Under the Swings

Every bit as important as the play equipment itself is the surfacing under and around it

BY CHERYL CORSON

We still call school playground time "recess," an industrial-age term defined as a "temporary cessation of customary activities." But for kids, free play is not time off. It is how crucial emotional, social, cognitive, and physical development occurs.

On the playground, as opposed to the sports field, children independently evaluate and choose physical challenges to undertake. It is the adults' job to provide a physical setting that offers children a range of opportunities to take risks and keeps them safe through good design, supervision, and maintenance.

Alone and in groups, the kids will do the rest.

Does this mean that playgrounds will be accident free? Unfortunately, no. In 1999, according to the National Program for Playground Safety, just over 70,000 children were injured on public play equipment in U.S. schools. Between 1990 and 2000, the U.S. Consumer Product Safety Commission (CPSC) received reports of 44 deaths of children under the age of 15 in public school and park playgrounds.

Statistics show that falls to the surface make up 68 percent of all playground accidents and are the most common cause of injury. Accordingly, surfacing is a major concern in playground design and maintenance—and an area of vigorous ongoing research and development. The era of school grounds that are completely paved over is coming to a close.

EVOLUTION OF THE PLAYGROUND

School grounds weren't always smothered in asphalt and concrete, of course. They got that way largely in the 1950s and 60s when school desegregation was accomplished through bussing. In the search for adequate space for bus turnarounds, pickups, and drop-offs, school grounds were often sacrificed by necessity. Decades later, classroom shortages saw these paved spaces appropriated for temporary classrooms.

As school renovation and construction surged in the 1990s, designers began planning school grounds that took into account current knowledge of child development, the mandate for accessible facilities, and new playground safety standards.

At the Siskin Children's Institute in Chattanooga, Tenn., accessible playground surfacing includes poured-in-place rubber, turf, engineered wood fiber mulch, and concrete paths, maximizing this playground's usefulness for children of all abilities.

Environmental awareness became another factor in playground design. New products using recycled materials—rubber-modified asphalt, wood-polymer lumber, engineered wood fiber, and recycled rubber mulch, for example—have become readily available and increasingly cost-effective and are often used in new playground construction. Today, municipalities are employing innovative recycling technology to remove old asphalt, relocate it, and recycle it on site to patch driveways and resurface parking lots.

So with all this new information available, what does your district need to know about playground design and safety—especially about surfacing?

GUIDELINES AND STANDARDS

First and foremost, it's important to know what standards apply. All school officials should be familiar with two sets of federal guidelines: the U.S. Consumer Product Safety Commission's *Handbook for Public Playground Safety* (CPSC Pub. 325) and the U.S. Access Board's *ADA Accessibility Guidelines for Play Areas,* covering compliance under the Americans with Disabilities Act.

User-friendly and available at no cost (see the resources on page 41), these two documents explain the basic requirements for placement of equipment and safety surfaces beneath it. They also spell out requirements for playground layout and design, including accessible routes.

In addition, the American Society for Testing and Materials has published national voluntary standards. The equipment your district purchases and the surfacing you install should comply with these standards. The standards are of more practical use to professional designers and playground equipment manufacturers than to board members and administrators, but you should be aware of them:

- ASTM F1292: Specification for impact attenuation of surfaces under and around playground equipment (1991)
- ASTM F1487: Specification for playground equipment for public use (1993)
- ASTM F1951: Specification for determination of accessibility of surfaces under and around playground equipment (1999).

While there is no federal law governing playground safety, six state legislatures have adopted the CPSC *Handbook for Public Playground Safety* as their standard of care: California, Connecticut, Michigan, New Jersey, North Carolina, and Texas. California has also mandated that public playgrounds be inspected regularly by playground safety inspectors certified by the National Recreation and Park Association's National Playground Safety Institute.

Playgrounds need not merely comply with minimum standards and guidelines, however. Some go beyond the minimum and achieve what the National Center for Boundless Playgrounds calls "play usefulness."

In a recent article in *Research Design Connections*, Jean Schappet, Antonio Malkusak, and Lawrence Bruya defined this concept as a collaborative environment involving children, teachers, administrators, parents, maintenance staff, and talented designers. The result, according to the article, is that "the design of the playground equipment, the pathways, and the impact-attenuating surfacing materials work together to achieve real play opportunities for all children."

