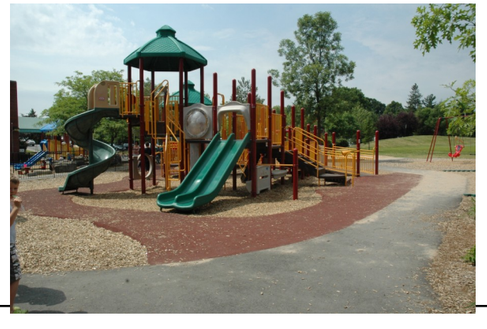
used in the determination of surface properties to meet the American with Disabilities Act (ADA) requirements of firm, stable and slip-resistant. The test method suggest for the ADA has never been considered or tested for injury prevention.

The need for accessibility and therefore firmness and stability in the playground raises another issue in the balancing act that the playground practitioner, owner/operator, surfacing supplier and playground designer must deal with in today's society. Currently in the United States the ADA is civil rights legislation that requires the inclusion of an accessible route within all playgrounds. Similar mandates are being brought into effect across Canada as various provinces bring standards for accessibility in the built environment into force. This will apply to all public access playgrounds and it will be interesting to see how the Toronto District School Board rises to the challenge when it comes to the playgrounds that have granitic sand. The maintained engineered wood fibre, as the Axelson research points out, will provide a firm and stable surface necessary for accessibility.

The provision of playspaces is at best and in no particular order a juggling act of age-appropriate challenge, mix of physical, social and quiet play, play value that attracts children of all abilities, compliance with standards and mandates, functional longevity of the play components and surfacing, cost-effective maintenance, injury prevention, and accessibility.

Playground practitioners would welcome the input of the injury prevention community with research specific of injuries and severity as they relate to specific falls and playground locations. These studies should be able to illicit the cooperation of persons with surface impact testing equipment to follow-up at the injury site within 24 to 72 hours to perform inspection and impact testing. Coupling the site data with the injury severity information should have significant influence on standards writers and therefore public health.



Canadian Playground Advisory Inc.

2344 Manor House Crt.
Mississauga, Ontario
L5M 5Y3

Phone: 416-410-7506
Fax: 905-812-8136
Email: rolf@playgroundadvisory.com

Testing and Education for Standards Compliance

We're on the web www.playground advisory.com

PLAYGROUND ADVISORY

Canadian Playground Advisory Inc.

Volume 3, Issue 1

June 2010

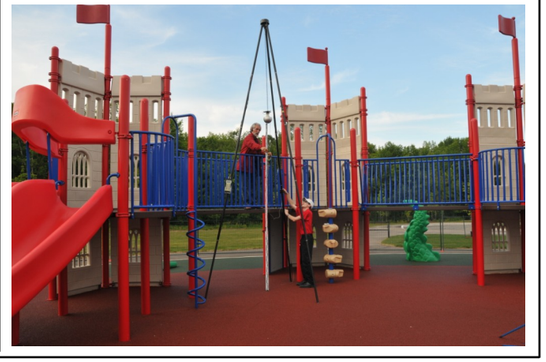
Are Playground Studies Helpful or do they Complicate Matters?

Playgrounds are complex environments and the children who use them are more complex. In combination the two often lead to play that is positive to the child's growth and development, but sometimes the play activity can result in injury. Playground practitioners, designers, owners, manufacturers, and caregivers have always worked diligently to provide an age-appropriate and challenging play experience balanced with the need to prevent life-threatening or debilitating injuries.

Injury statistics related to playground activity have been collected and analyzed for more than 40 years. Some of the studies, initiated back in the 1970s focused on the cause of injury and found that a large number were related to poor equipment design, poor quality manufacturing, delinquent maintenance, absence of impact-attenuating surfacing and horseplay. As a result of this, many standards organizations began developing guidelines to address the first four causes of injuries, while the fifth cause - horseplay remains at the discretion of children. The US Consumer Product Safety Commission, in cooperation with the National Parks and Recreation Association and the National Bureau of Standards, published the first *Handbook for Public Playground Safety* at the end of the 1970s. This document set 200 g's as the threshold below which the impact attenuation performance for playground surfacing was established for the prevention of the serious head injury.

