and shall be submitted to the Engineer of Materials and Physical Research, 126 East Ash Street, Springfield, Illinois 62704-4766.

- (e) Packaging. Unless otherwise directed, the paint shall be packaged and shipped in new 55 gal removable head, steel drums meeting the latest regulations of the United States Department of Transportation for shipping containers for this type of material. The drums shall be lined with a non-corrosive lining compatible with the waterborne paint. The opening in the drum shall be circular, and the diameter of the opening shall be substantially the diameter of the inside of the end of the drum. The drum shall be provided with gaskets of one-piece tubular neoprene construction and shall be completely airtight. The closure shall be securely attached to the drum by a bolt-action-type ring that shall enclose the edge of the lid and the chime of the drum. The closure bolt shall be tightened to a minimum of 40 ft lb (54 N m) torque, and a lock nut shall be securely tightened against the threaded end of the anchor. The white paint shall be packaged in white drums with white lids, and the yellow paint shall be packaged in white drums with yellow lids.

Fifty-five gallons of paint shall be placed in each drum, leaving approximately 2 in. (5 cm) of air space. The paint will be measured by volume, the unit of measure being a gallon [231 cu in. at 77 °F (25 °C)].

Each drum shall be stenciled on the removable head and on the side to show the kind of paint contained therein, the manufacturer's name, the lot number, and the month and year the paint is packaged.

- (f) Glass Beads. The glass beads used as drop on beads with the pavement marking paint shall be according to the requirements of Article 1095.07, Type B.

1095.03 Preformed Plastic Pavement Markings. The material shall consist of white or yellow (as specified) weather resistant reflective film according to the requirements specified herein.

- (a) Composition. The preformed plastic marking shall consist of high quality plastic materials, pigments, and glass beads and shall be furnished with a pressure sensitive precoated adhesive.

The markings shall have the following minimum composition without adhesive.

Components	Minimum Percent By Weight
Resins and Plasticizers	20 %

Pigment and Fillers	30 %
Graded Glass Beads	25 %

The remaining percentage shall be comprised of the above materials in various proportions.

- (b) Conformability and Resealing. The marking shall be according to pavement contours, breaks, faults, etc. through the action of traffic at all pavement temperatures. The film shall have resealing characteristics and shall be capable of fusing with itself or with previously applied marking material.
- (c) Thickness. Prior to application, the thickness of the material, without adhesive, shall be at least 60 mils (1.50 mm).

The Type B material shall feature an embossed pattern with a minimum thickness of 65 mils (1.65 mm) measured at the thickest point of the patterned cross section and a minimum of 20 mils (0.508 mm) measured at the thinnest point of the cross section.

- (d) Durability and Wear Resistance. The markings, when properly applied, shall provide a neat, durable marking that will not flow or distort due to temperature if the pavement surface remains stable. The markings shall provide a cushioned resilient substrate that reduces bead crushing and loss. The markings shall be weather resistant and, through normal traffic wear, show no appreciable fading, lifting, tearing, rollback, or other signs of poor adhesion.
- (e) Skid Resistance. The surface of the markings shall provide the following minimum skid resistance values when tested according to ASTM E 303.

Type B	45 BPN
Type C	55 BPN

- (f) Tensile Strength. The material shall have the following minimum tensile strength of cross section when tested according to ASTM D 638-76 using a jaw speed of 10 to 12 in./min (250 to 300 mm/min).

Type B	Not Applicable
Type C	150 psi (1033 kPa)

- (g) Elongation. The material shall have the following minimum elongation when tested according to ASTM D 638-76 using a jaw speed of 10 to 12 in./min (250 to 300 mm/min).

Type B	Not Applicable
Type C	50%

- (h) Glass Beads. Glass beads shall be uniformly distributed throughout the markings. A top coating of beads shall be bonded to or directly embedded into the surface of the markings in order to produce immediate retroreflectivity.

The glass beads shall be colorless and have a minimum index of refraction of 1.50 when tested using the liquid immersion method.

Type B material shall have an innermix of glass beads with a minimum index of refraction of 1.50 and a top coating of ceramic beads bonded to top urethane wear surface with a minimum index of refraction of 1.70. Beads with an index of refraction greater than 1.80 shall not be used.

Type C material shall have a layer of skid resistant ceramic particles bonded to the top urethane wear surface. The urethane wear surface shall have a nominal thickness of 5 mils (0.13 mm).

The bead adhesion shall be such that beads are not easily removed when the film is scratched firmly with a thumb nail.

