

**EXHIBIT I**

**SPECIAL PROVISIONS**

**NEXT 21 PAGES**

**WEST VIRGINIA DEPARTMENT OF TRANSPORTATION**

**DIVISION OF HIGHWAYS**

**SPECIAL PROVISION**

**FOR**

**SECTION 715**

**MISCELLANEOUS MATERIALS**

**715.9-WARNING DEVICES:**

**715.9.1 – General:**

**DELETE THIS SECTION AND REPLACE WITH THE FOLLOWING:**

**715.9.1-General:** Warning devices shall include, but shall not be limited to, signs, barricades, auxiliary barriers, channelizing devices, hazard warning lights, flares, and reflectors. Unless otherwise indicated such devices shall conform to the standard, "Manual On Temporary Traffic Control for Streets and Highways ", published by the Division. The Contractor shall exhibit evidence that the warning devices furnished meet the requirements detailed.

**715.9.2-Signs:**

**DELETE THIS SECTION AND REPLACE WITH THE FOLLOWING:**

**715.9.2-Signs:** Sign blank material shall be either 0.080 in. flat sheet aluminum, 0.040 in. flat sheet aluminum (guide sign demountable shields, legend, & border only), or extruded panel as specified in Section 661. Retroreflection shall be required and shall be accomplished by using approved retroreflective sheeting as specified in Section 661 and meeting the requirements specified herein.

All references herein to ASTM specification D4956 shall be interpreted as referencing version D4956 – 11a. Any portion of this specification which is in contradiction to ASTM D4956 shall supersede ASTM D4956. All references herein to AASHTO (American Association of State Highway and Transportation Officials) specification M268 shall be interpreted as referencing version M 268-10. Any portion of this specification which is in contradiction to AASHTO M268 shall supersede AASHTO M268. All AASHTO-NTPEP references herein shall be interpreted as referring to the AASHTO National Transportation Product Evaluation Program (NTPEP). All retroreflectivity values referenced herein shall be in units of  $\text{cd}/\text{fc}/\text{ft}^2(\text{cd}\cdot\text{lx}^{-1}\cdot\text{m}^{-2})$ . All "matched component" references herein shall be interpreted as referencing the retroreflective sheeting manufacturer's recommended inks and overlay films to be used for manufacturing purposes with the manufacturer's sheeting. All APL

references herein shall be interpreted as referring to the Division's Approved Products List (APL) for Retroreflective Sheeting. All CSS references herein shall be interpreted as referring to the Division's Central Sign Shop (CSS) internal sign manufacturing facility in Charleston, WV.

**715.9.2.1-Retroreflective Sheeting, Type ASTM-I:** A retroreflective sheeting referred to as "engineering grade" that is typically an enclosed lens glass-bead sheeting.

**715.9.2.1.1- Type ASTM-I Sheeting Requirements:**

**715.9.2.1.1.1- Coefficient of Retroreflection:** New sheeting shall meet the Minimum Coefficient of Retroreflection requirements in ASTM specification D4956 for Type I material, as defined in ASTM D4956.

For transparent ink printed or transparent film covered areas over white sheeting, the Minimum Coefficient of Retroreflection requirements shall be seventy (70) % of the values specified in ASTM D4956 for sheeting of the same color as the ink or film.

All testing shall be conducted in accordance with ASTM D4956.

**715.9.2.1.1.2- Color:** New sheeting shall meet the Daytime Color & Nighttime Color requirements in ASTM specification D4956 when tested in accordance with ASTM specification D4956. These requirements shall also apply to transparent ink and transparent film covered areas over white sheeting.

**715.9.2.1.1.3- Daytime Luminance Factor:** New sheeting shall meet the Daytime Luminance Factor requirements in ASTM specification D4956 when tested in accordance with ASTM specification D4956. These requirements shall also apply to transparent ink and transparent film covered areas over white sheeting.

**715.9.2.1.1.4- Adhesion:** New sheeting with a pressure sensitive backing shall meet the adhesion requirements in ASTM specification D4956 when tested in accordance with ASTM specification D4956.

**715.9.2.1.1.5- Shrinkage:** New sheeting shall meet the shrinkage requirements in ASTM specification D4956 when tested in accordance with ASTM specification D4956.

**715.9.2.1.1.6- Flexibility:** New sheeting shall meet the flexibility requirements in ASTM specification D4956 when tested in accordance with ASTM specification D4956.

**715.9.2.1.1.7- Liner Removal:** New sheeting shall meet the liner removability requirements in ASTM specification D4956 when tested in accordance with ASTM specification D4956.

**715.9.2.1.1.8- Impact Resistance:** New sheeting shall meet the impact resistance requirements in ASTM specification D4956 when tested in accordance with ASTM specification D4956.

**715.9.2.1.1.9-Rotational Sensitivity:** New sheeting shall meet the applicable requirements of AASHTO M268 in order for the sheeting to be considered rotationally insensitive. Testing shall be conducted at the viewing geometry of 0.5/-4 as recommended in AASHTO M268, and the results of retroreflectivity readings at rotation angles of 0, 45, 90, and 120 degrees shall be compared as recommended in AASHTO M268. If the sheeting does not meet these requirements, it shall be noted on the APL that the material is rotationally sensitive.

**715.9.2.1.1.10- Shelf Life:** Any Type ASTM-I material to be considered for listing on the Division's APL shall have a minimum one (1) year shelf life. The same provisions shall apply to the manufacturer recommended matched components. Reasonable conditional requirements pertaining to storage, such as temperature and relative humidity, shall be permitted.

**715.9.2.1.1.11- Backing Class:** Type ASTM-I sheeting shall have a Class 1 adhesive backing, as defined in ASTM D4956.

**715.9.2.1.1.12- Durability:** The durability requirements of finished products manufactured using Type ASTM-I sheeting are specified within Section 715.9.2.7.

**715.9.2.1.2- Approval Process:** The WVDOH approval process for Type ASTM-I sheeting products is specified within Section 715.9.2.9.

