
Establishing Best Management Practices for Recycled Tire Rubber Playground Surfaces to Comply with New ADA Accessible Design Requirements



California Department of Resources Recycling and Recovery

October 15, 2013

Contractor's Report
Produced Under Contract By:

SAIC[®]

STATE OF CALIFORNIA

Edmund G Brown Jr.
Governor

Matt Rodriquez
Secretary, California Environmental Protection Agency

DEPARTMENT OF RESOURCES RECYCLING AND RECOVERY

Caroll Mortensen
Director

Department of Resources Recycling and Recovery
Public Affairs Office
1001 I Street (MS 22-B)
P.O. Box 4025
Sacramento, CA 95812-4025
www.calrecycle.ca.gov/Publications/
1-800-RECYCLE (California only) or (916) 341-6300

Publication # DRRR-2014-1496

 To conserve resources and reduce waste, CalRecycle reports are produced in electronic format only. If printing copies of this document, please consider use of recycled paper containing 100 percent postconsumer fiber and, where possible, please print images on both sides of the paper.

Copyright © 2014 by the California Department of Resources Recycling and Recovery (CalRecycle). All rights reserved. This publication, or parts thereof, may not be reproduced in any form without permission.

Prepared as part of contract number DRR DRR10033 for \$1,199,675.46, including other services.

The California Department of Resources Recycling and Recovery (CalRecycle) does not discriminate on the basis of disability in access to its programs. CalRecycle publications are available in accessible formats upon request by calling the Public Affairs Office at (916) 341-6300. Persons with hearing impairments can reach CalRecycle through the California Relay Service, 1-800-735-2929.

Disclaimer: This report was produced under contract by SAIC Energy, Environment & Infrastructure, LLC. The statements and conclusions contained in this report are those of the contractor and not necessarily those of the Department of Resources Recycling and Recovery (CalRecycle), its employees, or the State of California and should not be cited or quoted as official Department policy or direction.

The state makes no warranty, expressed or implied, and assumes no liability for the information contained in the succeeding text. Any mention of commercial products or processes shall not be construed as an endorsement of such products or processes.

Table of Contents

Executive Summary	iii
Section 1 Introduction.....	1
Background	1
Section 2 Project Need and Approach	4
Project Need	4
Project Approach.....	5
Targeted Outcomes.....	5
Section 3 Accessible Design Requirements and Standards	6
Importance of Understanding Requirements.....	6
Accessible Route	7
Playground Surfacing	13
ADA-Mandated ASTM Standards for Playground Surfaces	16
The Development of ASTM Standards	20
Factors that Can Affect Playground Surfacing Standards	21
The Importance of Maintenance.....	23
The Importance of Planning for All Stages of the Playground’s Life Cycle.....	23
Section 4 Best Management Practices for ADA Compliance.....	25
Introduction	25
Cost and Payment for Playground Surfacing Product(s).....	26
Impact Attenuation	27
Documentation of Accessible Route	29
Change of Vertical Height.....	29
Running and Cross Slopes and Slope of Transfer Locations	30
Firmness and Stability	30
Toxins & Sharps.....	31
Playground Maintenance	32
Warranties	33
Section 5 Concluding Remarks.....	34
Glossary of Terms.....	35
Bibliography	38

List of Tables

Table 1 ASTM Standards Relevant to the ADA and Playground Accessibility	6
Table 2 Number and Types of Ground-Level Play Components Required to be on Accessible Routes	9

List of Figures

Figure 1 “2010 ADA Standard for Accessible Design” Guidelines	2
Figure 2 Example of an ADA-Compliant Playground	3
Figure 3 Accessible Route	8
Figure 4 Playground with Accessibility Terms	10
Figure 5 Playground with No Change in Vertical Height at Transition to Other Surface	11
Figure 6 Running and Cross Slopes	12
Figure 7 Example of Failure of Straight-Edge Test	12
Figure 8 Horizontal Gap Surface	13
Figure 9 Loose Fill Playground Surfacing – Rubber Nuggets	14
Figure 10 Playground with Pour-in-Place Surfacing	15
Figure 11 Playground with Rubber Mats	15
Figure 12 Playground with Synthetic Turf Surface	16
Figure 13 TRIAX Field Testing	17
Figure 14 Lab Testing of Wheel Chair Mobility on Playground Surfacing	19
Figure 15 Maintenance Field Test with Rotational Penetrometer	20
Figure 16 Considerations and Tradeoffs in Considering Options for Playground Surfacing	26
Figure 17 U.S. Consumer Product Safety Commission	28
Figure 18 Importance of Documenting Maintenance Responsibilities	33

Executive Summary

This report addresses the need for playground surfacing products made from recycled tire rubber to comply with the new accessible route requirements issued by the U.S. Access Board/Department of Justice that became a Federal Standard on Sept. 15, 2010 and became enforceable on March 15, 2012 under the Americans with Disability Act (ADA). The report provides an overview of the new regulations along with recommendations for best management practices (BMPs) that allow playground surfaces made using recycled tire rubber to comply with the new standards. The standards are also required and enforceable under the California Building Code as of July 2013. The report was prepared by DK Enterprises under subcontract to SAIC, as part of the California Department of Resources Recycling and Recovery (CalRecycle) Tire-Derived Product Business Assistance Program (TBAP).

Overview of ADA Regulations and Implications for Playgrounds

Because the ADA requirements for accessible routes within a playground are now law, playgrounds are under scrutiny and playground surfaces must become compliant. (An “accessible route” is defined as a continuous, unobstructed path connecting accessible elements and spaces in a building or within a site that can be negotiated by a person with a severe disability using a wheelchair and that is also safe for and usable by people with other disabilities.)

Playgrounds installed prior to the enactment of the new rules are not exempt, and action could potentially be required through a lawsuit filed by a complainant. As a result, all playgrounds in Title II (i.e., owned by state and local governments) and Title III (i.e., public accommodations and commercial owners) jurisdictions will be required to meet the requirements. Sections 105.2.3, 240 and 1008 of the ADA Standards for Accessible Design pertains specifically to play areas.

Compliance with the 2010 ADA Standards for Accessibility is possible for playground surfaces made with recycled tire rubber, although input and involvement is needed from professionals in the industry, including playground designers, specifiers, installers, and owners/operators. It will be vital for the industry to develop and implement sound contracts and maintenance and warranty documents.

Manufacturers of tire-derived product (TDP) play area surfacing (such as rubber tiles, ground rubber as a loose-fill material, and pour-in-place surfacing), as well as installers of TDPs in playgrounds, need to be especially cognizant of the 2010 ADA Standards in order to address related safety and performance requirements for their products. In some cases, this will require redesign of existing products, and may spur the industry to develop installation and maintenance standard operating procedures (SOPs) that will be required in contract documents by the owner/operators and their consultants/suppliers.

Project Approach

The project approach was to work with TDP industry participants, including crumb/ground rubber producers, TDP manufacturers, playground architects/designers and consultants, specifiers, and owner/operators to identify requirements of the 2010 ADA Accessibility Standards and to develop best practices that will result in high-quality playgrounds that are functionally compliant with the 2010 Standards.

Completing this project required extensive communication with the suppliers and installers of loose fill rubber playground surfaces; pour-in-place and tile manufacturers and installers that

utilize buffings and/or crumb rubber; synthetic turf installers that use crumb rubber infill in play settings, landscape architects, and several public agencies, as well as extensive analysis of the ADA Standards.

There are many stakeholders involved in the process of designing, installing, and maintaining a playground, from the playground: designer/architect, consultant, tire rubber supplier, other members of the supply chain, the installer, maintenance staff, and public and regulating agencies. While the owner of the playground is ultimately responsible for ensuring ADA compliance, success depends upon the owner working successfully with the other stakeholders to improve play opportunities for children, their caregivers, grandparents, parents, and for other relatives that may use the playground. Therefore, the owner of the playground needs to understand the nuances of the ADA Standards, and make careful playground surfacing choices. The desired outcome of this project is to help those involved in owning, designing, installing, and maintaining playgrounds to provide a safe and enriching experience for children, parents, and their caregivers.

Playground Standards and Requirements

Owner/operators face a complicated set of requirements in the installation and ongoing management of playgrounds at the time of specification, purchase, installation, and throughout their entire functional life. The prudent owner/operator will understand the legally required standards, and will include requirements as part of their terms of contract with associated designers contractors, installers, and suppliers. In addition to ADA requirements, pertinent standards include: ASTM Standards and Guidelines; U.S. CPSC Guidelines; the California Health and Safety Code; and the California Building Code). Additional requirements may include those for parking, access to the playground (i.e., from the parking area), water fountains, picnic areas, and sanitary facilities. Ultimately, for the entire length of time that the playground is open to the public, all of the standards and laws must be met. Failure to comply may result in injury to a child resulting in financial penalties from a liability claim or regulatory penalties for non-compliance.

Specific requirements related to ADA that are described in this report include:

- Providing an accessible route to all playground equipment. The properties of the accessible route do not just apply to the accessible route within the play space, but also the accessible routes transitioning into the play space, such as walkways and other junctions. An accessible route generally covers 18 to 22 percent of the area of the use zone of the playground as it connects the required elevated and ground level accessible play components.
- Ground-level play components accessed by children with disabilities must be integrated into the play area. The idea is that children with disabilities be able to interact and socialize with all children. Therefore, grouping all ground-level play components accessed by children with disabilities in one location is not considered to be integrated.
- There must be an accessible route in each playground that connects both elevated and ground-level play components. Requirements are very specific in relation to the number and type of components included in a given playground.
- Providing accessible routes whenever there is a change in vertical height of surfacing or a horizontal gap. Again, the requirements are very specific in relation to the dimensions of any vertical height changes or horizontal gaps.

The ADA mandates that certain ASTM Standards be achieved on publicly accessible playgrounds, including ASTM F1292 – Protection from Injury, which describes cushioning requirements, and ASTM F1951-99 – Provision for Mobility, which describes firmness requirements for playground surfacing. Compliance with ASTM F1292 for the entire playground is also a legal requirement in California.

Recommended Best Management Practices

Designing or purchasing a playground surface is a complicated process. Due to the 2010 ADA accessible route requirements, the owner/operator could face serious financial consequences if the playground surface does not conform to ADA standards over the life of the playground. The project team developed BMPs by analyzing strategies that not only achieve these ADA requirements, but that are also not in conflict with other requirements and that avoid creating new, undesirable tradeoffs in other design aspects for the entire playground.

Following is a list of the BMPs described in this report. This is not an exhaustive list, and there are other strategies which may have merit.

Playground Owners/Operators Should Drive ADA Compliance and BMP Implementation

Since this is a market-driven world, the BMP is best selected, adopted, and enforced by the owner/operator, because they have liability for the asset, are stated to be the responsible party in the ADA regulations, and have the most to potentially lose financially. The owner/operator will need to balance their product needs, tastes, budget, and ability to comply with the ADA standards given the variety of product choices. A successful project is one in which:

- All stakeholders involved in the project understand their roles and responsibilities throughout the life of the playground up front
- The playground achieves and maintains compliance with the ADA accessible route standards
- The playground is tested regularly to ensure continued compliance
- Children, parents, other relatives and caregivers have a safe, enriching experience at the playground
- Product installation and maintenance costs are as expected, and the playground surfacing performs as claimed in the product specifications
- If needed, the product warranty is honored in a timely manner by the product manufacturer.

It is recommended that there be clear specifications, performance measures, testing, and financial penalties such as non-payment for non-performance and strong warranties among the parties involved so that expectations are clear. The warranty should also clearly specify the length of the warranty and what specifically is covered, as well as responsible parties. BMPs that support these targeted outcomes for playgrounds are described below.

