Abstract: A modular surfacing mat that includes a base mat, a top mat secured to the base mat with an adhesive, and a top coat applied to the top of the top mat to form a protective finish. The top coat may be any coating that provides a protective top finish on the mat, and is preferably a polyurea or polyurethane. The top coat may include a colorant. The top mat is preferably at least partially made from rubber. For example, recycled rubber may be used. The adhesive that bonds the top mat to the base mat is preferably a polyurethane or a polyurea. The base mat is preferably made from a cellular foam structure. For example, cellular foam structure may be closed cell polyethylene foam nuggets fused together in a crosslinked matrix.
MODULAR SURFACING SYSTEM

Cross Reference to Related Applications

This application claims the benefit of U.S. Provisional Application No. 60/693,240, filed June 22, 2005, and U.S. Provisional Application No. 60/724,555, filed October 6, 2005, the contents of both of which are incorporated herein by reference.

DESCRIPTION OF THE INVENTION

Field of the Invention

The present invention relates generally to surfacing systems, and more particularly to a modular surfacing system for use in recreational, institutional and other applications.

Background of the Invention

Many factors are taken into consideration when selecting flooring and surfacing products for use in recreational and institutional settings. Such factors may include cost, ease of installation, durability, and aesthetics. In addition, safety and handicap accessibility are also often considered. Conventional flooring and surfacing systems are often exhibit poor characteristics with regard to at least one of these factors.

In playground and recreational settings, most injuries occur when people fall from playground equipment from a height of 3 to 10 feet onto the ground. To reduce the severity of these injuries, the U.S. Consumer Products Safety Commission (CPSC) has issued guidelines that playground safety surfacing must meet in order to be designated as an approved safety surface. The American Society for Testing and Materials (ASTM) has interpreted guidelines issued by the CPSC into standardized testing procedures in order to determine if a safety surface meets the CPSC requirements. One such standard is ASTM F1292-04 - Standard Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment. Critical Fall Height or Head Impact Criteria (HIC) is the ability of a surface to absorb and dissipate the force created when falling from a specified
height in order to protect from life threatening head injuries. The areas in and around playground equipment must be able to provide adequate impact attenuation from the highest point of the playground equipment. Currently, in the U.S., that is measured from the highest platform. In Canada, falls are measured from a specified measurement over the guard railing.

Conventional surfacing systems often vary the thickness of the surfacing to meet different ASTM safety standards, specifically standards for safe fall height like ASTM F1292. However, fall height requirements for some areas such as playgrounds vary across the area. For example, fall height requirements for an area around a swing may be greater than fall height requirements around playground equipment that is lower to the ground. As such, when choosing a playground surface, it is often necessary to select a surfacing that will meet the highest fall height requirement for the entire playground because surfaces that meet different requirements have different thicknesses. This increases the cost of installing such a surface because thicker surfaces are generally more costly than thinner surfaces.

One of the least expensive methods for surfacing ground under playground equipment is known as "engineered wood fiber," or "EWF." An engineered wood fiber surface traditionally is comprised of specialty shredded virgin wood or recycled pallets, wood chips or other cushioning materials scattered like mulch on the ground under the playground equipment. Unfortunately, engineered wood fiber can shift and become uneven due to weather and or kick-out by children, providing less protection in one spot than in another spot. If a person was to fall onto a less-protected spot, they could suffer injuries that would have been avoided had the engineered wood fiber been more evenly distributed.

Another problem with some engineered wood fiber is that areas protected by engineered wood fiber are rarely wheelchair accessible. The ASTM has promulgated a wheelchair accessibility standard known as F1951, and entitled "Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment..."
Document Number," that playgrounds that are protected only by engineered wood fiber are not likely to meet. In 1990, Congress passed the Americans with Disabilities Act commonly referred to as the ADA. The US Access Board has worked with outside agencies to determine guidelines for surface accessibilities. As the government becomes more aggressive in enforcing standards for handicap accessibility, the likelihood increases that engineered wood fiber will be targeted as failing to meet minimal standards.

Another method for surfacing ground under playground equipment is known as "loose fill." Loose fill is similar to engineered wood fiber in that it is scattered on the ground under the playground equipment, but loose fill is traditionally made of rubber chips or other cushioning material. Some loose fill is made of shredded tires or other recycled materials. Like engineered wood fiber, loose fill can shift and become uneven, providing less protection in one spot than in another spot. Loose fill is also unlikely to meet the ASTM standard F1951. Consequently, playgrounds covered with loose fill are unlikely to be certified as wheelchair accessible.

