PLAYGROUND SURFACING, INJURY SEVERITY AND LIABILITY

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It is obvious that the exposure to liability is very real. The volume of documentation with regard to playground safety and the standards that have been developed have provided the knowledge required to prevent most serious injuries and liability in the playground and to properly manage risk. As indicated above this has the effect of significantly increasing the required standard of care and thereby the exposure of all persons involved in the provision of the playground.

Formal Tests and Procedures for Playground Surfacing

To understand the degree of protection that is being provided through the installation of an appropriate surface, it is important to understand that the test procedures and pass/fail criteria have been time tested and developed through the input of professionals throughout the world. At present the standard quoted in North America is the ASTM F-1292, which states:

"6.1 When tested according to the Test Method F355 Procedure C, using the average of the last 2 of 3 drops, no value shall exceed 200 g-max at temperatures of 30, 72 or 120 degrees F (-I, 23 and 49 degrees C, respectively), at the height specified by the purchaser.

6.2 If the surface system, while in use, is tested according to Test Method F355 Procedure C, using an average of the last 2 of 3 drops, at each of three test sites which exceed 200-g's when tested within a temperature range of 30 to 120 degrees F (-I to 49 degrees C) as determined by section 12, at the height specified by the purchaser, the surface should be replaced."

The other often quoted criteria is that when the same test is utilized the head injury criteria ("HIC") is to be less than or equal to 1,000. The concept of the G-max being under 200 has been commonly quoted since the late 70's while the HIC is relatively new to North America. In any event there are two measures that have become accepted by standard and common usage.

Three types of head injury can occur as a result of an impact. The first is the deformation of the skull, when skull fracture and concussion can occur. The second is when the relative motion of the brain and the skull is different causing concussion and the third is rotation of the head with respect to the neck and torso producing stretching and damage to any one or all of the neck ligaments, cervical cord and brain stem.

Tests performed on cadavers and animals have resulted in the Wayne State University Tolerance Curve, which predicts human tolerance to linear fracture and concussion. In the tests performed by Hodgson, et al. by dropping adult cadavers, peak accelerations in the range of 190 to 370 g's were observed at the fracture level. A study by Mohan et al. reported a conservative estimate of head injury tolerance for head first falls of children are 150-200 g's average acceleration for 3 milliseconds or 200-250 g's peak acceleration.

Whereas the G-max measures peak acceleration, the HIC measures the total force that is applied to the skull during acceleration and is an enhancement of the severity index ("S.I.") developed by Gadd. An S.I. greater than or equal to 1,000 represents a danger to life, when assessing internal head injuries resulting from frontal impacts.

The foregoing is very critical in the development of the present and future standards for the safety surfaces for children's playgrounds. It is expected that not only the G-max of 200 or less will continue as maximum peak acceleration, but in addition the proviso that the surface when tested according to ASTM F355, Procedure C must also provide an HIC of less than 1,000 will appear in future standards. This will then take into consideration both peak force and the total force applied.

It is important to note that the threshold level of 200 G-max and an HIC of less than 1,000 are on the border of being a danger to life and definitely must raise questions of potentially causing concussion and serious brain damage. Installation of a surface that provides test data at, or close to, the threshold should be avoided and a surface with a G-max of under 160 should be seriously considered. This will allow for changes that occur during the life of the surface and its exposure to the outside environment.

The ASTM F-355 test procedure does not require any aging of the samples and it must therefore be assumed that the samples being tested by an independent test centre are newly manufactured. Although the samples are tested within a range of temperatures, they are always in a dry condition, which is especially critical in the tests performed at -1 degree C. Obviously the influence of weather, accumulated dust, or sand from the sand box, snow and ice will have an effect upon the performance of the surface. This is particularly true of surfaces that retain moisture, allow for the accumulation of silt and sand in the surface or are installed in a cold climate.

Since an injury will occur while the surface is in service, the potential for a reduction in resilience over time must be taken into consideration at the time of surface selection. Therefore the combination of a maintenance manual and the installation of a surface that will always be more resilient than the threshold is essential.

Independent Testing, Site Testing and Experts

The ASTM F355 test procedure was established subsequent to the research by the United States Consumer Product Safety Commission in 1979. This test has subsequently been utilized for the setting of standards for bicycle helmets and the other head protection. As a result there are a number of independent test centres in Canada and the United States that can perform tests on sample surfaces. Although synthetic surfaces are easily transported from the point of manufacture to the test laboratory, surfaces that consist of loose or natural materials require some very carefully drawn specifications and construction for the sample to simulate the surface that is to be installed. Generally the tests performed on surfaces consisting primarily of loose materials do not take into consideration the potential compaction or shifting of the materials over time.