BMPs Related to Cost and Responsibility for Payments

Design/Layout: A simpler layout (e.g. relatively few colors, figures) that supports long-term functionality could ultimately reduce the cost and potential risk of fines. “Simple” may help the

TDP producers lessen the need for educating the playground designer/architect, lower the initial cost of design, and also reduce the cost of implementation, maintenance and repair.

Payment to Manufacturer/Installer: Owner/operators should make payment for playground surfacing only after: it has been completely installed; successful performance testing is confirmed; maintenance documents are presented; and adequate warranties (e.g. covering a specified period such as five to eight years) are provided. An owner might be at risk if they provide payment prior to compliance, should the supplier fail to make corrections. ASTM F2479, section 14, provides guidance for a warranty for pour-in-place surfaces that would be adopted for all playground surfaces.

BMPs Related to Ensuring Proper Impact Attenuation

Drop Height Testing: The drop height used for testing at the time of installation is selected by the owner/operator and should be at least the height of tops of barriers, guardrails, swings, climbers, and any railing within 10 degrees of flat (i.e., a level surface). Specific fall height parameters should be attained which are identified in the body of this report. Since the 2010 ADA is based on field compliance, it is recommended that the owner adopt an annual or biannual testing program. Testing should be done at the time of installation and then at least annually. As the surface approaches end-of-life, more frequent testing or maintenance might be required.

Critical Height Test Certificate: Owner/operators should acquire the critical height test certificate for the surface being installed, with assurances that the certificate in fact is for the specific surface system that is being installed. For loose surfacing systems, the supplier must provide a certificate that the surface depth being installed will remain sufficient during normal use to continue to meet the performance of the impact attenuation standards from the original drop heights.

Contract Requirements: The bid/contract documents should require the surfacing supplier's instructions for surface and materials preparation and depth for performance of the ASTM 1292 in the laboratory. This must be the same as for the ASTM F1951-99 samples tests for the same contract.

Warranty: Owners should specify the required play surface warranty (e.g. five years), and test certification assurances should remain in place for the same period. The playground installer may have equal concerns as to how the play surface is maintained by the owner. It is understood that there could be significant costs associated with the warranty or fines for non-compliance with ADA requirements.

Maintenance and Monitoring: Owner/operators should ensure that playgrounds meet or exceed ADA Standards for impact attenuation throughout their useful life. This requires regular maintenance and monitoring, including regularly scheduled field testing. Maintaining the playground to standard may require additional staff and/or training or hiring of third-party inspectors.

BMPs Related to Defining the Accessible Route

Contract/Documentation Requirements: Drawings defining the elevated and ground-level accessible routes should be included in bid/contract documents and signed off as appropriate by the consultant, play structure supplier, and surfacing supplier. Any errors in the layout or deviations from the plan must be brought to the immediate attention of the owner prior to installation.

BMPs Related to Changes in the Vertical Height of Play Equipment

Contract Requirements: The bid/tender and/or contract documents must contain a section where the accessible route supplier agrees that their product meets, and will continue to meet, the relevant requirements for changes of vertical level at junctions with other surfaces and within the surface system for the functional life of the playground.

BMPs Related to Running and Cross Slopes and Slope of Transfer Locations

Plans and Layouts: All plans and layouts should set limits of 50 percent of the allowed values for slope and the target for installation shall be 75 percent of the allowed slope, and installers should be required to remove and replace any non-compliant product at their cost. To allow for installation errors or environmental changes during the life of the playground, all plans and layouts should set limits at the time of installation that are less than 50 percent of the maximum allowed.

Maintenance and Monitoring: Playground staff should monitor and maintain playground surfacing to ensure that proper running and cross slopes are maintained. In the case of loose-fill surfacing, it will likely be necessary to re-allocate material to high-traffic and high-impact areas, such as the bottom of slides and other components, and transition areas. This may require additional staffing and/or additional training. Staff should have a regular inspection program in place, and measuring running and cross slopes should be part of this process. In some cases correcting slopes may mean adding more material, and in others may mean a more in-depth repair.

BMPs Related to Firmness and Stability

Contract Documents and Testing: Owners should include in contracts a requirement that accessible routes remain firm and stable at all times to allow people with mobility devices to traverse the surface within a realistic limit of work. Suppliers should maintain a copy of their test certificate and be able to assure the owner that the materials tested are the same as those being installed. Prior to making payment, owners should have installed surfaces field-tested to ASTM F 1951-99. Additional details on such testing and contract terms are provided in the body of this report.

Certificate of Compliance: A certificate of compliance to ASTM F1951 is a requirement of any bid/contract submission. To limit the potential for accessibility complaints, or the expense of ASTM F1951-99 testing in the field, the contract documents must allow for the testing in the field using a rotational penetrometer.

Maintenance and Monitoring: Playground staff will need to monitor and maintain the playground surfacing to ensure ongoing compliance with ASTM F1951-99. Having a regular inspection program in place should be part of this process.

BMPs Related to Toxins and Sharps

Contract Documents: The specifications, bid, and contract documents must require that the materials installed will not contain toxins to a level that would preclude the material from not meeting or exceeding the levels permitted by local, state, or federal requirements at the time of installation. The specification, bid, and contract documents must include that the materials installed shall have no exposed metal that could come in contact with the playground user under normal use.

Maintenance and Monitoring/Immediate Removal of Toxins/Sharps: Playgrounds will need to be monitored to ensure that there are no toxins/sharps present in or on the playground surfacing material. Ensuring that proper monitoring and maintenance is performed such that the playground is always free of toxins and sharps may require additional staff and/or training.

Warranty Documents: The warranty documents will state that toxins or sharps present in the surfacing material as supplied that are found upon installation, prior to installation, or during the warranty period will be removed at the cost of the installer.

BMPs Related to Playground Maintenance

Contract Requirements: Owners should require maintenance manuals, and the associated cost of maintenance to keep the system in its original condition, to be included with any bid/contract for evaluation. Prudent owners will include a section in the contract that states that the surfacing supplier will reimburse the owner/operator for any costs greater than 25 percent of the estimated maintenance cost over the five-year warranty period, under normal use.

Training, Equipment, Staff and External Resources: As mentioned above, ensuring that the playground is kept in compliance with ADA standards may mean adding to playground staff and/or training staff. In addition, external resources may be required, such as third-party inspectors, consultants, and testing.

BMPs Related to Warranties

Bid/Contract Documents: The bid/contract documents should clearly state warranty terms. To limit liability on future claims and potential failure of the system, contracts should require a minimum level of comprehensive insurance. The owner/operator should have their attorney review all contracts and warranties before selecting the vendor, as will each vendor before finalizing.

Concluding Remarks

Implementing the best practices above requires that all stakeholders be informed, active participants. Owners/operators are ultimately responsible for compliance with the 2010 ADA Standards and other state and federal requirements and various ASTM Standards. Architects, landscape architects, and specification writers should have at least a broad understanding of the 2010 ADA Standards, and specifications should include best management practices to support both the installation and functional longevity of the playground. Manufacturers, suppliers, and installers should be well informed and capable of complying with all aspects of the 2010 ADA Standards. In many cases this may require them to seek outside support.

Establishment and consistent use of BMPs, along with continued education for all stakeholders involved in designing, installing, supplying, managing/owning, and regulating playgrounds will help insure that playgrounds comply with the ADA Standards for Accessible Design, resulting in improved play conditions for children, their caregivers, and families, as well as more stable, long-term markets for California crumb rubber used in playground surfacing products.

Section 1

Introduction

Background

This report provides a summary describing the accessible route requirements issued by the U.S. Access Board/Department of Justice that became a Federal Standard on Sept. 15, 2010 and became enforceable on March 15, 2012, under the Americans with Disability Act (ADA). The report provides recommendations for best management practices (BMPs) that allow playground surfaces made using recycled tire rubber to comply with the new standards, which will also be required under the California Building Code in July 2013. The report was prepared by DK Enterprises under subcontract to SAIC, as part of the California Department of Resources Recycling and Recovery (CalRecycle) Tire-Derived Product Business Assistance Program (TBAP).

This report also provides an overview of how the new ADA Standards impact suppliers of crumb rubber, ground rubber, and buffings for playground surfaces; architects; playground installers; maintenance firms; and owners of public playgrounds. Because the ADA requirements for accessible routes within a playground are now law, playgrounds are under scrutiny and playground surfaces must become compliant. (An “accessible route” is a continuous, unobstructed path connecting accessible elements and spaces in a building or within a site that can be negotiated by a person with a severe disability using a wheelchair and that is also safe for and usable by people with other disabilities.) The law affects how owners/operators of playgrounds select surfacing products, consider liability, and consider maintenance and costs of maintenance. The report demonstrates why BMPs are important to all industry participants and why it is important for owners to take steps to ensure that playground surfaces meet the requirements of the ADA at installation and during the life of the playground.

This report is structured as follows:

Section 2 provides a description of the need for the project and the project approach.

Section 3 provides a description of playground surface design requirements, particularly the requirements of the 2010 ADA, which mandates the use of certain ASTM standards for playground surfacing.

Section 4 provides a description of best management practices to be employed by all stakeholders for recycled tire rubber playgrounds surfaces to comply with ADA/ASTM design requirements.

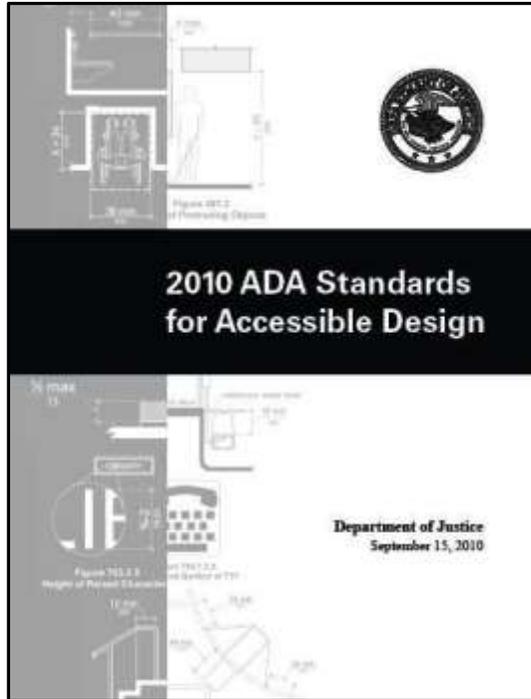
Section 5 provides concluding remarks, including what is needed going forward to help ensure ADA compliance in playground surfacing.

A Glossary of Terms is also provided to enhance the reader’s understanding of specific terms and phrases used in this Report.

Figure 1 depicts the cover of the new standards and provides the Internet access where they are available. The ADA law is enforceable by both federal and state governments, if state governments have adopted similar laws. Playgrounds installed prior to March 15, 2012, are not exempt from an ADA complaint through a lawsuit filed by the complainant. As a result, all playgrounds in Title II (owned by state and local governments) and Title III (public accommodations and commercial owners) jurisdictions will be required to meet the requirements

of the ADA that was originally enacted in 1991. Sections 105.2.3, 240 and 1008 of the ADA Standards for Accessible Design pertains specifically to play areas.

Figure 1
“2010 ADA Standard for Accessible Design” Guidelines



Available at: http://www.ada.gov/regs2010/2010ADAStandards/Guidance_2010ADAStandards_prt.pdf

Some exceptions to Section 240 of the Act are indicated, and include:

- Play areas located in family child care facilities where the proprietor resides
- Existing play areas where play components are relocated for the purposes of creating safe use zones and the ground surface is not altered or extended for more than one use zone
- Amusement attractions.

