SECTION 32 17 26.01
DETECTABLE WARNING SURFACING (DWS)

PART 1 - GENERAL

1.01 SUMMARY

A. This Section requires Applicators trained, certified, and authorized by the manufacturer.

B. This Section requires Applicator's Superintendent approval of substrate integrity and extent of substrate repair is required prior to mobilization.

C. Performance-type specification for: On-site, surface-applied, extruded polymer in shape of Detectable Warning Surfacing (DWS) applied as Tactile Walking Surface Indicator (TWSI).
   1. Extruded materials do not require adhesives, fasteners, mortars or grouts, or slab depressions or keyways.
   2. Extruded materials are not adversely affected by repetitive impact dislodging fastened products or water intrusion dislodging products due to cycles of freeze and thaw.
   3. Extruded materials are not adversely affected by high water tables.
   4. Extruded materials may be used in conditions of significant material abrasion such as repetitive exposure to snow removal equipment.

1.02 RELATED REQUIREMENTS

A. 01 74 19 - Construction Waste Management and Disposal: For additional sustainability requirements of products specified in this Section.

B. 03 30 00 - Cast-in-Place Concrete: Concrete for sidewalks and platforms.

C. 09 90 00 - Painting: Includes other products of similar function.

D. 10 14 00 - Signage: Includes other products of similar function.

E. 32 17 23 - Pavement Markings: Includes other products of similar function.

1.03 DEFINITIONS, ABBREVIATIONS, AND ACRONYMS

A. ADAAG: Americans with Disabilities Act Accessibility Guidelines. Standardized in 2010.

B. CSP: Concrete Surface Profile as defined by the International Concrete Repair Institute.

C. Detectable Warning: A standardized surface feature built in or applied to walking surfaces or other elements to warn of hazards on a circulation path.

D. DCoF: Dynamic Coefficient of Friction.

E. Equivalent Facilitation: A concept within accessibility standards, including the Americans with Disabilities Act (ADA), that allows for the use of alternative designs or technologies to meet accessibility requirements when they provide substantially equivalent or greater accessibility and usability.

F. PROWAG: Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way.

G. RCWS: Rumble Cycle Warning Surfacing.

H. TWSI: Tactile Walking Surface Indicator. Generic term used for types of walking surfaces to aid wayfinding by pedestrians who are blind or who have low vision.

1. DWS: Detectable Warning Surfacing. A standardized surface comprised of truncated domes built in or applied to walking surfaces to warn of hazards on a circulation path, such as at curb ramps and blended transitions, and at the edges of elevated transit boarding platforms. It is not intended to provide directional information.
2. TWD: Tactile Warning Delineator.
3. TDI: Tactile Direction Indicator.

1.04 REFERENCES

A. Accessibility Guidelines:
   1. 2010 ADA Standards for Accessible Design.
   2. ADA Standards for Transportation Facilities.
   3. ATBCB PROWAG - Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way; 2011.
   4. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines.
   5. 49 CFR 27, 37, and 38 - Standards for Accessible Transportation Facilities, Final Rule; Department of Transportation; current edition.
   6. 49 CFR 37, 38 - Department of Transportation (DOT) ADA Regulations:
      a. Includes requirements for certification of approval for Equivalent Facilitation.
      b. Includes requirements for dimensional tolerances.
   7. ADAAG Requirements (Title 49, Part 37.9 Standards for Accessible Transportation Facilities, Appendix A, Section 4.29.2 – Detectable warnings on walking surfaces)

B. ANSI A326.3 Dynamic Coefficient of Friction (DCOF) of Hard Surface Flooring Materials (Laboratory test).

C. ASTM C482 Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement Paste.

D. ASTM C501 Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser.

E. ASTM D570 Standard Test Method for Water Absorption of Plastics.

F. ASTM D635 Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.

G. ASTM D638 Standard Test Method for Tensile Properties of Plastics.

H. ASTM D711 Standard Test Method for No-Pick-Up Time of Pavement Markings.

I. ASTM D1148 Standard Test Method for Rubber Deterioration—Discoloration from Ultraviolet (UV) or UV/Visible Radiation and Heat Exposure of Light-Colored Surfaces.

J. ASTM D2196 Standard Test Methods for Rheological Properties of Non-Newtonian Materials by Rotational Viscometer.

K. ASTM D2205 Standard Guide for Selection of Tests for Traffic Paints.

L. ASTM D2240 Standard Test Method for Rubber Property—Durometer Hardness.

M. ASTM D2843 Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics.

N. ASTM E303 Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester.

O. EN ISO 9239-1 Reaction to Fire Tests for Floorings.

P. EN ISO 11925-2 Reaction to Fire Tests — Ignitability of Products Subjected to Direct Impingement of Flame; Part 2: Single-flame source test.

