

Injury Prevention on Playgrounds and Sport Surfaces

COLORADO

Department of Public
Health & Environment
Waste Tire Conference

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

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

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

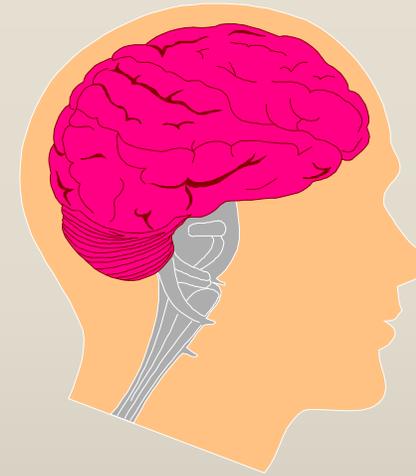


Typical Playground Surfaces



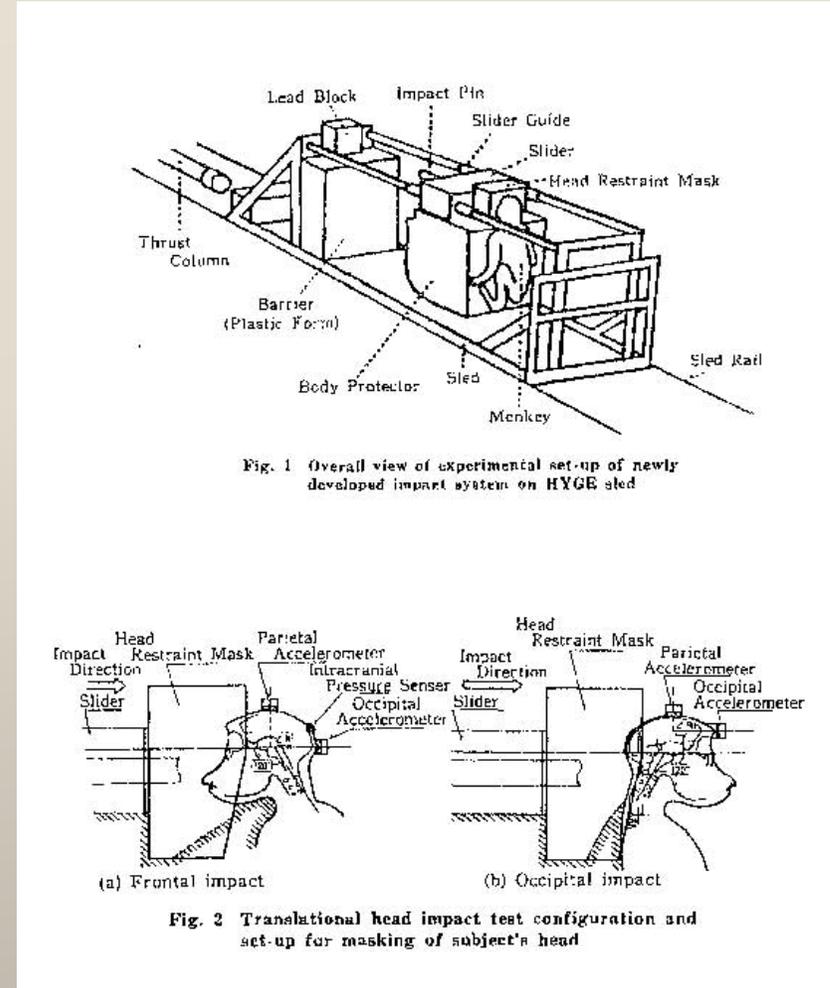
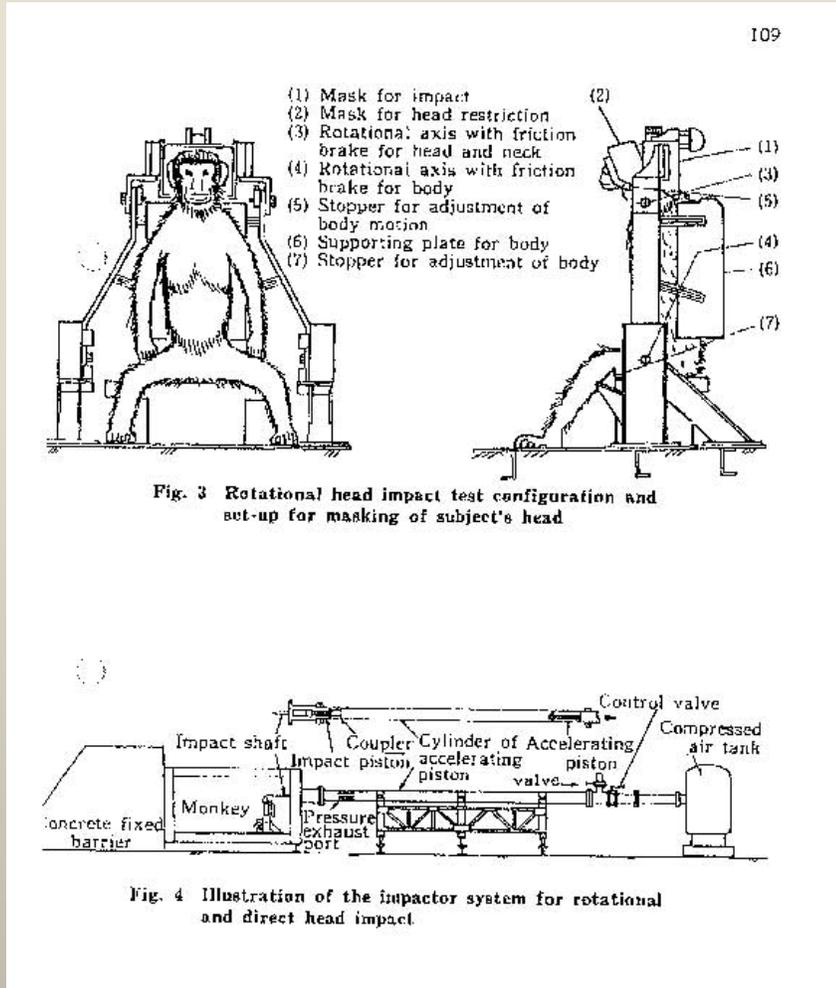
What is protected & how?