- (i) Plastic Pull Test. A test specimen of 1 x 3 in. (25 x 75 mm) shall support a dead weight of 4 lb (1.8 kg) for not less than five minutes at a temperature between 70 and 80 °F (21 and 27 °C).
- (j) Pigmentation. The pigment for the white preformed plastic compound shall be a high grade pure (minimum 89 percent) titanium dioxide (TiO₂). The white pigment content shall not be less than ten percent by weight and shall be uniformly distributed throughout the compound.

The pigment used for the yellow preformed plastic compound shall be colorfast yellows, golds, and oranges. The yellow pigment content shall not be less than three percent by weight and shall be uniformly distributed throughout the compound.

- (k) Color. The material shall meet the following requirements for daylight reflectance and color, when tested, using a standard color difference meter (0 degrees, 45 degrees) and a magnesium oxide standard or an approved secondary standard.

Type B		
White	Daylight reflectance, Y	65% min.
*Yellow	Daylight reflectance, Y	36 to 59%

Type C		
White	Daylight reflectance, Y	80% min.
*Yellow	Daylight reflectance, Y	36 to 59%

*Shall match Federal Highway Color Tolerance Chart, PR Color No. 1 December 1972.

- (l) Reflectance. The white and yellow films shall have the following initial minimum reflectance values at 0.2 degrees and 0.5 degrees observation angles and 86.0 degrees entrance angle as measured according to the testing procedures of Federal Test Method Standard 370. The photometric quantity to be measured shall be Specific Luminance (SL), and shall be expressed as millicandelas/footcandle/sq ft (millicandelas/lux/sq m). The test distance shall be 50 ft (15 m) and the sample size shall be a 1.0 x 2.0 ft (300 x 600 mm) rectangle. The angular aperture of both the photoreceptor and light projector shall be six minutes of arc. The reference center shall be the geometric center of the sample, and the reference axis shall be taken perpendicular to the test sample.

Type B				
Entrance Angle	White		Yellow	
	86°	86.5°	86°	86.5°
Observation Angle	0.2°	1.0°	0.2°	1.0°
Specific Luminance	1100	700	800	500

Type C				
Entrance Angle	White		Yellow	
	86°	86°	86°	86°
Observation Angle	0.2°	0.5°	0.2°	0.5°
Specific Luminance	700	500	410	250

- (m) Identification. The material delivered to the jobsite shall be identified by the same shipment number(s), if applicable, batch or lot number(s), as the sample(s) tested and approved for that job. The batch or lot number(s) of the material, and the month and year the material is packaged, shall be stenciled or embossed on the container or included on the label.
- (n) Sampling and Testing. All material samples for acceptance tests will be taken or witnessed by a representative of the Bureau of Materials and Physical Research and will be submitted to the Engineer of Materials and Physical Research, 126 East Ash Street, Springfield, Illinois 62704-4766. Random check samples may be taken at the jobsite at the discretion of the Engineer.

The Engineer will test and certify the basic requirements.

The Contractor shall provide the Engineer certification from the manufacturer that the material to be furnished meets all the requirements of these specifications.

Sample(s) of preformed plastic shall be a minimum of 2 sq ft (0.2 sq m) of each color to be used.

The sample(s) shall be labeled with the shipment number(s), if applicable, batch or lot number(s), all batch number(s) comprising a lot, date, quantity, and any other pertinent information.

1095.04 Epoxy Pavement Marking. All materials shall be according to the following.

- (a) The epoxy marking material shall consist of a 100 percent solid two part system formulated and designed to provide a simple volumetric mixing ratio of two components (must be two volumes of Part A and one volume of Part B). No volatile solvents or fillers will be allowed. Total solids shall not be less than 99 percent when determined, on the mixed material, according to ASTM D 2369, excluding the solvent dispersion.
- (b) The Epoxide Value (WPE) of Component A shall be tested according to ASTM D 1652 on a pigment free basis. The WPE shall not vary more than plus or minus 50 units of the qualification samples.
- (c) The Total Amine Value of Component B shall be tested according to ASTM D 2074. The Total Amine Value shall not vary more than plus or minus 50 units of the qualification samples.
- (d) Composition by Weight of Component A as Determined by Low Temperature Ashing. A 0.5 gram sample of component A shall be dispersed with a paperclip on the bottom of an aluminum dish, weighed and then heated in a muffle furnace at 1000 °F (538 °C) for one hour and weighed again. No solvents shall be used for dispersion. The difference in the weights shall be calculated and meet the following.

Pigment*	White	Yellow
Titanium Dioxide ASTM D 476 Type II	21-24%	
Organic Yellow, Titanium Dioxide, Other		± 2%**
Epoxy Resin	76-79%	± 2%**

* No extender pigments are permitted.