**715.9.2.2- Retroreflective Sheeting, Type ASTM-IV:** A retroreflective sheeting referred to as "high-intensity" that is typically an unmetallized microprismatic retroreflective element material.

**715.9.2.2.1- Type ASTM-IV Sheeting Requirements:**

**715.9.2.2.1.1- Coefficient of Retroreflection:** New material shall meet the Minimum Coefficient of Retroreflection requirements in ASTM D4956 for Type IV material, as defined in ASTM D4956.

For transparent ink printed or transparent film covered areas over white sheeting, the Minimum Coefficient of Retroreflection requirements shall be seventy (70) % of the values specified in ASTM D4956 for sheeting of the same color as the ink or film.

All testing shall be conducted in accordance with ASTM D4956.

**715.9.2.2.1.2- Color:** New sheeting shall meet the Daytime Color & Nighttime Color requirements in ASTM specification D4956 when tested in accordance with ASTM specification D4956. These requirements shall also apply to transparent ink and transparent film covered areas over white sheeting.

**715.9.2.2.1.3- Daytime Luminance Factor:** New sheeting shall meet the Daytime Luminance Factor requirements in specification D4956 when tested in accordance with

ASTM specification D4956. These requirements shall also apply to transparent ink and transparent film covered areas over white sheeting.

**715.9.2.2.1.4- Adhesion:** New sheeting shall meet the adhesion requirements in specification D4956 when tested in accordance with ASTM specification D4956. If the material is marketed as a reboundable material, the supplementary adhesion requirements in ASTM D4956 for reboundable materials shall apply.

**715.9.2.2.1.5- Shrinkage:** New sheeting shall meet the shrinkage requirements in ASTM specification D4956 when tested in accordance with ASTM specification D4956.

**715.9.2.2.1.6- Flexibility:** New sheeting shall meet the flexibility requirements in ASTM specification D4956 when tested in accordance with ASTM specification D4956. If the material is marketed as a reboundable material, the supplementary flexibility requirements in ASTM D4956 for reboundable materials shall apply.

**715.9.2.2.1.7- Liner Removal:** New sheeting shall meet the liner removability requirements in ASTM specification D4956 when tested in accordance with ASTM specification D4956.

**715.9.2.2.1.8- Impact Resistance:** New sheeting shall meet the impact resistance requirements in ASTM specification D4956 when tested in accordance with ASTM specification D4956. If the material is marketed as a reboundable material, the supplementary impact resistance requirements in ASTM D4956 for reboundable materials shall apply.

**715.9.2.2.1.9- Rotational Sensitivity:** New sheeting materials, with exceptions noted herein, shall meet the applicable requirements of AASHTO M268 in order for the sheeting to be considered rotationally insensitive. Testing shall be conducted at the viewing geometry of 0.5/-4 as recommended in AASHTO M268, and the results of retroreflectivity readings at rotation angles of 0, 45, 90, and 120 degrees shall be compared as recommended in AASHTO M268. If the sheeting does not meet these requirements, it shall be noted on the APL that the material is rotationally sensitive. With the exception of fluorescent-orange materials intended for application to rigid substrate signs, "work zone" materials as defined herein shall not be subject to rotational sensitivity testing.

**715.9.2.2.1.10- Shelf Life:** A minimum shelf life shall not be required for the sheeting to be listed on the APL. However, in order for the sheeting to be approved for manufacturing purposes within the Division's CSS, a minimum (1) year shelf life shall be required. The same provisions shall apply to the manufacturer recommended matched components. Reasonable conditional requirements pertaining to storage, such as temperature and relative humidity, shall be permitted.

**715.9.2.2.1.11- Backing Class:** All Type ASTM-IV material supplied to the Division for manufacturing purposes within the CSS shall have a Class 1 adhesive backing, as defined

in ASTM D4956. The adhesive backing on all Type ASTM-IV material supplied to manufacturers providing finished products to the Division or to Contractors performing work on Division Contracts shall have the most appropriate ASTM D4956 defined adhesive backing for the materials intended purpose, as determined by the manufacturer.

**715.9.2.2.1.12- Durability:** Durability requirements of finished products manufactured using Type ASTM-IV to be warranted by the sheeting manufacturer are specified within Section 715.9.2.7.

**715.9.2.2.2- Approval Process:** The WVDOH approval process for Type ASTM-IV sheeting products is specified within Section 715.9.2.9.

**715.9.2.3- Retroreflective Sheeting, Type ASTM-VI:** An elastomeric retroreflective sheeting without adhesive. This sheeting is typically a vinyl microprismatic retroreflective material.

**715.9.2.3.1- Type ASTM-VI Sheeting Requirements:**

**715.9.2.3.1.1- Coefficient of Retroreflection:** New sheeting shall meet the Minimum Coefficient of Retroreflection requirements as specified in Table 715.9.2.3.1.1-I below.

Observation Angle	Entrance Angle	Color	
		White	Fluorescent-Orange
0.2	-4	300	200
0.2	+30	180	120
0.2	+45	100	60
0.5	-4	200	120
0.5	+30	75	50
0.5	+45	60	30

For transparent ink printed areas over white sheeting, the Minimum Coefficient of Retroreflection requirements shall be as shown in Table 715.9.2.3.1.1-II below.

Observation Angle	Entrance Angle	Color				
		Green	Blue	Red	Yellow	Brown
0.2	-4	21	9.5	29	147	6.1

All testing shall be conducted in accordance with ASTM D4956.

**715.9.2.3.1.2- Color:** New sheeting shall meet the Daytime Color & Nighttime Color requirements in ASTM specification D4956 when tested in accordance with ASTM specification D4956. These same requirements shall apply to transparent ink covered areas over white sheeting.

**715.9.2.3.1.3- Daytime Luminance Factor:** New sheeting shall meet the Daytime Luminance Factor requirements of ASTM specification D4956 when tested in accordance with ASTM specification D4956. These requirements shall also apply to transparent ink covered areas over white sheeting.