A third prevalent method for surfacing ground under playground equipment is called unitary surfacing, such as a rubber mat or a "pour-in-place" surface (described below). Many commercially-available rubber mats are adequate to protect children from falls of 3 to 6 feet. Rubber mats may be purchased as separate interlocking pieces of rubber mat. For example, rubber mats are available in 2-ft by 2ft, 3-ft by 3-ft, or 3-ft by 4-ft, sections that can be locked together.

Rubber mats, however, can be very heavy to ship. To cover an entire playground, a very large number of separate interlocking pieces may be needed, and each piece may be required have a thickness adequate to protect children from at least a moderate fall. Also, rubber mats can be very expensive and can be easily vandalized. Due to the cost and the weight, rubber mats are not appropriate for all playgrounds.
"Pour-in-place," surfaces are more common than rubber mats. A pour-in-place surface is a unitary surface that is manufactured on the playground itself. First, a shock-absorbing material such as fine rubber crumbs, small rubber chunks, and/or rubber slivers are dumped into a mixer that is similar to a portable cement mixer. This mixture may be, for example, shredded recycled tires. A suitable liquid that subsequently can form a polymer upon exposure to moisture in the air, such as a polyurethane, is then poured into the mixer and mixed with the shock absorbing material to create a slurry. The slurry subsequently is transported, generally in a wheelbarrow or in several buckets, to a site that is to be protected. Laborers then trowel the slurry over the site and allow the slurry to set for at least a day. A guard might be posted to prevent children from playing on the surface during the day that is necessary for the slurry to set. Later, a second slurry composed of colored rubber particles in the same polymeric liquid precursor is poured and troweled over the previously prepared site to form a finished consolidated colored rubber surface.

The pour-in-place method is very labor intensive. Covering a typical 2000 square-foot playground may require three laborers two full work days to install. If the liquid precursor polyurethane is not mixed thoroughly enough with the fine rubber crumbs, the entire surface might have to be torn up and the site resurfaced so that the fine rubber crumbs can be distributed or mixed more evenly. Up to thirty percent of all pour-in-place surfaces fail during the first year, primarily due to improper temperature and humidity conditions.

Pour-in-place surfaces are typically porous, allowing water and environmental wastes to seep into cracks and pores, possibly lowering the Head Impact Criteria within a short time. These porous surfaces can act like a giant filter, trapping dirt, pollen and waste.
SUMMARY OF THE INVENTION

In view of the foregoing, the present invention provides modular surfacing mats and a modular surfacing system that is applicable for use useable outdoors (e.g., on playgrounds) as well as indoors (e.g., for institutional settings such as nursing homes).

According to one embodiment, the invention provides a modular surfacing mat that includes a base mat or shock absorbing mat, a top mat secured to the base mat with an adhesive, and a top coat applied to the top of the top mat to form a protective finish. The top coat may be any coating that provides a protective top finish on the mat, and is preferably a polyurea or polyurethane. The top coat may include a colorant. The top mat is preferably at least partially made from rubber. For example, recycled rubber may be used. The adhesive that bonds the top mat to the base mat is preferably a polyurethane or a polyurea, but any adhesive may be used. The base mat is preferably made from a closed cell foam. For example, the closed cell foam may be closed cell polyethylene foam nuggets fused together in a crosslinked matrix. The closed cell foam may also be made of expanded polypropylene, expanded polyethylene, or expanded polystyrene.

According to another embodiment of the invention, one or more modular surfacing mats may be combined to form a modular surfacing system. Preferably, the base mat and top mat of each modular mat have substantially symmetric horizontal cross sections and three or more sides. Each of these may be straight or have tab and slot features of interlocking two or more mats together. Straight side mats allow for easier customization by the end user, while mats with slot and tab features allow for improved locking of a plurality of mats together. The slot and tab features may be of any shape that allows for mats to interlock, such as mortise and tenon, dovetail, or generally shaped like a puzzle piece.

According to still another embodiment of the invention, a modular surfacing system may include two or more modular surfacing mats that include a first group of modular
surfacing mats and a second group of modular surfacing mats. The first group of modular surfacing mats has a base mat with a first density of closed cell foam and the second group of modular surfacing mats has a base mat with a second density of closed cell foam. The first and second groups of modular surfacing mats have the substantially the same thicknesses. In this way, mats of differing densities, and as such different fall height characteristics, may be used on the same playground as they have the same thickness.

