Injury Prevention on Playgrounds and Sport Surfaces

COLORADO
Department of Public Health & Environment
Waste Tire Conference

Rolf Huber, Alpha-Automation/
Canadian Playground Advisory Inc.

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What’s the Problem

• Playgrounds
  • 210,979 emergency room visits, 16,706 TBI (USA 2001-2009) (CDC)
  • 515,020 medically treated at a cost of $11,700,400,000.00 (CPSC 2002)
  • Falls are 79% of injuries on Public Playgrounds (CPSC, Tinsworth, 2001)

• Sports Fields (<19 years, 2001-2009) US CDC
  • Football - 351,562 emergency room visits, 25,376 TBI
  • Soccer - 135,988 emergency room visits, 10,436 TBI

• TBI (Traumatic Brain Injury) is believed to be under reported by 10 times

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Typical Playground Surfaces

• Unbound
  • Sand
  • Gravel
  • Wood (EWF, woodchips, bark) (ASTM F2075)
  • Rubber (crumb, mulch, chunks) (ASTM F3012)

• Unitary
  • Poured-in-place (ASTM F2479)
  • Tiles or Mats
  • Synthetic Turf
Typical Playground Surfaces
Typical Playground Surfaces
Typical Playground Surfaces
What is protected & how?

• Gmax not exceeding 200

• HIC not exceeding 1000

• Prevent the serious and life-threatening injury
  • ASTM F1487 scope
  • CPSIA prevent serious
  • Use AIS scoring system

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Impact Attenuation

Thank the Subhuman Primate

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Impact Attenuation

Thank the Human Cadaver

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NFL Concussion Study

• 25 players sustained concussions
• Reconstruction indicates that concussions occur at 98 g’s on average
• 3 players with head to surface concussions
• Head to turf concussions sustained at 123 g’s
• High speed film is used to reconstruct the angle, impact area and velocity of the impact for the injured players.

• Testing performed by BioKinetics, Ottawa
Personal Choices
which would you accept

• US Marine Boxer

• Going through Windshield at 25mph

• Compliant Playground

• Compliant Field
Gmax Equivalents

Professional Boxer 52 g’s

Don’t know

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100 g’s?

Driving a car at 25 mph (40kph) into a wall not wearing a seat belt and going through the windshield.

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Reference The New Yorker, October 2009
Abbreviated Injury Scale (AIS) Score

1. Minor injury
2. Moderate Injury
3. Serious injury - not life-threatening
4. Severe injury - life-threatening, but survival probable
5. Critical Injury - survival uncertain
6. Maximum injury untreated and virtually unsurvivivable
Impact Values & AIS>4

HIC15 AIS4 Injury Risk (Prasad & Mertz 85, data compilation)

1.6% risk of Severe injury - life-threatening, but survival probable

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Fatality Rate and AIS - head

<table>
<thead>
<tr>
<th>Injury severity AIS</th>
<th>Severity code</th>
<th>Fatality rate (range %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Minor</td>
<td>0.0</td>
</tr>
<tr>
<td>2</td>
<td>Moderate</td>
<td>0.1–0.4</td>
</tr>
<tr>
<td>3</td>
<td>Serious</td>
<td>0.8–2.1</td>
</tr>
<tr>
<td>4</td>
<td>Severe</td>
<td>7.9–10.6</td>
</tr>
<tr>
<td>5</td>
<td>Critical</td>
<td>53.1–58.4</td>
</tr>
<tr>
<td>6</td>
<td>Maximum (currently untreated)</td>
<td>…</td>
</tr>
</tbody>
</table>
Compliance Playgrounds - Impact

• CPSC Handbook on Public Playground Safety, 2.4
  • Fall height is the highest component in the playground

• ASTM F1487, sections 9.1.1 (design), 11.2.2 (install), 13.2.1 (maintain)
  Section 13.2.2 “the owner/operator shall maintain detailed installation, inspection, maintenance, and repair records for each public-use playground equipment area.”
  • Fall height varies according to type of equipment.

• ASTM F1292, mandatory 3 temperature lab test, optional field test
  • Critical height test determines height for 200g or 1000 HIC
  • Fall Height determined by the owner/operator sections 4.4.1, 19.1.2
  • Performance for Gmax and HIC set by owner section 4.4.2
Mandates – The Big One - ADA

- Establish number of accessible elevated components section 240
- Establish number of accessible ground level components section 240
- Must meet ASTM F1292, at installation and throughout life section 1008
- Must meet ASTM F1951, at installation and throughout life section 1008
- Section 1008.2.3 “Ground surfaces must be inspected and maintained regularly to ensure continue compliance with ASTM F1951 standard”

- ASTM F1951 requires compliance to ASTM F1292 – the circle is complete
Mandates - The Big One – ADA
DOJ 2010 ADA Standards for Accessible Design

• If running slope exceeds 1:20 (5%) this is a ramp and needs handrails
• Handrails are exempted within the F1487 use zone
• Maximum running slope 1:16 (6.25%)
• Maximum cross slope 1:48 (2%) – across or within
• Change in vertical height not to exceed ½”
  • First ¼” can be vertical
  • Second ¼” must on a slope < 1:2
• No openings greater than ½” exception is drainage lateral to route of travel
• No carpet (turf) with pile greater than ½”
Impact Attenuation Sports Fields

- ASTM F355 procedure A – informal test for many years
- ASTM F1936 – Testing in the field for Football, Soccer, Lacrosse, Field Hockey, Baseball and Open Fields
  - Not to exceed 200g

- STC, Synthetic Turf Council recommendation – not to exceed 165g
Where ASTM F355 A came from

This is the first A Missile

Ed Milner with equipment used to measure the impact-attenuation characteristics of artificial turf.

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Current Test Devices
Current Test Devices
Alternate Test Devices

- ASTM standards are very specific on the devices
- ASTM standards specify testing procedure in the laboratory
- ASTM standards specify testing procedure in the field

- There are no alternates or substitutes
- Owners run risk for State and Federal non-compliance and liability for substituting alternatives that are not based in the ASTM standards
Thank you

Rolf@playgroundadvisory.com