Preparing Activity: USACE Superseding
UFGS-32 18 16.13 (April 2008)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
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08/17

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SECTION 32 18 16.13

PLAYGROUND PROTECTIVE SURFACING
08/17

NOTE: This guide specification covers the requirements for furnishing and installing protective surfacing in children's outdoor play areas.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

PART 1 GENERAL

NOTE: Designer should require materials, products, and innovative construction methods and techniques which are environmentally sensitive, take advantage of recycling and conserve natural resources.

1.1 REFERENCES

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date,

and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C136/C136M	(2019) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D412	(2016; R 2021) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D1557	(2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D2047	(2017) Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine
ASTM D2261	(2013; R 2017) Standard Test Method for Tearing Strength of Fabrics by the Tongue (Single Rip) Procedure (Constant Rate-of-Extension Tensile Testing Machine)
ASTM D6112	(2013) Compressive and Flexural Creep and Creep-Rupture of Plastic Lumber and Shapes
ASTM F1015	(2003; R 2017) Standard Test Method for Relative Abrasiveness of Synthetic Turf Playing Surfaces
ASTM F1292	(2022) Standard Specification for Impact Attenuation of Surfacing Materials Within the Use Zone of Playground Equipment
ASTM F1487	(2021) Standard Consumer Safety Performance Specification for Playground Equipment for Public Use
ASTM F1951	(2014) Standard Specification for

Determination of Accessibility of Surface Systems Under and Around Playground Equipment

CONSUMER PRODUCT SAFETY COMMISSION (CPSC)

CPSC Pub No 325 (2015) Public Playground Safety Handbook

1.2 DEFINITIONS

1.2.1 Critical Height

The fall height at which the protective surfacing meets the requirements of ASTM F1292.

1.2.2 Designated Play Surface

Any elevated surface for standing, walking, sitting, or climbing; or a flat surface a minimum 50 mm 2 inches wide having up to a maximum 30 degree angle from horizontal. In some play events the platform surface will be the same as the designated play surface. However, the terms should not be interchanged as they do not define the same point of measurement according to ASTM F1487.

1.2.3 Head Injury Criteria (HIC)

A measure of impact severity that considers the duration over which the most critical section of the deceleration pulse persists as well as the peak level of that deceleration. Head impact injuries are not believed to be life threatening if the HIC does not exceed a value of 1,000.

1.2.4 Impact Attenuation

The ability of protective surfacing to reduce and dissipate the energy of an impacting body.

1.2.5 Loose Fill

Consisting of small independent movable components such as sand, gravel, or wood chip. The percent of fine material in the loose fill affects its compression properties from rainfall.

1.2.6 Maximum Equipment Height

The highest point on the equipment (i.e.: roof ridge, top of support pole).

1.2.7 Play Event

A piece of manufactured playground equipment that supports one or more play activities.

1.3 SYSTEM DESCRIPTION

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NOTE: Drawings will indicate the perimeters of the play event use zone defining fall height, platform height, and maximum equipment height; spot elevations; and details as required to install

protective surfacing to meet child safety requirements.

Accessibility: Drawings will indicate spot elevations; dimensions; ramp slope and rise; transfer platform height and transfer space; transfer step and height; and maneuvering space as required to install protective surfacing to meet child accessibility requirements.

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Measure the perimeters of the play event use zone in accordance with the requirements of Section 11 68 13 PLAYGROUND EQUIPMENT.

1.3.1 Child Safety

Meet or exceed the impact attenuating performance requirements of synthetic surfacing and loose-fill surfacing systems, installed in the use zones, as follows. The surfacing critical height value must yield up to both a maximum 200 G's peak deceleration, and a maximum 1,000 Head Injury Criteria (HIC) value for a head-first fall from the play event in accordance with CPSC Pub No 325 and ASTM F1292. The protective surfacing should have a minimum critical height value equal to the height of the highest designated play surface. Measuring fall heights for play events is defined in paragraph FALL HEIGHT. Do not install sand, gravel, and wood products over a concrete or bituminous subsurface in accordance with CPSC Pub No 325.

1.3.2 Child Accessibility

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NOTE: Facilities will be accessible in accordance with TI 800-01 and 36 CFR 1191, Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities.

Ensure one access and egress point for a furnished play event meets accessibility. Ensure all children are accommodated on the playground in a 'play for all' socialization skill development environment. When children with disabilities are allowed to choose play events, they are more eager to learn the skills necessary to participate.

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The accessibility requirement in accordance with ASTM F1487 includes the following: When the play event use zone consists of a protective surfacing rated as inaccessible, at least one accessible route must be provided from the use zone perimeter to the play event. When there is more than one of the same play activity provided, only one must meet accessibility requirements (i.e.: one swing seat or one spring rocking play event). When the access and egress points are not the same for a play event, an accessible route must be provided to both. The accessible route must access all accessible play events and elements. The protective surfacing materials that meet accessibility are synthetic surfacing and engineered wood fiber in accordance with ASTM F1951. When the accessible surface is within the use zone, it must meet the requirements of paragraph CHILD SAFETY.