- 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



Impact Attenuation

Thank the Subhuman Primate



Impact Attenuation

Thank the Human Cadaver

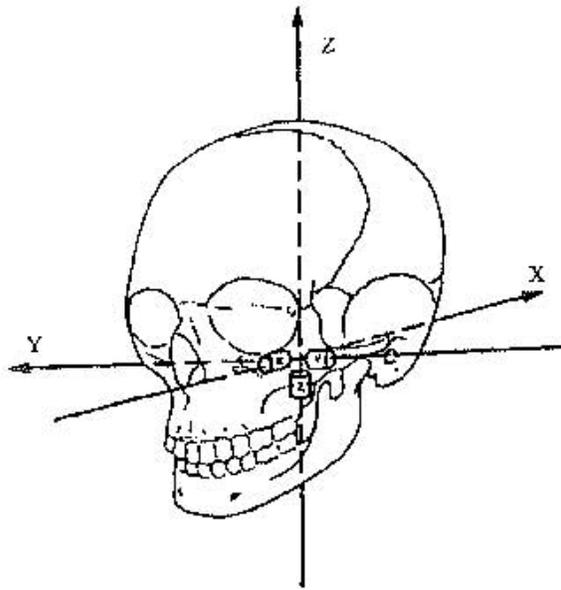


Fig. 14 Instrumentation reference frame and location of the tri-axial accelerometer (Combination of three uniaxial accelerometers)

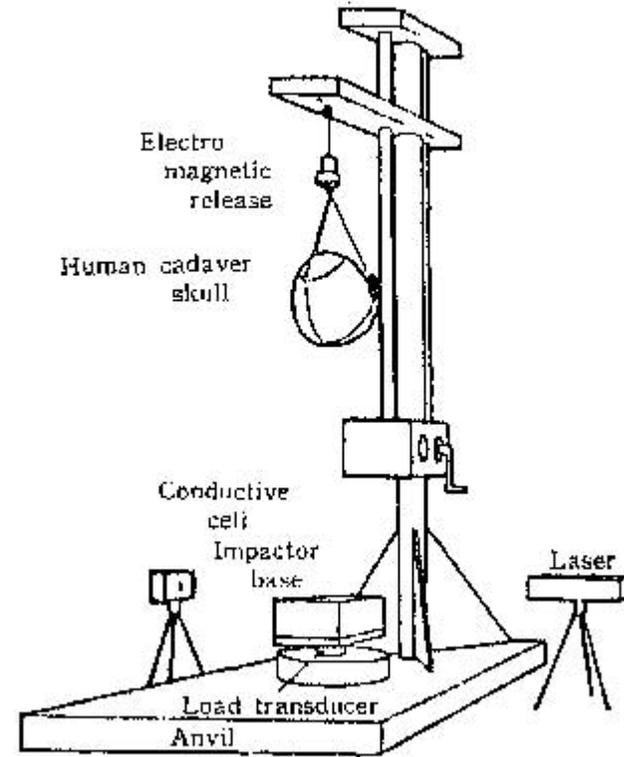
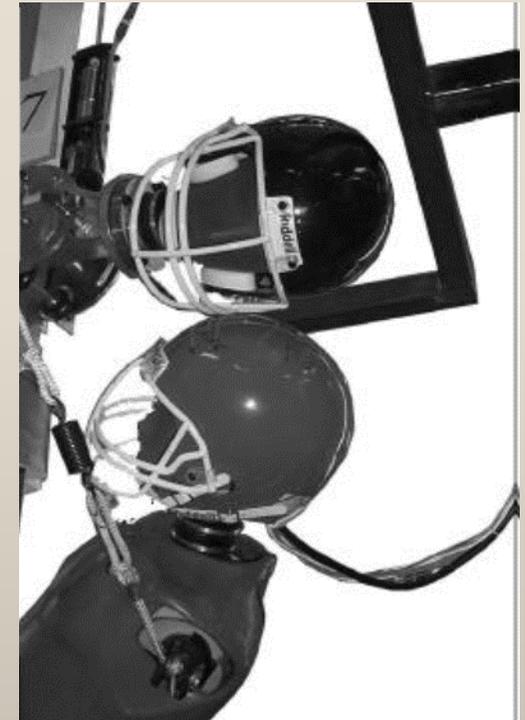