**715.9.2.3.1.4- Shrinkage:** New sheeting shall meet the shrinkage requirements in ASTM specification D4956 when tested in accordance with ASTM specification D4956.

**715.9.2.3.1.5- Flexibility:** New sheeting shall meet the flexibility requirements in ASTM specification D4956 when tested in accordance with ASTM specification D4956.

**715.9.2.3.1.6- Impact Resistance:** New sheeting shall meet the impact resistance requirements in ASTM specification D4956 when tested in accordance with ASTM specification D4956.

**715.9.2.3.1.7- BLANK**

**715.9.2.3.1.8- Backing Class:** All Type ASTM-VI material shall have a Class 5 backing, as defined in ASTM D4956.

**715.9.2.3.1.9- Durability:** Durability requirements of finished products manufactured using Type ASTM-VI material to be warranted by the sheeting manufacturer are specified within Section 715.9.2.7.

**715.9.2.3.2- Approval Process:** The WVDOH approval process for Type ASTM-VI sheeting products is specified within Section 715.9.2.9.

**715.9.2.4- Retroreflective Sheeting, Type ASTM-XI:** A retroreflective sheeting typically manufactured as an unmetalized cube corner microprismatic retroreflective element material.

**715.9.2.4.1- Type ASTM-XI Sheeting Requirements:**

**715.9.2.4.1.1- Coefficient of Retroreflection:** New sheeting shall meet the Minimum Coefficient of Retroreflection requirements in ASTM specification D4956 for Type XI material, as defined in ASTM D4956.

For transparent ink printed or transparent film covered areas over white sheeting, the Minimum Coefficient of Retroreflection requirements shall be seventy (70) % of the values specified in ASTM D4956 for sheeting of the same color as the ink or film.

All testing shall be conducted in accordance with ASTM D4956.

**715.9.2.4.1.2- Color:** New sheeting shall meet the Daytime Color & Nighttime Color requirements in ASTM specification D4956 when tested in accordance with ASTM specification D4956. These same requirements shall apply to transparent ink and transparent film covered areas over white sheeting.

**715.9.2.4.1.3- Daytime Luminance Factor:** New sheeting shall meet the Daytime Luminance Factor requirements in ASTM specification D4956 when tested in accordance with ASTM specification D4956. These same requirements shall apply to transparent ink and transparent film covered areas over white sheeting.

**715.9.2.4.1.4- Adhesion:** New sheeting shall meet the adhesion requirements in ASTM specification D4956 when tested in accordance with ASTM specification D4956. If the material is marketed as a reboundable material, the supplementary adhesion requirements in ASTM D4956 for reboundable materials shall apply.

**715.9.2.4.1.5- Shrinkage:** New sheeting shall meet the shrinkage requirements in ASTM specification D4956 when tested in accordance with ASTM specification D4956.

**715.9.2.4.1.6- Flexibility:** New sheeting shall meet the flexibility requirements in ASTM specification D4956 when tested in accordance with ASTM specification D4956. If the material is marketed as a reboundable material, the supplementary flexibility requirements in ASTM D4956 for reboundable materials shall apply.

**715.9.2.4.1.7- Liner Removal:** New sheeting shall meet the liner removability requirements in ASTM specification D4956 when tested in accordance with ASTM specification D4956.

**715.9.2.4.1.8- Impact Resistance:** New sheeting shall meet the impact resistance requirements in ASTM specification D4956 when tested in accordance with ASTM specification D4956. If the material is marketed as a reboundable material, the supplementary impact resistance requirements in ASTM D4956 for reboundable materials shall apply.

**715.9.2.4.1.9-Rotational Sensitivity:** New sheeting materials, with exceptions noted herein, shall meet the applicable requirements of AASHTO M268 in order for the sheeting to be considered rotationally insensitive. Testing shall be conducted at the viewing geometry of 0.5/-4 as recommended in AASHTO M268, and the results of retroreflectivity readings at rotation angles of 0, 45, 90, and 120 degrees shall be compared as recommended in AASHTO M268. If the sheeting does not meet these requirements, it shall be noted on the APL that the material is rotationally sensitive. With the exception of fluorescent-orange materials intended for application to rigid substrate signs, "work zone" materials as defined herein shall not be subject to rotational sensitivity testing.

**715.9.2.4.1.10- Shelf Life:** A minimum shelf life shall not be required for the sheeting to be listed on the APL. However, in order for the sheeting to be approved for



manufacturing purposes within the Division's CSS, a minimum (1) year shelf life shall be required. The same provisions shall apply to the manufacturer recommended matched components. Reasonable conditional requirements pertaining to storage, such as temperature and relative humidity, shall be permitted.

**715.9.2.4.1.11- Backing Class:** All Type ASTM-XI material supplied to the Division for manufacturing purposes within the CSS shall have a Class 1 adhesive backing, as defined in ASTM D4956. The adhesive backing on all Type ASTM-XI material supplied to manufacturers providing finished products to the Division or to Contractors performing work on Division Contracts shall have the most appropriate ASTM D4956 adhesive backing for the materials intended purpose.

**715.9.2.4.1.12- Durability:** Durability requirements of finished products manufactured using Type ASTM-XI material to be warranted by the sheeting manufacturer are specified within Section 715.9.2.7.

**715.9.2.4.2- Approval Process:** The WVDOH approval process for Type ASTM-XI sheeting products is specified within Section 715.9.2.9.

**715.9.2.5-Transfer Film:** Transfer film for premasking or applying prespaced legends using transparent or opaque films.

**715.9.2.5.1 – Transfer Film Requirements:**

**715.9.2.5.1.1 – Transparency:** Transfer films shall be transparent.

**715.9.2.5.2 – Approval Process:** The WVDOH approval process for Transfer Film is specified within Section 715.9.2.9.

**715.9.2.6-Matched Components:**

**715.9.2.6.1-Black Opaque Overlay Film:** A black, opaque, typically vinyl or acrylic pressure-sensitive film designed for permanent graphics that may be prespaced and electronically cut. These films have a synthetic liner that resists moisture absorption and static buildup.