In addition, where play components are altered and the ground surface is not altered, the ground surface shall not be required to comply with 1008.2.6 (which stipulates ongoing maintenance to conform with ASTM F1951) unless required by 202.4 (Alterations Affecting Primary Function Areas).

Compliance with the 2010 ADA Standards for Accessibility will be possible, both upon initial installation and on an ongoing basis, with input from professionals in the industry, including playground designers, specifiers, installers, and owners/operators. It will be vital for the industry to develop and implement sound contracts and maintenance and warranty documents.

Manufacturers of tire-derived product (TDP) play area surfacing (such as rubber tiles, ground rubber as a loose-fill material, and pour-in-place surfacing), as well as installers of TDPs in playgrounds, need to be especially cognizant of the 2010 ADA Standards in order to best understand the safety and performance requirements for their products. In some cases this will

require redesign of existing products and will spur the industry to develop installation and maintenance standard operating procedures (SOPs) that will be required in contract documents by the owner/operators and their consultants/suppliers.

A playground that does not meet the Department of Justice 2010 Standards for Accessible Design will be expensive to the owner, consultant, and suppliers, and may put children at risk for injury. Figure 2 shows an example of an ADA-compliant playground.

Figure 2
Example of an ADA-Compliant Playground



A playground owner/operator must be aware of the ADA standards required, and work with qualified suppliers, designers, and consultants to implement Best Management Practices to help ensure that a safe, enriching playground experience is provided to users of the playground, and to ensure that the owner/operator is in compliance with federal and state requirements. The owner/operator will want to be sure that they select playground materials that have critical to quality attributes (as defined in the glossary), and are well-maintained and continue to meet or exceed ADA and other relevant standards over the useful life of the playground.

Section 2

Project Need and Approach

Project Need

The project approach was to work with TDP industry participants, including crumb/ground rubber producers, TDP manufacturers, playground architects/designers and consultants, specifiers, and owner/operators, to identify requirements of the 2010 ADA Accessibility Standards and to develop best practices that will result in high-quality playgrounds that are functionally compliant with the 2010 Standards. The anticipated period of use (e.g., functional lifespan) for playgrounds is typically 12 to 25 years, during which time they must remain in compliance. The development and implementation of best management practices (BMPs) in playground design, manufacture and installation will result in high-quality, accessible play environments that will benefit neighborhoods and society as a whole, and ensure usability of playgrounds for disabled children and their parents and caretakers. In this context, an accessible surface is defined as one that is firm, stable, and without deviation, in that it can be accessed by persons with physical constraints and that may use mobility devices.

Play spaces and playgrounds are complex and dynamic environments subject to stresses such as high traffic and detrimental effects such as rain, snow, and high levels of ultraviolet light that can negatively impact performance, and thus compliance with the 2010 ADA Standards for Accessible Design. Degradation of the play area can potentially lead to an ADA complaint being filed against the owner of a playground, can pose risk of injury to a child, and can possibly result in infringement of civil liberties for the disabled population. While playground owners are ultimately responsible for ensuring compliance with the ADA Standards for Accessible Design, they are not necessarily knowledgeable about the standards and requirements that exist (ASTM or ADA). Playground owners often rely on suppliers or consultants to identify and ensure such requirements. Suppliers and installers, however, may also not be familiar with all of the requirements of the 2010 ADA Accessibility Standards.

Participants in all aspects of the creation, installation, and maintenance of the playground actively contribute to the delivery and ongoing use of a functional, successful product. This requires exceptional product design, implementation, and maintenance. It also involves clear communication about responsibility at each stage of the playground's life – design, material manufacture, material installation, and during the entire useful life of the playground. Many suppliers will have to modify products or develop accessibility-specific maintenance documents to comply with the new requirements.

Clear contracts also will make clear whose responsibility playground repair is, and should stipulate specific timeframes and normal wear and tear vs. abuse of a system that leads to non-compliance issues.

Because there are so many entities involved in the development, installation, and ongoing maintenance of playgrounds, the guidelines and standards are relatively new, and the impacts of non-compliance can be severe, there is a need to clearly document the requirements of the 2010 ADA Standards and to develop and communicate best management practices that will protect the interests of all entities.

Further, the requirements of the ADA are complex — while playgrounds need to be firm, stable and without deviation in order to safely support mobility enhancement devices, they also need to

be soft enough to cushion falls appropriately. ADA requirements address both of these issues. Different playground surfaces will perform differently with regard to these standards. This makes selecting playground surfacing complicated for the owner/operator. At the same time, the owner/operator is facing increased liabilities and costs associated with designing, installing, and maintaining the playground.

Project Approach

Completing this project required extensive communication with the suppliers and installers of loose fill rubber playground surfaces, pour-in-place manufacturers and installers that utilize buffings and/or crumb rubber in their pour-in-place applications, synthetic turf installers that use crumb rubber infill in play settings, landscape architects and several public agencies, as well as extensive analysis of the ADA Standards.

The short- and long-term educational process is much larger than the scope of this project, however, and will be vital for playgrounds to achieve ADA compliance on an ongoing basis. There is a need for ongoing education of landscape/playground designers and architects, parks and playground owner/operators, manufacturers, supplier/installers, and maintainers of the full effect of the 2010 ADA Standards for Accessible Design. The education needed will include the manner in which an ADA complaint can be filed from the point of view of the owner/operator, and the potential of a complaint to be deemed to be the responsibility of the manufacturer: for example, in instances where a systemic problem may exist with the surfacing material supplied.

Targeted Outcomes

The desired outcome of this project is to help those involved in designing, installing, and maintaining playgrounds that provide a safe and enriching experience for children, parents, and their caregivers. The project also aims to provide awareness and tools so that it is clear to each stakeholder who has responsibility for ensuring compliance at each stage of the playground's life cycle.

There are many stakeholders involved in the process of designing, installing, and maintaining a playground, from the playground: designer/architect, consultant, tire rubber supplier, other members of the supply chain, the installer, maintenance staff, and public and regulating agencies. While the owner of the playground is ultimately responsible for ensuring ADA compliance, success depends upon the owner working successfully with the other stakeholders to improve play opportunities for children, their caregivers, grandparents, parents, and other relatives that may use the playground. The owner of the playground therefore needs to understand the nuances of the ADA standards, and make careful playground surfacing choices.

Section 3

Accessible Design Requirements and Standards

Importance of Understanding Requirements

In order to understand the requirements for the Department of Justice 2010 ADA Standards for Accessible Design and to develop best management practices (BMPs) it is important to describe the complexity of the playground environment and related standards guides and practices. (i.e., ASTM Standards and Guidelines, U.S. CPSC Guidelines, California Health and Safety Code, and the California Building Code). Additional requirements that are not described in this report but are also of importance include those for parking, access to the playground (i.e., from the parking area), water fountains, picnic areas, and sanitary facilities.

The owner/operator of the playground faces a complicated set of requirements in the installation and ongoing management of the playground surface assets at the time of specification, purchase, installation, and throughout its entire functional life. The prudent owner/operator will understand the legally required standards, and will include requirements as part of their terms of contract with associated designers contractors, installers, and suppliers. Some owners/operators may choose to select playground surfacing that exceeds the requirements, so that the surfacing is more likely to adhere to the standards over time.

Ultimately, for the entire length of time that the playground is open to the public, all of the standards and laws must be met. Failure to comply may result in injury to a child resulting in financial penalties from a liability claim or regulatory penalties for non-compliance.

Table 1
ASTM Standards Relevant to the ADA and Playground Accessibility

ASTM Standard	Title	Most Relevant Section of Standard
ASTM F1292-99	Standard Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment	105.2.3 008.2.6.2
ASTM F1292-04	Standard Specification for Impact Attenuation of Surfacing Materials Within the Use Zone of Playground Equipment	105.2.3 1008.2.6.2
ASTM F1487-01	Standard Consumer Safety Performance Specification for Playground Equipment for Public Use	105.2.3 106.5

ASTM Standard	Title	Most Relevant Section of Standard
ASTM F 1951-99	Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment	1008.2.6.1
ASTM F2479	Standard Guide for Specification, Purchase, Installation and Maintenance of Poured-In-place Playground Surfacing	Not specific to ADA, but relevant in that it provides information for owners considering a pour-in-place or other unitary or manufactured surface for a playground.
ASTM F2075	Standard Specification for Engineered Wood Fiber for Use as a Playground Safety Surface Under and Around Playground Equipment	Not specific to ADA, but relevant in that it provides information for owners considering using wood fiber for a playground surface.

Accessible Route

An Accessible Route connects elements, spaces, and facilities on a site required to be accessible. It is important to understand that the requirements described herein only apply to the section of the playground surface that is considered to be the accessible route, as defined in the 2010 ADA Standards. Although many owners select a surface to meet the accessibility requirements over a larger area, there is no requirement to make this extension. As the accessible route is rarely marked on the surface, where a synthetic surface is installed the entire surface could be considered to be required to meet the 2010 ADA Standards as the person using the playground may choose to approach the playground from various directions and to various play components, either elevated or ground level.

The American with Disabilities Act (ADA) and Architectural Barriers Act (ABA) have been in place for more than 20 years, and the playground rule, Section 1008, has been in place as ADA Accessible Guidance for more than 10 years and is now enforceable in the 2010 ADA Standards. These Standards are now enforceable by the Department of Justice, which is expected to result in stronger compliance efforts, and more significant penalties for non-compliance. The accessible route is difficult to define unless the play surface has a combination of loose fill and pour-in-place surfacing. An accessible route generally covers 18 to 22 percent of the area of the use zone of the playground as it connects the required elevated and ground level accessible play components. An inspector could go anywhere on the surface to perform testing because the accessible route is not often physically defined in the play space. It has been recommended to place the loose fill rubber under the higher items and pour-in-place under the lower fixtures because loose fill performs better to F1292. Figure 3 shows an accessible route on a playground.

**Figure 3
Accessible Route**



Play Components and Accessibility

Although not of primary importance to manufacturers of tire-derived play surfaces, it may be helpful for those in the industry to understand the ADA requirements for play components.

Examples of play components include spring rockers, swings, diggers, and stand-alone slides. Playground designers aim to select play components that will provide the user with different types of play experiences. Ground-level play components accessed by children with disabilities must be integrated into the play area. The idea is that children with disabilities be able to interact and socialize with all children. Therefore, grouping all ground-level play components accessed by children with disabilities in one location is not considered to be integrated.

For example, where a stand-alone slide is provided, an accessible route must connect the base of the stairs at the entry point to the exit point of the slide. A ramp or transfer system to the top of the slide is not required. Where a sand box is provided, an accessible route must connect to the border of the sand box. Ramps are preferred over transfer systems because they are more widely usable. Where ramps connected elevated play components, the maximum rise of any ramp run is limited to 12 inches.

There must be an accessible route in each playground that connects both elevated and ground-level play components. Although there are limited exceptions to the width, an accessible route is typically a three-dimensional space with a width of 60" (1524 mm), vertical clearance of 80" (2032 mm), a cross-slope that does not exceed 1:48 (2 percent grade) and a running slope for elevated components that does not exceed 1:12 (8 percent grade), while for ground-level components does not exceed 1:16 (6.25 percent grade). All 60" x 60" (1524 mm x 1524 mm) turning, transfer or resting areas must have a slope in all directions that does not exceed 1:48 (2 percent grade).