** From the pigment and epoxy resin content determined on qualification samples.

- (e) Upon heating to application temperature, the material shall not exude fumes which are toxic or injurious to persons or property.
- (f) The daylight directional reflectance of the paint (without glass spheres) applied at 14 to 16 mils (0.35 to 0.41 mm) shall meet the following requirements when tested, using a color spectrophotometer with 45 degree circumferential/zero degree geometry, illuminant C, and two degree observer angle. The color instrument shall measure the visible spectrum from 380 to 720 nm with a wavelength measurement interval and spectral bandpass of 10 nm.

White	Daylight Reflectance (Y)	80 % min.
Yellow*	Daylight Reflectance (Y)	50 % min.

*Shall meet the coordinates of the following color tolerance chart.

x	0.490	0.475	0.485	0.530
y	0.470	0.438	0.425	0.456

- (g) The epoxy pavement marking material, when mixed in the proper mix ratio and applied at 14 to 16 mils (0.35 to 0.41 mm) wet film thickness and with the proper saturation of glass spheres, shall exhibit a dry no pick-up time of twenty minutes or less when tested according to ASTM D 711.
- (h) The epoxy pavement marking material, when mixed in the proper mix ratio and tested according to ASTM D 7234 shall have a degree of adhesion which results in a 100 percent concrete failure in the performance of this test.
- (i) The epoxy pavement marking materials when tested according to ASTM D 2240, shall have a shore D hardness of between 75 and 100. Films shall be cast on a rigid substrate at 14 to 16 mils (0.35 to 0.41 mm) in thickness and allowed to cure at room temperature for 72 hours before testing.
- (j) The abrasion resistance shall be evaluated, according to ASTM D 4060, on a Taber Abrader with a 1,000 gram load and CS 17 wheels. The duration of test shall be 1,000 cycles. The loss shall be calculated by difference and be less than 82 mgs. The tests shall be run on cured samples of material which have been applied at a film thickness of 14 to 16 mils (0.35 to 0.41 mm) to code S-16 stainless steel plates. The films shall be allowed to cure at room temperature for at least 72 hours before testing.
- (k) When tested according to ASTM D 638, the epoxy pavement marking materials shall have a tensile strength of not less than 6,000 psi (41,300 kPa). The Type IV specimens shall be cast in a suitable mold not more than 1/4 in. (6.3 mm) thick and pulled at a rate of 1/4 in./min (6.3 mm/min) by a suitable dynamic testing machine. The samples shall be allowed to cure at room temperature for at least 72 hours before testing.
- (l) When tested according to ASTM D 695, the catalyzed epoxy pavement marking materials shall have a compressive strength of not less than 12,000 psi (83,000 kPa). The cast sample shall be conditioned at room temperature for a minimum of 72 hours before performing the indicated tests. The rate of compression of these samples shall 1/4 in./min (6.3 mm/min) or less.
- (m) The glass beads shall meet the requirements of Article 1095.07 and the following.
 - (1) The first drop glass beads shall be tested by the standard visual method of large glass spheres adopted by the Department. The first drop glass shall contain a minimum of 63 percent silica (SiO₂).The beads shall have a silane coating and meet the following sieve requirements.

U.S. Standard Sieve Number	Sieve Size	% Passing (By Weight)
12	1.70 mm	95-100
14	1.40 mm	75-95
16	1.18 mm	10-47
18	1.00 mm	0-7
20	850 µm	0-5

- (2) The second drop glass beads shall be Type B.
- (3) The glass beads shall have a silane coating.
- (n) The epoxy paint shall be applied to an aluminum alloy panel (Federal Test Std. No. 141, Method 2013) at a film thickness of 14 to 16 mils (0.35 to 0.41 mm) and allowed to cure for 72 hours at room temperature. Subject the coated panel for 75 hours to accelerated weathering using the light and water exposure apparatus (fluorescent UV - condensation type) as specified in ASTM G 53 (equipped with UVB-313 lamps).

The cycle shall consist of four hours UV exposure at 122 °F (50 °C) followed by four hours of condensation at 104 °F (40 °C). UVB 313 bulbs shall be used. At the end of the exposure period,

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the panel shall show no more than 10 Hunter Lab Delta E units or substantial change in gloss from the original, non-exposed paint.