1.3.3 Play Areas at CDC

The technical representative for outdoor play areas at CDC must be the installation Child Development Services (CDS) Coordinator. The design of the CDC outdoor play area must be based on the developmental play program for the age groups accommodated at the CDC. The play area is designed to support the CDC program and to provide a stage set for creative play. Developmental activities are selected which promote the intellectual, social, emotional and physical growth of the children. The developmental play program is developed by the MACOM CDS Director, installation CDS Coordinator and CDC Director. They are responsible for the developmental play program, child safety and accessibility to meet that program.

1.3.4 Sites Other than CDC

The technical representative for outdoor play areas on sites other than CDCs is the Director of Public Works or designated representative. The design of these outdoor play areas must be based on the play program and the age groups to be accommodated as determined by the play area committee.

1.4 SUBMITTALS

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NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a “G” to an item, if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

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Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop Drawings

Finished Grade and Underground Utilities

SD-03 Product Data

Synthetic Surfacing

Loose Fill Surfacing

Geotextile Fabric

Wood

Temperature Limitation

Wood By-Products

Wood Treatment

Adhesive

Color

SD-04 Samples

Synthetic Surfacing

Loose Fill Surfacing System

SD-06 Test Reports

Percolation Test

Recycled Plastic

Synthetic Surfacing

Sand

Gravel

SD-07 Certificates

Manufacturer's Qualification

Manufacturer's Representative

Installer's Qualification

Substitution

Protective Surfacing Acceptance

SD-10 Operation and Maintenance Data

Maintenance Instructions; G[, [_____]]

SD-11 Closeout Submittals

Protective Surfacing Acceptance

Certificate of Insurance

Warranty

1.5 QUALITY ASSURANCE

1.5.1 Manufacturer's Qualification

Submit name of the owner or user; service or preventive maintenance provider; date of the installation; point of contact and telephone number; and address for 10 sites. Protective surfacing should have been installed in a minimum 10 sites and been in successful service for a minimum 5 year calendar period. The manufacturer must provide a Certificate of Insurance AA rated for a minimum one million dollars covering both product and general liability.

1.5.2 Manufacturer's Representative

Submit the individual's name, company name and address, and playground safety training certificate. The manufacturer's certified playground safety inspector or the manufacturer's designated certified playground safety representative must supervise the installation and adjustment of the protective surfacing to verify the installation meets the requirements of the manufacturer, this specification, and paragraphs CHILD SAFETY and CHILD ACCESSIBILITY.

1.5.3 Installer's Qualification

Submit the installer's company name and address, training and experience certification. The installer must be certified by the manufacturer for training and experience installing the protective surfacing.

1.5.4 Shop Drawings

When the use zone perimeter and play event configuration conflict with the requirements and paragraphs CHILD SAFETY and CHILD ACCESSIBILITY, submit scale drawings defining corrective measures to include the following: Adjustment to the play event with the use zone perimeter; use zone perimeter overlaps; fall height and critical height value.

1.6 DELIVERY, STORAGE, AND HANDLING

Provide a delivery schedule at least 10 calendar days prior to the first day of delivery. Deliver, handle, and store protective surfacing material in accordance with the manufacturer's recommendations. The storage area must be as designated. Store the materials in a dry, covered area until installed. Inspect protective surfacing material, upon arrival at the job

site, for meeting specified quality. Unacceptable materials must be removed from the job site.

1.7 WARRANTY

Furnish protective surfacing with a minimum 1 year calendar period warranty.

1.8 MAINTENANCE INSTRUCTIONS

Submit [2] [_____] bound copies of the manufacturer's operation and maintenance manual describing the recommended preventive maintenance, inspection frequency and techniques, periodic adjustments, lubricants, and cleaning requirements. Furnish protective surfacing spare parts provided by the manufacturer.

PART 2 PRODUCTS

2.1 MATERIALS

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NOTE: Before selecting a protective surfacing system, evaluate the different types of protective surfacing systems to determine the most appropriate surfacing for the climate, accessibility, play value, and cost. Consider life cycle maintenance cost.

Synthetic Surfacing System: Synthetic surfacing systems, either unified or combined, meet accessibility requirements and have less daily maintenance requirements than loose-fill surfacing systems. Synthetic surfacing systems have limited play value. These systems may be used to add color patterns to the playground to be used for play activities.

Loose Fill Surfacing System: The only loose fill surfacing that meets accessibility is engineered wood fiber. To maintain accessibility there needs to be a commitment to replenishing the material every month with the same engineered material. Some loose-fill materials such as sand, not only provide a good impact attenuation surface, but have excellent play value. Loose fill surfacing systems require daily maintenance to maintain impact attenuation performance due to material displacement, decomposition, and compression.

Depth of Material: Depth of the protective surfacing is determined by both the fall height and the type of protective surfacing system selected.