Q. ASTM G155 Standard Practice for Operating Xenon Arc Lamp Apparatus for Exposure of Materials.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preapplication Meeting at Project Site in accordance with 01 30 00 - Administrative Requirements:

1. Applicator's Superintendent approval of substrate integrity and extent of substrate repair is required prior to mobilization.
2. Convene prior to start of Work of this Section.
3. Required Attendees: Architect's representative, Owner's representative, and Applicator Superintendent.
4. Review:
    a. Substrate:
        1) Determination of existing concrete surface profile (CSP).
        2) Confirm products and processes required for surface preparation of existing substrate.
        3) Confirm need for Reducer as determined by substrate condition.
    b. Preparation and application procedures to include finalization of personnel and equipment.
    c. Masking:
        1) Locations for protection of adjacent materials.
        2) Locations of applied product for continuation of substrate construction and control joints.
    d. Schedule and coordination required with related work to avoid delays.

1.06 SUBMITTALS

A. Submittal Procedures: Refer to 01 30 00 - Administrative Requirements.

B. Product Data:
    1. Do not provide manufacturer’s Safety Data Sheets.
    2. Provide product criteria, characteristics, and current accredited testing data.
    3. Provide manufacturer’s written application instructions.

C. Shop Drawings: Markup of architectural or engineer drawings acceptable as approved by architect.
    1. Provide plan indicating dimensioned product and locations of application from adjacent materials and transitions.
    2. Provide locations of joints to remain free of applied product.

D. Qualification Statements for: Manufacturer and Applicator.
    1. Applicator to provide current documentation of training, certification, and authorization by manufacturer.

E. Certification of Approval through Equivalent Facilitation for Transportation Agencies:
    1. Liquid-applied extrusions (not pre-manufactured and stamped tiles) may possess slight visual but not distinctly measurable variations in shape and size, within manufacturer-required tolerances. When required for approval by Transportation Agencies, provide project-specific certification for approval of the extruded product on the basis of "Equivalent Facilitation."
    2. 2010 ADA Standards for Accessible Design:
        a. Nothing in these requirements prevents the use of designs, products, or technologies as alternatives to those prescribed, provided they result in substantially equivalent or greater accessibility and usability.
        b. The responsibility for demonstrating equivalent facilitation in the event of a challenge rests with the covered entity. With the exception of transit facilities, which are covered by regulations issued by the Department of Transportation, there is no process for certifying that an alternative design provides equivalent facilitation.
        c. Refer to 49 CFR 37, 38 for Submittal Requirements regarding Equivalent Facilitation at Transit Facilities.

F. Manufacturer's Installation Instructions:
    1. Provide summary of manufacturer requirements to include special preparation of substrate, application and attachment methods, and conditions requiring special attention.

G. Warranty Documentation:
    1. Provide Executed Warranty.
        a. Refer to exceptions affecting validation of warranty.
    2. Submit warranties listed below, completed in Owner’s name and registered with manufacturer.

1.07 MAINTENANCE REQUIREMENTS

A. For additional requirements refer to 01 60 00 - Product Requirements.

B. Methods for maintaining materials and finishes.

C. Precautions about cleaning materials and methods that could be detrimental to components, finishes, and performance.

1.08 SAMPLES AND MOCKUPS

A. Samples:
   1. Verification Sample at Architect's request: Provide minimum 3-1/2 inch by 5 inch sample of DWS, indicating manufacturer, product line, and specified color.

1.09 QUALITY ASSURANCE

A. Refer to 01 40 00 - Quality Requirements for additional requirements.

B. Source Quality Control: Products and accessories to be by a single manufacturer.

C. Qualifications:
   1. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least ten (10) years of documented experience with facilities equipped to meet requirements.
   2. Applicator Qualifications: Company specializing in performing work of the type, using personnel trained, certified, and authorized by manufacturer to apply product specified at application location.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Refer to 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.

B. Store in environment meeting a temperature range between 25 degrees F and 90 degrees F.

C. Remove and replace components at no additional cost to the Owner which are delivered to site damaged or otherwise not suitable for application.

1.11 FIELD CONDITIONS

A. Environmental Limitations: Successful application of products specified in this Section are dependent on ambient temperature and substrate moisture content requirements within tolerances required by manufacturer.
   1. Ratio of Catalyst is determined by Applicator based on ambient temperature.