In the 80s, the Canadian Standards Association (CSA) and the American Society for Testing Materials (ASTM) struck technical committees to look into the development of standards for Canada and the United States. For the CSA the first document was published in June of 1990 and revised in August of 1991 as The *CAN/CSA - Z614-M90, A Guideline on Children's Playspaces and Equipment* which covered technical requirements and practices for play equipment and protective services. ASTM struck two subcommittees, F15.29, responsible for public access play equipment, and F08.63, responsible for the surfacing under and around the play equipment. The first ASTM F1292, for protective surfacing, was published in 1991 established a threshold of 200 Gmax. The threshold limit of 1000 HIC (head injury criteria) was added in 1993. F1487 was published in 1993. These standards have undergone revisions and the current versions are; CSA Z614 the 2007 revision, ASTM F1487 the 2007 revision, and ASTM F1292 will be the 2010 revision.

Each of these key North American playground standards, have a statement to the effect that compliance with the requirements of the specification is intended to reduce life-threatening and debilitating injuries. This has been further reinforced in *ASTM F2223, a Standard Guide for ASTM Standards on Playground Surfacing*, which states in section 7 "it should be recognized that serious injuries (for example, long bone injuries, and so forth) might occur even though the



See page 2

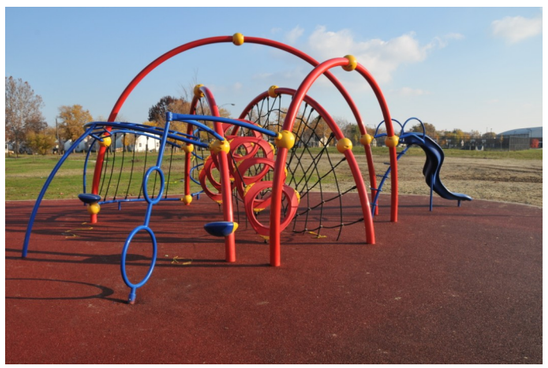
playground surfacing system meets the requirements of specification F1292." Putting it quite bluntly, the consensus at the standards-writing level for playgrounds in relation to hazard recognition and injury prevention is not to maim or kill a child.

The message is two-fold: first that noncompliance with the standards places the child at even greater risk of serious injury or death. The second is that not surprisingly injury prevention groups such as Safe Kids Canada and medical researchers and practitioners such as Dr. Shauna Sherker take the matter seriously enough to publish articles such as *"Are current playground safety standards adequate for preventing arm fractures?"*. Another articles by Sherker *"The in situ performance of playground surfacing: implications for maintenance and injury prevention"* and based on the work by Rolf Eppinger suggests that the HIC threshold for children under 3 years should not exceed 570 in the HIC for children under 6 years should not exceed 700 as these values represent a risk of fatal head injury. Other studies such as that by Laforest et al. *"Surface characteristics, equipment height, in the occurrence and severity of playground injuries"* conclude that the height of play structures should be limited. Importantly this study did take into consideration both the height of the play structure and a measure of the impact attenuating properties of the surfacing using an instrumented headform. It was found that the greater the height at which the tests were performed, the higher the Gmax and HIC values were for the same surface and depth. This correlation is consistent with many other critical height studies that look at the increasing drop height of surfacing and higher impact values. Other studies such as that by Fiisel et al. *"Severity of playground fractures: playground equipment versus standing height falls"* found a correlation between falls from playground equipment and injury severity versus a standing surface and low injury severity. This study was able to determine that "playground equipment falls represented the vast majority (85%) of the major fractures" and that "The odds of the major fracture were 3.91 times greater when the fall was from a piece of equipment as compared with falls from a standing surface on the playground". The researchers were not able to determine whether the surfacing in the playgrounds was compliant to the CSA Z614 standard. Through the study *"The effect of safer playground equipment on playground injury rates among school children"* found a significant reduction in injury rate in schools where noncompliant play structures and surfacing were removed. Subsequently the new structures that were significantly lower in height and surfacing, primarily engineered wood fibre was installed. Unfortunately this study did not compare impact attenuation performance in relation to injury severity or frequency in the field.