According to other aspects of the invention, an adhesive sealant may also be used to bond one or more base mats to a substrate that underlies the modular surfacing mats. Examples of substrates include concrete, cement, asphalt, crushed limestone, tile, linoleum, wood, and existing pour-in-place surfaces.

According to another aspect of the invention, the modular surfacing mats may configured as a multi-layer arrangement having a plurality of layers, each of the plurality of layers being at least one of a base mat and a top mat with an adhesive as both the topcoat and adhesive between the layers.

According to another aspect of the invention, the modular surfacing mats may be configured with a plurality of layers that include a first seam having a first direction and a second seam having a second direction, the first seam having a relationship to the second seam, the relationship being one of substantially parallel, substantially perpendicular, and substantially diagonal. In addition, the first layer may overlap the second layer.

It is to be understood that the descriptions of this invention herein are exemplary and explanatory only and are not restrictive of the invention as claimed.

**BRIEF DESCRIPTION OF THE DRAWINGS**

Figure 1 is a vertical cross-sectional view of a modular surfacing mat in accordance with one embodiment of the invention.
Figure 2 is a vertical cross-sectional view of a modular surfacing mat with a carpeted top mat in accordance with one embodiment of the invention.

Figure 3 is a vertical cross-sectional view of a modular surfacing mat with an artificial turf top mat in accordance with one embodiment of the invention.

Figure 4 shows examples of shapes of modular surfacing mats according to various aspects of the invention.

Figure 5 shows vertical cross-sectional views of modular surfacing mats with differing base mat densities in accordance with one embodiment of the invention.

Figure 6 shows the arrangement of modular surfacing mats in a modular surfacing system according to one embodiment of the invention.

Figure 7 shows a vertical cross-section of a multiple layer mat according to one embodiment of the invention.

**DESCRIPTION OF THE EMBODIMENTS**

Reference will now be made in detail to the present exemplary embodiments of the invention, examples of which are illustrated in the accompanying drawings.

In accordance with various embodiments of the present invention, a surfacing systems, and more particularly, a modular surfacing system for use in recreational, institutional and other applications is described.

Figure 1 is a vertical cross-sectional view of a modular surfacing mat in accordance with one embodiment of the invention. Modular surfacing mat 100 includes a base mat 101, an adhesive 102, a top mat 103, and a top coat 104. The top mat is bonded to the base mat with adhesive 102. Top coat 104 provides a protective finish to top mat 103.

Base mat 101 is preferably made from a cellular foam structure. Cellular foam structures may be formed from various densities of expanded polymers including polyethylene, polypropylene, poly(ethylene-co-propylene), and other expanded polymers.
such as polystyrene, crosslinked polyurethanes, thermoplastic elastomers, etc. Preferably, the base mat is formed from a closed cell foam structure. Closed cell foam is a cellular foam structure material that includes millions of tiny, air-filled bubbles or closed cells, which contribute to its cushioning characteristics. For example, the closed cell foam utilized may be formed from closed cell polyethylene foam nuggets fused together in a crosslinked matrix. In addition, the base mat may be formed from a plurality of recycled closed cell polyethylene foam nuggets. The mat also may contain other recycled materials comprised of polyurethanes, linear rubbers, vulcanized rubbers, EPDM rubbers (both linear and crosslinked), polymers used in the automotive industry or other deformable materials or combinations thereof permanently fused together in a crosslinked matrix. Depending on their original source, these recycled materials may or may not exist in a foamed state. The base mat is therefore shock and impact absorbent, capable of helping prevent injury by absorbing shock and dissipating the G-forces associated with a fall and impact.

Alternatively the base mat may be formed from crosslinked rubber particles such as natural rubber, styrene butadiene rubber, or EPDM (Ethylene Propylene Diene Rubber). This material is manufactured to a crumb like consistency in a variety of colors. In these cases, the rubber may be either linear or crosslinked. Closed cell foams are made when poly resins are combined with other ingredients and extruded pellets expand to become consistently shaped beads of expanded foam. Closed cell structure foams provide sufficient protection to prevent or minimize the effects of physical abuse, corrosion, temperature extremes, chemical attack, aging, and other adverse conditions. Its softness, resilience, impact strength, anti-abrasion, and strain recovery characteristics make it ideal for continued impact protection even after repeated impacts.
Any thickness of base mat may be used, but preferably has a thickness between substantially 50mm (2”) and substantially 12mm (1/2”), depending on the required fall height of the project.