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Prior to the delivery of materials, submit certificates of compliance attesting that materials meet the specified requirements. Certified copies of the material certificates must include composition and tests to which the material has been subjected. Submit manufacturer's descriptive data; catalogue cuts; and the latest edition of ASTM F1487 and

CPSC Pub No 325. Provide materials which are the standard products of a manufacturer regularly engaged in the manufacture of protective surfacing and that are similar to surfacing in satisfactory use a minimum 5 year calendar period. Protective surfacing consists of two systems; synthetic surfacing and loose fill surfacing.

2.2 SYNTHETIC SURFACING

Submit a minimum 50 by 50 mm 2 by 2 inch sample. Submit impact attenuation and critical height performance for each thickness of synthetic surfacing and loose fill surfacing provided. Submit delivery schedule and manufacturer's name for synthetic surfacing and loose fill surfacing plus delivery, storage and handling information. Furnish a list to include part numbers of furnished protective surfacing materials and components for synthetic surfacing and loose fill surfacing and manufacturer's specifications, handling and storage requirements, installation procedures, and safety data sheets to include warnings and critical height performance standards for synthetic surfacing and loose fill surfacing. Synthetic surfacing includes the following: poured-in-place system; tile system; and combination system. The synthetic surfacing consists of either impact attenuating substrate covered by a wear surface bonded to produce a unified system; a shredded rubber or aggregate substrate covered by a polyethylene plastic woven sheet wear surface; or a uniform material manufactured in such a way that the top portion meets the requirements specified for wear surface. Submit chemical composition, color granule percentage, and test results to which material has been subjected, identifying each material and component containing recycled materials and showing the estimated percentage of recovered material content. Furnish freezing temperature life-cycle durability.

2.2.1 Subbase

The subbase for synthetic surfacing may be either concrete, aggregate, or bituminous material.

2.2.1.1 Concrete Subbase

Provide concrete material conforming to Section 32 13 14.13 CONCRETE PAVING FOR AIRFIELDS AND OTHER HEAVY DUTY PAVEMENTS.

2.2.1.2 Bituminous Subbase

Provide bituminous material conforming to Section 32 01 13.62 ASPHALT SURFACE TREATMENT.

2.2.1.3 Aggregate Subbase

Provide aggregate material conforming to Section 32 11 20 [BASE COURSE FOR RIGID][AND][SUBBASE] [SELECT-MATERIAL] [FOR FLEXIBLE PAVING].

2.2.2 Impact Attenuating Substrate

Provide a substrate compatible with the wear surface, and consisting of modular units; poured-in-place; or loose fill.

****

NOTE: layground surface products are EPA designated recycled content products. Use materials with recycled content where appropriate for use. Verify

suitability, availability within the region, cost effectiveness and adequate competition before specifying product recycled content requirements. A resource that can be used to identify products with recycled content is the "Comprehensive Procurement Guidelines (CPG)" page within the EPA's website at http://www.epa.gov. Other products with recycled content are also acceptable when meeting all requirements of this specification.

Research has shown that products are available among US national manufacturers meeting the recycled content percentage in the following substrate sections.

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2.2.2.1 Poured-In-Place Substrate

Poured-in-place substrate must consist of a 100 percent recycled, shredded, styrene butadiene rubber (SBR) adhered with a 100 percent solid polyurethane binder to form a resilient, porous material or shredded rubber. Strands of SBR may vary from a minimum 0.5 mm 1/50 inch to a maximum 2 mm 2/25 inch thickness; by a minimum 3 mm 1/8 inch to a maximum 20 mm 4/5 inch length. Binder must be between a minimum 12 percent and a maximum 16 percent of the total weight of the mixture of rubber and urethane; and must provide 100 percent coating of the particles. Foam rubber will not be accepted in the substrate.

2.2.2.2 Loose Fill Substrate

The loose fill substrate must consist of 100 percent recycled shredded rubber produced from recycled vehicle tires without non-steel belts. Loose-fill strands may vary from a minimum 3 mm 1/8 inch to a maximum 6 mm 1/4 inch thickness; a minimum 3 mm 1/8 inch to a maximum 13 mm 1/2 inch width; and a minimum 13 mm 1/2 inch to a maximum 50 mm 2 inch length.

2.2.3 Wear Surface

Wear surfaces consist of the following: a poured-in-place durable, weather-resistant, ultraviolet stable, water permeable material top-coat; an integral component of a tile system; synthetic turf wear surface; rubber sheet wear surface; or a polyethylene woven plastic sheet wear surface. The wear surface must meet requirements of ASTM D2047 for a minimum 0.8 coefficient of friction.

2.2.3.1 Poured-in-Place Wear Surface

Poured-in-place wear surface consists of ethylene propylene diene monomer (EPDM) particles adhered with a polyurethane binder formulated to produce an even, uniform surface. Particles of EPDM must meet ASTM D412 for tensile strength and elongation, and contain a minimum 25 percent of rubber hydrocarbons. Particles of EPDM must be peroxide or sulfur cured in accordance with the manufacturer. Size of rubber particles must be between a minimum 1 mm 1/32 inch, and a maximum 3 mm 1/8 inch diameter. Binder must be between a minimum 16 percent and a maximum 21 percent total weight of rubber used in the wear surface, and must provide 100 percent coating of the particles. Wear surface must be a minimum 10 mm 3/8 inch thick. The wear surface must be porous.