A SAFE, ACCESSIBLE SURFACE

Playground surfacing must accomplish two tasks, both addressed in the CPSC *Handbook* and the Access Board's *ADA Accessibility Guidelines for Play Areas.* The surfacing must:

Photo courtesy of GameTime and Boundless Playgrounds, Inc.

■ Allow children to approach and enter the playground safely.

■ Minimize the risk from falls.

To be considered accessible, pathways between school facilities, parking lots, and playgrounds must be:

■ Firm, stable, and slip resistant

■ At least 5 feet wide

■ Less than or equal to a 5 percent slope, or a 1 foot rise over a 20 foot distance

■ Built with wheel stops, curbs, or handrails where needed to prevent wheelchair users from accidentally leaving the pathway.

These requirements also apply to movement within play spaces, although the ADA *Guidelines* allow steeper slopes on ground-level and elevated accessible routes, such as platforms between areas on play equipment. Slopes greater than 1:20 are, technically speaking, ramps, for which ADA provisions for handrails, guardrails and landings apply.

SURFACING FOR PATHWAYS

Although unsuitable for use directly under and around playground equipment, hard surfacing materials such as concrete or asphalt may be used for pathways around play areas.

New types of asphalt are being developed. One is rubber-modified asphalt, or RMA, the result of a convergence of recycling technology with state and local mandates to reduce the amount of waste destined for landfills.

RMA, which uses "crumb rubber" (granules) from recycled tires, is being used in bike paths, walkways, and basketball courts because of its resiliency. It is also being used on playing fields in loose form to improve the quality of the soil. Testing shows a 30 percent reduction in the surface hardness of athletic fields treated with an RMA product called REBOUND, made by American Rubber Technologies, which says it limits "the potential for serious player injury and liability."

Recycled glass, treated to remove rough edges and screened to include only small pieces, can also be added to asphalt. "Glassphalt" surfaces last longer than typical asphalt and are more attractive, as the surface is reflective with the subtle colors of the glass.

The appropriate use of readily available recyclables such as glass and rubber in asphalt makes sense for parks and playgrounds. And now, old asphalt itself can be recycled. The Bagela Asphalt Recycler, in production in Germany for 15 years, has been used in the United States since 2001. This machine can be towed to a site and used to recycle asphalt from one area, such as an old playground, and resurface another, such as a parking lot, at the same time. While costly, the machine can ultimately produce savings.

SURFACING UNDER PLAY EQUIPMENT

Surfacing within play areas must be firm enough to withstand wheelchair use, yet resilient enough to protect children from falls.

Different playground surfacing materials offer different "critical heights," defined as the "fall height below which a life threatening head injury would not be expected to occur."

The depth of the surfacing is also a factor in the protection the material offers. The CPSC *Handbook* indicates recommended depths of materials calibrated to various fall heights. For example, 9 inches of uncompressed wood chips will protect children falling from a height of 10 feet, while the same depth of fine sand only protects from a fall height of 5 feet, or half the distance.

Though more costly, 6 inches of shredded rubber protects children from fall heights of 10 to 12 feet. And because it does not decompose, it does not need to be replaced as frequently as sand or wood chips.

These surfacing materials can be divided into two broad categories: loose fill materials, such as sand or mulch, and unitary materials, such as rubber mats, tiles, or poured-in-place rubber:

1. Mulch and other loose fill materials. Because there is currently no statutory or regulatory definition for mulch, districts must specify the material and quality required when purchasing. Wood chips are

More on mulch

If you're using mulch on your playgrounds, be sure it's nontoxic. By specifying nontoxic mulch materials, you will help protect children from mulch containing, for example, the wood preservative chromated copper arsenate, or CCA, a known carcinogen now voluntarily withdrawn from U.S. markets. CCA lumber is no longer being manufactured, but it persists in existing structures and in the waste stream.

A typical specification for engineered wood fiber might read, "manufactured from engineered, nontoxic, crushed wood fiber comprised of softwoods or hardwoods, consisting of randomly sized wood fibers with the average size of 1.5" to 3" in length, and containing 10 percent to 20 percent of fine pieces to aid in compaction."

