7 Things Every Playground Owner Should Know About the Accessibility of Their Playground Surfaces

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7 Commit to ongoing maintenance of accessible playground surfaces as a responsibility of ownership.

Selecting an Accessible Play Surface Is One of the Most Important Decisions

The U.S. Census Bureau's American Community Survey (2011) estimates there to be 2.8 million school-aged children with disabilities in the United States. The Census Bureau (2009) estimates that one in every seven American families is affected by disability. For children with and without disabilities, the community playground can facilitate a positive environment for physical activity and inclusion. Today, lack of physical activity is considered one of the leading factors contributing to poor health among children. The neighborhood playground fulfills a critical role in community wellness, enabling children to play with friends and burn calories at the same time.

When the playground has barriers prohibiting use by a child with a disability, the opportunity for play and physical activity is lost. Inaccessible surfaces can pose barriers for children with disabilities who may use canes, crutches, walkers or wheelchairs from ambulating through the play area. Pushing a wheelchair over loose gravel or sand requires tremendous physical effort. When so much effort is exerted, little to no energy is left for play.

The presence of physical barriers can prevent children with disabilities from accessing all play elements on the playground. Most significantly, inclusive play between children with disabilities and children without disabilities is threatened when the playground does not have accessible equipment and surfaces. Physical barriers also prohibit adult caregivers with disabilities from engaging with their children and/or responding when a child is in need of assistance.

Recreation professionals and playground owners are confronted with questions of how to install and maintain safe and accessible public playgrounds that are fun; promote inclusion and physical activity; are cost effective and able to withstand a full life cycle of public use.

Choosing play surfaces that are accessible and that can be maintained as accessible surfaces, becomes one of the most important decisions during the playground planning and design phases. The purpose of this guide is to provide practical information that every public playground owner should know about the accessibility of their playground surfaces.

Surfacing the Accessible Playground:

7 Things Every Playground Owner Should Know About the Accessibility of Their Playground Surfaces

From 2008 to 2012, the National Center on Accessibility (NCA) at Indiana University-Bloomington conducted a longitudinal study on the accessibility of playground surfaces. The research study was funded by the U.S. Access Board. The information presented in this publication is based on the research findings and presented as guidance to public playground owners and operators.

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1 All Successful, Inclusive Playgrounds Start with Comprehensive Planning

An economic assessment conducted during the development of accessibility standards for play areas estimated there to be 5,300 new public playgrounds constructed each year and more than 18,600 existing playgrounds that are renovated. The decision to build a public playground, whether it be in a park, school, mall or childcare setting, is an initial financial commitment of $60,000 to $100,000 and upward just for the purchase of equipment and construction (NCA Playground Surface Study, 2013). This cost can be overwhelming. Often times, new playground owners do not realize that owning a playground is not a one-time purchase. It is a commitment to maintain the equipment and surface for as long as it is open to the public. Most public playgrounds are designed to be in place for 10-20 years. At some point, the equipment will need to be serviced to meet revised safety standards and the surface will likely need to be repaired or replaced. A comprehensive planning process is essential to ensure everyone is educated on the safety requirements, the accessibility standards, design considerations, installation and ongoing maintenance needs.

An accessible playground starts with an accessible site plan. The site selection and layout of the accessible route should be considered alongside the selection of the play equipment. The accessible route must be designed as the main pedestrian route and connect all accessible equipment, both points of entry and egress. This means everyone enters and uses the site together.

A site survey may be necessary even on sites deemed "relatively flat." A site survey, even for sites considered "flat" or without substantial change in elevation, should be conducted to design for a continuous accessible route, with compliant cross slope and adequate site drainage. At playgrounds without site surveys, the National Center on Accessibility research found more instances of non-compliant accessible routes. Most often equipment was moved during construction, deviating from the original plan, to accommodate the use zones. These changes negatively affected the accessible routes.

The site plan should include the layout of equipment and the planned accessible route should be drawn on the site plan connecting entry and egress from each accessible elevated play component and each accessible ground level play component. It is highly recommended that the accessible route be clearly defined on the site plan and construction drawings. If the playground owner decides to go with a surface material, such as loose fill that has a higher degree of surface variability, designation of the accessible route on the site plan will give the installer and maintenance personnel specific guidance on the appropriate location of the accessible route, installation of the surface material, and its ongoing maintenance to meet the accessibility standards.

2 Follow the Accessibility Standards

The 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design apply to state and local governments (Title II) and places of public accommodation (Title III). The Architectural Barriers Act (ABA) Accessibility Standards apply to federal facilities. Both standards require newly constructed playgrounds and those existing playgrounds that are altered to comply with a series of technical provisions for accessible play components and the accessible route connecting these components.

The accessibility standards are minimum standards and do not require the entire play surface area to be accessible. The only required accessible surface area includes the accessible route from the entry of the play area, at least one connection to each accessible play component (points of entry and egress) and any clear space requirements adjacent to accessible play components. Children's play behavior indicates they spontaneously move throughout the play equipment, navigating on their own preferred routes. Designing the entire use zone as a congruent accessible route is recommended as a best practice to accommodate the free play behavior of all children navigating the play space.

Playground owners, designers and maintenance personnel must have a good understanding of the requirements for accessible routes within the play area and comply with the provisions of the accessibility standards. Outside of the play area, an accessible route must connect at the site arrival point, include parking, and the path to the main entrance of the play area. The accessible route must also connect all accessible elements and features of the play area within the site.