**715.9.2.6.1.1-Black Opaque Overlay Film Requirements:**

**715.9.2.6.1.1.1- Adhesive:** This material shall utilize a pressure sensitive adhesive.

**715.9.2.6.1.1.2- Chemical Resistance:** This material shall resist mild alkalis, mild acids, and salt. The material shall exhibit excellent resistance to water, with exception to cases of submersion.

**715.9.2.6.1.1.3- Shrinkage:** After application, this material shall not exhibit shrinkage in excess of 0.010 inches.

**715.9.2.6.1.1.4- Durability:** Durability requirements of black opaque overlay films, depending on the Type sheeting the material is to be utilized with and the intended application, are specified in Sections 715.9.2.1 through 715.9.2.4.

**715.9.2.6.1.1.5 – Shelf Life:** A minimum shelf life shall not be required for the film to be approved for use with the manufacturer's sheeting products. However, in order for the film to be approved for manufacturing purposes within the Division's CSS, a minimum (1) year shelf life shall be required. Reasonable conditional requirements pertaining to storage, such as temperature and relative humidity, shall be permitted.

**715.9.2.6.1.1.6- CSS Requirements:** In addition to, but not limited to, any other requirements stated herein, all black opaque overlay film to be approved for manufacturing purposes within the CSS shall be a vinyl material. In addition, this material shall have sufficient strength so that it can be handled, processed, and applied according to the recommendations of the manufacturer without appreciable stretching, tearing, or other damage. The material shall permit cutting and application at temperatures of 40 to 100°F (4 to 38°C).

**715.9.2.6.1.2-Approval Process:** The WVDOH approval process for Black Opaque Overlay Film is specified within Section 715.9.2.9.

**715.9.2.6.2- Transparent Overlay Films:** A colored, transparent, typically acrylic, transparent pressure-sensitive film designed for permanent graphics that may be prespaced and electronically cut. These films have a synthetic liner that resists moisture absorption and static buildup.

**715.9.2.6.2.1- Transparent Overlay Film Requirements:**

**715.9.2.6.2.1.1- Adhesive:** This material shall utilize a transparent pressure sensitive adhesive.

**715.9.2.6.2.1.2- Chemical Resistance:** This material shall resist mild alkalis, mild acids, and salt. The material shall exhibit excellent resistance to water, with exception to cases of submersion.

**715.9.2.6.2.1.3- Color Standards:** Transparent overlay films applied to the manufacturer's approved white sheeting shall produce colors meeting the daytime and nighttime color requirements of ASTM D4956 for like colored sheeting. Testing shall be conducted in accordance with ASTM D4956.

**715.9.2.6.2.1.4- Transparency:** After application over the manufacturer's white sheeting, the film's level of transparency shall result in a minimum retroreflectivity level of seventy (70) % of the minimum required retroreflectivity level, as specified herein, of the like colored sheeting of the same grade as the white sheeting. Testing shall be conducted in accordance with ASTM D4956.

**715.9.2.6.2.1.5- Durability:** Durability requirements of transparent overlay films, depending on the Type sheeting the material is to be utilized with and the intended application, are specified in Sections 715.9.2.1 through 715.9.2.4.

**715.9.2.6.2.1.6 – Shelf Life:** A minimum shelf life shall not be required for the film to be approved for use with the manufacturer's sheeting products. However, in order for the film to be approved for manufacturing purposes within the Division's CSS, a minimum (1) year shelf life shall be required. Reasonable conditional requirements pertaining to storage, such as temperature and relative humidity, shall be permitted.

**715.9.2.6.2.1.7- CSS Requirements:** In addition to, but not limited to, any other requirements stated herein, all transparent overlay film to be approved for manufacturing purposes within the CSS shall be an acrylic material and shall be supplied on a clear liner. In addition, this material shall have sufficient strength so that it can be handled, processed, and applied according to the recommendations of the manufacturer without appreciable stretching, tearing, or other damage. The material shall permit cutting and application at temperatures of 40 to 100°F (4 to 38°C).

**715.9.2.6.2.2-Approval Process:** The WVDOH approval process for Transparent Overlay Film is specified within Section 715.9.2.9.

**715.9.2.6.3- Opaque and Transparent Inks:** Weather resistant, quick drying inks designed for use in traffic sign screen printing processes.

**715.9.2.6.3.1- Opaque and Transparent Ink Requirements:**

**715.9.2.6.3.1.1- Chemical Resistance:** This material shall resist mild alkalis, mild acids, and salt. The material shall exhibit excellent resistance to water, with exception to cases of submersion.

**715.9.2.6.3.1.2- Color Standards:** Transparent inks applied to the manufacturer's approved white sheeting shall produce colors meeting the daytime and nighttime color requirements of ASTM D4956 for like colored sheeting. Testing shall be conducted in accordance with ASTM D4956.

**715.9.2.6.3.1.3- Transparency:** After application over the manufacturer's white sheeting, the level of transparency of the transparent ink shall result in a minimum retroreflectivity level of seventy (70) % of the minimum required retroreflectivity level, as specified herein, of the like colored sheeting of the same grade as the white sheeting. Testing shall be conducted in accordance with ASTM D4956.

**715.9.2.6.3.1.4- Durability:** Durability requirements of opaque & transparent inks, depending on the Type sheeting the material is to be utilized with and the intended application, are specified in Sections 715.9.2.1 through 715.9.2.4.

**715.9.2.6.3.1.5– Shelf Life:** A minimum shelf life shall not be required for the ink to be approved for use with the manufacturer’s sheeting products. However, in order for the ink to be approved for manufacturing purposes within the Division’s CSS, a minimum (1) year shelf life shall be required. Reasonable conditional requirements pertaining to storage, such as temperature and relative humidity, shall be permitted.

**715.9.2.6.3.2-Approval Process:** The WVDOH approval process for Opaque and Transparent Ink is specified within Section 715.9.2.9.