2.2.3.2 Synthetic Turf Wear Surface

Synthetic turf wear surface must consist of nylon fibers a minimum 500 denier, or heavy face weight polypropylene fiber a minimum 5,000 denier; and tufted construction conforming to ASTM F1015. Fibers in each roll must be from the same dye lot.

2.2.3.3 Rubber Sheet Wear Surface

Rubber sheet wear surface must consist of a smooth, uniform formulation of EPDM rubber granules bonded under pressure in the factory with polyurethane to form a continuous sheet, and must be a minimum 10 mm 3/8 inch thick. Up to a maximum 80 percent of the rubber may consist of SBR particles. Particle size must vary from a minimum 1 mm 1/32 inch to a maximum 5 mm 3/16 inch diameter.

2.2.3.4 Polyethylene Plastic Woven Sheet Wear Surface

Polyethylene plastic woven sheet wear surface must be lockstitched and meet the tear resistance test, ASTM D2261 and must have an accelerated ultra-violet degradation protection feature.

2.2.4 Synthetic Tile

Synthetic tile must be sized [as indicated] [_____]. Synthetic tile must be a factory-molded unit consisting of the following: combining impact attenuating substrate and wear surface meeting requirements specified for substrate and wear surface; or a dual-density, uniform material, the top portion of which must conform to wear surface requirements specified.

2.2.5 Color

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NOTE: Specify the percentage of each color granule for a unified poured-in-place system. Recommend the overall color of the surfacing be light colors to reduce contact burn risk from solar heat buildup. An EPDM wear surface is preferred for color retention.

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Submit [2] [_____] color charts displaying surfacing colors, color granule percentages and finishes. The color must be [as shown in Section 09 06 00 SCHEDULES FOR FINISHES] [as indicated] [_____]. An EPDM wear surface is preferred for color retention. Black or the following dark colored SBR wear surfaces retain heat and are not acceptable: color combinations containing more than 10 percent black; or color combinations averaging more than 10 percent dark colors.

2.2.6 Sealant

Sealant for tile or combined protective surface systems must be compatible with the protective surfacing, and must match the color of the wear surface.

2.2.7 Hardware

Hardware, anchors or fasteners must be corrosion resistant stainless steel

or galvanized steel to anchor the surfacing system securely, in accordance with manufacturer's instructions. Hardware must provide or be recessed to provide a flat surface and must be covered by the required depth of protective surfacing.

2.2.8 Binder

Binder for synthetic surfacing must be nontoxic, weather-resistant, ultraviolet stable, non-hardening, and retaining impact-attenuating performance. It must be 100 percent solids containing polyurethane, methylene diphenel isocyanate (MDI), or as recommended by the manufacturer. The use of toluene diphenel isocyanate (TDI) must not exceed 2 percent. Weight of polyurethane must be between a minimum 1.02 kg/L 8.5 lbs/gal and a maximum 1.14 kg/L 9.5 lbs/gal. Coloring pigments must be inorganic oxides.

2.2.9 Adhesive

Provide a two component polyurethane adhesive as recommended by the manufacturer.

2.2.10 Containment Curbs

Containment curbs include the following: treated wood, concrete, recycled plastic, or recycled plastic molded as lumber. Containment curbs must provide a smooth and hazard-free transition from the protective surfacing to the adjacent surface. Curbs must be free of sharp vertical edges, protruding elements and trip hazards. Curbs must be as recommended by the manufacturer. Provide all edges with a minimum 13 mm 1/2 inch radius.

2.2.11 Transition Edge

The transition edge must be designed to maintain the protective surfacing performance, support the surfacing between changes of material, and must be concrete in accordance with paragraph CONCRETE CURB. The face of the edge to the subgrade must be covered with the impact attenuating surface and meet the requirements of paragraph CHILD SAFETY.

2.2.12 Combination System

Combination systems must consist of combined protective surfacing materials specified. Each component is a part of a manufactured surfacing system. Wear surface must be of the materials specified.

2.3 LOOSE-FILL SURFACING

Loose-fill surfacing installed in the use zone must consist of sand, gravel or wood by-products.

2.3.1 Sand

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NOTE: Sand provides both a protective surface when installed to the recommended depth and play value as in deep digging. When selecting sand, the composition of fine to coarse particles becomes a factor as sand compresses from rainfall. Compressed sand no longer meets impact attenuation for the fall height specified. Also, sand is displaced from

running, digging or dragging activities, requiring replenishment on a daily basis to maintain impact attenuation performance. "Uniformly graded" sand is to be specified as it has less tendency to compact than "well graded" sand. The specified sieve sizes provide a range of passing percentages that meet paragraph CHILD SAFETY requirements. The range of sieve sizes provided give a sand composition that is locally available and reduce custom mixing.