Within the play area, the clear width of the ground level accessible routes shall be 60 inches minimum. Two exceptions may be applied: 1) In play areas less than 1000 square feet, the clear width of accessible routes shall be permitted to be 44 inches minimum, if at least one turning space is provided where the restricted accessible route exceeds 30 feet in length; or 2) the clear width of accessible routes shall be permitted to be 36 inches minimum for a distance of 60 inches maximum provided that multiple reduced width segments are separated by segments that are 60 inches wide minimum and 60 inches long minimum.

Where accessible routes serve ground level play components:

- The vertical clearance shall be 80 inches high minimum.
- The running slope not steeper than 1:16 or 6.25%.
- The cross slope shall not be steeper than 1:48 or 2.08%.
- Openings in floor or ground surfaces shall not allow passage of a sphere more than ½ inch diameter.
- Changes in level between ¼ inch high minimum and ½ inch high maximum shall be beveled with a slope not steeper than 1:2.

For a playground surface to be compliant, both safe and accessible, it must meet the above mentioned technical provisions for running slope, cross slope, openings, changes in level, and vertical clearance. Public playgrounds must also meet referenced standards set by the American Society for Testing Materials (ASTM) related to resiliency for falls (ASTM F1292-99/04) and accessibility (ASTM F1951-99) around accessible equipment. Some jurisdictions and municipalities require surface systems to have certificates of compliance with ASTM standards. These certificates are often awarded through laboratory testing of surface samples. The standards require the actual site-installed surface systems to comply with ASTM F1292-99/04 and ASTM F1951-99.

The surface for the accessible route within the play area must meet the technical provisions of the standards as long as it is open for public use. Further, ground surfaces used for the accessible route are required to be inspected and maintained regularly and frequently to ensure continued compliance with ASTM F 1951-99. From the grand opening celebration to the coldest January day when parents bring their children outside to play and get some fresh air; as long as the playground is open for use, it must meet safety and accessibility standards.

Applying the Accessibility Standards to the Plan, Installation, and Maintenance of Ground Level Accessible Routes for Playgrounds

The following questions can be used through the planning process, during construction and as part of routine maintenance.

- ✓ Is the surface for the accessible route, clear ground space and turning space compliant with ASTM F1951-99 Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment?
- ✓ Does the playground surface comply with ASTM F1292-99/04 Standard Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment when ground surfaces are part of the accessible route and also located in the use zones?
- ✓ Is the accessible route part of the main circulation path and is it continuous to each accessible play component?
- ✓ Is the running slope for the ground level accessible route less than 1:16 or 6.25%?
- ✓ Is the maximum cross slope for the ground level accessible route less than 1:48 or 2.08%?
- ✓ Is there a minimum clear width of 60 inches for the ground level accessible route (some exceptions apply)?
- ✓ Are openings in the surface for the ground level accessible route no greater than .50 inch?
- ✓ Are changes in level along the ground level accessible route less than .50 inch beveled?
- ✓ Is the vertical clearance a minimum of 80 inches for the ground level accessible route?
- ✓ Does the clear ground space, 30 x 48 inches minimum, at egress of accessible equipment have a cross slope less than 1:48 or 2.08%?
- ✓ Are the ground surfaces inspected and maintained regularly and frequently to ensure continued compliance with ASTM F1951-99?

For more explanation on the application of the accessibility standards to public playgrounds, see A Summary of Accessibility Guidelines for Play Areas, www.access-board.gov/guidelines-and-standards/recreation-facilities/guides/play-areas.

3 Review the Research Findings to Learn More About Accessibility Issues for Surfaces

From 2008 to 2012, the National Center on Accessibility at Indiana University-Bloomington, conducted a longitudinal study on the accessibility of playground surfaces. The study was funded by the U.S. Access Board. The purpose of this study was to evaluate a variety of playground surfaces, their ability to meet accessibility requirements, their costs upon initial installation and maintenance issues over a 3-5 year period.

The research design for this study of playground surfaces began in 2005 with input from a national advisory committee. During the study, quantitative and qualitative data was collected through on-site inspections for a 3-5 year period. A national advisory committee provided feedback on the categories of surfaces to be evaluated, the criteria to be used for evaluation, the locations within each playground to be evaluated, data collection worksheets and on-site protocol. In addition, advisory committee members helped to expand the network for recruitment in the study and increase national awareness among playground owners.

The sample population for this study depended upon an established, or to be established, congenial relationship with the playground owner and the research team. The data for analysis required the research team to make a number of inquiries to the operation, planning, budgeting and maintenance procedures conducted by the playground owner. Most importantly, if there were any instances where locations on the playground were found to be in non-compliance with the accessibility or safety guidelines, the playground owner was to be informed and then carried the burden of bringing those instances into compliance.

Approximately 35 playground sites were recruited for participation during the evaluation period from October 2008 through May 2011. Data collection concluded in September 2012 so that all playground sites in the study would have a minimum of two years of data. All of the playground sites were located in public parks owned/operated by 16 different municipalities from Indiana, Illinois and Michigan. Sites included either neighborhood playgrounds or those located in regional parks. The 16 participating municipalities operated anywhere from 4 to 53 playgrounds each. None of the playground owners were "first time" owners. All of the owners had a history of managing playgrounds. They considered themselves somewhat knowledgeable of playground surface issues and eager to learn how they could improve upon their playground surface maintenance efforts for costs savings.