**715.9.2.7 – Durability Requirements:** The durability requirements of the various type sheeting materials described herein and their matched components are specified in this Section. The sheeting manufacturer’s obligations in the event that the manufacturer’s material(s) fails to meet the durability requirements specified herein, as applicable, are specified within Section 715.9.2.8.

**715.9.2.7.1-Non Work Zone Applications:**

**715.9.2.7.1.1-Type ASTM-I Sheeting:** Finished signs manufactured using Type ASTM-I sheeting shall exhibit the minimum level of performance described herein for a period of seven (7) years after field installation.

The retroreflectivity levels maintained by the sheeting placed on the signs shall be a minimum of fifty (50) % of the required values for new sheeting of the same color, per 715.9.2.1.1.1. For transparent ink and film covered areas over white sheeting, the retroreflectivity levels maintained by these areas of the signs shall be a minimum of thirty-five (35) % [seventy (70) % of the fifty (50) % value specified above] of the required values for new sheeting of the same color as the ink or film, per 715.9.2.1.1.1.

The colors and luminance factors of all areas of finished signs shall be such that the sign remains effective for its intended purpose when viewed from a moving vehicle under normal day and night driving conditions by drivers with normal vision.

All retroreflectivity testing shall be done in accordance with ASTM D4956. All retroreflectivity testing shall be done at the set observation angle / entrance angle geometry of 0.2/-4.

**715.9.2.7.1.2-Type ASTM-IV Sheeting:** Finished signs manufactured using Type ASTM-IV sheeting shall exhibit the minimum level of performance described herein for a period of ten (10) years after field installation.

The retroreflectivity levels maintained by the sheeting placed on the signs shall be a minimum of eighty (80) % of the required values for new sheeting of the same color, per 715.9.2.2.1.1. For transparent ink and transparent film covered areas over white sheeting, the retroreflectivity levels maintained by these areas of the signs shall be a minimum of fifty-six (56) % [seventy (70) % of the eighty (80) % value specified above] of the required values for new sheeting of the same color as the ink or film, per 715.9.2.2.1.1.

The colors and luminance factors of all areas of finished signs shall be such that the sign remains effective for its intended purpose when viewed from a moving vehicle under normal day and night driving conditions by drivers with normal vision.

All retroreflectivity testing shall be done in accordance with ASTM D4956. All retroreflectivity testing shall be done at the set observation angle / entrance angle geometry of 0.2/-4.

#### **715.9.2.7.1.3-Type ASTM-XI Sheeting:**

**715.9.2.7.1.3.1-Non Fluorescent Materials:** Finished signs manufactured using Type ASTM-XI non-fluorescent sheeting shall exhibit the minimum level of performance described herein for a period of twelve (12) years after field installation.

The retroreflectivity levels maintained by the sheeting placed on the signs shall be a minimum of eighty (80) % of the required values for new sheeting of the same color, per 715.9.2.4.1.1. For transparent ink and film covered areas over white sheeting, the retroreflectivity levels maintained by these areas of the signs shall be a minimum of fifty-six (56) % [seventy (70) % of the eighty (80) % value specified above] of the required values for new sheeting of the same color as the ink or film, per 715.9.2.4.1.1.

The colors and luminance factors of all areas of finished signs shall be such that the sign remains effective for its intended purpose when viewed from a moving vehicle under normal day and night driving conditions by drivers with normal vision.

All retroreflectivity testing shall be done in accordance with ASTM D4956. All retroreflectivity testing shall be done at the set observation angle / entrance angle geometry of 0.2/-4.

**715.9.2.7.1.3.2-Fluorescent Materials:** Finished signs manufactured using Type ASTM-XI fluorescent sheeting shall exhibit the minimum level of performance described herein for a period of ten (10) years after installation.

The retroreflectivity levels maintained by the sheeting placed on the signs shall be a minimum of eighty (80) % of the required values for new sheeting of the same color, per 715.9.2.4.1.1.

The colors of all areas of finished signs shall be such that the sign remains effective for its intended purpose when viewed from a moving vehicle under normal day and night driving conditions by drivers with normal vision.

The daytime luminance factor of all areas of finished signs shall be in conformance with the daytime luminance factor requirements referenced in Section 715.9.2.4.1.3.

All testing shall be done in accordance with ASTM D4956. All retroreflectivity testing shall be done at the set observation angle / entrance angle geometry of 0.2/-4.

#### **715.9.2.7.2-Work Zone Applications:**

##### **715.9.2.7.2.1-Type ASTM-IV Sheeting:**

**715.9.2.7.2.1.1-Channelization & Delineation Devices:** Products in this category include but may not be limited to plastic posts, tubes, barricades, drums, cones, and channelizer cones, including "permanently" installed plastic posts and tubes. Applicable colors are orange, white, yellow, blue, and red. The sheeting placed on finished products of this type shall have its' performance warranted for a period of three (3) years after application on the finished product.

The Minimum Coefficient of Retroreflection shall be fifty (50) % of the values specified in Section 715.9.2.2.1.1 for sheeting of the same color.

The colors and luminance factors of the applied sheeting shall be such that the sheeting remains effective for its intended purpose when viewed from a moving vehicle under normal day and night driving conditions by drivers with normal vision.

All retroreflectivity testing shall be done in accordance with ASTM D4956. All retroreflectivity testing shall be done at the set observation angle / entrance angle geometry of 0.2/-4.

#### **715.9.2.7.2.2-Type ASTM-VI Sheeting:**

**715.9.2.7.2.2.1-Roll-Up Signs:** Finished roll-up signs manufactured using Type ASTM-VI sheeting shall have their performance warranted for a period of three (3) years after manufacturing.

The retroreflectivity levels maintained by the white or fluorescent-orange areas of the finished signs shall be a minimum of fifty (50) % of the required values for new sheeting of the same color, per Table 715.9.2.3.1.1-I. For transparent ink covered areas over white sheeting, the retroreflectivity levels maintained by these areas of the signs shall be a minimum of fifty (50) % of the required values for like colored screen printed areas over new sheeting (50% of the values in Table 715.9.2.3.1.1-II).