- (o) The material shall be shipped to the jobsite in substantial containers and shall be plainly marked with the manufacturer's name and address, the name and color of the material, date of manufacture, and batch number.
- (p) Prior to approval and use of the epoxy pavement marking materials, the manufacturer shall submit a notarized certification from an independent laboratory, together with the results of all tests, stating these materials meet the requirements as set forth herein. The certified test report shall state the lot tested, manufacturer's name, brand name of epoxy and date of manufacture. The certification shall be accompanied by 1 pt (1/2 L) samples each of Part A and Part B. After approval by the Department, certification by the epoxy manufacturer shall be submitted for each batch used. New independent laboratory certified test results and samples for testing by the Department shall be submitted any time the manufacturing process or paint formulation is changed. All costs of testing (other than tests conducted by the Department) shall be borne by the manufacturer.
- (q) Acceptance samples, shall consist of two 1 pt (1/2 L) samples of Part A and one 1 pt (1/2 L) sample of Part B, of each lot of paint. The samples shall be submitted to the Department for testing, together with a manufacturer's certification. The certification shall state the formulation for the lot represented is essentially identical to that used for qualification testing. All acceptance samples shall be taken by a representative of the Illinois Department of Transportation. The epoxy pavement marking materials shall not be used until tests are completed and they have met the requirements as set forth herein.

1095.05 Preformed Thermoplastic Pavement Marking. All materials shall be according to Article 1095.01 and the following.

- (a) The preformed thermoplastic pavement marking film shall consist of resin, aggregates, pigments, binders and glass beads which have been factory produced as a finished product supplied in a preformed state.
- (b) Glass beads shall be uniformly distributed throughout the entire cross sectional area. Immediate retroreflectivity can be provided by a preapplied layer of beads or by scattering surface beads on a molten material during application. The bead adhesion shall be such that beads are not easily removed when the material surface is scratched with a thumbnail.
- (c) The pavement markings shall contain a minimum of 30 percent graded glass beads by weight. The beads shall be clear and transparent and free of pits and scratches. Not more than 20 percent shall consist of irregular, fused spheroids, or silica. The index of refraction shall be not less than 1.50 when tested using the liquid immersion method.
- (d) The pavement markings shall have a minimum thickness of 125 mils (3.15 mm) as supplied by the manufacturer.
- (e) The pavement markings shall be capable of conforming to pavement contours, breaks, and faults through the action of traffic at normal pavement temperatures. The markings shall have resealing characteristics and shall be capable of fusing with itself and previously applied thermoplastic when heated with a propane blowtorch.
- (f) The pavement markings shall be resistant to deterioration due to the exposure to sunlight, water, oil, gasoline, salt or adverse weather conditions.
- (g) The preformed thermoplastic markings shall not be brittle and must be sufficiently cohesive and flexible at temperatures exceeding 50 °F (10 °C) for one person to carry without the danger of fracturing the material prior to application.

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- (h) The surface of the preformed thermoplastic markings shall provide a minimum skid resistance value of 45 BPN when tested according to ASTM E 303-74.
- (i) The preformed thermoplastic marking material shall have flexibility at 85 degrees such that when a 2 1/2 x 6 in. (63 x 150 mm) sample is bent through an arc at 90 degrees at a uniform rate in ten seconds (9 degrees/second) over a 1 in. (25 mm) mandrel, no cracking occurs in the test sample. The sample must be conditioned prior to testing at 85 ± 2 °F (29 ± 1 °C) for a minimum of four hours. At least two specimens tested must meet the flexibility requirements at 85 °F (29 °C) for a passing result.
- (j) Identification. The material shipped to the job site shall be identified by the same shipment number(s), if applicable, batch or lot number(s), as the sample(s) tested and approved for that job. The batch or lot number(s) of the material, and the month and year the material is packaged, shall be stenciled or embossed on the container or included on the label.
- (k) Sampling and testing. All material samples for acceptance tests will be taken or witnessed by a representative of the Bureau of Materials and Physical Research, 126 East Ash Street, Springfield, Illinois 62704-4766. Random check samples may be taken at the job site at the discretion of the Engineer.

The Engineer will test and certify the basic requirements.

The Contractor shall provide the Engineer certification from the manufacturer that the material to be furnished meets all the requirements of these specifications.

Sample(s) of preformed plastic shall be a minimum 2 sq ft (0.18 sq m) of each color to be used.

The sample(s) shall be labeled with the shipment number(s), if applicable, batch or lot number(s), all batch number(s) comprising a lot, date, quantity and any other pertinent information.

1095.06 Pavement Marking Tape. White or yellow marking tape shall consist of glass spheres of high optical quality embedded into a binder on a suitable backing that is precoated with a pressure sensitive adhesive. The spheres shall be of uniform gradation and distributed evenly over the surface of the tape.

The material shall be white or yellow as specified. The colors shall conform closely to Federal color tolerances for pavement marking paint.