The playground surface products considered for this study had to initially meet the requirements of the accessibility standards for: accessible routes; ground surfaces; the ASTM F1292-99/04 Standard Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment as determined by the surface manufacturer in laboratory testing; and the ASTM F1951-99 Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment as determined by the surface manufacturer in laboratory testing. Information on the surface vendor, specifications, costs and labor for installation was then collected. In turn, the research team contacted each vendor to collect additional information on laboratory certification with ASTM F1951-99 for each surface.

Five categories of surfaces were studied: poured in place rubber (PIP), rubber tiles (TIL), engineered wood fiber (EWF), shredded rubber (SHR) and hybrid (HYB) systems. Nine critical areas were inspected within 12 months of installation and continued to be evaluated at least once a year for the longitudinal study:

1) Entry to playground where playground surface starts;
2) Accessible route connecting accessible play elements;
3) Egress point of slide(s);
4) Swings;
5) Entry point(s) to composite structure(s)/transfer stations;
6) Climber(s);
7) Ground level play element(s) such as spring rockers, play tables, interactive panels, etc;
8) Sliding poles; and
9) Other areas (i.e. water play elements, etc).

A preliminary accessibility assessment of the playground surface was conducted and the surface tested for firmness and stability with the Rotational Penetrometer. At the discretion of the playground owner, the playground surface was also tested for impact attenuation with the TRIAX (surface impact testing device). The playground owner was notified immediately of test results for both the Rotational Penetrometer (firmness/stability) and the TRIAX (impact attenuation) and given opportunity to correct surfaces where deficiencies or non-compliance with standards were noted.

NCA Play Surface Study Findings

The most valuable lesson to be learned from this longitudinal study is that there is no perfect playground surface. Even within 12 months of installation, each type of surface had some type of issue or series of issues that affected the product's performance and contributed to the necessity and frequency of surface maintenance to assure accessibility and safety for use by children on a daily basis. A playground surface with poured-in-place rubber had a use zone found in non-compliance with the ASTM standard for impact attenuation. Playgrounds surfaced with tiles were observed with puncture holes, buckling and separating seams that created openings and changes in level on the accessible route. Inaccessible routes with undulating surface material were identified at playgrounds with engineered wood fiber. Each occurrence and event was weighed and balanced with the product's feature advantages and drawbacks. The information can serve as guidance to both future playground planning and priorities for designing new research. The following are the predominant findings from this study:

1. No single type of surface material/system was found to be the most accessible surface or better than others when comparing its ability to meet the accessibility standards with issues related to installation and maintenance.

2. Within 12 months of installation, playground sites in the sample with the loose fill EWF were found to have the greatest number of deficiencies, such as excessive running slope, cross slope, and change in level, affecting the accessible route to play components.

3. Within 12 months of installation, playground sites in the sample with loose fill EWF were found to have the highest values for firmness and stability, indicating greater work force needed to move across the surface, while playground sites with the unitary surfaces TIL and PIP were found to have the lowest values for firmness and stability– indicating less work force necessary to move across the surface.

4. Deficiencies (excessive running slope, cross slope, change in level, or openings) for PIP, TIL and HYB began to emerge 24-36 months after installation.

5. Occurrences were identified in the sample where the surface material installation did not parallel either the manufacturer's installation instructions or the procedural instructions on the laboratory test sample for ASTM F1951-99.

6. A playground surface with fewer accessibility deficiencies and a lower measurement for firmness and stability did not necessarily meet the safety standards for impact attenuation.

7. Surface cost for material cannot serve as an indicator or predictor of performance.

The full report *A Longitudinal Study of Playground Surfaces to Evaluate Accessibility: Final Report* is available on the National Center on Accessibility web site: ncaonline.org

Comparison of Playground Surfaces Evaluated in NCA

Poured in Place Rubber (PIP)

DESCRIPTION

Wear layer with larger rubber particles and finished with a custom top layer of granular particles. A binding agent is used and the material is poured out on site or “in place” as it gets its name.

COST (Average market cost 2009-2012)(MATERIAL ONLY)

$6.59 to $19/sq ft

INSTALLATION

Installer must be specially trained/certified by the manufacturer.

REPAIRS

Repairs must be conducted by trained installer.

COMMON ACCESSIBILITY ISSUES

Cracking or flaking of the top layer can lead to divots and openings greater than 1/2 inch. Top layer deficiencies are often accelerated in high use areas (under swings, slides, teeter-totters). Results in non-compliant routes and clear ground spaces at equipment. May also result in non-compliant cross slope at entry/egress. Surface deficiencies can be traced to improper binding agent ratio, inability for product to properly cure, and deterioration of product over years of exposure to the elements.

Tiles (TIL)

DESCRIPTION

Bonded rubber constructed as 2 ft x 2 ft squares with interlocking sides.

COST (Average market cost 2009-2012)(MATERIAL ONLY)

$8.96 to $21/sq ft

INSTALLATION

Can be installed by contractor or park/facility personnel. Learning curve associated with installation.

REPAIRS

Repairs may be completed by contractor or park/facility personnel.

COMMON ACCESSIBILITY ISSUES

Puncture holes and shifting seams can create openings and changes in level along the accessible route and at clear ground space for equipment. Foreign particles can lodge in seams causing separation including lift from adhesive for subsurface. Instances of cracking may occur as the product ages. Settled or washed out subsurface may compromise structural integrity of individual tiles.

Longitudinal Research Study

Engineered Wood Fiber (EWF)

DESCRIPTION

ASTM defines EWF as processed wood ground to a fibrous consistency, randomly sized, approximately 10 times longer than wide with a maximum length of 2 inches. Free of hazardous substances. Not to be confused with wood chips.