Top mat 103 is preferably made at least partially from rubber, and most preferably from recycled rubber. For example, the top mat may be manufactured from recycled rubber, primarily scrap tires that are ground up to produce a crumb rubber material that is consolidated into a solid surfacing. Other types of top mats such as PVC, carpeting, and synthetic turf (e.g., Astro Turf) may also be used. Any thickness of top mat may be used, but it is preferably 12 mm (1/2”) thick.

An adhesive 102 is used to secure top mat 103 to base mat 101. Preferably, adhesive 102 is a polyurethane or polyurea. However, any adhesive capable of bonding top mat 103 to base mat 102 may be used.

Top coat 104 may be any material that provides a protective and/or decorative finish to top mat 104. Preferably, top coat 104 is a polyurethane or polyurea. Polyurethane (which may be water-based) or polyurea top coats form very wear-resistant barriers and may be water-resistant such that water or environmental wastes do not penetrate. Alternatively, the top-layer coating may be applied in such a manner that water and environmental wastes are allowed to drain through the surface. The polyurethane or polyurea coating can be cut, for example, with a circular saw, so if there were somehow some damage to a portion of the modular surfacing system, the damage could be cut out and replaced with another section of like material. In accordance with the first embodiment of the present invention, the topcoat sealant (which may be an adhesive sealant) provides a colorful protective barrier against at least one of: deterioration due to moisture, weathering, UV degradation, and normal wear and tear. The topcoat sealant also has pigments that produce a variety of colors in the adhesive
sealant. If desired, a logo or other design may be painted onto the top mat before the topcoat sealant coating is applied, and will be visible after the topcoat sealant coating cures.

The polyurea or polyurethane top coat can be applied at room temperature, with a brush, roller, or sprayer, and cures in approximately 45 minutes. If desired, the polyurea, polyurethane, or other sealant can be applied at ambient or an elevated temperature by either spraying, rolling (with a roller), brushing or squeegeeing, and bonds the two surfaces together and produces a durable top coat. The sealant adhesive used between the various layers of the modular surfacing system may or may not be a polyurea or polyurethane. The polyurea used as a topcoat may be an aromatic polyurea, an aliphatic polyurea, an aromatic aliphatic polyurea, a polyurea containing cycloaliphatic structures or combinations thereof. When used as an adhesive between the various layers of the modular surfacing system, the polyurea may or may not be the same chemical composition as the polyurea used in the topcoat. The compositions of polyurea may be varied widely from diverse groups of monomeric reactants to produce topcoat surface property characteristics tailored to particular end use requirements such as hardness, stiffness, softness/resiliency/elasticity, anti-skid, abrasion resistance, chemical resistance, and gloss/matte appearance.

Top coat 104 may also contain one or more pigments or colorants to add color to the modular surfacing mat. Top coat 104 may also be applied in different manners to provide for different textures (e.g., smooth or rough texture). In some situations, top mat 103 may already have a protective finish, and as such, an additional top coat may not be needed. In addition, some top mats may not be suited for application of an additional top coat. Figures 2 and 3 show examples of modular surfacing mats that do not need a top coat.

Figure 2 is a vertical cross-sectional view of a modular surfacing mat with a carpeted top mat in accordance with one embodiment of the invention. Modular surfacing mat 200 includes a base mat 101 and an adhesive 102 as described above with reference to Figure 1.
However, rather than the top mat shown in Figure 1, modular surfacing mat 200 includes a carpet layer 203. Carpet layer 203 may be any type of carpeting material. This embodiment is preferably used in indoor settings, but may also be used in outdoor settings.

Figure 3 is a vertical cross-sectional view of a modular surfacing mat with an artificial turf top mat in accordance with one embodiment of the invention. Modular surfacing mat 300 includes a base mat 101 and an adhesive 102 as described above with reference to Figure 1. However, rather than the top mat shown in Figure 1, modular surfacing mat 300 includes an artificial turf layer 303. Artificial turf layer 303 may be any type of artificial turf. This embodiment is suitable for both indoor and outdoor use.

As shown in each of Figures 1 through 3 each base mat and top mat have substantially symmetric horizontal cross sections. In this way, multiple modular surfacing mats may be installed next to each other to create a continuous surface. The modular surface mats of Figures 1 through may be constructed in any shape that allows for multiple mats to be installed together to form a substantially continuous surface.