B. Inclusion of Reducer is determined by existing substrate condition by Applicator.

1.12 WARRANTY

A. Applicator's Warranty, Standard: Provide 5-year applicator warranty against each TWSI failing to maintain more than 95 percent of its surface adhesion, or slip-resistant characteristics. Complete forms in Owner's name and register with applicator within thirty (30) days of completion.
   1. Exception: Where DWS has been exposed to mechanical abrasion due to traffic from vehicles such as shopping carts, cars, trucks, tractors, or snow removal equipment.
   2. Exception: Where substrate contamination is present from additives such as coloring agents, sealers, or bond breakers.

PART 2 - PRODUCTS

2.01 DETECTABLE WARNING COMPONENTS - PERFORMANCE

A. Products require certified compatibility with concrete mix for a warrantable application of the designed condition.

B. No substitutions. Products proposed for reselection due to availability to include the following salient features. Refer to Section 01 60 00 - Product Requirements.

C. Basis of Design: Detectable Warning (Truncated Dome) by Vanguard ADA Systems; www.VanguardOnline.com.
   1. Source Limitations: Furnish products produced by single manufacturer and obtained from single supplier.
   2. Salient Features:
      a. Shape: Raised truncated domes.
      b. Size:
         1) Coating Thickness at Pavement Surface: As recommended by Applicator while maintaining ADA compliance.
         2) Extruded DWS (Truncated) Dome Size (nominal):
            (a) Height: 0.2 inch.
            (b) Base Diameter: 0.9 inches minimum to 1.4 inches maximum.
            (c) Truncation Ratio: Top Diameter to be 50 percent minimum to 65 percent maximum of base diameter.
         3) Extruded DWS (Truncated) Dome Spacing:
            (a) Center-to-Center Spacing: 1.6 inches minimum to 2.4 inches maximum.
            (b) Minimum Base-to-Base Spacing: 0.65 inches, measured between most adjacent domes on square grid.
      c. Width of DWS Application: Varies as required by application. Refer to manufacturer's details.
      d. Depth of DWS Application: Twenty-four (24) inch depth across by width of opening. For applications with radiused curb, depth will vary to meet requirement for edge of detectable warning surfacing to match radius of curb.
      e. Color: LI-B35 [White] [Red] [Blue] [Black] [Yellow] [Gray] [Green] [Custom].
   3. Performance Requirements:
      a. Extruded materials to achieve and retain a level of slip-resistance at least meeting those of surrounding pedestrian surfaces.
      b. Wet Surface Friction: Minimum Average 54, in accordance with ASTM E303.
      c. Dynamic Coefficient of Friction (DCoF):
         1) Greater than or Equal to 0.69: Wet Dynamic CoF as tested in accordance with ANSI A326.3.
      d. Material Properties, extruded polymer:
         1) Abrasion Resistance: Average 4.162 gram loss in accordance with ASTM C501.
         2) Adhesion (Substrate to be confirmed through submittal of mix design):
            (a) Asphalt: Dependent on tensile nature of substrate.
            (b) Portland Cement: 200 PSI, minimum.
         3) Bond Strength: 613 PSI in accordance with ASTM C482.
         4) Chemical Resistance: Tested for 7 days.
            (a) Road Salts: no effect.
            (b) Anti-freeze: no effect.
            (c) Diesel fuel: no effect.
            (d) Gasoline: no effect.
            (e) Transmission fluid: no effect.
            (f) Motor oil: no effect.
         5) Discoloration from UV and Heat: Average 2.91, in accordance with ASTM D1148.
         6) Elongation: 20 percent minimum, in accordance with ASTM D638.
         7) Flame Spread: Less than 150 mm, in accordance with EN ISO 11925-2.

8) Hardness: Shore Durometer, A-1, 80 minimum after 24 hours.
9) Rate of Burn: No sustained burn, in accordance with ASTM D635.
10) Smoke Density Rating: Average 0.1, in accordance with ASTM D2843.
11) Smoke Development: Pass, in accordance with EN ISO 9239-1.
12) Shore Hardness: Shore Durometer, A-1, 80 minimum after 24 hours, in accordance with ASTM D2240.
13) Tensile Strength: 125 PSI minimum at break, in accordance with ASTM D638.
14) Tracking: None after 60 minutes max, in accordance with ASTM D711, 50 mils wet at 77 deg F.
15) UV Resistance: 99% minimum Fade Resistance and Color Retention in accordance with ASTM G155.
16) Viscosity: 6000-12000 cps ASTM D2196 - Brookfield #7 spindle at 20 rpm, 77 deg F.
17) VOC: Less than 10 grams per liter maximum, in accordance with ASTM D2205.
18) Water Absorption: Maximum 1.81 percent. Tested in accordance with ASTM D570.