COST (Average market cost 2009-2012)(MATERIAL ONLY)

$ 0.74 to $2.50/sq ft

INSTALLATION

Can be installed by contractor or park/facility personnel.

REPAIRS

Repairs may be completed by contractor or park/facility personnel.

COMMON ACCESSIBILITY ISSUES

Improper installation and/or maintenance can result in undulation across the horizon of the surface affecting running slope, cross slope and change in level. Product material should be installed in layers and compacted in order to achieve an accessible route and level clear ground space at equipment. Surface material is likely to displace at heavy use areas with motion, such as at swings, slides, sliding poles, climbers, spinners and teeter totters. Displaced material should be raked level and compacted before additional fill is added.

Hybrid Surface Systems (HYB)

DESCRIPTION

Multi-layer system where the base layer may consist of either contained or loose particles like shredded rubber or carpet pad. The top layers may be outdoor carpeting, artificial turf, or rubber top mat.

COST (Average market cost 2009-2012)(MATERIAL ONLY)

$7.50 to $12.65/sq ft

INSTALLATION

Installer must be specially trained/certified by the manufacturer.

REPAIRS

Usually repairs must be conducted by the installer. In some cases, park/facility personnel may be trained to make smaller repairs.

COMMON ACCESSIBILITY ISSUES

Seams may separate or detach from the border creating changes in level and openings affecting the accessible route. Shifting of loose fill in the base layer may affect running and cross slopes. The artificial turf top layer may experience build-up of static electricity requiring application of anti-static solution.

4 Assess During the Planning, Installation and Maintenance Phases

Quick Reference

Running slope = 1:16 or 6.25% max

Cross slope = 1:48 or 2.08% max

Changes in level = 1/4 inch max (no bevel)
1/2 inch max (with bevel)

Openings = 1/2 inch max

Once the playground surface is installed, an on-site inspection of the surface system should be conducted along the accessible routes, at the clear ground spaces for entry/egress of equipment and required turning spaces. A digital level can be used to measure the running slope and cross slope. A 2 ft. digital level is most commonly used for accessibility assessments as it can measure greater variances within the cross slope than a longer level. A tape measure can be used to check any changes in level and openings on the accessible route. Changes in level should also be checked at transition points where the surface material changes. The firmness and stability of the playground surface along the accessible route can be measured in the field with a Rotational Penetrometer.

The maximum running slope for the ground level accessible route must not exceed 1:16 or 6.25%. Using a digital level is one option for measuring the slope of the ground level accessible route.

Measure the clear ground space in all directions with a digital level to ensure it is less than 1:48 or 2.08%. The clear ground space at all accessible play components entry and egress must be level for a child to transfer safely from a wheelchair to the play component.

Openings or gaps in the surface cannot exceed a 1/2 inch.

Check for changes in level, especially at transitions between surfaces. Changes in level from 1/4 inch to 1/2 inch must be beveled.

When conducting an assessment of the ground level accessible route, it helps to start with "the big picture" -- to view the play area in its entirety. Begin at the entry to the play area. Identify the accessible play components and the path to entry/egress for each piece of accessible equipment. Then focus in on the accessible route. Each segment of the route should be assessed for compliance with the accessibility standards. Look for the worst areas, those locations where the slope or cross slope may exceed the standard, where changes in level may be too high, or where openings may be too large.

One method to assess the ground level route using the photo above would be to look at each route segment, such as:

1. From the entry of the play area where the surface begins to the transfer system at the composite play structure.

2. The clear ground space at the transfer system.

3. Segments at each accessible elevated component egress to ground level, the clear ground space at egress, and the connector loop back to the transfer system, such as the segment from the right of the double slide and the clear ground space at the bottom of the slide to the transfer system; and

4. The segment to the right of the transfer system to the climbing wall including the transition from the poured in place surface to the engineered wood fiber and the clear ground space at the climber.

5. The segments from the entry and composite structure to the swings, including the clear ground space at a swing.

6. Segments to each accessible ground level play component.

7. Segments to other accessible play areas.

The purpose here is to look for deficiencies in order to make corrective actions. All of the technical provisions must be met through the entire route for it to be considered accessible. Thus, each segment should be assessed for slope, cross slope, change in level, openings, firmness and stability (which will be discussed in greater detail in the next sections). It would be inaccurate and incomplete to only measure slope at one segment, cross slope at another, or to average the data for three segments. Every segment of a route is used by people with disabilities, therefore it is critical that each segment meet the minimum standards.

Measuring Up: Playground Surface Field Testing

Regular inspections of the playground surface and equipment should be conducted to ensure continued safety and accessibility for all users. These inspections should include safety checks, the accessibility assessment of the accessible route, and field testing of the playground surface. Field testing conducted on the playground surface in the use zone should measure the impact attenuation for children who may fall, along with firmness and stability for accessibility to people with disabilities. This field testing should be conducted upon installation and throughout the life cycle of the playground. The Accessibility Standards require the accessible route within the play area comply with two referenced ASTM standards: ASTM F1951-99 Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment; and ASTM F1292-99/04 Standard Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment.

ASTM F1951-99: Lab Test

This is a laboratory test measuring the work force required for a 165 (+11 or -4.4) lb. individual in a manual wheelchair to propel across a given surface.