Fig. 15 Overall view of free drop test on human cadaver skull

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



100 g's ?

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

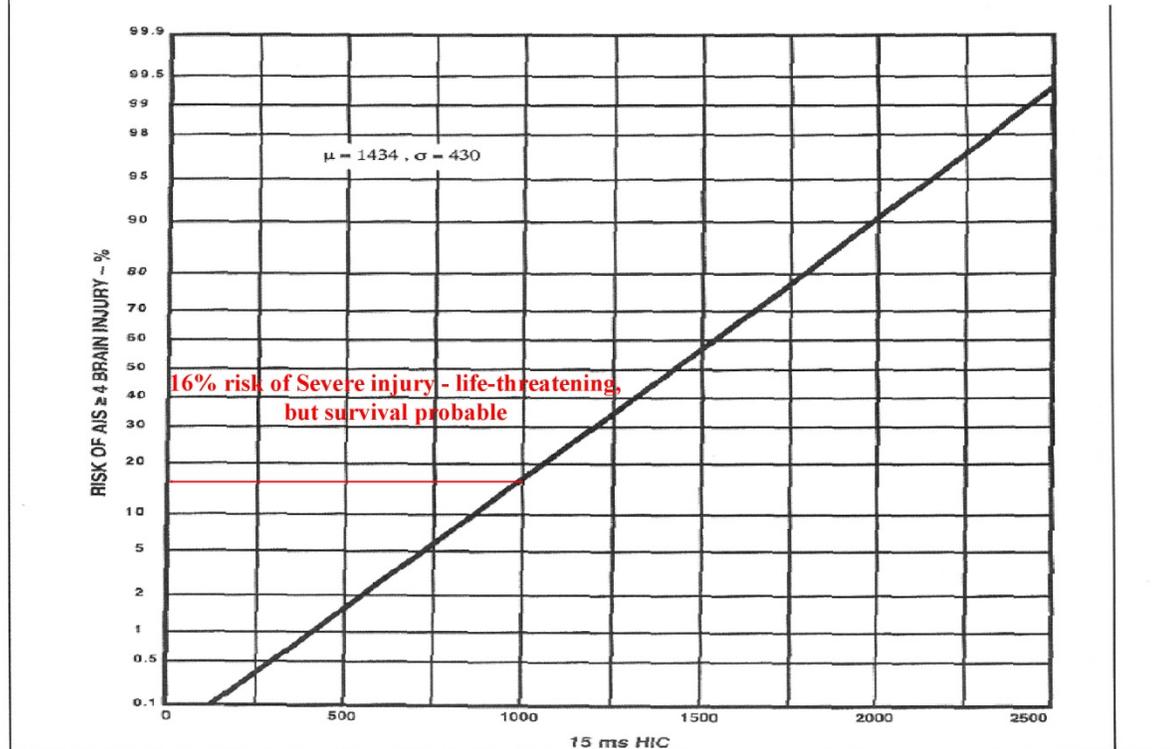


Abbreviated Injury Scale (AIS) Score

- 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 untreatable and virtually unsurvivable

Impact Values & AIS>4

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



Fatality Rate and AIS - head

Injury severity AIS	Severity code	Fatality rate (range %)
1	Minor	0.0
2	Moderate	0.1–0.4
3	Serious	0.8–2.1
4	Severe	7.9–10.6
5	Critical	53.1–58.4
6	Maximum (currently untreatable)	...