The white and yellow tape shall be readily visible when viewed under automotive headlights at night. Reflective values, measured in accordance with the photometric testing procedure of ASTM D 4061 shall not be less than those listed in the table below. The Coefficient of Retroreflected Luminance R_L , shall be expressed as average millicandelas/foot candle/sq ft (millicandelas/lux/sq m), measured on a 2 x 1 ft (600 x 300 mm) panel at 86 degree entrance angle.

Coefficient of Retroreflected Luminance					
Type I			Type III		
Observation Angle	White	Yellow	Observation Angle	White	Yellow
0.2°	2700	2400	0.2°	1300	1200
0.5°	2250	2000	0.5°	1100	1000

The pavement marking tape shall have a precoated pressure sensitive adhesive and shall require no activation procedures. Test pieces of the tape shall be applied according to the manufacturer's instructions and tested according to ASTM D 1000, Method A, except that a stiff, short bristle roller brush and heavy hand pressure will be substituted for the weighted rubber roller in applying the test pieces to the metal test panel. Material tested as directed above shall show a minimum adhesion value of 750 g/in. (30 g/mm) width at the temperatures specified in ASTM D 1000. The adhesive shall be resistant to oils, acids, solvents, and water, and shall not leave objectionable stains or residue after removal. The material shall be flexible and conformable to the texture of the pavement.

Type III tape shall be capable of performing for the duration of a normal construction season and shall then be capable of being removed intact or in large sections at pavement temperatures above 40 °F (4 °C) either manually or with a roll-up device without the use of sandblasting, solvents, or grinding. The Contractor shall provide the Engineer certification, from the manufacturer of the Type III tape, that the material to be furnished meets the requirements for being removed after the following minimum traffic exposure based on transverse test decks with rolling traffic.

- (a) Time in place - 400 days
- (b) ADT per lane - 9,000 (28 percent trucks)
- (c) Axle hits - 10,000,000 minimum

Samples of the material, applied to standard specimen plates will be measured for thickness, and tested for durability in accordance with Federal Test Method Standard No. 141A, Method 6192, using a CS-17 wheel and 1000-gram load, and shall meet the following criteria for minimum initial thickness and for durability, showing no significant change in color after being tested for the number of cycles indicated.

Test	Type I		Type III	
	White	Yellow	White	Yellow
Initial Thickness mils (mm)	20 (0.51)	20 (0.51)	20 (0.51)	20 (0.51)
Durability (Cycles)	5,000	5,000	1,500	1,500

The pavement marking tape, when applied according to the manufacturer's recommended procedures, shall be weather resistant and shall show no appreciable fading, lifting, or shrinkage during the useful life of the marking. The tape, as applied, shall be of good appearance, free of cracks, and edges shall be true, straight, and unbroken.

1095.07 Glass Beads for Pavement Markings. The glass beads used for reflectorizing pavement marking lines shall be Type A or Type B. Type A (uncoated) is intended for use as drop-on beads with solvent-based pavement marking paints and as intermix beads with thermoplastic pavement marking materials. Type B (moisture resistant, silicone coated) is intended for use as drop-on beads with thermoplastic pavement marking materials and waterborne-type marking paints.

(a) Properties. The glass beads furnished under this specification shall consist essentially of transparent, water-white glass particles of a spherical shape. They shall be manufactured from a glass of a composition designed to be highly resistant to traffic wear and to the effects of weathering. The glass beads shall be according to the following.

(1) Sieve Analysis. The glass beads shall meet the following sieve requirements.

U. S. Standard Sieve No.	Sieve Sizes	Total Percent By Weight (Mass) Passing
20	850 μm	100
30	600 μm	75 – 100
50	300 μm	15 – 40
100	150 μm	0 – 5
200	75 μm	0 – 1

(2) Imperfections. The surface of the glass beads shall be free of pits and scratches. The glass beads shall be spherical in shape and shall contain not more than 20 percent by weight of irregular shapes when tested by the standard method using a vibratile inclined glass plate as adopted by the Department.

(3) Index of Refraction. The index of refraction of the glass beads shall not be less than 1.50 when tested by the immersion method at 77 °F (25 °C).

(4) Silica Content. The glass beads shall contain not less than 70 percent silica (SiO_2).

(5) Chemical Stability. Glass beads which show tendency toward decomposition, including surface etching, when exposed to paint or thermoplastic constituents shall be rejected. The glass beads shall be tested according to Federal Specification TT-B-1325B, Section 4.3.9 (water resistance) and evaluated for compliance with Section 3.2.9, with the following exceptions.

The size of sample to be tested shall be 25 grams and the reflux time shall be five hours.

(6) Flowing Properties. The glass beads shall flow uniformly through dispensing equipment in atmospheric humidity up to 94 percent.