The lab test uses a 7 percent ramp as a baseline for the wheelchair rider. After the baseline is established, the rider conducts a series of straight propulsions over the sample surface for a minimum distance of 6.56 ft. The force needed to propel the wheelchair rider over the surface is measured. A second series of tests are then run where the wheelchair rider makes a 90 degree turn and the force is measured again. If the average work per foot for the sample surface is *less* than the work force to propel up the 7 percent ramp, the surface sample is considered as passing ASTM F1951-99. The advantage of the ASTM F1951-99 test procedure is that it provides a starting point to compare various surfaces by an objective measurement. However, the primary disadvantage and criticism of the protocol is that it is designed as a lab test in a controlled environment and cannot be easily replicated in the field or outdoors at multiple playground sites. Researchers have attempted to address the portability of this test protocol with the development of the Rotational Penetrometer (RP) described below.

Firmness and Stability: Field Test

While the ASTM F1951-99 protocol does not include a procedure for field testing outdoors at a playground, a field test method has been developed by the same engineering company that developed the original lab test method. A portable instrument known as a Rotational Penetrometer (RP) has been designed to measure the firmness and stability of surfaces. For the purpose of the NCA study, the Rotational Penetrometer was used as the field instrument to measure firmness and stability in lieu of the costly equipment for ASTM F1951-99. Documented research has shown the Rotational Penetrometer to have a high degree of repeatability and reproducibility (ASTM, May 27, 2005; ASTM, September 2010). These research findings also correlate to the lab test.

The “wheelchair test” is conducted on a sample test bed in the lab to determine the results for ASTM F1951-99.

A Rotational Penetrometer (RP) is used here to measure the firmness and stability of the surfaces.

The RP design includes a wheelchair caster placed on a spring loaded caliber in a metal tripod frame which suspends the caster about 6 inches over the surface. When the caster is released, the spring load gauge replicates the force of an individual in a wheelchair over a given surface. The penetration into the surfaces is measured for readings of "firmness" and "stability." National experts recognize the use of the Rotational Penetrometer as a portable and relatively easy device to use for surface testing. The field test method with the RP can be added to the assessment process just as measurements for slope, cross slope, change in level and openings are taken along segments of the accessible route for the play area. The RP can measure those segments for firmness and stability. This can be valuable in assessing how an installed surface performs over time.

Impact Attenuation: Lab & Field Test

In the field, ASTM F1292-99/04 Standard Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment is also known as the "head drop test." It is a test to make sure the surface is resilient enough to prevent a life-threatening injury from a fall. A 6 inch diameter aluminum hemisphere in the shape of a child's head is dropped from the top of a tripod based on the fall height of play components. The aluminum hemisphere, or missile as it is called, contains an accelerometer. When dropped, the impact attenuation of the surface is measured in G-max and by the Head Injury Criteria (HIC). G-max is a measurement of the maximum acceleration, while HIC measures an integral of the acceleration time. The maximum values allowable by the standard are 200 for G-max and 1,000 for HIC. A TRIAX is the instrument used to conduct this test in the field.

A TRIAX is used here to test impact attenuation or the play surface's ability to absorb a fall and reduce severity of injury.

Playground Owners Can Utilize Field Testing to Get the Most Out of Their Surface Installation

The NCA surface study found the need to conduct field testing immediately following installation and throughout the life of the playground surface is critical to insure compliance with ASTM F1292-99/04 and ASTM F1951-99. A surface location can appear to be very accessible by the "look" of it. However, results may be surprising when the surface is actually field tested. This point is illustrated at NCA study sites managed by two different agencies.

One of the participating municipalities manages more than 30 park playgrounds, predominately surfaced with engineered wood fiber (EWF). The park maintenance personnel usually install the EWF by raking it level, allowing it to settle over time and topping off seasonally. The research team found the results for firmness and stability were not consistent with the manufacturer's ASTM F1951-99 results. The inconsistency was found in the installation process. The research team informed the playground owner of the field test results. Then the park maintenance crew changed their procedure for installation and also began compacting the surface material when it was topped off. Subsequent field testing yielded much better results for firmness and stability.

Another playground owner opted to also have the surface tested for impact attenuation and compliance with ASTM F1292. Drop heights from composite equipment up to 8 ft. high passed the field test. But it was the poured in place (PIP) surface at two swing bays that was found in non-compliance with HIC scores well over the 1,000 HIC allowable under the standard. The playground owner used the terms of the warranty and purchase order as a binding agreement requiring the manufacturer, at its own expense, to return to the site and repair the surface installation. Approximately 2,000 sq. ft. at the swing bays was resurfaced to add more depth to the PIP. When the surface area was retested, the HIC ranged from 650-750 at the swings, well under the 1,000 maximum allowable by the standard. Had the playground owner not discovered the non-compliant surface area until after the warranty had expired, it would have cost the agency in excess of $35,000 to correct the surface area serving four swings. During the course of the longitudinal study, at least two additional playgrounds surfaced with PIP were found in non-compliance with ASTM F1292. In each case, the playground owners required the installers to return to the site to make corrective actions.

The only way to verify the surface is installed similar to that in which it passed the laboratory test is to conduct field testing.

5 Comparing Surface Options Can Assist Planning Team in Selection Process

Like any big ticket purchase, comparison shopping is essential in the planning process. The planning team should embark on a purposeful mission to determine the playground surface system most appropriate for their site and operational resources. Some agencies may have more capital dollars at the front of the project for a surface system that costs a little more but requires less maintenance. Others may have a smaller project budget for a less costly surface, but have more operational funds for daily/weekly maintenance.