In accordance with the US Army Community and Family Support Center (CFSC-FSCY) requirements for the Army developmental play program, sand is a required play element and must not be eliminated from the play area.

****

Submit sieve test results. Sand must be uniformly graded, washed, free of dust, clay, dirt, hazardous substances, or foreign objects. Sand particles must be rounded naturally or by mechanical means and sieved in accordance with ASTM C136/C136M to be in the following gradation range.

SIEVE SIZE, mm	PERCENT PASSING
2.36 No. 8	100
1.18 No. 16	80-100
0.60 No. 30	40-75
0.30 No. 50	0-25
0.15 No. 100	less than 2

2.3.2 Gravel

Gravel must be washed, free of dust, clay, dirt, hazardous substances or foreign objects. Gravel particles must be rounded naturally or by mechanical means and sieved in accordance with ASTM C136/C136M to be in the following gradation range.

SIEVE SIZE, mm	PERCENT PASSING
12.5 1/2 inch	100
9.5 3/8 inch	75-85

2.3.3 Wood By-Products

Wood by-products include wood mulch and engineered wood fiber. Wood by-products must be free of sharp or foreign objects or toxic chemicals; poisonous plant material; protrusions; or hazardous material; provide information regarding composition, source, and particle size. Wood by-products manufactured from recycled pallets or lumber containing nails

or metal fasteners must be rejected.

2.3.3.1 Wood Mulch

Wood mulch must be untreated chipped bark or untreated chipped tree prunings a maximum 40 mm 1-1/2 inches long and must be free of twigs, leaves, branches, thorns, dirt, grass, yard clippings, soil, or poisonous plants.

2.3.3.2 Engineered Wood Fiber

Engineered wood fiber manufactured for the purpose of protective surfacing must consist of particles varying from a minimum 3 mm 1/8 inch wide to a maximum 13 mm 1/2 inch thick; and a minimum 25 mm 1 inch wide to a maximum 75 mm 3 inches long.

2.4 GEOTEXTILE FABRIC

Geotextile fabric consists of the following: nonwoven polypropylene sheet; nonwoven 100 percent polyester sheet; or nonwoven needle punched polyester sheet composed of recycled polyester resins.

2.5 RECYCLED PLASTIC

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NOTE: Plastic lumber used for landscaping timbers and posts is an EPA designated product for recycled content. Use materials with recycled content where appropriate for use. Verify suitability, availability within the region, cost effectiveness and adequate competition before specifying product recycled content requirements. A resource that can be used to identify products with recycled content is the "Comprehensive Procurement Guidelines (CPG)" page within the EPA's website at http://www.epa.gov. Other products with recycled content are also acceptable when meeting all requirements of this specification.

Research shows products are available among US national manufacturers meeting the minimum recycled content of the percentage listed.

****

Provide the estimated percentage of recovered material content in the material and components; and life-cycle durability. Submit individual component and assembled unit structural integrity test; creep tolerance; deflection tolerance; and vertical load test results; and life-cycle durability. Recycled plastic must contain a minimum 85 percent of recycled content.

2.5.1 High Density Polyethylene

The material must be molded of ultraviolet (UV) and color stabilized polyethylene; and consist of a minimum 75 percent plastic profile of high-density polyethylene, low-density polyethylene, and polypropylene raw material. The material must be non-toxic and have no discernible contaminants such as paper, foil, or wood. The material must contain no more than 3 percent air voids. The material must be free of splinters,

chips, peels, buckling, and cracks. Material must be resistant to deformation from solar heat gain. Material must have factory-drilled holes. Components with extra holes not filled by hardware or covered by other components must be rejected. The material must not be painted.

2.5.2 Structural Component

Recycled plastic materials will not be used as load bearing structural members.

2.5.3 Recycled Plastic Molded As Lumber

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NOTE: Recycled plastic molded as lumber and wood-polymer lumber are susceptible to both creep and deflection; therefore, it cannot be used for a load bearing structural member of protective surfacing systems. To overcome creep and deflection, the product is increased in volume of material and dimension.

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The component deflection must not exceed 1/360 of the span of the frame when exposed to a uniform live load of 585 N/m 40 lbs/ft. The product must meet the structural integrity test requirements set forth in ASTM F1487 and ASTM D6112.

2.6 CURBS

2.6.1 Concrete Curb

Concrete curbs must conform to Section 32 16 19 CONCRETE CURBS, GUTTERS AND SIDEWALKS.

2.6.2 Wood

2.6.2.1 Wood Components

Wood components must be exterior premium grade and free of knots. Wood components must have factory-drilled holes. Components with extra holes not filled by hardware or covered by other components must be rejected.

2.6.2.2 Wood Treatment

Wood components that are not naturally rot and insect resistant must be treated to resist rot and insect attack by using standard treatment procedures. Provide wood treatment chemical content, toxicity level, and life-cycle durability. Any wood placed up to a maximum 150 mm 6 inches above, or any portion below the top elevation of the protective surfacing, must be treated after fabrication. Creosote, pentachlorophenol, and tributyl tin oxide are prohibited according to ASTM F1487.