- a. Type A. The beads shall be free of silicones, waxes, oils, or other coatings and pass the following test.

One hundred grams of glass beads, spread evenly and thinly in a suitable container, shall be conditioned at 77 °F (25 °C) for four hours over a solution of sulfuric acid (Sp. Gr. 1.10) in a closed desiccator. After four hours, the glass beads shall flow readily through a clean glass analytical funnel, 60 degree, 3 in. (75 mm) diameter and 6 in. (150 mm) stem. Inside diameter of the stem shall be a nominal 1/4 in. (6.33 mm).

- b. Type B. The beads shall have a silicone, moisture resistant coating and pass the following test.

One hundred grams of beads are placed in a 600 ml beaker and an equivalent volume of distilled water shall be added to the beaker. The beaker will then stand for five minutes, at the end of which time the water shall be carefully poured off and the beads transferred to a clean dry beaker and allowed to stand for five minutes. The beads will then be poured slowly into a standard glass funnel (Corning 6120), 5 in. (127 mm) diameter, 4 in. (102 mm) stem length and 7/16 in. (11 mm) stem inside diameter. The beads shall flow through the funnel stem without stoppage. Slight initial agitation to start the flow through the funnel at the beginning of the test is permissible.

- (b) Packaging. The glass beads shall be packaged in approved moisture proof bags consisting of at least five ply paper construction unless otherwise specified. Each bag shall contain 50 lb (22.7 kg) net, and shall be legibly marked with the manufacturer, IDOT specification and type, lot number, and the month and year the glass beads were packaged. The letters and numbers used in the stencils shall be a minimum of 1/2 in. (12.7 mm) in height.
- (c) Sampling and Testing. Unless otherwise provided, all materials shall be sampled and tested in accordance with the latest published standard methods of the American Society for Testing and Materials, and revisions thereof, in effect on the date of the invitation for bids, where such standard methods exist. In case there are no ASTM Standards which apply, applicable standard methods of the American Association of State Highway and Transportation Officials, or the Federal Government, or of other recognized standardizing agencies shall be used.

The right is reserved to inspect the glass beads either at the place of manufacture or at the destination or at both places. If inspected at the place of manufacture, the manufacturer shall furnish such facilities as may be required for collecting and forwarding samples, and shall also furnish facilities for testing the glass beads during the process of manufacture, if required. During the manufacturing operations, the Department's representative shall have free entry at all times to such parts of the plant as concern the manufacture of the glass beads. Tests will be made by and at the expense of the Department unless otherwise specified.

All material samples for acceptance tests shall be taken or witnessed by a representative of the Bureau of Materials and Physical Research and shall be submitted to the Engineer of Materials and Physical Research, 126 East Ash Street, Springfield, Illinois 62704-4766.

1095.08 Polyurea Pavement Marking. Materials shall be according to the following.

- (a) Polyurea Pavement Marking. The polyurea pavement marking material shall consist of a 100 percent solid two-part system formulated and designed to provide a simple volumetric mixing ratio of two components (must be two or three volumes of Part A to one volume of Part B). No volatile or polluting solvents or fillers will be allowed.
- (b) Pigmentation. The pigment content by weight (mass) of component A shall be determined by low temperature ashing according to ASTM D 3723. The pigment content shall not vary more than ± two percent from the pigment content of the original qualified paint.

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White Pigment shall be Titanium Dioxide meeting ASTM D 476, Type II Rutile.

Yellow Pigment shall be Organic Yellow and contain no heavy metals.

- (c) Environmental. Upon heating to application temperature, the material shall not exude fumes which are toxic or injurious to persons or property.
- (d) Daylight Reflectance. The daylight directional reflectance of the cured polyurea material (without reflective media) shall be a minimum of 80 percent (white) and 50 percent (yellow) relative to magnesium oxide when tested using a color spectrophotometer with a 45 degree circumferential/zero degree geometry, illuminant C, and two degree observer angle. The color instrument shall measure the visible spectrum from 380 to 720 nm with a wavelength measurement interval and spectral bandpass of 10nm. In addition, the color of the yellow polyurea shall visually match Color Number 33538 of Federal Standard 595a with chromaticity limits as follows.

x	0.490	0.475	0.485	0.539
y	0.470	0.438	0.425	0.456

- (e) Weathering Resistance. The polyurea marking material, when mixed in the proper ratio and applied at 14 to 16 mils (0.35 to 0.40 mm) wet film thickness to an aluminum alloy panel (Federal Test Std. No 141, Method 2013) and allowed to cure for 72 hours at room temperature, shall be subjected to accelerated weathering for 75 hours. The accelerated weathering shall be completed by using the light and water exposure apparatus (fluorescent UV – condensation type) and tested according to ASTM G 53.