The planning team should engage with all representatives from all surface systems under consideration. Decision-makers should dialogue with the surface supplier regarding realistic, objective measurements to evaluate surface performance and maintain the surface material over the life span of the playground. Decision makers must ask very specific questions to fully benefit from the advantages and costs-savings of a surface system. The dialogue with the manufacturer or sales rep should address:

- Specific written instructions for installation.
- Written description of the base, sub-base and required drainage system.
- Results of ASTM F1951-99 laboratory tests, including the values for the baseline, straight propulsion and turning runs. The test results should also include a description of how the surface was prepared for the lab tests and should be consistent with the installation instructions.
- Results of ASTM F1292-99/04, with written confirmation of the critical fall height for the surface material. These test results should include the depth of the surface material for drop heights. The critical fall height shall be higher than the fall height of the highest equipment on the playground.
- Written description of the maintenance and frequency necessary to maintain the accessible route and clear ground spaces.
- The field test procedures to assess the surface for impact attenuation and accessibility upon initial installation and periodically through the life of the product. This should include selection of an independent testing agent and optimum values for ASTM F1292-99/04 and ASTM F1951-99 when field tested.
- A minimum 5-year warranty that stipulates compliance with ASTM F1292-99/04 and ASTM F1951-99, field testing strategy, limitations, exclusions or preconditions, remedies available to the playground owner, and process for making a claim.

The playground owner should also ask the manufacturer for a list of customers in the area that have installed the surface material in the last 5-10 years. The planning team should talk to those customers and visit older installations to find out what issues may have come up with installation and maintenance.

If the surface system is to be installed by a contractor, those customer sites should also be visited to view the contractor's expertise and craftsmanship. It is important to visit older installations to see how the product has aged and what maintenance issues may have arisen over time.

The chart provided on pages 8-9 describes the playground surfaces included in the NCA surface study: poured in place rubber, rubber tiles, engineered wood fiber and hybrid systems. Other surface materials such as sand, pea gravel and shredded rubber have been used in playground construction. However, if used as part of the ground level accessible route, these surface materials must meet the accessibility standards, including the referenced ASTM standards. Many manufacturers continue to use technology and research to develop new and improved surface systems. The planning team should be on the lookout for new innovations, but at the same time ask questions and visit site installations. This inquiry will give the decision makers a greater understanding of what to expect from different products over the lifespan of the playground.

6 Proper Installation of Playground Surface is Key for Long Term Use and Maintenance

An accessible surface system can be rendered useless if it is not properly installed. Installation of surface systems should be performed by individuals knowledgeable of the accessibility standards and with expertise working with the surface materials. Surface materials/systems can be installed by both contractors and the playground owner's maintenance staff. Some manufacturers require contractors/installers to have special training and/or certification. Poured in place rubber (PIP) is almost exclusively installed by contractors specializing in the surface material. Some playground owners believe the intensive installation requirements for PIP, from mixing the binder to troweling the material level, are best completed by contractors experienced with the surface material. On the other end of the spectrum, engineered wood fiber (EWF) is most frequently installed by park maintenance crews and perceived as relatively easy compared to other surface materials. Somewhere in the middle, tile (TIL) and hybrid systems (HYB) are known to be installed by both contractors and park maintenance personnel.

The playground site has been graded with earth-moving equipment. The concrete base has been prepared and is awaiting the application of the poured-in-place rubber (PIP) system. At this site, the playground equipment and surface system will be installed by a contractor specializing in playground construction.

There is a perception among playground owners that installation of surface systems by their own park crew will produce cost savings for the agency. However, there is a learning curve with the installation process that can prove to be challenging. During the NCA surface study, a playground owner selected a surface based on the perception it would be easy for park crews to install. The first installation was perceived as so difficult for the park maintenance crew that any cost savings was mitigated by the lengthy learning process. By the time the playground owner had installed its fourth playground with TIL, the agency had decided to transition to a different surface. On the contrary, another playground owner that contracted the installation to a preferred manufacturer's installer was very pleased. Intensive installation may mean the contractor is the only one able to make repairs such as those due to vandalism or patches at locations where equipment may have been removed. The costs for return repairs or patches can be dependent upon whether the project is covered under the warranty.

The base layer of crumb rubber has been installed. The top layer, a rubber mat system, is fit around equipment and the seams are joined. Both the equipment and surface system at this site will be installed by the park maintenance crew.

Critical details must be communicated between the design and construction phases, regardless of whether the installation is by contractor or park/facility personnel. Site plans and construction drawings should provide details like maximum running slopes and cross slopes, beveled edges, transitions, adjoining seams and affixing the surface material to the border. Preparation of the base and sub-surfaces should be explained. Lack of attention to drainage or omission of weed barriers between layers can lead to sub-surfaces being washed away, base layers infiltrating top layers, and excessive moisture contributing to the growth of mold and vegetation. All of these issues can affect the usability, the safety and the accessibility of the playground surface. Accessibility deficiencies arising out of installation were associated with all of the surfaces in the NCA study.

Poured in Place Rubber (PIP)

Accessibility deficiencies at PIP sites were commonly found in areas where the granules from the top layer had started flaking off. This flaking condition has been linked to either inadequate ratio of bonding agent to granules when mixed on site; and/or failure of the bonding agent to properly cure when installed at 40 degrees Fahrenheit and falling. The manufacturer installation instructions show the preferred atmospheric temperature for installation to be 40 degrees Fahrenheit and rising. Left unattended over time, areas where the top granular layer has flaked away can lead to non-compliant clear ground space at play equipment such as swings, transfer systems and the egress of slides. Deficiencies related to installation methods may not become evident for months or even years. Thus, it is necessary for the playground owner to prepare for these situations prior to purchase through the terms of the warranty and/or specified funds for maintenance.