Hayes et al. 2007

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

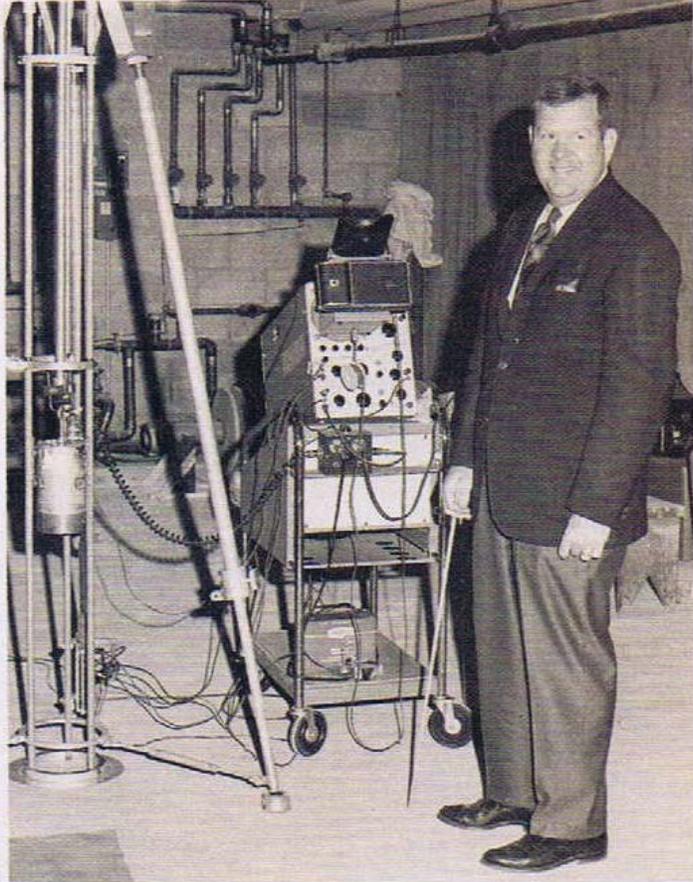
DOJ 2010 ADA Standards for Accessible Design

- 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



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

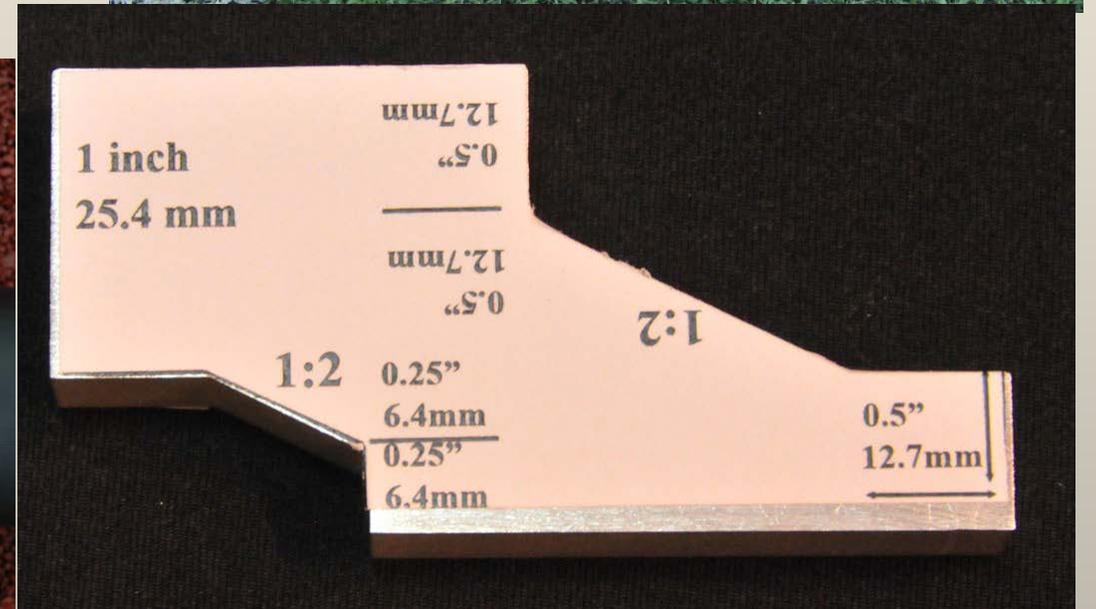
**This is
the first
A Missile**



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