As an example, all play structures with more than eight elevated play components are required to have three elevated accessible play components and three ground level accessible play components. Should one of the elevated accessible play components start on the play structure and end on the ground, such as a slide, that will require travel from the elevated accessible route to a ground-level accessible route, there will have to be an accessible route to this slide entrance and ultimately returning at ground level from the slide exit to the structure entrance. This same play structure will also require a minimum of three non-redundant ground-level play components that must be on an accessible route. Generally, one of the ground-level components will be a swing; an accessible route must be provided for both the user of the swing and their potential caregiver. Depending upon the play space surface system selected, such as pour-in-place or mats, it may be difficult to visualize the accessible route. Alternatively, where a loose fill surface is selected it may be difficult to maintain the surface to the requirements. Table 2 shows the number and types of ground-level play components required to be on accessible routes. Figure 4 shows a playground and labels accessibility terms relevant to playgrounds.

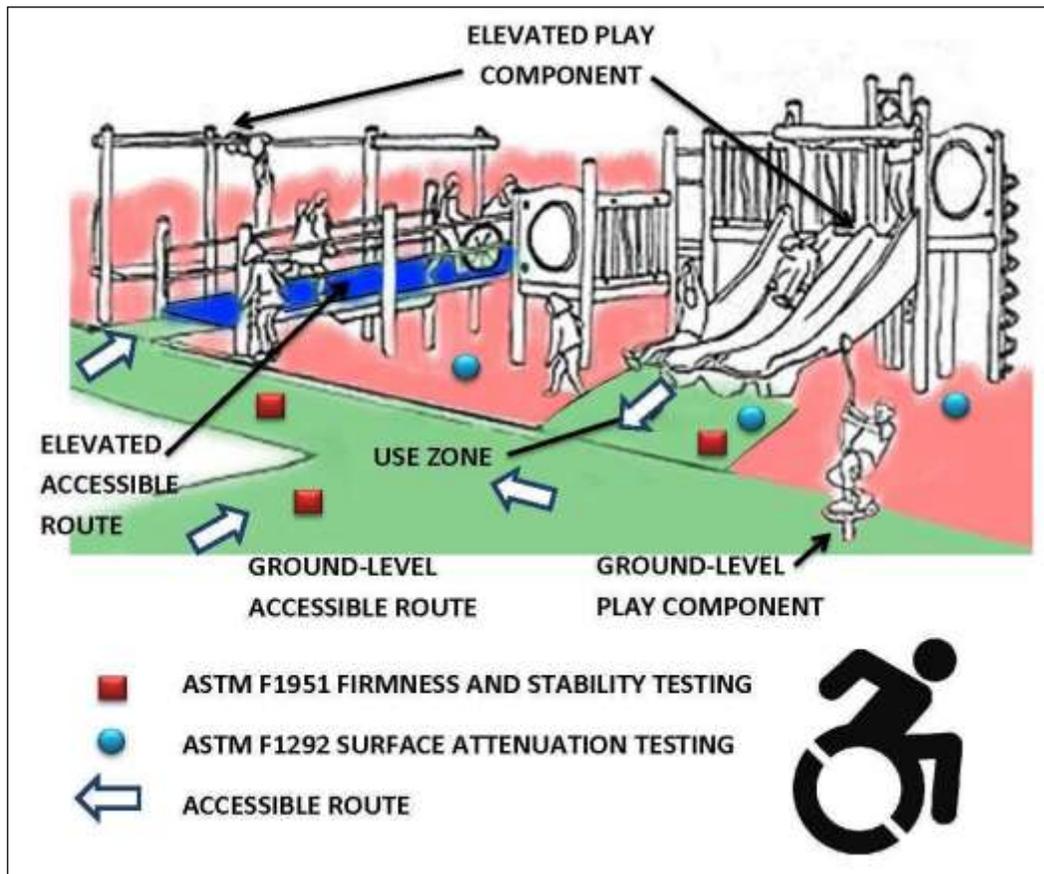
**Table 2
Number and Types of Ground-Level Play Components Required
to be on Accessible Routes**

Number of Elevated Play Components Provided	Minimum Number of Ground-Level Components Required to be on an Accessible Route	Minimum Number of Different Types of Ground Level Play Components Required to be on an Accessible Route
1	Not applicable	Not applicable
2 to 4	1	1
5 to 7	2	2
8 to 10	3	3
11 to 13	4	3
14 to 16	5	3
17 to 19	6	3
20 to 22	7	4
23 to 25	8	4
26 and over	8, plus 1 for each additional 2, or fraction thereof, over 25	5

Source: 201 ADA Standards, 240.2.1.2

If at least 50 percent of the elevated play components are connected by a ramp and at least three of the elevated play components connected by the ramp are different types of play components, then the play area is not required to comply with 240.12.2.

**Figure 4
Playground with Accessibility Terms**



Changes in Vertical Height

Changes in vertical level also have requirements for the accessible route. For the ADA the change in vertical height must be less than $\frac{1}{2}$ " with the first $\frac{1}{4}$ " allowed to be vertical and the second $\frac{1}{4}$ " required to have a slope of less than 1:2. Additionally, when the 60" (1524 mm) straight edge is placed on the surface and across the accessible route, there shall be no gap under the straight edge for the ADA greater than $\frac{1}{2}$ " (12.7 mm). This will be a particular problem at the junction with hard surfaces such as sidewalks, curbs, ramps, and transitions to other surface types within the accessible route. Figure 5 shows a playground that incorporates two different surface types, with an even transition (no vertical gaps) between the two surfaces.

Figure 5
Playground with No Change in Vertical Height at Transition to Other Surface



As is described above under play components, the accessible route cannot have a cross slope that exceeds 2 percent. Similarly, turning or resting areas must have a slope in all directions that does not exceed 2 percent.

Running and Cross Slopes and Slope in Transfer Location

The maximum running slope (slope that is parallel to the direction of travel) for a ground-level accessible route shall not exceed 1:16 (6.25 percent grade) and the cross slope shall not exceed 1:48 (2.08 percent grade). To be in compliance with the ADA, the resting, transfer, and turning areas (which are 60" in all directions) shall have a slope of less than 2 percent within and across the area. Wear and tear tends to occur in high traffic areas or in areas where there is turning and where higher impact play (e.g., landing from a higher play component) occurs. Most disruption will cause either a change in slope and/or change in vertical level.

Figure 6 shows running and cross slopes that meet the ADA Standards.

A running slope (parallel to the direction of travel) for elevated components must not exceed 8 percent. Figure 6 shows running and cross slopes that are in compliance.

Figure 6
Running and Cross Slopes



Figure 7 shows a playground that, although it has a cross slope over the entire width of less than 2 percent, it fails the straight edge test, as the gap under the 60" straight edge exceeds $\frac{1}{2}$ ".

Figure 7
Example of Failure of Straight-Edge Test



Horizontal Gaps

Since a mobility device (i.e. cane, walker, or wheelchair) could become trapped in an opening in the surface, nowhere along the accessible route shall there be a gap greater than $\frac{1}{2}$ " (12.7 mm). This is a particular problem for many synthetic surfacing systems that might shrink at the edges or at seams. Figure 8 shows instances of horizontal gaps which compromises the safety of the playground surface.

Figure 8
Horizontal Gap Surface



Another problem for people with mobility devices is the negotiation of carpeted surfaces. The 2010 ADA standard requires the pile height of carpet on the accessible route to be less than $\frac{1}{2}$ " (12.7 mm). This also applies to the artificial turf surfaces that are installed in the playground. Either the initial turf must have a pile less than $\frac{1}{2}$ " (12.7 mm) or where the turf has a higher pile height with crumb rubber infill for impact attenuation; the exposed pile height must be maintained to less than $\frac{1}{2}$ " (12.7 mm).

Playground Surfacing

The ADA requirements apply to all playground surfaces. Some types of playground surfacing may be more reliable for cushioning, for example, but may be prone to gaps or may lack stability. Playground material selection and testing is important for designers and owners/operators. There are two broad categories of surfacing — loose fill surfaces and unitary (i.e., solid) surfaces. These types of surfaces are described below. As described above, playground surfacing must be soft to absorb the impact of falls and thereby prevent injury, but at the same time stable enough to provide support for mobility devices. The properties of the accessible route do not just apply to the accessible route within the play space, but also the accessible routes transitioning into the play space, such as walkways and other junctions.

Loose Fill Surfaces

Loose fill surfaces are those that are comprised of multiple surfaces. They can be organic or inorganic. For example, they might consist of sand, wood mulch or wood chips, pea gravel, rubber nuggets, crumb or ground rubber, or rubber buffings. Loose fill surfaces can vary considerably in terms of type, size, and shape of the material of which they are comprised. These surfaces can:

- Provide excellent impact attenuation through free movement
- Provide poor impact attenuation over time due to compaction or contamination
- Require replacement/addition of material over time due to attrition
- Lack adequate firmness and stability for mobility devices.

Figure 9 shows a loose fill playground surface comprised of rubber nuggets.

Figure 9
Loose Fill Playground Surfacing – Rubber Nuggets



Unitary Surfaces

Unitary surfaces are solid in nature, and include rubber tiles, pour-in-place surfacing, hybrid surfaces (such as a combination of two surfaces, such as rubber tiles over which synthetic turf or loose-fill materials are installed), mats, and synthetic turf (e.g., with crumb rubber infill material). In general, unitary surfaces:

- Are manufactured to stay intact
- Require less maintenance
- Provide impact attenuation through deflection with a falling object
- Provide adequate stiffness for use of mobility devices

- May be so stiff (either by design or due to aging) as to pose risk of injury.

Figure 10 provides a picture of a playground with pour-in-place surfacing.

Figure 10
Playground with Pour-in-Place Surfacing



Figure 11 shows an example of a playground that uses rubber mats as a play surface.

Figure 11
Playground with Rubber Mats



Figure 12 shows a playground with artificial turf (using crumb rubber as an infill material).

Figure 12
Playground with Synthetic Turf Surface



ADA-Mandated ASTM Standards for Playground Surfaces

The ADA mandates that certain ASTM Standards be achieved on publicly accessible playgrounds. Described below are the standards for ASTM F1292 — Protection from Injury, which describes cushioning requirements, and ASTM F1951-99 — Provision for Mobility, which describes firmness requirements for playground surfacing.

ASTM F1292 – Protection from Injury

The primary role of the playground surface is to protect children from life-threatening head injuries and to reduce the severity of all other injuries in the event of a fall. The playground surface is, according to ASTM F1292, to attenuate the impact forces on an object falling from a drop height determined by the owner/operator prior to purchase. The pass/fail values are that the G-max (the measure of the maximum acceleration of the impact, measured in Gs, where G equals the acceleration of gravity at the Earth's surface) shall not exceed 200 and the Head Injury Criterion (HIC) shall not exceed 1000. These are values where there is a 50 percent risk of skull fracture and a 16 percent risk of a serious injury with “life-threatening, but survival probable” and 11 percent risk of fatality. Lower values of either G-max or HIC reduce the risk of a life-threatening injury as well as the severity of any other potential impact-related injury. This would be critical in reducing the incidence of concussions. The ASTM F1292 requires that all surfacing suppliers provide a test that is not older than five years for surface materials that are “identical in design, materials, components, thickness, and manufacture as the installed playground surface.” The requirement of the 2010 ADA is that the accessible route must comply with ASTM F1292 (Standards for Protection from Injury, 1999 or 2004 revisions) (1008.2.6.2) when the accessible route is within the play structure use zone as defined by ASTM F1487 (Standard Consumer Safety Product Specification for Playground Equipment for Public Use). Specifically, the sections of ASTM F1292-04 standard that are of most interest to playground designers, installers, consultants, inspectors, suppliers, and owners/operators include:

Section 4.4.1 – When an installed playground surface is tested in accordance with the requirements of Sections 16-19 at the reference drop height, the surface performance parameters at every tested location in the use zone shall meet the performance criteria of this specification. The reference drop height shall be the greater of (1) the height specified by the owner/operator prior to purchase; (2) the critical fall height specified when the playground surface was installed; (3) the equipment fall height, or (4) the critical height of the surface at the time of installation.