Tiles (TIL)

The NCA study identified accessibility deficiencies with TIL most often related to puncture holes ranging from .50 inches to more than 2 inches in diameter and locations where the seams had started to shift or buckle creating openings and changes in level along the accessible route. The puncture holes may be products of intentional vandalism or unintentional damage from users stepping on rocks and other foreign objects with enough force to penetrate the surface. Loose particles are also known for lodging in the TIL seams causing separation at the seams. Left unattended, the particles can lodge so deep in the seams that the adhesive can degrade and the TIL can separate from the concrete subsurface. As the product continues to age, instances of cracking have been identified where either the subsurface or structural integrity of the surface product is compromised. Because TIL are made from rubber product, the surface should continue to be monitored throughout its life cycle for its ability to meet the impact attenuation requirements of ASTM F1292.

Engineered Wood Fiber (EWF)

Sites installed with EWF were found to have the highest number of accessibility deficiencies within the first year of installation. Because EWF is a loose fill surface, it is frequently observed with accessibility deficiencies related to running slope, cross slope and change in level. EWF has been observed with undulation across the horizon of the surface area. The undulating surface material creates changes in level, running and cross slopes exceeding the maximum allowable standards resulting in non-compliant accessible routes to play components. It is critical for the manufacturer/supplier and the playground owner to communicate the process for installation. In most instances it is necessary for the loose material to be installed in layers, watered and compacted in order to achieve an accessible route and level clear ground space at equipment. Some playground owners consider the installation of EWF as an opportunity to use volunteers to assist in compaction by running drum roller teams across the surface area.

Hybrid Surface Systems (HYB)

Two of the three different types of HYB systems (outdoor carpet and artificial grass) were installed by contractors representing the manufacturers. These surface systems required installers experienced with laying the sub-surface, adjoining seams, and affixing the surface material to the border. Separation at the seams appeared to be the most prevalent concern following installation. Repairs to seams must be made by the contractor and costs are dependent upon the terms of the product warranty.

7 Commitment to Ongoing Care and Maintenance

Maintenance is one of the greatest factors affecting the accessibility of playground surfaces. The accessibility standards require ground surfaces to be inspected and maintained regularly and frequently to ensure continued compliance with ASTM F1951-99. Therefore playground owners should have a thorough understanding of the care and maintenance required for their selected surface systems. Some surface materials may only require seasonal maintenance, while others may require weekly or daily maintenance. The frequency of maintenance is dependent on the surface material and number of users.

The NCA surface study showed there was a lack of installation/maintenance information provided by the manufacturer to the playground owner prior to purchase and there was a steep learning curve related to working with various surface systems. Each of the 16 participating municipalities had maintenance personnel trained through either the National Recreation and Park Association's Certified Playground Safety Inspector program or the Illinois Park District Risk Management Association (PDRMA). The participating agencies recognized maintenance as a critical need in order to provide a safe environment for the public to recreate. All of the municipalities had "playground crews" responsible for visiting each playground site, making visual inspection of the area, collecting trash, and completing repairs as needed. The playground crews ranged in number from 1-3 staff, usually with one full-time employee and 2-3 seasonal staff during the summer months. At least 30 minutes was spent on site. However, the frequency of visits to each site varied among the different agencies. Large playgrounds at regional parks and sites where programming occurred were most often visited. Some were visited daily during peak summer months. Smaller neighborhood parks may have been visited 1-3 times per week or two times per month.

Surface deficiencies were found to exist at each site regardless of the frequency of visits by the playground crew. Maintenance crews should receive training both on the accessibility standards and the care specific to the surface material. Over the course of the longitudinal study, the research team found that where the playground crews became more engaged in the study, the maintenance specific to accessibility began to improve. At least three EWF sites had improved accessibility where the surface material was observed as more level and better compacted than previous site visits. One site utilizing PIP as the primary access route and EWF as the secondary access route was assessed with less than 1 percent slope at the transition between the two surface materials. This was observed as the most improved and maintained transition between surface materials of the sample.

Over time, the unitary surface may separate at the seams or from the border creating gaps, openings or changes in level that will require repair.

Loose fill materials, like EWF, may experience undulation of the surface material and or displacement under heavy use areas with motion such as at swings, slides, sliding pools, climbers, spinners and teeter totters. This will require the surface material to be raked level, filled and compacted so that the clear ground space is level in all directions for a safe transfer onto and off the equipment.

Poured in Place Rubber (PIP)

PIP was recorded as the surface material requiring the fewest instances of maintenance. Maintenance areas were noted where the surface had cracks, buckles, openings or a granular layer had worn away under high traffic areas like swings, transfer steps and the egress at slides. While PIP had the fewest instances requiring maintenance, it is still notable because the surface repairs can be extensive. Repairs must be done by either the original installer or professional certified by the manufacturer resulting in added costs. The patch repairs also necessitate cutting away a larger section of surfacing in order to fill and level the deficient area.