Figure 4 shows examples of shapes of modular surfacing mats according to various aspects of the invention. Modular surface mats 400 are shown to be in a square shape, however any polygonal shape may be used. By constructing the modular surface mats in a square shape, the end user has the flexibility to install the mats in any configuration by cutting the mats to shape. Modular surface mats 401, 408, and 409 are shown in shapes with interlocking tabs and slots. Modular surfacing mat 401 has generally "puzzle-shaped" slots 402 and tabs 403. Modular surfacing mat 408 has generally square-shaped slots 404 and tabs 405. Modular surfacing mat 409 has dovetail-shaped slots 406 and tabs 47. The shapes the surfacing mats show in Figure 4 are exemplary only. Any shape that allows for the mats to be placed next to each other to form a substantially continuous surface may be used.
Figure 5 shows vertical cross-sectional views of modular surfacing mats with differing base mat densities in accordance with one embodiment of the invention. As shown in Figure 5, modular surfacing mats 100a and 100b have substantially the same thickness of 1” to 2.1/4”. However, as can be seen in the exaggerated view of base mats 101a and 101b, the closed cell foam is formed with different densities. By using different densities of foam in the base mat while maintaining the same thickness, modular surfacing mats meet different fall height densities may be created. The foam density is controlled by the amount of foam beads contained within the tool or form when creating the foam. The more beads forced into the tools, the harder or stiffer (and more dense) the final product will be. By having modular surfacing mats with different fall height ratings yet the same thickness, an end user may efficiently install the higher fall-rated (and often more expensive) high density foam mats (e.g., 101a) in places where needed and/or required. For example, in playground settings, the fall height rating of surfaces surrounding certain playground equipment is mandated by state and/or local government. In general, the taller the piece of playground equipment, the higher the fall rating of surfaces that surround the equipment.

Multiple modular surfacing mats, with or without different densities of base mats and different fall height ratings, may be combined to form a modular surfacing system. Figure 6 shows the arrangement of modular surfacing mats in a modular surfacing system according to one embodiment of the invention. In the embodiment shown in Figure 6, modular surfacing mats with different densities are shown in a playground setting forming a modular surfacing system 600. Crosshatched modular surfacing mats 101a are installed within a predetermined circle around playground equipment 601. Modular surfacing mats 101b are used outside this circle. Referring back to Figure 5, modular surfacing mats 101a have a higher density base mat than modular surfacing mats 101b, and thus a higher fall height rating. Additional levels
of base mat density (and thus fall height rating) could be used for installations where two or more fall height ratings regions are needed.

Figure 7 shows a vertical cross-section of a multiple layer mat according to one embodiment of the invention. As shown in Figure 7, modular surfacing mat 700 may include two base mats 101 and two top mats 103. Each layer is secured to the next with adhesive 102, and a top coat 104 is applied to the top. It should be noted that each base mat and top mat may be comprised of different materials to carry out different functions. For example, modular surfacing mat 700 may utilize a base mat that is useful to prevent water accumulation, a first top mat that is useful to absorb shock and impact, and an additional top mat that has thermally dissipative properties that allow children to play barefoot regardless of the heat or cold of the ground. As such, when using a multiple layer modular surfacing mat, each layer may have desirable properties and is also sufficiently light-weight to be carried easily to the site.

*Installation*

When a modular surfacing mat or system is desired at a site, such as a playground, modular surfacing mats (or their individual components) are carried to the site. The modular surfacing mats may be pre-constructed or may be assembled on site. The site may already have a covering, such as concrete, cement, asphalt, crushed limestone, tile, or linoleum. Such a covering may be regarded as a substrate on which the modular surfacing system is constructed.

If desired, the base mat is adhered to the substrate. In many situations, adhering the base mat to the substrate can be effective to prevent the base mat from slipping out of position. If desired, the base mat is secured to the substrate by either bonding with an adhesive sealant or with anchors.
On the other hand, if the modular surfacing system is to be used in-doors, then adhering the base mat to a substrate may not be necessary. For example, in a nursing home or daycare center, adhering the base mat to the substrate may be unnecessary.

If it is desired that the base mat be adhered to the substrate, then an adhesive sealant may be used. The adhesive sealant is, for example, polyurethane. The adhesive sealant may cover the entire surface between the substrate and the base mat, or may be used in spots, or may be used only on the periphery. A determination of how the adhesive sealant can best be used to adhere the base mat to the substrate should consider environmental conditions that the base mat may encounter. The adhesive sealant also may be selected from the group consisting of pressure sensitive adhesives, adhesives specially designed for the base mat and particular substrate involved, or commercially available adhesives.