Section 4.4.3 – More Stringent Specification. The specifier may specify additional impact attenuation performance requirements, providing that such additional performance requirements are more stringent than the performance requirements of this specification.

Figure 13 shows field testing of the G-max rating using TRIAX.

Figure 13
TRIAX Field Testing



Compliance with ASTM F1292 for the entire playground is also a legal requirement in California. This standard is in accordance with the California Health and Safety Code, Sections 115725 to 115735 and the California Building Code (when the revised Code is published in July 2013). This Standard requires a three-temperature laboratory certificate (where testing is performed at 24°F, 72°F, and 120°F) and ongoing field testing to confirm compliance over time. In some jurisdictions where surfacing manufacturers have not performed the laboratory testing, a field test is performed at the time of installation and ongoing passing of field testing is allowed to satisfy requirements.

A key element of the ASTM F1292 field test procedure is that the drop height is determined by the owner/operator prior to purchase with the equipment fall height as stated in the ASTM F1487 or the U.S. CPSC Handbook as the minimum. This allows an owner to select a higher height to ensure best practice. Additionally the ASTM F1292 allows for more stringent (lower) values for

G-max and HIC than the minimums in the standard at the discretion of the specifier for the project.

When the impact attenuation of a protective surface is designed, there are two primary considerations: the ability of the product(s) to attenuate impact, and the ability of the surface to return to its original position, ready for the next impact. Loose surfaces consist of particles of rubber, stone, wood, or sand that will require maintenance to return to its original position. The ability of the surface to absorb energy lies in the ability of the particles to move in relation to each other. Loose materials are generally installed in such a manner as to continuously absorb impact through the resistive moving of particles away from the force of the impact. This is repeatable in the playground when the surface materials have sufficient depth to resist excessive displacement and disruption. Synthetic surfaces rely on a binder to hold the particles together as in pour-in-place or mats, while other systems such as synthetic turf rely on the carpet pile to stabilize the loose fill particles, and the underlying bonded particles of rubber move in relation to each other. How this movement is performed on a consistent basis will determine the impact attenuating properties of the surface. The ability of the particles to remain in place over time, continuing to provide the intended impact attenuation, will determine the value of the surface as a viable system.

ASTM F1951-99 – Provision for Mobility

ASTM F 1951-99 assesses the accessibility of a surface by measuring the work an individual must exert to propel a wheelchair across the surface. The standard includes tests of effort for both straight-ahead and turning movements, using a force wheel on a rehabilitation wheelchair as the measuring device. To meet the standard, the force required must be less than that which is required to propel the wheelchair up a ramp with a slope of 1:14. If located within the use zone, accessible ground surfaces must also be impact attenuating and meet ASTM F 1292-04 Standard Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment.

All surfaces, according to ADA section 1008, must comply with ASTM F1951-99. The supplier is required to provide a certificate of compliance to this standard for both straight-line propulsion and 90-degree turn turning and the owner/operator must ensure compliance to ASTM F1951-99 of the installed surface throughout the entire life of the playground.

It is commonly considered that the ASTM F1951-99 is performed in an indoor setting by “an accredited testing laboratory,” but this test has been performed in the field with the transfer of the ‘work measure wheelchair and data acquisition devices’ to the playground and the tests performed by “an accredited testing laboratory.” Although there is a significant cost associated with the transport of the testing devices, an owner may be required to perform the test should a complaint be lodged against a specific site. Depending upon the contractual stipulations, specifications, hold harmless statements, and warranties, this cost might be borne by the owner/operator or the supplier of the playground surface system.

Figure 14 shows a lab test in which mobility in a wheelchair is tested using an instrumented wheelchair and a 1:14 ramp.

Figure 14
Lab Testing of Wheel Chair Mobility on Playground Surfacing



A lower-cost alternative to test the performance of ASTM F1951-99 is to have the surface installed to the sample requirements for ASTM F1951 and utilize a device known as a rotational penetrometer to acquire a baseline measurement for firmness and stability for the installed system. This device can then be used to confirm continued performance or a measure of the maintenance that is being performed by the owner. Figure 15 shows the use of a rotational penetrometer in the field, which is used to check maintenance procedures to continue to keep the surface in a firm and stable condition to the time of installation.

Figure 15
Maintenance Field Test with Rotational Penetrometer



The properties of the accessible route do not just apply to the accessible route within the play space, but also the accessible routes transitioning into the play space, such as walkways and other junctions.

The Development of ASTM Standards

Standards-writing bodies, such as ASTM, have established technical committees comprised of industry experts to write standards related to playgrounds and also for playground surfacing. Standards content is developed by the responsible sub-committee and committees and following set procedures a standard is published. The standards-writing process allows and requires that standards are revised or reaffirmed within five years of the publishing of the current standard. This is the way in which standards remain relevant and reflect changes within the product, service, and use environment.

The ASTM F08.63 sub-committee has developed, in addition to ASTM F1292 and ASTM F1951, a “Standard Specification for Engineered Wood Fiber for Use as a Playground Safety Surface Under and Around Playground Equipment” (ASTM F2075), a “Standard Guide for Specification, Purchase, Installation, and Maintenance of Poured-in-Place Playground Surfacing” (ASTM F2479) and a Summary Standard for the standards that this group has published (ASTM F2223).

The sub-committee is working on items that will become standards in areas such as firmness and stability of an accessible route, performance requirements for pour-in-place surfaces, loose rubber surfaces used in the playground, and sand surfaces used in the playground. Some of these standards will take years to publish, while others will be published in a shorter time period. Some of these will be important in the provision of certain surfaces and the development of BMPs.

Factors that Can Affect Playground Surfacing Standards

When a playground owner/operator selects the surfacing system to be used, the decision is performance-based. Performance can be tested in the development stages at the product manufacturer level, or in the field, after its installation, up to the point of end of useful life and replacement. An owner/operator might aim to exceed the minimum standards, to ensure functional longevity and decrease maintenance costs.

There are several factors that can affect the ability of the playground surfacing system to be compliant with the ADA Standards. It is important that those involved in designing, manufacturing, installing, and maintaining the playground are aware of these factors, and each understands their role in assuring compliance – both initially and on an ongoing basis. Testing (both in the laboratory and in the field) is used to determine the extent to which these elements have or are expected to degrade the material. Laboratory testing is not the same as field testing due to the fact that the surfacing area may be affected by installation, maintenance, weather, play activity, and wear and tear that are not experienced in a laboratory setting.

Temperature

The temperature has a bearing on how playground surfacing products made of rubber perform and ASTM F1292 (Standard Specification for Impact Attenuation of Surfacing Materials within the Use Zone of Playground Equipment) requires that surfaces systems be tested in the laboratory at 24°F, 72°F and 120°F to demonstrate that they are suited to the range of temperatures children will play in. ASTM F1292 recommends that if the surface is to be installed outside the tested temperature range or in frozen conditions, tests should be conducted under those conditions to determine suitability to a particular environment. The recognition of the actual installed environment being a factor is further recognized with testing in the field to ASTM F1292 through the recording of the temperature at the time of testing and not limiting field testing to the temperature range of the laboratory testing and this is the anticipation of the 2010 ADA Standards. These tests are performed in the conditions and ambient temperature that the surface is found and air and surface temperatures and other weather conditions are recorded. Failure of this test in the field results in the play structure related to the failed surface being taken out of service until the surface complies.

Laboratory Testing: The ASTM F1292 laboratory testing was established to allow comparative testing of surfacing materials and to allow manufacturers to test uniform samples to a uniform procedure and controlled conditions. From a practical point of view there are shortcomings to the laboratory testing. The sample size for the laboratory testing for ASTM F1292 is a box that is 18”x 18”. For synthetic systems, the box structure can be left in place or removed as the rigid box side should not have an influence on the result. Alternatively, for loose materials, the box sides cannot be removed and do not allow for the displacement of the materials sideways nor does it indicate how this surface will perform in high traffic areas in the actual playground. As a result, a test report for loose fill that provides excellent test results in a laboratory condition should not be construed as providing assurance to the owner/operator of continued “safe” performance in the field.

Degradation and Attrition

Degradation or attrition of the playground surface during its useful life can affect the ability of the play surface to comply with ASTM F1292. Degradation and attrition can be caused by natural elements, normal wear, and removal of materials or abuse of the surface. For example, many aggregate loose fill systems particles will break down when abraded against their adjoining

particles and the dust will fill the void space that was originally there, with a resulting loss of attenuating features. This degradation causes many of these surfaces to fail the impact requirements. Although only mineral aggregates will be subject to this type of contamination (a dust is created in the grinding of sand and gravel, which binds, allowing for material to harden, also called “hardpan”), every material will be subject to contaminants that can be set between the systems particles. A peculiarity of wood chip systems is that when these products abrade and form sawdust and compost, there is a tendency for the surface to have better impact attenuating properties. As a result, each system must be reviewed as to its performance during active use over 12 to 25 years.

Loss of depth through wind, rain, attrition or removal from the play space is also not predicted by the laboratory results of ASTM F1292. It is for this reason that standards such as the Canadian CSA Z614, Children’s play spaces and equipment recommend the installation of a minimum of 12” of loose materials to allow for disruption over time.

ASTM F1292 laboratory testing is performed on new samples and there is no consideration of aging or weathering. Many bound rubber systems utilize a polymer binder that is not UV stable and these systems tend to get more ridged over time. This can also be the cause of shrinkage and gaps that would fail the 2010 ADA Standards. Given that almost every playground is located outdoors, the potential for failure is a major problem for the owner/operator. Failure of these systems generally results in a complete replacement.

Binder Selection

Pour-in-place surfacing systems are the subject of a guide standard, ASTM F2479. This standard recognizes that there are choices in binders; the non ultra-violet (UV) stable and low cost aromatic binders and the UV stable and higher cost aliphatic binders or some containing toluene diisocyanate (TDI), which is UV stable and when used judiciously will provide long term non-harmful beneficial performance. The choice of binder is generally made on a cost vs. longer-term conformance to the ASTM F1292 for the installed surface. Many manufactures make the least cost choice with owners finding that failure of ASTM F1292 testing places them with liability and non-compliance with the ADA, an embarrassing shutdown of the playground and an expensive replacement.

Other Potential Hazards

Other hazards beyond impact attenuation need to be considered in the design of the playground surfacing system. These will include, but are not limited to toxins, sharps and other hazardous materials. Toxins and sharps have long been understood to be undesirable as they might be absorbed by or cause injury to the skin or other body parts, or consumed. In some cases, toxins may include fire retardants. Sharps can not only cause direct injury, but cause concern for tetanus. In addition, when there is a puncture that results in blood being left in the playground; children may subsequently be exposed to a biohazard. For this reason the Engineered Wood Fiber Standard (ASTM F2075) does not allow for any tamp metal to be within the product and the proposed pour-in-place performance standard, while allowing ¼” exposed wire in the base cushion, the upper bound wear layer cannot contain any exposed steel and must be at least ⅜” thick to prevent exposure of the cushion layer to children. Other toxins, such as heavy metals, including lead, mercury and other known contaminants can be tested for. A list of contaminants and allowable levels should be available within federal, state or local requirements. This would also extend to lead limits for children under the age of 12 as set out by the U.S. Consumer Product Safety Commission (CPSC). The US CPSC Handbook for Public Playground Safety,

Section 3.7 on used tires, points out that “recycled tire rubber mulch products should be inspected before installation to ensure that all metal has been removed.”