Tiles (TIL)

TIL sites were recorded with a high number of locations in need of maintenance. TIL deficiencies included punctures holes ranging from .50 inches to more than 2 inches in diameter; and instances where the seams had started to shift or buckle creating openings and changes in level along the accessible route. It was unclear whether the puncture holes were products of intentional vandalism or unintentional damage from users stepping on rocks and other foreign objects with enough force to penetrate the surface. Playground owners in the NCA study reported their maintenance crews were able to replace the TIL with puncture holes. Deficiencies were also identified at sites surfaced with a combination TIL and EWF. The intent of the playground design was to use the TIL as the primary accessible route to points of entry/egress and fill the remaining use zone with EWF. The loose fill particles of EWF were scattered throughout the play area, across the tiles, concrete walkway and in the grass. Some of the particles had started to lodge in the TIL seams causing separation at the seams. There were even instances where the particles had lodged so deep in the seams that the adhesive had degraded and the TIL had separated from the concrete subsurface. Over time, these areas would be identified with changes in level and openings requiring repair or replacement of the individual tiles.

Engineered Wood Fiber (EWF)

EWF sites were recorded in need of maintenance most frequently and earliest in the NCA study. Sites surfaced with EWF were commonly found to have an undulating surface material creating changes in level, along with running and cross slopes exceeding the maximum allowable standards. This would result in non-compliant accessible routes to play components. Large areas where the loose material had been displaced under heavy use areas with motion such as at swings, slides, sliding poles, climbers, spinners, and teeter totters were observed at all of the sample sites with EWF. A kick-out area at a swing could be as large as 3 ft. x 8 ft. with a depth of more than 5 inches. The accessibility standards require the minimum 30 x 48 inch clear floor space for transfer to/from the accessible play components to have a level surface with less than a 2.08 percent cross slope in all directions. The displaced surface material at locations such as the bottom of slides, a swing, or ground level play component rendered the accessible route to the play component non-compliant with the accessibility standards. Maintenance issues at sites began to emerge where the product was filled at the kick-out area rather than the raked level, compacted and then filled and compacted. Where the kick-out areas had been filled, the surface material would eventually be displaced. Over time this created higher undulating mounds at the front and back of the kick-out area and greater cross slopes within the required clear floor space.

At locations where the EWF was paired with a unitary surface, deficiencies were identified at the transition between the two surface materials. The EWF had settled by 1-5 inches creating a change in level and excessive running slope up to 16 percent at the transition. This was most prevalent at sites installed with PIP as the primary access route. At locations where TIL was intended as the primary accessible route and EWF was used as secondary safety surfacing, the EWF particles began contaminating the TIL seams.

To the layman, the terms EWF and woodchips are often, incorrectly, interchanged. The difference between EWF and wood chips are the additional processes beyond the typical landscape chipper. Unlike woodchips out of the chipping equipment, EWF is shredded again, stamped/flattened and made pliable to the extent that the particles will weave together to create a traversable, impact attenuating surface. In addition, there is an ASTM standard specification for EWF (ASTM F2075) further distancing the material from any product made on site or purchased from a nursery or home improvement store. The ASTM standard for EWF requires the particles be small enough to pass through a series of three sieves, ¾ inch, 3/8 inch and No. 16 (0.0469 inch). The sample is considered compliant if no more than 1 percent residue is left on any individual sieve. Large wood particle chips, chunks and shredded twigs were found at all of the EWF sample sites. The observable quantity of large wood particles raised into question whether a test sample from any of the sites would comply with the ASTM standard specification for EWF and specifically the sieve test. In addition to the large particles, there were instances where vegetation and mold were found growing in the surface material.

Hybrid Surface Systems (HYB)

As tested within 12 months of installation, all three HYB surface systems were observed to have minimal deficiencies, comparable to PIP. One of the most commonly noted deficiencies among the HYB was separation at the seams that created openings and changes in level greater than ½ inch. A build up of static electricity was also found to occur seasonally with the artificial grass hybrid system.

What Every Playground Owner Should Know About the Accessibility of Their Playground Surfaces

1 All successful, inclusive playgrounds start with comprehensive planning. The site selection and layout of the accessible route should be considered alongside the selection of the play equipment. A site survey may also be necessary.

2 The accessibility standards apply to playgrounds in parks, malls, schools, child care facilities and other public accommodations covered by the ADA and the ABA. Playground owners, designers and maintenance personnel must have a good understanding of the requirements for ground level accessible routes within the play area.

3 Accessibility assessments of the play area should be conducted during planning on paper, installation on site, and for ongoing maintenance. The assessment should include the accessible route throughout the play area along with clear ground space at entry/egress to accessible equipment. The areas should be checked for compliance with running slope, cross slope, changes in level and openings.

4 Comparison shopping is essential in the planning process. Decision makers should engage with suppliers to gather information on various surfaces and evaluate surface options. The sales rep should provide documentation on installation, field testing, maintenance and a minimum 5-year warranty. The planning team should talk to customers and visit installations to find out what issues may have come up with installation and maintenance.

5 The research findings tell us there is no perfect surface. Each type of surface requires the playground owner understand its characteristics and what is required with installation and maintenance.

6 Proper installation of the playground surface is critical for long term use and maintenance. An accessible surface system can be rendered useless if it is not properly installed. Installation should be performed by those knowledgeable of the accessibility standards and with expertise working with the surface materials. Field testing should be conducted following installation and periodically through the life of the surface system.

7 Playground ownership is a commitment to ongoing care and maintenance. Maintenance is one of the greatest factors affecting the accessibility of playground surfaces. Playground owners should have a thorough understanding of the care and maintenance required for their selected surface systems.

Adapted from *7 Things Every Playground Owner Should Know About the Accessibility of Their Playground Surfaces*, a publication of the U.S. Access Board and the National Center on Accessibility.