The colors and luminance factors of all areas of finished signs shall be such that the sign remains effective for its intended purpose when viewed from a moving vehicle under normal day and night driving conditions by drivers with normal vision.

The daytime luminance factor of fluorescent-orange finished signs shall be in conformance with the daytime luminance factor requirements referenced in Section 715.9.2.3.1.3.

All testing shall be done in accordance with ASTM D4956. All retroreflectivity testing shall be done at the set observation angle / entrance angle geometry of 0.2/-4.

#### **715.9.2.7.2.3-Type ASTM-XI Sheeting:**

**715.9.2.7.2.3.1-Signs:** Finished work zone signs manufactured using fluorescent-orange Type ASTM-XI material shall have their performance warranted for a period of three (3) years after manufacturing.

The retroreflectivity levels maintained by the sheeting placed on the signs shall be a minimum of fifty (50) % of the required values for new fluorescent-orange sheeting, per 715.9.2.4.1.1.

The colors of all areas of finished signs shall be such that the sign remains effective for its intended purpose when viewed from a moving vehicle under normal day and night driving conditions by drivers with normal vision.

The daytime luminance factor of all areas of finished signs shall be in conformance with the daytime luminance factor requirements referenced in Section 715.9.2.4.1.3 for fluorescent-orange.

All testing shall be done in accordance with ASTM D4956. All retroreflectivity testing shall be done at the set observation angle / entrance angle geometry of 0.2/-4.

**715.9.2.7.2.3.2--Channelization & Delineation Devices:** Products in this category include but may not be limited to plastic posts, tubes, barricades, drums, cones, and channelizer cones, including “permanently” installed plastic posts and tubes. Applicable colors are orange, white, yellow, blue, and red. The sheeting placed on finished products of this type shall have its’ performance warranted for a period of three (3) years after application on the finished product.

The Minimum Coefficient of Retroreflection shall be fifty (50) % of the values specified in Section 715.9.2.4.1.1 for sheeting of the same color.

The colors and luminance factors of the applied sheeting shall be such that the sheeting remains effective for its intended purpose when viewed from a moving vehicle under normal day and night driving conditions by drivers with normal vision.

The daytime luminance factor of fluorescent-yellow sheeting shall be in conformance with the daytime luminance factor requirements referenced in Section 715.9.2.4.1.3.

All testing shall be done in accordance with ASTM D4956. All retroreflectivity testing shall be done at the set observation angle / entrance angle geometry of 0.2/-4.

**715.9.2.8- Warranty Claims:** The sheeting manufacturer’s obligations in the event that the manufacturer’s material(s) fails to meet the warranty requirements specified herein are specified within this Section. The retroreflective sheeting and/or matched components used to manufacture finished signs, channelization devices, & delineation devices shall be considered to be in non-compliance with these specifications where it can be shown that during the specified warranty period the finished product has deteriorated due to natural causes to the extent that is in non-compliance with the quantitative requirements contained herein related to retroreflectivity or luminance factor, as applicable, or is otherwise determined to be ineffective for its intended purpose when viewed from a moving vehicle under normal day and night driving conditions by drivers with normal vision. Under such circumstances, the sheeting manufacturer’s warranty obligations shall be as outlined as described herein. The retroreflectivity, color, & luminance factor durability requirements of the various type sheeting materials described herein and their matched components, as well as the required warranty periods, are specified within Section 715.9.2.7.

Warranty claims shall be based on failures which occur as a result of design or manufacturing defects in the manufacturer’s sheeting and/or matched components and not of outside causes such as improper fabrication, handling, maintenance, or installation; use of non manufacturer recommended inks, thinners, coatings, or overlay films for the sheeting being used; use of application equipment not recommended by the manufacturer; failure of sign substrate; exposure to chemicals, abrasion, or damage from fasteners used to mount the sign; snow burial; collisions, vandalism, or malicious mischief. It shall be the sheeting

manufacturer's responsibility to investigate and demonstrate that the recommendations contained in their product bulletins, information folders, and technical memos have not been followed in cases where the manufacturer chooses to contest the warranty claim.

Replacement sheeting shall carry the unexpired warranty of the sheeting it replaces.

#### **715.9.2.8.1-Non Work Zone Applications:**

##### **715.9.2.8.1.1-Signs:**

**715.9.2.8.1.1.1-Non Fluorescent Type ASTM-IV and Type ASTM-XI Sheeting:** If the failure occurs within the first seven (7) years from the date of field installation, the sheeting manufacturer shall, at its expense, restore the sign surface to its original effectiveness. The Division will be responsible for no labor, equipment, or material costs in this case.

If the failure occurs after seven (7) years from the date of field installation, but less than ten (10) years from the date of field installation for Type ASTM-IV material or less than twelve (12) years from the date of field installation for Type ASTM-XI material, the manufacturer shall furnish the necessary amount of sheeting to restore the sign surface to its original effectiveness.

**715.9.2.8.1.1.2-Fluorescent Type ASTM-XI Sheeting:** If the failure occurs within the first seven (7) years from the date of field installation, the sheeting manufacturer shall, at its expense, restore the sign surface to its original effectiveness. The Division will be responsible for no labor, equipment, or material costs in this case.

If the failure occurs after seven (7) years from the date of field installation, but less than ten (10) years from the date of field installation, the manufacturer shall furnish the necessary amount of sheeting to restore the sign surface to its original effectiveness.

#### **715.9.2.8.2-Work Zone Applications:**

##### **715.9.2.8.2.1-Signs:**

**715.9.2.8.2.1.1-Type ASTM-VI and Type ASTM-XI Sheeting:** If the failure occurs within one (1) year from the date of manufacturing, the sheeting manufacturer will, at its expense, provide all required sheeting to restore the effected sign(s) to their original effectiveness.

If failure occurs after one (1) year from the date of manufacturing, but less than two (2) years from the date of manufacturing, the sheeting manufacturer will, at its expense, provide two-thirds (2/3) of the required sheeting to restore the effected sign(s) to their original effectiveness.