One concern in designing products using recycled components is that toxins could have been introduced in the products as part of the original manufacturing process, or toxins could have become attached or bonded to the product during the first life of the product. For these reasons the system designer should test for known contaminants and those that might be reasonably expected to have come into contact with their raw materials. In addition, contaminants could be introduced to the surface material after installation, which is why playground maintenance is important.

The Importance of Maintenance

Since the playground surface must meet all of the performance requirements set out in ASTM F1292-99 or 04, ASTM F1951 and other federal, state and local requirements and since no product stays as it was when originally installed, a maintenance procedure and program must be in place. Specifically ASTM F1487, Standard Consumer Safety Performance Specification for Playground Equipment for Public Use, section 13.2.1 requires “The owner/operator shall maintain the protective surfacing within the use zone of each play structure in accordance with Specification F 1292 appropriate for the fall height of each structure and Specification F 1951 where applicable” and section 13.2.2 states that “The owner/operator shall maintain the protective surfacing within the use zone of each play structure free from extraneous materials that could cause injury, infection, or disease.” In Canada, the CSA Z614 considers both the maintenance program and the cost of such a program with the following “Playground inspection and maintenance are integral parts of budgetary costing. The cost of inspection and maintenance shall be considered and incorporated into the budget at the time of design, purchase of equipment, and installation.”

Failure to provide the appropriate maintenance could lead to premature failure, liability, penalties, and/or premature replacement. Having detailed product maintenance costs might lead the owner/operator to determine that the system is not financially feasible and another system will be selected.

For loose fill materials, maintenance can include loosening, re-grading, topping up, and even the removal and/or replacement of the entire system. The 2010 ADA Standards state that regular maintenance will be expected, required, and must be performed to ensure that the accessible route will continuously meet the performance requirements of both ASTM F1292 and ASTM F1951 and all other aspects of the physical measurements of the relevant laws. All of these standards and laws provide for testing of the installed surfaces with the portable test devices. Therefore, the determination of a failure is generally not as difficult as some would be lead to believe.

The Importance of Planning for All Stages of the Playground’s Life Cycle

Playgrounds are complex assets that require extensive up-front planning. Like any asset, the owner should consider the planning/design stage, the installation stage, the maintenance stage, and the post-useful-life stage before purchasing and installing the playground. Considerations will include details regarding:

- **Design and Planning** —What materials are being considered? What are their strengths and weaknesses? Should materials be combined? Examine all other considerations for proper staffing/budgeting and to help select playground surfacing. What pre-installation tests are

required for the playground material selected? Who will conduct the tests? Who will pay for the tests?

- **Installation** — What recourse does the owner/operator have if installation is not performed as specified, or if products do not meet initial specification? How do all involved communicate, and who is the ultimate “project manager” for the installation?
- **Maintenance** — What tests are required on an ongoing basis? What is the cost of those tests? How frequently must they be performed? Who will pay for the tests? Is additional staffing required? Does staff need training? What is the warranty period? What, specifically, is covered under the warranty? Do materials need to be replaced, repaired, cleaned, amended, or otherwise maintained over time? How frequently? What is the expected cost?
- **End of Useful Life** — Who is responsible for dismantling and disposing of the materials? Can they be recycled at the end of their useful life? What is the cost of disposal/ultimate disposition expected to be? Consider labor costs as well as actual disposal costs.

In terms of resources and level of effort, life cycle resources and responsibilities throughout the entire life of the playground can be thought of in the following manner:

- **Who is Responsible** — The owner/operator of the playground is ultimately responsible for ensuring compliance.
- **Annual Cost of Maintenance** — With the help of the product supplier, expected annual maintenance costs should be estimated before project installation, and should be factored as part of the project budget.
- **Additional Surfacing** — As is described above, traffic, weather, contamination, and normal wear-and-tear or abuse of the surface can cause material to need to be supplemented or repaired to remain in compliance.
- **Additional Equipment** — Maintenance of some surfaces may require the owner/operator to purchase additional equipment, such as a vacuum, to maintain the surface.
- **People** — The ADA accessibility standards may mean that playgrounds use additional human resources, or further train employees or subcontractors already being used. For example, playground owners/operators may desire to have or hire an internal inspector, an external certified playground safety inspector*, additional personnel for playground monitoring/maintenance, training, and they may wish to implement a regular inspection schedule.

* The National Recreation and Park Association has a Certified Park Safety Inspector (CPSI) program. The NRPA aims to train at least one inspector per community. For more information, see <http://www.nrpa.org/CPSI/>.

Section 4

Best Management Practices for ADA Compliance

Introduction

Designing or purchasing a playground surface is a complicated process. Due to the 2010 ADA accessible route requirements, the owner/operator could face serious financial consequences if the playground surface does not conform to ADA standards over the life of the playground. Because the playground protective surface is dynamic and subject to the elements, decisions about product selection are complex.

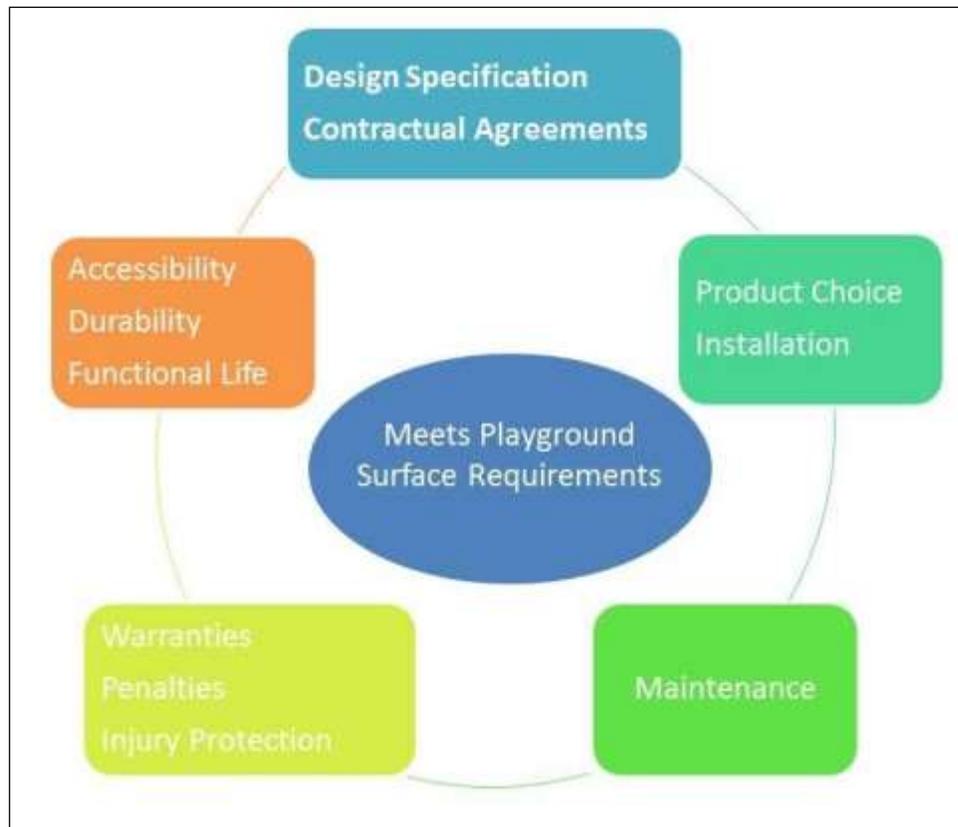
The project team developed BMPs by analyzing strategies that achieve ADA requirements. In addition, the team reviewed the strategies to be sure they are not in conflict with other requirements or that the enhancement of one aspect of the project will not negatively affect other requirements. This does not mean that other strategies will not achieve a positive result. There can be many strategies and each will have its merit.

Since this is a market-driven world, the BMP is best selected, adopted, mandated, and enforced by the owner/operator. They have liability for the asset, are stated to be the responsible party in the ADA, and have the most to potentially lose financially. The owner/operator will need to balance their product needs, tastes, budget, and ability to comply with the ADA standards given the variety of product choices. A successful project will be one in which:

- All stakeholders involved in the project understand their roles and responsibilities throughout the life of the playground up front.
- The playground achieves and maintains compliance with the ADA accessible route standards.
- The playground is tested regularly to ensure continued compliance.
- Children, parents, other relatives and caregivers have a safe, enriching experience at the playground.
- Product installation and maintenance costs are as expected, and the playground surfacing performs as claimed in the product specifications.
- If needed, the product warranty is honored in a timely manner by the product manufacturer.

In general, the owner/operator of a playground has many decisions to make regarding playground surfacing. Now there will be potential consequences for making uninformed choices, or for failing to monitor and maintain the playground surfacing such that it remains in compliance with ADA Accessibility Design Standards. Figure 16 summarizes the choices and tradeoffs the owner/operator will have to consider when selecting the playground surfacing system.

Figure 16
Considerations and Tradeoffs in Considering Options for Playground Surfacing



It is recommended that there be well-written specifications, performance measures, testing, and financial penalties such as non-payment for non-performance and strong warranties among the parties involved so that expectations are clear. The warranty should also clearly specify the length of the warranty and what specifically is covered by the warranty, as well as who is the responsible party, specifically. Ensuring that documentation is clear and thorough in advance of a project installation will result in playground designers, consultants, manufacturers, suppliers, and installers responding in a competitive manner to provide high-quality products that meet the ADA accessibility requirements. BMPs that support these targeted outcomes for playgrounds are described below.

Cost and Payment for Playground Surfacing Product(s)

There are a myriad of playground products and surfacing options available in the marketplace. While playground users might perceive that a more complicated playground layout/design could be exciting, the owner/operator should keep in mind that they have to not only to install, but maintain all aspects of the play area for the useful life of the playground. Owners must understand that many of the choices they have are likely to be proprietary or incorporate technology not available to the owner. This could pose challenges in the future if the business

ceases to operate, or the owner/operator may lack the ability to negotiate if only one supplier is able to repair the surface in the future.

Best Management Practices

Design/Layout: A simpler layout (e.g. relatively few colors, figures) that supports long-term functionality could ultimately reduce the cost and potential risk of fines. “Simple” may help the TDP producers lessen the need for educating the playground designer/architect, lower the initial cost of design, and also reduce the cost of implementation, maintenance, and repair.

Payment to Manufacturer/Installer: It is recommended that the owner/operator only pay for the protective surfacing installation after it has been completely installed, successful performance testing is confirmed, maintenance documents are presented, and warranties for a specified number of years (e.g. five to eight years) are provided. An owner might be at risk if they provide payment prior to compliance should the supplier fail to make corrections. Assurances and warranties will increase the cost of the play surfaces. ASTM F2479, section 14, provides guidance for a warranty for pour-in-place surfaces that would be adopted for all playground surfaces.

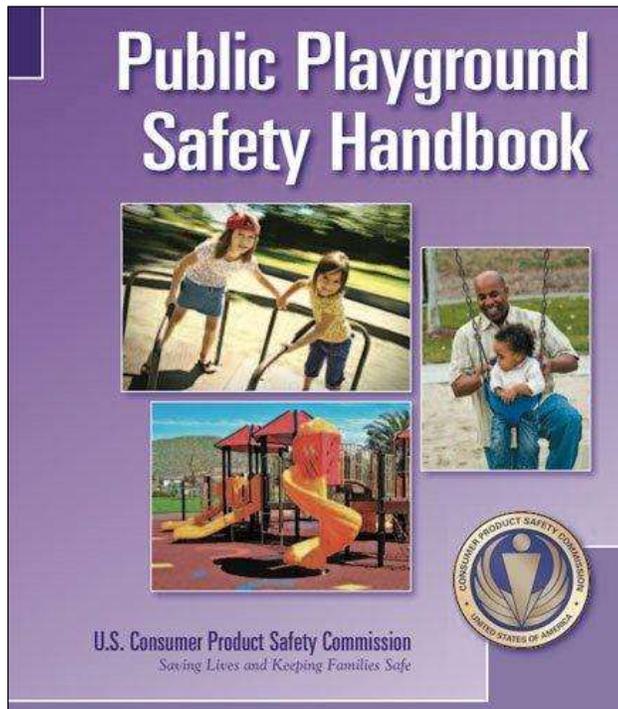
Impact Attenuation

Not only is it important for impact attenuation to be adequate to conform to ADA Standards upon initial implementation, but impact attenuation needs to be maintained for the useful life of the playground.