PART 3 EXECUTION

3.1 SITE PREPARATION

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NOTE: Provide positive drainage for the proper functioning of protective surfacing. Ensure a

minimum 2 percent slope is provided for the protective surfacing subgrade. Ensure ponding at the perimeter does not occur. To ensure proper drainage, provide a percolation test to establish the requirement for a subdrainage system.
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Prior to installing the protective surfacing, verify the playground equipment and site furnishings are installed in accordance with Section 11 68 13 PLAYGROUND EQUIPMENT, and Section 12 93 00 SITE FURNISHINGS.

3.1.1 Finished Grade and Underground Utilities

Submit finished grade, underground utilities, storm-drainage system and irrigation system status; and location of underground utilities and facilities. Verify that finished grades are as indicated; the smooth grading has been completed in accordance with Section 31 00 00 EARTHWORK; installation of the underground utilities through the area has been completed in accordance with Section 31 00 00 EARTHWORK; installation of the storm-drainage system through the area has been completed in accordance with Section 33 40 00 STORMWATER UTILITIES; and the installation of underground sprinklers through the area has been completed in accordance with Section 32 84 24 UNDERGROUND SPRINKLER SYSTEMS. The location of underground utilities and facilities in the area of the operation must be verified. Damage to underground utilities and facilities must be repaired at the Contractor's expense.

3.1.2 Layout

The layout of the entire use zone perimeter must be staked before excavation begins. The location of all elements must be staked to include the following: All play event configuration access and egress points; and use zone perimeters. The use zone is defined as the area beneath and immediately adjacent to a play structure or equipment that is designated for unrestricted circulation around equipment; and on whose surface it is predicted that a user would land when falling from or exiting the equipment. Also, the use zone is associated with the following terms; "Clear Area," and "Fall Zone". The use zone must be free of hard surfaces, objects or obstacles that a child could run into or fall on top of and be injured. Use zone perimeters must not overlap hard surfaces. The use zone perimeter must meet or exceed the requirements of paragraphs CHILD SAFETY and CHILD ACCESSIBILITY. Use zone perimeters must not overlap except for certain play events as defined in ASTM F1487.

3.1.3 Obstructions Below Ground

When obstructions below ground affect the work, shop drawings showing proposed adjustments must be provided.

3.1.4 Percolation Test

Submit a certified report of inspection, test method used and compliance with recognized test standard must be described. A test for percolation must be done to determine positive drainage, to include the lowest elevation of the subgrade in the areas containing the following: sand; gravel; wood by-products; or synthetic surfacing installed over a pervious base. A positive percolation must consist of a minimum 25 mm 1 inch per 3 hour period. When a negative percolation test occurs, a shop drawing must be provided to indicate the corrective measures.

3.1.5 Substitution

Under no circumstances are substitutions to be allowed or protective surfacing to be selected without written approval from the technical representative. Evaluate manufacturer substitutions for the critical height value with meeting the site conditions and paragraph FALL HEIGHT.

3.1.6 Subgrade

Correct subgrade irregularities to ensure the required depth of protective surfacing is provided. The subgrade elevation must be as required by the manufacturer.

3.1.7 Subsurface

Install the subsurface in a true, even plane, and sloped to provide positive drainage as indicated.

3.1.8 Subbase

Tolerance of the concrete or bituminous subbase must be within a maximum 6 mm in 3 m 1/4 inch in 10 feet. Tolerance of aggregate subbase must be within a maximum similar to 6 mm in 3 m 1/4 inch in 10 feet. Compact aggregate subbase to a maximum 95 percent, ASTM D1557. The compaction must be completed in accordance with Section 31 00 00 EARTHWORK. Sand, gravel, and wood products must not be installed over a concrete, aggregate, or bituminous subbase, in accordance with paragraph CHILD SAFETY.

3.1.9 Concrete or Bituminous Curing

Bituminous or concrete subbase must be cured [a minimum of 7 days] [in accordance with the manufacturer's requirements]. Curing compounds and other deleterious substances that adversely affect adhesion must be removed. Surface must be clean and dry.

3.1.10 Fall Height

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NOTE: To determine the required depth of protective surfacing, the fall height; maximum equipment height dimensions; and spot elevations for each play event must be shown on the drawings.

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3.1.10.1 General Requirements

The fall height is defined as the vertical distance between the finished elevation of the designated play surface and the finished elevation of the protective surfacing beneath it. For some play events the fall height and platform height are the same, while for other play events the fall height and maximum equipment height are the same, Section 11 68 13 PLAYGROUND EQUIPMENT. When the furnished play event fall height varies from the play event shown, shop drawings must be provided defining the revised depth or type of protective surfacing to meet or exceed the requirements of paragraphs CHILD SAFETY and CHILD ACCESSIBILITY.