EWF's critical height is distinct from that of either wood chips or shredded hardwood mulch. Because it's made of wood, EWF decomposes, but it will last longer if it's installed above a sandwich of three-quarters to 1 inch of gravel between two layers of geotextile—a fabric manufactured from synthetic fiber that provides necessary drainage and slows the natural decomposition process.

In a study sponsored by the U.S. Access Board, EWF was treated with a synthetic binder resting above a thick underlying layer of unbonded EWF. The resulting stabilized EWF was soft and impact absorbing but was still easy to travel across with wheelchairs and walkers, thus satisfying ASTM standards for playground surfacing that is accessible yet also lessens impact.

Stabilized EWF is being used in parks but is not yet commercially available for playground use. Testing is still being done, however, and the product shows promise for the future.—*C.C.*

At New York City's Brooklyn Bridge Park, accessible elevated decks on play equipment are made of recycled plastic with wood fiber. Semi-enclosed play areas below are paved with rubber safety tiles.

distinct from double shredded bark mulch, for example, and have different critical heights, affecting the depth required. One grade of mulch used frequently in playground applications is called "engineered wood fibers" or EWF (see sidebar on page 33).

Not all mulch is wood, however. Another option is shredded rubber, an inorganic playground mulch made of clean, ground crumb rubber from car and truck tires. It is available in basic black or in colors ranging from muted earth tones to bright blues and greens. While it may not be stable enough to satisfy ASTM F1951 for accessibility, it excels at ASTM F1292 for absorbing impacts and is appropriate for use in more active play areas.

In addition, shredded rubber can be treated with a fire retardant and used in conjunction with other, more accessible surfaces.

2. Rubber surfacing. The second broad category of playground surfacing is unitary material, which includes rubber tiles, poured-in-place rubber, and bonded rubber surfacing. Besides being resilient and accessible, poured-in-place rubber has the additional aesthetic benefit of accommodating inlaid designs and graphics, which can provide kids invitations for imaginative play.

Rubber tile or rubber mats strategically placed beneath swings, slides, and other high-impact areas can reduce the need to rake and replenish loose fill materials in these areas. Overall, unitary rubber surfacing requires less maintenance and is more resilient than loose fill materials.

Another factor to consider in selecting surfacing materials is adequate drainage. Loose fill materials should never be installed above asphalt or concrete, while some unitary materials may be.

COSTS AND BENEFITS

Compared strictly on the basis of up-front cost, organic loose fill materials, such as mulch, wood chips, or EWF, cost less than inorganic loose fill materials, such as black or colored rubber mulch. Rubber tile and poured-in-place rubber cost the most, at least initially.

Not including the cost of transportation or labor, EWF for a 2,000-square-foot playground will cost about $1,500. Black rubber mulch for the same area will be $4,000; colored rubber mulch or stabilized EWF will cost $8,000; and poured-in-place rubber surfacing will cost about $15,000.

But up-front cost is not the only consideration. Since EWF decomposes, it needs to be periodically replaced, so its true cost, including labor, must be amortized over a number of years, at which point higher-priced materials may be justified.

That's what Mark White, risk manager for the Lee's Summit School District in Missouri, has found. White manages 16 elementary school playgrounds and spends more than $100,000 per year on EWF. He is gradually converting the playgrounds to a combination of poured-in-place rubber, rubber tile, and loose rubber with rubber mats under slides and swings.

White is also installing better drainage beneath existing EWF areas to increase the material's useful life. Poured-in-place rubber is now used in 70 percent of the district's early childhood facilities.

Changes like this carry a price tag, and White has found that keeping track of the benefits can build support for the higher cost. Over his five-year tenure at Lee's Summit, he says, he can easily show at least a 25 percent reduction in injuries. In fact, in playgrounds that have been completely redesigned, six months can go by without incident.

Playground surfacing is a critically important component of a safe playground. Knowing the properties of various materials and combining them in appropriate play areas will literally support the rest of a good playground design.

"The real goal," White says, "is keeping children totally engaged in play and safe."

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Photo: Nancy Prince, Manhattan Capital Team, City of New York Parks & Recreation