4. Accessories required for application:
   a. Silica Sand, added by volume: As determined by Applicator.

PART 3 - EXECUTION

3.01 EXAMINATION AND VERIFICATION

A. Verify existing conditions meet Manufacturer's and Applicator's requirements before starting Work.
   1. Assess CSP existing substrate profile to determine extent of surface preparation required below.
   2. Verify written approval has been received for material selection and application design for the substrate makeup and conditions of the application location. In addition, verify the following:
      a. Substrate Requirements for Existing or New Concrete:
         1) Strength: 3,000 PSI minimum.
         2) Finish: Medium broom finish or coarser profile.
         3) Cure: Fifteen (15) day minimum.
      b. Substrate Requirements for Asphalt:
         1) Compaction: Ninety-five (95) percent minimum.
         2) Finish: Rolled, compacted, smooth.
         3) Cure: Fifteen (15) day minimum.
   3. Verify surface is clean and dry, and free of surface applied sealers, coloring agents, or other materials detrimental to surface bond.
   4. Verify surface temperature is between 35 degrees F and 88 degrees F.
   5. Verify moisture content of concrete substrate does not exceed six (6) percent.

3.02 PREPARATION

A. Protection of In-Place Conditions: Applicator to protect applied work areas required by the Owner until work is complete to maintain product performance, design criteria and warranty.

B. Surface Preparation: Prepare surfaces to receive work in accordance with manufacturer's instructions.
   1. Grind clean or abrade to remove surface applied sealers, coloring agents, oils, bond breakers, or any surface applied or infused materials that will cause rejection of adhesion and provide required surface profile.
      a. Concrete Substrates:
         1) Grind new concrete to ensure no surface or other seal coat has been applied.
         2) Grind with walk-behind or handheld grinder to CSP 3 - 5.
      b. Asphalt Substrates:
         1) If seal-coated, grind to remove sealer with walk-behind or handheld grinder to CSP 3 - 5.

2. Fill large holes or crevices resulting from the grinding process with manufacturer's recommended materials.
3. Broom or air sweep clean surfaces free of dust and debris, vegetation and material impacting adhesion, prior to installation of liquid-polymer extrusion materials.
4. Measure, layout, and mask Work area.

C. Removal of Existing Materials at Application Surface:
1. Refer to 02 41 19 - Selective Demolition for additional requirements.

3.03 APPLICATION OF DETECTABLE WARNING SURFACING (DWS) COMPONENTS

A. Grind substrate to CSP required as determined by substrate mix and current profile condition.
1. Do not create unnecessary divots in existing asphalt surfaces
2. Asphalt with seal coat requires removal of coating prior to DWS application.

B. Apply in accordance with manufacturer's written instructions. Refer to manufacturer's instructions and details.
1. Liquid polymer extrusion material to be mixed evenly and thoroughly for two minutes minimum.
2. Quantities of additional catalyst and proprietary components to polymer mixture is determined by certified applicator based on current ambient weather conditions and according to viscosity.
3. Reducer / SkidGuard Base Coat:
   a. Reducer as a sealer may not be required for DWS installed on asphalt. Use reducer as determined by Applicator.
   b. Fill surface deformities with manufacturer's recommended materials.
   c. If on Concrete; Catalyze Reducer and Seal surface. Cross roll at 90 degrees to ensure appropriate coverage and penetration.
   d. If on Asphalt; Add Reducer to Base component to create SkidGuard base coat and catalyze in accordance with application instructions, cross roll at 90 degrees to ensure appropriate coverage and penetration.
   e. Immediately pull tape. Wait minimum 30 minutes for Reducer or SkidGuard mix component to cure.
4. Domes (DWS):
   a. Layout Vanguard extruded dome mats in accordance with contract documents and dimensional allowances.
   b. Mix and catalyze Base component in approved color(s) in accordance with application instructions.
   c. Pour catalyzed Base component onto mats in coverage rates indicated by manufacturer.
   d. Apply material per manufacturers recommended procedures to ensure adequate coverage and penetration of all apertures.
   e. Remove excess material.
   f. Remove forms immediately in accordance with manufacturer’s instructions.
   g. Wait minimum 30 minutes for final component to cure.
   h. When material is tack free, surface is ready for pedestrian traffic.

3.04 CLEANING

A. Dispose of all waste material in compliance with project’s Waste Management Plan in accordance with 01 74 19 - Construction Waste Management and Disposal.

3.05 PROTECTION

A. Protect applied product from subsequent construction operation until cured or as required.

B. Do not permit traffic over unprotected floor surface during cure.

END OF SECTION