3.1.10.2 Measuring Fall Height

EQUIPMENT	MEASURING FALL HEIGHT
Composite Equipment Structure	For a platform surrounded by protective barriers, measure from the platform finished elevation.
	For a platform surrounded by guardrails, measure from the guardrail top elevation.
Infant Crawl Area	A maximum 600 mm 24 inches height, measured from the crawl wall or barrier finished elevation.
Playhouse, Nonclimbable	Measure from the designated play surface finished elevation.
Spring Rocking Equipment	Measure from the seat top elevation.
Stationary Equipment, Climbable	Measure from the maximum equipment height finished elevation.
Stationary Equipment, Nonclimbable	Measure from the designated play surface finished elevation.
Swing	Measure from the bottom of the pivot point.

3.2 INSTALLING SYNTHETIC SURFACING SYSTEM

Surfacing edges must fully adhere to the subsurface. Fully cover the subsurface to ensure no hard surfaces are exposed through displacement of loose fill. Rolled or beveled containment curb or transition edges must maintain the full thickness required to meet paragraphs CHILD SAFETY and CHILD ACCESSIBILITY. Material must cover foundation and cutouts around elements penetrating the surface. Seams must be the minimum necessary and must be tight.

3.2.1 Temperature Limitation

Provide temperature limitations for applying adhesive.

3.2.2 Poured-in-Place System

Components of the poured-in-place system must be mixed mechanically on site in accordance with manufacturer's recommendations. Hand-mixing is prohibited. Installation of poured-in-place surfacing must be seamless and completely bonded to subsurface. Material must cover foundations and must be tight around elements penetrating the surface. Add a minimum 2 mm 1/16 inch depth to the required surfacing depth to ensure the full depth of material is installed to meet paragraph CHILD SAFETY.

3.2.2.1 Geotextile Fabric for Poured-In-Place

Install geotextile fabric over a compacted aggregate base as indicated. Fabric must cover the entire area and must be lapped a minimum 100 mm 4 inch width at the seams. Seams must be adhered in accordance with manufacturer's recommendations. The aggregate base must be free of ruts or protruding objects. The fabric must be installed smooth; and free of tensile stresses, folds, and wrinkles. The fabric must be protected from clogging, tears, or other damage. Damaged fabric must be repaired or

replaced as directed.

3.2.2.2 Poured-in-Place Substrate

The substrate layer of the poured-in-place system must be installed in one continuous pour on the same day. When a second pour is required, the edge of the previous work must be fully coated with polyurethane binder to ensure 100 percent bond with new work. Adhesive must be applied in small quantities so that new substrate can be placed before the adhesive dries.

3.2.2.3 Poured-in-Place Wear Surface

Wear surface must be bonded to substrate. Adhesive must be applied to substrate in small quantities so that wear surface can be applied before adhesive dries. Surface must be hand troweled to a smooth, even finish. When wear surface is composed of different color patterns, pour must be continuous and seamless. When seams are required due to color change or field conditions, the adjacent wear surface must be placed as soon as possible, before initial pour has cured. The edge of initial pour must be coated with adhesive and wear surface mixture must be immediately applied.

3.2.3 Tile System

Tile must be laid out to ensure that end cuts are equal. Tile must be installed in accordance with manufacturer's instructions. Hardware must be as recommended by the manufacturer. Tile must be bonded to the subsurface with an adhesive approved by the manufacturer. Cutouts must be filled with sealant according to manufacturer's instructions to eliminate voids at equipment. Sealant must be the minimum amount necessary, must not exceed a maximum 10 mm 3/8 inch width. Where excessive voids occur at cutouts, tile must be removed and refitted. The tile system must be installed throughout the play equipment use zone with the proper thickness.

3.2.4 Combination System

The combination system must consist of [modular impact attenuating substrate units, adhered to form a unified system], [shredded rubber tires over a gravel substrate] [_____]. The substrate must be covered with a wear surface as specified. Cutouts around equipment must be properly filled and sealed according to manufacturer's instructions to eliminate voids. Sealant must be the minimum amount necessary, must not exceed a maximum 10 mm 3/8 inch width. Where excessive voids occur at cutouts, the modular substrate must be removed and refitted. Construction methods must be employed to ensure full depth installation of specified surfacing material and the finished wear surface.

3.2.4.1 Geotextile Fabric

Geotextile fabric must be installed where a modular or shredded rubber substrate is installed over an aggregate base. It should be installed with poured-in-place wear surface or polyethylene plastic woven sheet wear surface installed over substrate. Fabric must cover the entire area to receive the tile system and must be lapped a minimum 100 mm 4 inch width at the seams. Seams must be adhered in accordance with manufacturer's recommendations.

3.2.4.2 Modular Substrate

Modular substrate must be laid out to minimize small end pieces. The

substrate must be installed in accordance with manufacturer's instructions.

3.2.4.3 Poured-in-Place Substrate

Same as paragraph POURED-IN-PLACE SYSTEM.

3.2.4.4 Synthetic Turf Wear Surface

Wear surface must be bonded to substrate with 100 percent solids polyurethane adhesive. Surface irregularities and wrinkles must be corrected. Seams must be secured in accordance with manufacturer's recommendations. Wear surface roll width must be as wide as practical for the installation.