Another reason for adhering the base mat to the substrate is to help protect the substrate or the base mat from becoming slippery and hard due to freezing water. The modular surfacing system may be constructed to divert rainwater to a periphery of the modular surfacing system, and adhering the base mat to the substrate may be useful to prevent water from accumulating under the base mat. The base mat can be easily trimmed and fitted using either a knife, hand saw or reciprocating saw.

Once the base mat has been placed into position, regardless of whether it has been adhered to the substrate, the top mat may be placed on the base mat. The top mat is also easily transportable to the site on which the modular surfacing system is desired to be assembled. Because the modular surfacing system is comprised of layers, each layer may be easily carried to the site by one or two laborers, without the weight considerations that might be prohibitive if a single rubber mat were to be used. Also, because the top mat need not be composed of the same material as the base mat, mats may be chosen from different suppliers.
The top mat typically is shipped in a roll (for situations where modular surfacing mats
are not preconstructed) and is secured over the base mat using an adhesive (e.g., polyurea,
polyurethane coating other commercially available adhesives). The top mat, like the base
mat, can easily trimmed by using either a knife, hand or reciprocating saw. Once the top mat
is installed and secured to the base mat, a top coat is applied to bond all materials together.

It will be recalled that an adhesive may be used to adhere the base mat to the
substrate. Additionally, an adhesive may be placed, if at all, at the periphery of each modular
surfacing mat. Also, a top surface of a top mat is covered with a top coat (which may be a
sealant). Any of these adhesives and top coats may be identical to any of the other adhesives
and top coats, or a variety of adhesive and top coats (some adhesive, some not) may be used.
The top coat that is used to cover the top surface of the top mat need not be adhesive, since
no further mats are to be placed on the top surface of the top mat. Any or all of these
adhesives and/or top coats may be polyurea. If desired, polyurea need not be present in the
modular surfacing system. The top coat provides several advantages including wheelchair
accessibility.

Because the modular surfacing system is comprised of layers, each layer being a mat,
the modular surfacing system can be both customized and transported easily. The modular
surfacing system can be customized easily, since additional mats can be added. For example,
under gymnastics equipment, where athletes may fall while in awkward body positions or
with additional velocity, additional layers of mats can be added to exceed mandated and/or
recommended safety margins by any desired margin.

When multiple mats are used, the mats may be stacked and overlapped. The mats
may also be placed along side one another to form a layer (i.e., a first layer), and then other
mats are stacked on top of the first layer to form an additional layer. When the mats are
placed along side one another, a first seam may exist between adjacent mats within the first
layer. The additional layer may have a second seam that is parallel, perpendicular, or diagonal with respect to the first seam (i.e., the seam of the first layer).

*Detailed Installation*

**INSTALLING THE BASE MAT**

In this installation description, the base mats are assumed to be of an interlocking design, which does not need to be glued together. Before installation of the base mat, the sub-base (substrate) should be compacted and smooth. The sub-base should be without ridges, rolls, or depressions, as the base mats are of uniform thickness.

To start, snap a chalk line around the perimeter of the installation area (e.g., a playground), making sure it is square. Start installing the base mats from a square corner of the playground, interlocking them together. Use a fine hand saw to cut any straight lines, and a keyhole or drywall saw for fitting the mat around the equipment. Use some of the waste material to completely fill in any gaps.

**INSTALLING THE TOP MAT**

The top mat is installed much like you would the base mat, interlocking them together, cutting and fitting around the equipment. If using a utility knife to cut the top mat, it is recommended that you change blades often to ensure a clean cut.

To Begin:

Measure in two feet from the edge of the playground and snap a chalk line. This is your starting point for the top mat. Next apply the adhesive directly to the base mat, coating the entire surface for a first row of top mats. Use a squeegee or a trowel to spread the adhesive to a consistency of approximately 1/32 of an inch thick and about wide enough to cover the over the edge-line of the first row of top mats. Install your first row of the top mats making sure it is square along the chalk line. Next, apply adhesive on the base mat for the next row. Avoid getting the adhesive on the surface of the top mats.
JOINING THE TOP MAT AND SEAMS

A bad seam will not effect the impact attenuation or the accessibility of the surface, but a bad seam can affect the appearance of the final product. The Top Coat will assist in hiding some bad seams, but attention to this step will produce an "invisible" seam. Avoid getting the adhesive on the surface of the top mats. Interlock and install the second mat so the seam is flush. Do not apply adhesive to the edges of the top mat as this will result in visible seams.