If failure occurs after two (2) years from the date of manufacturing, but less than three (3) years from the date of manufacturing, the sheeting manufacturer will, at its



expense, provide one-third (1/3) of the required sheeting to restore the effected sign(s) to their original effectiveness.

**715.9.2.8.2.2-Channelization & Delineation Devices:**

**715.9.2.8.2.2.1-Type ASTM-IV and Type ASTM-XI Sheeting:** If the failure occurs within one (1) year from the date of manufacturing, the sheeting manufacturer will, at its expense, provide all required sheeting to restore the effected device(s) to their original effectiveness.

If failure occurs after one (1) year from the date of manufacturing, but less than two (2) years from the date of manufacturing, the sheeting manufacturer will, at its expense, provide two-thirds (2/3) of the required sheeting to restore the effected device(s) to their original effectiveness.

If failure occurs after two (2) years from the date of manufacturing, but less than three (3) years from the date of manufacturing, the sheeting manufacturer will, at its expense, provide one-third (1/3) of the required sheeting to restore the effected device(s) to their original effectiveness.

**715.9.2.9-Approval Processes:** The WVD OH processes for review and approval of the various material types described in Sections 715.9.2.1 through 715.9.2.6 are described within this Section.

Retroreflective sheeting materials of the Types described herein, manufacturer recommended matched components for use with the sheeting materials, and transfer films to be considered for inclusion on the WVD OH APL shall be submitted to the Materials Division following the current procedures specified by the Materials Division. The manufacturer may contact the Traffic Engineering Division for verification. The manufacturer should include all relevant documentation and information with their submittal, including but not limited to Product Data Sheets, Product Flyers, Manufacturer Product Specifications, Product Bulletins, and any required independent test results described herein.

In addition to the above described documentation and information, the manufacturer shall submit a letter of certification prior to approval. This letter shall include the following:

1. Certification that the material(s) submitted for approval will meet all applicable requirements contained within Section 715 of the WVD OH Standard Specifications. The applicable material Type designation, as defined in this specification, should also be referenced. If the material is a Type ASTM-I, IV, or XI material and not intended solely for application to work zone devices as defined herein, or is a fluorescent-orange material intended for application to rigid substrate signs, and does not meet the requirements of this specification to be considered rotationally insensitive, the

- manufacturer should note this exception in the certification letter. Classification of the material as being rotationally sensitive will not prevent approval of the material.
2. Certification that the manufacturer agrees to warranty the performance of the material(s) in accordance with Section 715 of the WVDOH Standard Specifications.
  3. Certification that the material(s) have a minimum one (1) year shelf life, when stored as recommended by the manufacturer, if the manufacturer is seeking approval of the material(s) for manufacturing purposes within the CSS.

All submitted information will be forwarded to the WVDOH Traffic Engineering Division, which will in turn contact and work directly with the manufacturer during the evaluation process. The Traffic Engineering Division will evaluate all submitted literature and documentation for compliance with the specified requirements as well as satisfactory independent testing results, as applicable. The Traffic Engineering Division will also arrange for the manufacturer to furnish test samples for evaluation of the materials suitability for use within the CSS, as applicable. After the evaluation is complete, the Traffic Engineering Division will inform the Materials Division in writing of the outcome of its evaluation.

The WVDOH reserves the right to conduct testing, whether internally or through an independent testing agency of its choice, on any material submitted for approval in order to verify that the material meets any of the material specifications herein. This testing may be conducted prior to or any time after approval is issued. Any such testing shall be conducted in accordance with the testing requirements of the applicable standardization body, such as ASTM or AASHTO.

#### **715.9.2.9.1-Retroreflective Sheeting Materials & Matched Components:**

**715.9.2.9.1.1-Independent Test Results:** In order for the material to be evaluated and considered for approval, independent test results must be supplied by the manufacturer demonstrating the sheeting material's conformance with the requirements specified within the applicable Section 715.9.2.1, 715.9.2.2, 715.9.2.3, or 715.9.2.4, with the exception of the requirements specified in the "Shelf Life", "Backing Class", and "Durability" subsections. The independent test results shall include accelerated outdoor weathering test results conducted in conformance with ASTM D4956. Artificial accelerated lab weathering shall not be accepted except for materials intended for work zone applications. Materials intended for work zone applications shall include all Type ASTM-VI materials and shall include, but may not be limited to, other "Type" materials intended for use on plastic posts, tubes, barricades, drums, cones, and channelizer cones, including "permanently" installed plastic posts and tubes. However, any approval granted based on the results of artificial accelerated lab weathering shall be provisional in nature and noted as such on the APL. As a condition of the acceptance of artificial accelerated

lab weathering results in lieu of accelerated outdoor weathering results, the accelerated outdoor weathering process shall be ongoing at the time of issuance of the provisional approval. In addition, the material manufacturer shall submit the standard outdoor weathering test results to the WVDOH within nine (9) months after the effective date of the provisional approval for Type ASTM-VI materials, and within fifteen (15) months after the effective date of the provisional approval for all other material "Types". AASHTO-NTPEP results shall be considered acceptable for meeting the accelerated outdoor weathering test results requirement.

Rotational sensitivity testing is not required for sheeting materials intended solely for application to work zone devices, as defined herein, with the exception of fluorescent-orange materials intended for application to rigid substrate signs. Otherwise, if a material submitted for approval does not meet the rotational sensitivity requirements herein, rotational sensitivity testing may be omitted from the independent test results provided that the manufacturer notes that the material does not meet the rotational sensitivity requirement in their required certification letter described in Section 715.9.2.9.

**715.9.2.9.1.1-Accelerated Weathering Test Results:** The duration of testing required shall be based on the sheeting material Type, as defined by this specification, and the intended application of the material. All Type ASTM-I sheeting materials shall be subjected to two (2) years of accelerated outdoor weathering. Type ASTM-IV and Type ASTM-XI materials intended for non work zone applications shall be subjected to three (3) years of accelerated outdoor weathering. Type ASTM-IV and Type ASTM-XI materials intended for work zone applications shall be subjected to one (1) year of accelerated outdoor weathering. Type ASTM-VI materials shall be subjected to six (6) months of accelerated outdoor weathering.