The cycle shall consist of four hours UV exposure at 122 °F (50 °C) and four hours of condensation at 104 °F (40 °C). UVB 313 bulbs shall be used. At the end of the exposure period, the material shall show no substantial change in color or gloss.

- (f) Dry Time. The polyurea pavement marking material, when mixed in the proper ratio and applied at 14 to 16 mils (0.35 to 0.40 mm) wet film thickness and with the proper saturation of reflective media, shall exhibit a no-tracking time of ten minutes or less when tested according to ASTM D 711.
- (g) Adhesion. The catalyzed polyurea pavement marking materials when applied to a 4 x 4 x 2 in. (100 x 100 x 50 mm) concrete block shall have a degree of adhesion which results in a 100 percent concrete failure in the performance of this test.

The concrete block shall be brushed on one side and have a minimum strength of 3500 psi (24,100 kPa). A 2 in. (50 mm) square film of the mixed polyurea shall be applied to the brushed surface and allowed to cure for 72 hours at room temperature. A 2 in. (50 mm) square cube shall be affixed to the surface of the polyurea by means of an epoxy glue. After the glue has cured for 24 hours, the polyurea specimen shall be placed on a dynamic testing machine in such a fashion so that the specimen block is in a fixed position and the 2 in. (50 mm) cube (glued to the polyurea surface) is attached to the dynamometer head. Direct upward pressure shall be slowly applied until the polyurea system fails. The location of the break and the amount of concrete failure shall be recorded.

- (h) Hardness. The polyurea pavement marking materials when tested according to ASTM D 2240 shall have a shore D hardness of between 70 and 100. Films shall be cast on a rigid substrate at 14 to 16 mils (0.35 to 0.40 mm) in thickness and allowed to cure at room temperature for 72 hours before testing.
- (i) Abrasion. The abrasion resistance shall be evaluated according to ASTM D 4060 using a Taber Abrader with a 2.20-lb (1000-gram) load and CS 17 wheels. The duration of the test shall be 1000 cycles. The loss shall be calculated by difference and be less than 120 mgs. The tests shall be run on cured samples of polyurea material which have been applied at a film thickness of 14 to 16 mils

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(0.35 to 0.40 mm) to code S-16 stainless steel plates. The films shall be allowed to cure at room temperature for at least 72 hours and not more than 96 hours before testing.

(j) Reflective Media. The reflective media shall meet the following requirements.

(1) Type I – The glass beads shall meet the requirements of Article 1095.07 and the following.

a. First Drop Beads. The first drop glass beads shall be tested by the standard visual method of large glass spheres adopted by the Department. The beads shall have a silane coating and meet the following sieve requirements.

U.S. Standard Sieve Number	Sieve Size	% Passing By Weight (Mass)
12	1.70 mm	95 – 100
14	1.40 mm	75 – 95
16	1.18 mm	10 – 47
18	1.00 mm	0 – 7
20	850 µm	0 – 5

b. Second Drop Glass Beads. The second drop glass beads shall meet the requirements of Article 1095.07 for Type B.

(2) Type II – The combination of microcrystalline ceramic elements and glass beads shall meet the following requirements.

a. First Drop Glass Beads. The first drop glass beads shall meet the following requirements.

1. Composition. The elements shall be composed of a titania opacified ceramic core having clear and or yellow tinted microcrystalline ceramic beads embedded to the outer surface.
2. Index of Refraction. All microcrystalline reflective elements embedded to the outer surface shall have an index of refraction of 1.8 when tested by the immersion method.
3. Acid Resistance. A sample of microcrystalline ceramic beads supplied by the manufacturer shall show resistance to corrosion of their surface after exposure to a one percent solution (by weight (mass)) of sulfuric acid. Adding 0.2 oz (5.7 ml) of concentrated acid into the water shall make the one percent acid solution. This test shall be performed by taking 1 x 2 in. (25 x 50 mm) sample and adhering it to the bottom of a glass tray and placing just enough acid solution to completely immerse the sample. The tray shall be covered with a piece of glass to prevent evaporation and allow the sample to be exposed for 24 hours under these conditions. The acid solution shall be decanted (do not rinse, touch, or otherwise disturb the bead surfaces) and the sample dried while adhered to the glass tray in a 150 °F (66 °C) oven for approximately 15 minutes. Microscope examination (20X) shall show no white (corroded) layer on the entire surface.

b. Second Drop Glass Beads. The second drop glass beads shall meet the requirements of Article 1095.07 for Type B or the following manufacturer's specification.