Continue this pattern, cutting and fitting the top mat around the playground equipment. Try to avoid gaps, but they can be filled with a mixture of fine loose top mat and adhesive. Smooth out all patches with a putty knife or other trowel.

CUTTING THE TOP MAT

The top mat can be cut with either a utility knife or 6" Aviation snips.

It is recommended that the utility knife have a titanium blade for easier cutting and longer blade life. For each cut, snap a chalk line first to ensure a straight cut. Be sure to change blades often to keep a neat and clean cut.

Install beveled edges as required. If needed only at the approach, you may use a reciprocating saw with fine blade to cut the top and base mats at the angle needed, then glue a top mat onto the angle, overlapping the base mat, making sure enough adhesive is used to adhere the angled top mat. If the playground has curbs, be sure to glue the top mat to the curbs for a tight seal.

APPLYING THE TOP COAT

Next, the top coat is applied. For example, the top coat may be a two-party polyurea such as TuffShell™ Topcoat sealant available from SafeStructure LLC of Solon, OH.

TuffShell™ Topcoat sealant is a two-part, technically advanced polymer coating designed to add color, UV resistance, and extra durability to your playground surface. It is extremely
durable, is applied at ambient temperatures, and is resistant to most water- and petroleum-based chemicals.

For best results, the surface temperatures of the playground should be above 50°F, and below 130° F. Surfaces must be completely dry, free of moisture, no bubbles, and clean of any debris.

Using a 3/8" hand drill with a large mixer head, mix the color material with Part "B" for at least 3 minutes. Mix Part "B" with Part "A" (four gallons). Use the larger mixer to blend materials for at least 3-4 minutes, occasionally scraping sides and bottom with the mixer to ensure complete blending of products. Blending is complete when you do not see any streaks in the material. The total of Part "A" and Part "B" produces the five-gallons of the polymeric top coating, which is now ready to use.

Work time of TuffShell Top Coat is about 40 minutes. You and your equipment must be ready to apply this material quickly.

Using a disposable 3" paintbrush cut-in the surface around the edges and playground equipment. Beginning at the farthest from your exit point, pour a workable amount of the Top Coat Sealant into a tray, or dip roller into bucket. Using the 18" roller with at least a ½ " nap, outfitted with an extension handle, spread a thin coat of the top coating evenly, working the coating into the surface with a cross hatch pattern. For the first thin coat, application rate should be approximately 800 sq. ft. per 5 gallons. With the second heavier coat, application rate should be approximately 400 sq. ft. per 5 gallons.

Apply a second heavier coat of the top coating evenly, leaving the coating on the surface with a Crosshatch pattern. Protect the surface from intrusion during the drying time until tack free. The TuffShell Top Coat Sealant is humidity sensitive and therefore cure times vary with locale, time of day and time of year. Although play could resume after two to four
hours, we recommend considering the weather conditions, and that heavier applications could prolong the drying time 12- to 24-hours.

As will be appreciated, the modular surfacing system may also be used in manufacturing facilities or other locations where heavy fragile items or people are in danger of falling or colliding, such as flooring under baggage handling areas, parcel handling areas, movie theater aisles, and sidewalks. The modular surfacing system may also be installed vertically, such as on a baseball diamond outfield back wall.

Other embodiments of the invention will be apparent to those skilled in the art from consideration of the specification and embodiments disclosed herein. Thus, the specification and examples are exemplary only, with the true scope and spirit of the invention set forth in the following claims and legal equivalents thereof.
WHAT IS CLAIMED IS:

1. A modular surfacing mat comprising:
   a base mat;
   a top mat secured to the base mat with an adhesive; and
   a top coat applied to the top of the top mat to form a protective finish.

2. The modular surfacing mat of claim 1 wherein the top coat includes a colorant.

3. The modular surfacing mat of claim 1 wherein the top coat is a polyurethane.

4. The modular surfacing mat of claim 1 wherein the top coat is a polyurea.

5. The modular surfacing mat of claim 1 wherein the top mat is at least partially made of rubber.

6. The modular surfacing mat of claim 5 wherein the rubber is recycled rubber.

7. The modular surfacing mat of claim 1 wherein the adhesive is a polyurethane.

8. The modular surfacing mat of claim 1 wherein the adhesive is a polyurea.

9. The modular surfacing mat of claim 1 wherein the base mat is a closed cell foam mat.

10. The modular surfacing mat of claim 9 wherein the closed cell foam mat is formed from closed cell polyethylene foam nuggets fused together in a crosslinked matrix.