After completion of the accelerated outdoor weathering, all materials shall be in conformance with the general durability requirements related to cracking, scaling, pitting, blistering, edge lifting, curling, shrinkage, and expansion specified in ASTM D4956.

The retroreflectivity level of the sheeting material after completion of the accelerated outdoor weathering, when tested in accordance with ASTM D4956, shall be in conformance with the requirements of ASTM D4956. ASTM D4956 specifies the level of retroreflectivity to be maintained by the material as a percentage of the initial required retroreflectivity level specified in ASTM D4956. An exception to this shall apply to Type ASTM-VI materials. In this case, the percentage specified in ASTM D4956 shall be applied to the applicable initial required retroreflectivity levels specified in Section 715.9.2.3.1.1 rather than the initial values specified in ASTM D4956.

After completion of the accelerated weathering, the sheeting material shall be in conformance with the requirements specified in the "Color" (daytime) and "Luminance Factor" subsections within the applicable Section 715.9.2.1, 715.9.2.2, 715.9.2.3, or 715.9.2.4 when tested in accordance with ASTM D4956.

The manufacturer recommended matched components for use with the sheeting material must also be subjected to accelerated outdoor weathering in order for approval to be given for the manufacturing of signs requiring the use of these matched components. The duration of accelerated outdoor weathering required for the matched components shall be the same as the applicable duration required for the sheeting.

The retroreflectivity level of the areas of all signs processed with transparent inks or transparent films after completion of the accelerated outdoor weathering, when tested in accordance with ASTM D4956, shall be a minimum of seventy (70) % of the retroreflectivity values required for like colored sheeting of the same material Type upon completion of the accelerated outdoor weathering.

After completion of the accelerated outdoor weathering, the areas of all signs processed with transparent inks or transparent films shall be in conformance with the requirements specified in the "Color" (daytime) and "Luminance Factor" subsections within the applicable Section 715.9.2.1, 715.9.2.2, 715.9.2.3, or 715.9.2.4 when tested in accordance with ASTM D4956.

If artificial accelerated lab weathering is conducted in order to obtain provisional approval for a material intended for work zone applications, per Section 715.9.2.9.1.1, the weathering process shall be done in accordance with the ASTM D4956 specifications. The performance requirements for the results of the testing shall be the same as described herein for accelerated outdoor weathering.

**715.9.2.9.1.2--CSS Evaluation:** Material Types and their matched components that are typically used in manufacturing processes within the CSS are subject to evaluation by WVDOH personnel for their suitability for use within the Division's CSS. This evaluation is primarily focused on the compatibility, workability, and general "user friendliness" of the materials when used for production purposes within the CSS using the equipment in place at the CSS, as well as the characteristics of the materials in these regards relative to other materials which have already been approved. The suitability of the materials in these regards shall be based solely on the judgment of the Division. The un-acceptance of the manufacturer's sheeting material and/or matched components based on this evaluation shall not prevent the listing of these materials on the APL and the use of these materials by private fabricators supplying finished products to the WVDOH or to Contractors performing Contracts for the WVDOH.

In order for a sheeting material to be eligible for bidding on any Division raw material supply Contract, particular Section(s) of the Contract may require that only the sheeting material be determined to be suitable for use within the CSS. Other Section(s) may require that one or more of the matched components also be determined to be suitable for use within the CSS. These requirements shall be indicated in the raw material supply Contract.

In addition to any other requirements specified herein, in order to be accepted for manufacturing purposes within the CSS all sheeting materials shall permit application to aluminum blanks and shall permit processing with compatible matched components at temperatures between 60 to 100°F (16 to 38°C) and relative humidity at 20% to 80 % when performed in accordance with the manufacturer's recommendations. In addition, the sheeting and the matched component inks shall allow oven accelerated curing, providing that the manufacturer's recommendations are followed.

Any restrictions on the use of the material or any of the matched components within the CSS shall be noted on the APL.

In addition to the information provided above, note the following:

1. Type ASTM-I material is not specified for any applications on WVDOH advertised construction projects. The specifications and approval process described herein for Type ASTM-I material are in place solely for the purpose of establishing requirements for the placement of Type ASTM-I materials on the Division's APL. A listing of approved Type ASTM-I materials is maintained in order to establish a list of materials approved for bidding on Division raw material supply Contracts. Therefore, no Type ASTM-I material that is not accepted by the Division for manufacturing purposes within the CSS shall be placed on the APL.
2. Type ASTM-IV sheeting materials and their matched components intended for work zone (as described herein) applications only are not required to be evaluated for use within the CSS.
3. Type ASTM-VI sheeting materials and their matched components are not required to be evaluated for use within the CSS.
4. With the exception of fluorescent-orange material and its' applicable matched components intended for use in manufacturing temporary work zone signs, Type ASTM-XI sheeting materials and their matched components intended for work zone (as described herein) applications only are not required to be evaluated for use within the CSS.

**715.9.2.9.2-Transfer Films:** The transfer film section of the APL is solely for the purpose of establishing an approved list of transfer tapes for bidding on Division raw material

supply Contracts. Private fabricators are not required to utilize transfer tapes listed on the APL. This shall be noted on the APL. Therefore, no transfer film that is not accepted by the Division for manufacturing purposes within the CSS shall be placed on the APL.

All transfer films submitted for approval shall be transparent. No other specific requirements are listed herein. However, transfer films shall be thoroughly evaluated by personnel within the Division's CSS. The CSS evaluation is primarily focused on the compatibility, workability, and general "user friendliness" of the material when used for production purposes within the CSS using the equipment in place at the CSS, as well as the characteristics of the material in these regards relative to other transfer films which have already been approved. The suitability of the material in this regard shall be based solely on the judgment of the Division.