The minimum requirement for impact attenuation in ASTM F1292 is that the G-max value must not exceed 200 and the HIC value shall not exceed 1,000 from the drop height for each play component, as stipulated by the owner/operator prior to purchase. These are also the values where a child runs a 10 to 15 percent risk of fatality. Every surfacing supplier must have a test certificate that is less than five years old and the critical height must be greater than the fall height of any play structure to be installed. (ASTM F1292). It is critical that the owner of the playground require that the critical height is higher than any fall height on the playground that a child might climb to.

It should also be remembered that the California Health and Safety Code invokes the U.S. Consumer Product Safety Commission (U.S. CPSC), Handbook on Public Playground Safety (Figure 17), which states that the fall height used for testing should be greater than or equal to the fall height of the highest piece of equipment on the playground. The fall height of a piece of equipment is the distance between the highest designated play surface on a piece of equipment and the protective surface beneath it.

Figure 17
U.S. Consumer Product Safety Commission



Available at: <http://www.cpsc.gov/PageFiles/122149/325.pdf>

Many surface systems will lose impact attenuation, either through attrition or system failure causing maintenance or replacement.

Best Management Practices

ASTM Standards allow and recommend that the owner/operator select lower initial values and with the drop height being determined by the owner/operator prior to purchase, this can be higher than the minimal fall heights in the structure standards. BMPs pertaining to achieving impact attenuation standards include:

Drop Height Testing: The drop height used for testing at the time of installation is selected by the owner/operator and shall be at least the height of tops of barriers, guardrails, swings, climbers, and any railing within 10° of flat (i.e., a level surface). The G-max value shall be less than 125, and the HIC value shall be less than 700 at that height. At the end of the five- to eight-year warranty period, the G-max and HIC values shall not exceed the requirements of the relevant standard from the initial drop heights. Since the 2010 ADA is based on field compliance, it is recommended that the owner adopt an annual or biannual testing program. The frequency of testing to ASTM F1292 might be at a minimum at the time of installation to confirm compliance, then annually where the values are less than 50 percent of the 200 G-max and 1000 HIC and biannual where the impact values are greater than 50 percent of the 200 G-max and 1000 HIC. As the surface approaches higher values and therefore end-of-life, more frequent testing or maintenance might be required.

Critical Height Test Certificate: The owner/operator shall acquire the critical height test certificate for the surface being installed and assure themselves that the surface system in the

certificate is, in fact, the surface system that is being installed. For loose surfacing systems, the supplier must provide a certificate that the surface depth being installed will remain sufficient during normal use to continue to meet the performance of the impact attenuation standards from the original drop heights.

Contract Requirements: The bid/contract documents will require the surfacing supplier's instructions for surface and materials preparation and depth for performance of the ASTM 1292 in the laboratory. Note: this must be the same as for the ASTM F1951-99 samples tests for the same contract.

Warranty: The owner specifies the number of years to warranty the play surface (e.g. five years) and test certification assurances should remain in place for five years. The playground installer may have equal concerns as to how the play surface is maintained by the owner. It is understood that there could be significant costs associated with the warranty or fines for non-compliance with ADA requirements.

Maintenance and Monitoring: The owner/operator of the playground will need to ensure that the playground meets or exceeds the ADA Standards for impact attenuation throughout its useful life. This will require regular maintenance and monitoring and regularly scheduled field testing of the playground surfacing. Maintaining the playground to standard may require additional staff and/or training or hiring of third-party inspectors. Additional maintenance may mean adding loose fill material or repairing/supplementing unitary surfaces.

Documentation of Accessible Route

Accessible route means a continuous unobstructed path connecting accessible elements (such as various play structures) and spaces in the play space that can be negotiated by a person with a severe disability using a wheelchair and that is also safe for and usable by people with other disabilities. Under the ADA Accessible Route Design Standards, the accessible route must be defined/laid out for all of the play components, whether they are elevated or located on ground level. There are playgrounds where all of the play structures are supplied by the same manufacturer, and there are instances where the owner or their consultant selects structures from a number of manufactures. Regardless, each play structure supplier must define the elevated and ground-level accessible components as required in the appropriate requirements (ADA Standards 240.1.1.2). It is the responsibility of the play structure suppliers and the owner or their consultant to ensure that the accessible route is appropriately defined, particularly the ground level routes and the junction with accessible routes to the play space.

Best Management Practices

Contract/Documentation Requirements: Drawings defining the elevated and ground-level accessible routes shall be included in bid/contract documents and signed off as appropriate by the consultant, play structure supplier, and surfacing supplier. Any errors in the layout or deviations from the plan must be brought to the immediate attention of the owner prior to installation of that particular supplier's portion of the work.

Change of Vertical Height

Changes in vertical height can have a negative impact on the ability of a person with physical limitations to use the play space. Therefore, change in vertical height at any point on the accessible route will result in the failure of the surface to comply with the 2010 ADA Standards. The changes in vertical height are most likely to occur at the entrance to the play space, along

ramps, within the surface system, or at the entrance or exit of a play component. A failure could take place at the time of installation or at any time during the use of the playground. Each supplier of accessible route materials or systems, ramping for elevated routes, and protective surfacing for ground level must be able to assure the owner of continued compliance. Where the surface can be bonded to the surrounding hard surfaces a recess should be provided to ensure a smooth transition.

Best Management Practices

Contract Requirements: The bid/tender and/or contract documents must contain a section where the accessible route supplier agrees that their product meets and will continue to meet the relevant requirements for changes of vertical level at junctions with other surfaces and within the surface system for the functional life of the playground.

Running and Cross Slopes and Slope of Transfer Locations

Maximums for running and cross slopes and the slope in transfer locations are described in Section 3 of this report. Areas that are likely to exceed allowed running and cross slopes are high traffic areas, where disruption will cause either a change in slope and/or change in vertical level.

Best Management Practices

Plans and Layouts: All plans and layouts shall set limits of 50 percent of the allowed values for slope and the target for installation shall be 75 percent of the allowed slope with non-compliance requiring removal and replacement at the supplier's cost. To allow for installation errors or environmental changes during the life of the playground, all plans and layouts shall set limits at the time of installation that are less than 50 percent of the maximum allowed.

Maintenance and Monitoring: Playground staff will need to monitor and maintain the playground surfacing to ensure that proper running and cross slopes are maintained. In the case of loose-fill surfacing, staff will likely need to reallocate material to high-traffic and high-impact areas, such as the bottom of slides and other components, and transition areas. This may require additional staffing and/or additional training. Staff should have a regular inspection program in place, and measuring running and cross slopes should be part of this process. In some cases correcting slopes may mean adding more material, and in others may mean a more in-depth repair. In either case, regular measuring and monitoring will help ensure that needed repairs are anticipated and planned appropriately.

Firmness and Stability

The requirement for Floor and Ground Level Accessible Routes in the ADA 2010 Standard requires under Section 302.1 General. Floor and ground surfaces shall be stable, firm, and slip resistant and shall comply with Section 302.

As is described in Section 3 of this report, ASTM F1951-99 establishes a uniform means to measure the characteristics of surface systems in order to provide performance specifications to select materials for use as an accessible surface under and around playground equipment. While cushioning is important for protecting the user during falls, stability and firmness are important for providing a surface that allows the user to move in a safe fashion, particularly if using a wheel chair or other mobility-enhancing device.

Best Management Practices

Contract Documents and Testing: Write into the contract that the accessible route must be firm and stable at all times to allow people with mobility devices to traverse the surface within a realistic limit of work. A measure of the work required was initially established with the work measure test published in ASTM F 1951-99, and required in the 2010 ADA Standards. It is recommended that every surface system supplier maintain a copy of their test certificate and be able to assure the owner that the materials tested are the same as those being installed. The owner, prior to payment for the materials, should have their installed surface field-tested to ASTM F 1951-99 at a considerable cost to the supplier or, with the consent or within the contract, test the site using the a field test (e.g. rotational penetrometer), which would be a lower cost. Though not required, this device has demonstrated a high correlation with the results of the ASTM F1951-99.

It is prudent for a supplier to design and test their product to the anticipated values for firmness and stability to ensure they will not incur costs for bringing their product into compliance.

The bid/contract documents will require the surfacing supplier's instructions for surface and materials preparation and depth for performance of the ASTM F1951-99 in the laboratory. Note: this must be the same as for the ASTM F1292 samples tests for the same contract.

Certificate of Compliance: A certificate of compliance to ASTM F1951 is a requirement of any bid/contract submission. To limit the potential for accessibility complaints, or the expense of ASTM F1951-99 testing in the field, the contract documents must allow for the testing in the field using the rotational penetrometer.

Maintenance and Monitoring: Playground staff will need to monitor and maintain the playground surfacing to ensure ongoing compliance with ASTM F1951-99. Having a regular inspection program in place should be part of this process.

Toxins & Sharps

Should a toxin, sharp, or hazardous material be in the playground, the owner/operator will have to take steps to remove it. The toxin may be known as being in the raw materials by the nature of their manufacture, while other toxins might have come into contact with the raw material during storage or processing or during the use of the material in its first life, if it is a recovered material. These could be lead from car exhaust on old tires, liquids such as antifreeze, solvents, or other liquid chemicals that were contacted during the primary life of the raw material. Additionally, there may be naturally occurring toxins such as fungi in wood-based products or organisms that become trapped in the pores of a pour-in-place system. Toxins must not be allowed in inorganic materials, while organic materials will have naturally occurring fungi and toxins. Maintenance instructions for such materials must provide the instructions for removal and remediation of these naturally occurring toxins.

Sharps include staples, nails, wires, etc. that could cause a puncture or internal damage should it be ingested. There may also be contaminated blood in the playground that becomes a biohazard problem requiring closure of the playground.

Best Management Practices

Contract Documents: The specifications, bid, and contract documents must include that the materials installed will not contain toxins to a level that would preclude the material from not meeting or exceeding the levels permitted by local, state, or federal requirements at the time of installation.

The specification, bid, and contract documents must include that the materials installed shall have no exposed metal that could in contact with the playground user under normal use.

Maintenance and Monitoring/Immediate Removal of Toxins/Sharps: Playgrounds will need to be monitored to ensure that there are no toxins/sharps present in or on the playground surfacing material. Should toxins or sharps be found at the time of installation, they must be removed prior to operation of the playground. Ensuring that proper monitoring and maintenance is performed such that the playground is always free of toxins and sharps may require additional staff and/or training.

Warranty Documents: The warranty documents will state that toxins or sharps present in the surfacing material as supplied that are found upon installation, prior to installation, or during the warranty period will be removed at the cost of the installer.

Playground Maintenance

Playgrounds and the protective surfacing are dynamic and subject to high traffic, wear, weather, and other factors that can deteriorate the systems. This can lead to a failure of one or more of the requirements and raise the need for maintenance or replacement of the system. Maintenance is the process of keeping the surfacing system in, or close to, its original state.

Some systems will need more maintenance than others, and the extent of maintenance required will pose financial consequences for the owner/operator. The budget—including labor, financial resources, and replacement of materials—must be established prior to the purchase of any system. Each manufacturer/supplier should be able to supply a maintenance manual and recommend the frequency of maintenance activities for their system.