11. The modular surfacing mat of claim 1 wherein the base mat and top mat have substantially symmetric horizontal cross sections.

12. The modular surfacing mat of claim 1 wherein the base mat and top mat have three or more sides.
13. The modular surfacing mat of 12 wherein the three or more sides of the base mat and top mat include tab and slot features of interlocking two or more mats together.

14. A modular surfacing system comprising:
   two or more modular surfacing mats comprising:
   a base mat;
   a top mat secured to the base mat with an adhesive; and
   a top coat applied to the top of the top mat to form a protective finish,
wherein each base mat and top mat has three or more sides.

15. The modular surfacing system of claim 14 wherein the three or more sides of each base mat and top mat include tab and slot features of interlocking two or more mats together.

16. The modular surfacing system of claim 14 wherein each base mat and top mat has substantially symmetric horizontal cross sections.

17. The modular surfacing system of claim 14 wherein the top coat includes a colorant.

18. The modular surfacing system of claim 14 wherein the top coat is a polyurethane.

19. The modular surfacing system of claim 14 wherein the top coat is a polyurea.

20. The modular surfacing system of claim 14 wherein the top mat is at least partially made of rubber.

21. The modular surfacing system of claim 20 wherein the rubber is recycled rubber.

22. The modular surfacing system of claim 14 wherein the adhesive is a polyurethane.
23. The modular surfacing system of claim 14 wherein the adhesive is a polyurea.

24. The modular surfacing system of claim 14 wherein the base mat is a closed cell foam mat.

25. The modular surfacing system of claim 24 wherein the closed cell foam mat is formed from closed cell polyethylene foam nuggets fused together in a crosslinked matrix.

26. The modular surfacing system of claim 24 wherein the two or more modular surfacing mats include a first group of modular surfacing mats and a second group of modular surfacing mats, wherein the first group of modular surfacing mats have a base mat with a first density of closed cell foam and the second group of modular surfacing mats have a base mat with a second density of closed cell foam.

27. The modular surfacing system of claim 26 wherein the first density is greater than the second density, whereby the first group of modular surfacing mats meet a higher fall height safety standard than the second group of modular surfacing mats.

28. The modular surfacing system of claim 22 wherein the first and second group of modular surfacing mats have substantially the same thickness.
Figure 2
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

INV. E01C13/04  E01C5/20  B32B7/00  E04F15/10  E04F15/02

According to International Patent Classification (IPC) or to both national classification and IPC.

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
EOIC  B32B  E04F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
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<th>Category</th>
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<th>Relevant to claim No</th>
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<td>X</td>
<td>US 5 085 424 A (WOOD JR SIDNEY B [US]) 4 February 1992 (1992-02-04)</td>
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<tr>
<td>Y</td>
<td>GB 2 000 726 A (FREUDENBERG C) 17 January 1979 (1979-01-17) page 1, lines 27-130 figures 1,2</td>
<td>10,11, 13,15,25</td>
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X  Further documents are listed in the continuation of Box C

X  See patent family annex

Special categories of cited documents:

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'P' document published prior to the International filing date but later than the priority date claimed

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Date of the actual completion of the international search

13 November 2006

Date of mailing of the international search report

20/11/2006

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Fax (+31-70) 340-3016

Authorized officer
Kerouach, May
<table>
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<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
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<tbody>
<tr>
<td>A</td>
<td>WO 03/000994 A (BOWERS FRANK [MT]) 3 January 2003 (2003-01-03) page 10, line 25 - page 11, line 5 figures 3b, 3c</td>
<td>26-28</td>
</tr>
<tr>
<td>Patent document cited in search report</td>
<td>Publication date</td>
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<tr>
<td>US 5085424 A</td>
<td>04-02-1992</td>
<td>NONE</td>
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<tr>
<td>GB 2000726 A</td>
<td>17-01-1979</td>
<td>CA 1068527 A1</td>
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<td>DE 7720993 U1</td>
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<td>FR 2397132 A7</td>
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<td>IT 1105311 B</td>
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<td>US 4172168 A</td>
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<tr>
<td>WO 03000994 A</td>
<td>03-01-2003</td>
<td>NONE</td>
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