1. Sieve Analysis. The glass beads shall meet the following requirements.

U.S. Standard Sieve Number	Sieve Size	% Passing By Weight (Mass)
20	850 µm	100
30	600 µm	75 – 95
50	300 µm	15 – 35

100	150 μm	0 – 5
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The manufacturer of the glass beads shall certify that the treatment of the glass beads meets requirements of the polyurea manufacturer.

2. Imperfections. The surface of the glass beads shall be free of pits and scratches. The glass beads shall be spherical in shape and shall contain a maximum of 20 percent by weight (mass) of irregular shapes when tested by the standard method using a vibratile inclined glass plate as adopted by the Department.
 3. Index of Refraction. The index of refraction of the glass beads shall be a minimum of 1.50 when tested by the immersion method at 77 °F (25 °C).
- (k) Packaging. Microcrystalline ceramic reflective elements and glass beads shall be delivered in approved moisture proof bags or weather resistant bulk boxes. Each carton shall be legibly marked with the manufacturer, specifications and type, lot number, and the month and year the microcrystalline ceramic reflective elements and/or glass beads were packaged. The letters and numbers used in the stencils shall be a minimum of 1/2 in. (13 mm) in height.
- (1) Moisture Proof Bags. Moisture proof bags shall consist of at least five ply paper construction unless otherwise specified. Each bag shall contain 50 lb (22.7 kg) net.
 - (2) Bulk Weather Resistance Boxes. Bulk weather resistance boxes shall conform to Federal Specification PPP-8-640D Class II or latest revision. Boxes are to be weather resistant, triple wall, fluted, corrugated-fiber board. Cartons shall be strapped with two metal straps. Straps shall surround the outside perimeter of the carton. The first strap shall be located approximately 2 in. (50 mm) from the bottom of the carton and the second strap shall be placed approximately in the middle of the carton. All cartons shall be shrink wrapped for protection from moisture. Cartons shall be lined with a minimum 4 mil polyester bag and meet Interstate Commerce Commission requirements. Cartons shall be approximately 38 x 38 in. (1 x 1 m), contain 2000 lb (910 kg) of microcrystalline ceramic reflective elements and/or glass beads and be supported on a wooden pallet with fiber straps.
- (l) Packaging. The material shall be shipped to the job site in substantial containers and shall be plainly marked with the manufacturer's name and address, the name and color of the material, date of manufacture, and batch number.
- (m) Verification. Prior to approval and use of the polyurea pavement marking materials, the manufacturer shall submit a notarized certification of an independent laboratory, together with the results of all tests, stating these materials meet the requirements as set forth herein. The certification test report shall state the lot tested, manufacturer's name, brand name of polyurea and date of manufacture. The certification shall be accompanied by one 1 pt (1/2 L) sample each of Part A and Part B. Samples shall be sent in the appropriate volumes for complete mixing of Part A and Part B.
- After approval by the Department, certification by the polyurea manufacturer shall be submitted for each batch used. New independent laboratory certified test results and samples for testing by the Department shall be submitted any time the manufacturing process or paint formulation is changed. All costs of testing (other than tests conducted by the Department) shall be borne by the manufacturer.
- (n) Acceptance Samples. Acceptance samples shall consist of one 1 pt (1/2 L) sample of each Part A and Part B, of each lot of paint. Samples shall be sent in the appropriate volumes for complete mixing of Part A and Part B. The samples shall be submitted to the Department for testing, together with a manufacturer's certification. The certification shall state the formulation for the lot represented is essentially identical to that used for qualification testing. All acceptance samples will be taken by a representative of the Department. The polyurea pavement marking

materials shall not be used until tests are completed and they have met the requirements as set forth herein.

- (o) Material Retainage. The manufacturer shall retain the test sample for a minimum of 18 months.

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:)
)
PROPOSED AMENDMENTS TO CLEAN)
CONSTRUCTION OR DEMOLITION) R12-09
DEBRIS FILL OPERATIONS (CCDD)) (Rulemaking—Land)
AND UNCONTAMINATED SOIL)
FILL OPERATIONS)
PROPOSED AMENDMENTS TO 35)
35 Ill. Adm. Code 1100)

CERTIFICATE OF SERVICE

The undersigned hereby certifies that he has served the foregoing PROPOSED AMENDMENT TO AND PREFILED TESTIMONY OF STEVEN GOBELMAN REGARDING ILLINOIS EPA's PROPOSED AMENDMENTS TO SECTION 1100.212 upon the persons listed below by email addressed to the following:

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on this 7th day of October, 2011. A hardcopy of this filing will be mailed to you upon request.


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