Irrespective of the tests that are performed according to ASTM F355, the surface must be installed under a play structure and perform to the expectations of the user. That is to provide impact forces below the threshold. In the past liability for the performance of the surface has been limited to the tests originally performed on the designed system. The only option to testing a surface in service has been the removal of a section of a core sample of the surface and testing in a laboratory. This is difficult and costly.

The invention of the MAX / HIC instrumented head provides the capability to measure a G-max and HIC for a surface at the ambient temperature at the time of the test wherever the surface is located. Although this is an approximation of the fixed test apparatus utilized in the ASTM F-355, a test result of a drop with the MAX / HIC that exceeds the specified criteria will be a failure provided the test is performed within the temperature range stipulated in F-355. A failure with MAX / HIC will warrant the expense of the taking of a core sample for testing and confirmation at a test laboratory.

Failure of the surface at any time during its life will raise the exposure for liability to all persons involved in the surface selection, installation and operation. The designer, specifier, owner and manufacturer and installer are all exposed. This exposure to liability can be limited on behalf of all parties through the selection of a surface that has met the following:

- test results are provided for the surface according to F-1292 and F355 performed by an independent test laboratory and generating a G-max of less than 200 and the HIC of less than 1,000 for the maximum platform

and/or fall height for the play structure installed.
- the surface is installed according to the specifications and duplicates the properties and performance of the tested surface; and
- on site testing by removal of a test core or the use of an MAX / HIC head within one month of the installation.

This will ensure the performance of the surface for impact attenuation at the time of installation. To limit the exposure to liability during subsequent years, the following must be performed:
- test the surface by removal of a core or the use of an MAX / HIC head a minimum of once per year at 3 sites around the play structure;
- provision of a maintenance manual for the surface;
- performance of the maintenance required in the manual.

The extent to which negligence and therefore liability exposure can be established will be in part dependent upon the ability of the plaintiff to find experts that are able to provide evidence with regard to the danger that is present within a site. With the passage of time since the field has come to the forefront of the industry and the volume of information that has been generated in the field of playground injuries and related subjects, there are a significant number of experts available within both industry and academia.

Conclusions

For more than 15 years there has been active discussion and the development of tests and standards within the area of accidents in playgrounds. This volume of information and the ability to test for performance has raised the risk of, and significance of, liability for negligence for designers, specifiers, manufacturers, installers and operators. The availability of information and, in the case of Canada, a National Standard, almost all persons involved in the building of a playground will have skills and experience that will not excuse negligence. In addition the invention of on site test apparatus has now allowed for performance testing of actual conditions at any time.

All of the studies of playground injuries indicate that the majority of the injuries are as a result of an impact with the underlying surface or intermediate platform below play structures. The issuance by IBC of the above mentioned AM 93-02 indicates that the risk of exposure to liability and the potential for litigation is very real, especially when one considers the costs that can be associated with any head injury.

It is the responsibility of everyone involved in the construction of playgrounds to provide the maximum amount of care as they are able for today and into the future. Failure to do so will inevitably result in injury and financial loss.

Article References are available upon request.

Ontario Energy Network Two Phases for Recreation Facility Profile

As appeared in the January, 1994 issue of ***Facility Forum****, a publication of the Ontario Recreation Facilities Association Inc.*

It's time for facility managers to sharpen their pencils and provide valuable input to a survey that will ultimately benefit recreation facilities across the province.

The Recreation Facility Profile, the survey currently being developed by the Ontario Recreation Facilities Association (O.R.F.A.) in partnership with the Ministry of Environment and Energy (MOEE), got under way in December, 1993 and will be completed in March, 1994. The Angus Reid Group Inc., has been contracted by the O.R.F.A. to administer the survey.

"The study will be done in two phases", said Don Harrison, chairman of O.R.F.A.'s Environment and Energy Committee. "In Phase One, the goal is to make sure we haven't missed any recreation facilities, such as arenas, pools or recreation complexes with multiple uses. Therefore, the first mailing, an inventory package, went to every municipality in Ontario to verify the current list and add any missing facilities."

"Once all the replies are entered into a computer, we will be in a position to start Phase Two by sending out a detailed profile survey to the primary contact in almost every recreation facility in Ontario."

O.R.F.A. members will probably be handling inquiries from their clerks or treasurers who have received the first package and will come to facility managers for assistance. During Phase Two, many O.R.F.A. members will also receive the detailed questionnaire, available in English or French.

The questionnaire will ask about the type of facility (arena, curling rink, pool or sportsplex), its size, age, and the construction materials used to build it. There will be questions on utility consumption, types of equipment used, what retrofits have been completed and if any building automation systems have been installed.

"Once the data is entered into a computer, we can start creating a base of useful information to assist in energy management planning," said O.R.F.A. Executive Director John Milton. "The information base developed from the survey will be key to making energy management in recreation facilities a higher priority."

For more information on this project please contact O.R.F.A. at (416) 495-4200.