Best Management Practices

Contract Requirements: Require that maintenance manuals and the associated cost of maintenance to keep the system in its original condition be included with any bid/contract for evaluation. Prudent owners will include a section in the contract stating that the surfacing supplier will reimburse the owner/operator for any costs greater than 25 percent of the estimated maintenance cost over the five-year warranty period, under normal use.

Training, Equipment, Staff and External Resources: As mentioned above, ensuring that the playground is kept in compliance with ADA Standards may mean adding to playground staff and/or training staff. In addition, external resources may be required, such as third-party inspectors, consultants, and testing. Some playgrounds may need additional equipment to keep them maintained, such as vacuums. The industry as a whole will need to be trained more fully to ensure that the playground owner/operator can foresee when non-compliance will occur, and resolve the issue before the playground becomes non-compliant with ADA Standards for Accessible Design.

Figure 18 shows how gaps in surfacing can appear in playgrounds over time.

Figure 18
Importance of Documenting Maintenance Responsibilities



Warranties

Ideally, the playground owner has the protection of the well-written specification and compliance testing requirements at the time of installation to ensure initial compliance. Once the installation has been paid for, however, only the terms of the warranty ensure continued compliance. The terms of the warranty must be clear and performance-based. The terms of the warranty must include the timeframe of the warranty (generally a minimum of five years) and must clearly describe the repairs or replacements that the supplier must perform, under what conditions, and how quickly.

In some cases, the owner may do everything to ensure compliance with a specification before, during, and after the installation, such as testing at the time of installation and performing regular maintenance, only to find that when there is a warranty claim the manufacture/supplier is either not around, or not capable of correcting the failure. This is often, but not necessarily, the case with suppliers that are new or agents operating on behalf of a non-responsive supplier.

Best Management Practices

Bid/Contract Documents: The bid/contract documents will have the terms of the warranty clearly stated and will require the corporate history of each supplier. To limit liability on future claims and potential failure of the system, the contract will require a minimum of \$2 million of comprehensive insurance. Insurance may be required by a public agency that owns the playground. The owner/operator will have their attorney review all contracts and warranties before selecting the vendor, as will each vendor before finalizing.

Section 5

Concluding Remarks

Implementing the best practices described within this report requires all stakeholders in the industry to be informed and to take action. For example, playground owners/operators, suppliers/manufacturers, inspectors, and public regulators will need to have individually tailored programs directed at their particular aspect of compliance with the 2010 ADA Standards.

There is also a need for architects, landscape architects, and specification writers to have at least a broad understanding of the 2010 ADA Standards, and specific specifications that include best management practices to support both the installation and functional longevity of the playground. As this group is considering the entire playground, they will need to have an understanding of the attributes of specific surfacing materials, and the positive and negative features and issues related to those surfacing materials relative to ADA compliance.

Similarly, owners/operators of playgrounds are ultimately responsible for compliance with the 2010 ADA Standards and other state and federal requirements and various ASTM standards. Owners and operators should be educated to the level of consulting professionals, at a minimum, but will also need to have an understanding of accessible routes based on the elevated and ground-level play components and the types and frequency of maintenance and warranties that would be specific to various surfacing systems.

Manufacturers, suppliers, and installers of components and final products for the playground surfacing should participate with specialists capable of providing them with all aspects of the 2010 ADA Standards and how their TDPs can best fit with the specifications and installation and maintenance requirements of the standards. Since failure is not an option, this may be by far the most intense program and require the most one-on-one and direct involvement for a period of time. Successful TDP manufacturers will ensure success for the compliance program.

A group of playground practitioners have taken a playground inspection course provided by the National Playground Safety Institute of the National Recreation and Parks Association and are designated as Certified Playground Safety Inspectors. These inspectors will need to expand their knowledge to include a minimum of a one-day course to understand the requirements of ASTM F1292 and a two-day course to familiarize themselves with the complexities of the 2010 ADA Standards in the playground. There will be certain members of this group who will likely become Certified Playground Inspection Practitioners with a recommended set of tools, devices, and appropriate insurance coverage to perform all of the required inspections described within this report. This group will ultimately confirm conformance of a playground at the time of installation and during its functional life. They will also, over time, likely become consultants to the designers, owners/operators, maintainers, and providers of the playground components.

Establishment and consistent use of BMPs, along with continued education for all stakeholders involved in designing, installing, supplying, managing/owning, and regulating playgrounds will help result in playgrounds' achieving ongoing compliance with the ADA Standards for Accessible Design, and will result in improved play conditions for children, their caregivers, and families.

Glossary of Terms

Term	Acronym	Definition
ABA	ABA	Architectural Barriers Act – A 1968 law requiring that facilities designed, built, altered, or leased with funds supplied by the United States federal government be accessible to the public.
ADA Accessible Route		A continuous unobstructed path connecting all accessible elements and spaces of a building or facility. Interior accessible routes may include corridors, floors, ramps, elevators, lifts, and clear floor space at fixtures. Exterior accessible routes may include parking access aisles, curb ramps, crosswalks at vehicular ways, walks, ramps, and lifts.
Americans With Disabilities Act	ADA	An Act to establish a clear and comprehensive prohibition of discrimination on the basis of disability. First signed into law in 1990, and amended in 2008 and 2010.
Aesthetic		Visually appealing. In design, may be at the expense of functionality.
Accessible Route		A continuous unobstructed path connecting accessible elements and spaces in a building or within a site that can be negotiated by a person with a severe disability using a wheelchair and that is also safe for and usable by people with other disabilities.
American Society for Testing and Materials	ASTM	An organization that develops and delivers international, voluntary consensus standards for materials, products, systems and services used in construction, manufacturing and transportation.
Best Management Practices	BMP	Those practices determined to be the most efficient, practical, cost- effective measures identified to guide a particular activity or to address a particular problem.
Critical Height		A measure of the impact attenuation performance of a playground surface or surfacing materials; defined as the highest theoretical drop height from which a playground protective surface meets the impact attenuation performance criterion of ASTM F1292. The fall height below which a life-threatening head injury would not be expected to occur.
Critical to Quality		A process characteristic or component that has a direct effect on whether the overall process or product is perceived by the customer to be of acceptable quality.
Cross Slope		The slope that is perpendicular to the direction of travel.

Term	Acronym	Definition
Crumb Rubber	CR	Material derived by reducing scrap tires or other rubber into uniform granules with the inherent reinforcing materials such as steel and fiber removed along with any other type of inert contaminants. (Alternate definition): --fine particles of vulcanized rubber resulting from mechanical or cryogenic size reduction of scrap tires or other rubber products.
Drop Height		Height from which the missile is dropped during an impact test, measure between the lowest point of the elevated missile and surface under test and for ASTM F1292, stipulated by the owner/operator prior to purchase
Elevated Play Component		A play component that is approached above or below grade and that is part of a composite play structure consisting of two or more play components attached or functionally linked to create an integrated unit providing more than one play activity.
Fall Height		The vertical distance between the highest designated play surface on a piece of equipment and the protective surfacing beneath it
G-max		The maximum acceleration of a missile during an impact, expressed in g units.
Ground Level Play Component		A play component that is approached and exited at the ground level.
Ground Rubber	GR	A material defined by ASTM D11 Rubber Committee as particulate rubber composed of mainly non-spherical particles that span a range of maximum particulate dimension from well below 40 mesh to 2.032 mm (0.08 in) as a maximum particle dimension. The smallest reported mesh size for ground rubber is 450 mesh.
Head Injury Criteria	HIC	A specific integral of acceleration-time history of an impact, used to determine the relative risk of head injury
Life Cycle of a Product		Relates to the stages of introduction, growth, maturity or stagnation, and decline of a product.
Life Cycle Performance		Performs as expected over lifetime of a product.
Play Component		An element intended to generate specific opportunities for play, socialization or learning. Play components may be manufactured or natural, and may be stand alone or part of a composite play structure.
Product Standard		Established test or guideline for a specific product or raw material.
Pulverized Rubber	PR	Material that has been crushed, pounded, or ground to smaller particles.
Quality		The totality of features and characteristics of a product or service that bears its ability to satisfy stated or implied customer or user requirements.

Term	Acronym	Definition
Running Slope		The slope that is parallel to the direction of travel.
Standards		Include terminology, symbols, testing and methods, packaging, or label requirements as they apply to a product or industry
Tire-Derived Product	TDP	Product derived from waste tires after processing such as, but not limited to, chipped, shredded, cut or sliced tires, crumb rubber, steel/wire, fiber cord material, oil or carbon black and has been sold or removed from the facility of the waste tire processor.
Transfer Location (Transfer Area)		Locations on the playground where a person with a disability transfers from a mobility device from the play structure transfer system or from the play component back to a mobility device. For the 60" in all directions this area must have a slope across it or within of less than 2%.
Use Zone		The ground level area beneath and immediately adjacent to a play structure or piece of equipment that is designated by ASTM F 1487 Standard Consumer Safety Performance Specification for Playground Equipment for Public Use for unrestricted circulation. This is the play surface upon which it is predicted a user would land when falling from or exiting the equipment.

Bibliography

- ASTM F1292, “Standard Specification for Impact Attenuation of Surfacing Materials Within the Use Zone of Playground Equipment,” ASTM International, West Conshohocken, PA, USA, 1991, 1993, 1999, 2004, 2009.
- ASTM F1487, “Standard Consumer Safety Performance Specification for Playground Equipment for Public Use,” ASTM International, West Conshohocken, PA, USA, 2001, 2005, 2007.
- ASTM F1951, Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment, ASTM International, West Conshohocken, PA, USA, 1999.
- ASTM F2223, “Standard Guide for ASTM Standards on Playground Surfacing,” ASTM International, West Conshohocken, PA, USA, 2003, 2009, 2010.
- ASTM F2479, “Standard Guide for Specification, Purchase, Installation, and Maintenance of Poured-In-Place Playground Surfacing,” ASTM International, West Conshohocken, PA, USA, 2007, 2010.
- CSA Z614, “Children’s Playspaces and Equipment,” Canadian Standards Association, Mississauga, ON, Canada, 1991, 1998, 2003, 2007.
- California Department of General Services, Division of the State Architect, Updated Accessibility Regulations Approved by California Building Standards Commission, <http://www.dgs.ca.gov/dsa/programs/progaccess/access2013.aspx>.
- DSA's California Access Compliance Reference Manual, <http://www.dgs.ca.gov/dsa/Programs/progAccess/accessmanual.aspx>
- Huber, Rolf, “The Sustainable Playground Protective Surface,” Canadian Playground Advisory Inc., February 2011.
- Huber, Rolf, “Impact Attenuation Values and Prevention of Head Injuries in Children’s Playgrounds,” Canadian Playground Advisory Inc., July, 2011.
- PD CEN/TR 16148:2011, Head and neck impact, burn and noise criteria – A Guide for CEN Helmet standards committees, Brussels, Belgium, 2011.
- United States Access Board, <http://www.access-board.gov/>.
- United States Access Board, ADA Standards, <http://www.access-board.gov/ada/>.
- Standards pertaining to play areas and access, <http://www.access-board.gov/adaag/html/adaag.htm>
- Subsection for play areas, <http://www.access-board.gov/adaag/html/adaag.htm#15.6%20Play%20Areas>
- Subsection for outdoor developed areas, <http://www.access-board.gov/outdoor/nprm.pdf>

United States Access, File a Complaint, <http://www.access-board.gov/enforcement/filing.htm>.

United States Consumer Product Safety Commission Public Playground Safety Handbook, <http://www.cpsc.gov/PageFiles/122149/325.pdf>