It becomes obvious that the definition of a hazard and the severity of injuries are very different between the standards writers and injury prevention and medical communities. To close this gap, there is a need for a better understanding of what the measurable interventions would be, balanced with the need for challenging play in the playground. This can only occur with a new, clearly defined injury severity threshold that is measureable. This has implications for all stakeholders in playspaces. Without a clear statement as to the intended standard of care, there will be serious liability concerns for all parties as injuries will continue to occur in the playground setting. If the intention is to prevent serious head injuries and long bone injuries requiring emergency or operating room reduction then a collaborative approach to setting objectives, developing standards and measuring outcomes is required. Reducing injuries to the head could begin with a review of the current head injury information, as was done back in the 1970s, with a view to establishing new Gmax and HIC thresholds. The serious long bone injury would likely need further studies such those done by Pierce et al. *"Evaluating long bone fractures in children: a biomechanical approach with illustrative cases"* and Bertocci et al. *"Influence of fall height and impact surface on biomechanics of feet-first falls in children"*. The result may involve the development of new test protocols and/or looking at collecting additional data such as jerk and critical time using traditional impact testing devices.

Unfortunately studies such as the one by Howard et al. *"School playground surfacing and arm fractures in children: a cluster randomized trial comparing sand to woodchip surfaces"* are not helpful in achieving this goal. Although the Howard study assumes that the surfaces are compliant with CSA Z614, this is seldom if ever confirmed at the time of the injury nor is the depth of the surfacing confirmed. The study suggests that the impact attenuation testing is performed on an annual basis and the surface depths are inspected three times annually. The depth inspections data table indicates that all of the surfaces are not being maintained or topped up to the required depth, whereas the study states that the depths were actually adequate. Depth is a major factor for the impact attenuating performance of loose fill surfaces. Failure to have the appropriate depth may have had a negative effect on the occurrence of an injury or the severity as opposed to a surface at the correct depth.

Statistics from Safe Kids Canada indicate that the highest incidence (43%) of injuries on playgrounds occur in the summer. This would suggest that the



injury rate outside of supervised school time would be a significant factor for consideration in studies related to playground injury prevention. For example, this particular study was limited to a very short period of exposure: "the lunch break, two 15 minute recesses, and for 20 minutes before and after school". This suggests the likelihood or reasonable supervision during these times. Almost all playgrounds in the subject school board are not fenced or gated. This raises a question around the merits of investigating the injury rates outside of school hours and the effect of supervision as an injury prevention strategy.

The study also indicates that “the playgrounds are not used under frozen conditions”; however there is no indication as to how the non-frozen condition was determined. Toronto, Canada is subject to severe cold every winter and there can be ground frost penetration as deep as 3 feet. Playground surfacing is particularly susceptible to freezing. One positive aspect of all aggregate materials is that they allow warmth to penetrate quite readily and will free themselves of frost and ice very early in the spring. Alternatively engineered wood fibre (EWF) can have an insulating effect and not thaw as quickly. Only by probing the EWF can it be determined if it is loose for its entire depth. There may well be injuries on the EWF in the early spring that were affected by frost or a frozen condition and these should e be excluded.

One positive aspect of the study is that overall the injury rate was less than anticipated based on previous studies. The authors quite rightly conclude that compliance with standards in relation to matching structure height and impact attenuating surface, coupled with maintenance of the surface are positive strategies for injury reduction. This is borne out in the statement "our findings are consistent with prior case-control studies that provided evidence that compliant impact-absorbing surfaces reduce the risk of severe playground injury". This is some of the validating messages that standards writers have been waiting for.

As mentioned above, it would be extremely important to develop a definable and measureable protocol and test for the reduction of long bone injuries. In the conclusion of the study there is a suggestion that the granitic sand has lower friction and therefore potentially reduces tensile overload that can occur, causing a long bone fracture, without a tested procedure or method. It further suggested that EWF has a higher friction, based on the firmness and stability studies done by Beneficial Designs, Inc., in support of its work to develop test methods to determine the firmness and stability of accessible surfaces. This is not friction test, but