3.2.4.5 Rubber Sheet Wear Surface

Wear surface must be bonded to substrate with 100 percent solids polyurethane adhesive. Surface irregularities and wrinkles must be corrected. Seams must be secured in accordance with manufacturer's recommendations. Wear surface roll width must be as wide as practical for the installation.

3.2.4.6 Poured-in-Place Wear Surface

Same as paragraph POURED-IN-PLACE SYSTEM.

3.2.4.7 Polyethylene Plastic Woven Sheet Wear Surface

Wear surface must be securely anchored to a perimeter containment material with hardware in accordance with the manufacturer's instructions. Hardware must be appropriate for the type of system and secured to eliminate protrusions.

3.3 LOOSE FILL SURFACING SYSTEM

Submit a minimum 0.003 cubic m 0.125 cubic foot sample.

3.3.1 Sand Surfacing System

Sand must be installed over a compacted subgrade at a minimum 450 mm 18 inches depth throughout the use zone. The finished elevation of sand must be determined after sand has been settled by saturating with water and percolating. The sand depth in high play activity areas must be as indicated. Sand must meet the requirements of paragraph CHILD SAFETY.

3.3.2 Gravel Surfacing System

Gravel must be installed over a compacted subgrade at a minimum 300 mm 12 inch depth throughout the use zone. The depth of gravel in high play activity areas must be as indicated. Gravel must meet the requirements of paragraph CHILD SAFETY.

3.3.3 Wood By-Product Surfacing System

Engineered wood fiber protective surfacing must be installed according to manufacturer's instructions. Wood products must meet the requirements of paragraph CHILD SAFETY.

3.3.3.1 Wood Mulch Surfacing System

Wood mulch must be installed over a compacted subgrade covered with geotextile fabric. Wood mulch must meet the requirements of paragraph CHILD SAFETY.

3.3.3.2 Engineered Wood Fiber Surfacing System

Engineered wood fiber protective surfacing must be installed according to manufacturer's instructions. The surfacing must meet the requirements of paragraphs CHILD SAFETY and CHILD ACCESSIBILITY.

3.3.3.3 Geotextile Fabric for Wood By-Product

Geotextile fabric must cover the entire area and must be lapped a minimum 100 mm 4 inch width at the seams. Seams must be adhered in accordance with manufacturer's recommendations. Folds, wrinkles, or loose fabric must be smoothed. Fabric must be protected from damage during wood product placement.

3.3.3.4 Minimum Depth for Wood By-Product

Wood by-product must be installed at a minimum 300 mm12 inch depth throughout the use zone. The depth of wood products in high play activity areas must be as indicated.

3.4 RESTORATION AND CLEAN UP

When the operation has been completed, clean up and protect the site. Existing areas that have been damaged from the operation must be restored to original condition at the Contractor's expense.

3.4.1 Clean Up

The site and play events must be cleaned of all materials associated with the operation. Play events and surfaces must be cleaned of dirt, stains, filings, and other blemishes occurring from shipment and installation. Cleaning methods and agents must be as recommended by the manufacturer.

3.4.2 Protection

The area must be protected as required or directed by providing barricades and signage. Signage must be in accordance with Section 10 14 00.10 EXTERIOR SIGNAGE.

3.4.3 Disposal of Materials

Excess and waste material must be removed and disposed of off Government property.

3.5 PROTECTIVE SURFACING ACCEPTANCE

Submit record of measurements and findings by the certified playground safety inspector. When the protective surfacing is installed, the play events and protective surfacing must be thoroughly inspected and measured to verify the playground meets manufacturer's recommendations, paragraphs CHILD SAFETY and CHILD ACCESSIBILITY, and paragraph FALL HEIGHT as follows: 1) secure anchoring; 2) all hardware and connectors are tight and below the wear surface; 3) sharp points, edges, and protrusions; 4)

entanglement; and 5) pinch, crush, and shear points.

a. Measure use zone distances to determine the area is free of hard surfaces, objects or obstacles. Determine exceptions to use zone overlaps occur in accordance with ASTM F1487. Measure play event fall height and compare to critical height value for the thickness of installed synthetic surfacing. Measure play event fall height and depth of loose fill protective surfacing.

b. Ensure installed chopped tire material is free from steel belts. Ensure the slide exit region has the required clear zone. Swing seat clearances are measured while occupied by a maximum user for the age group using the equipment.

c. The finished installation must have the appearance of a single covering. Protective surfacing that does not comply must be reinstalled. Hardware that does not comply must be replaced. Ensure positive drainage for the area and the lowest elevation of protective surfacing subgrade has been provided.

d. A written report describing the results of the evaluation must be provided.

3.6 RE-INSTALLATION

When re-installation is required, the following must be accomplished at no additional cost to the Government re-install the product as specified; provide new replacement materials supplied by the manufacturer; repair any damage caused by the failed installation.

-- End of Section --