INTERNATIONAL ASSOCIATION FOR SPORTS SURFACE SCIENCES

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Summaries of Speakers

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A novel approach to study athlete surface interaction in athletic track competitions

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Modern athletic track systems are designed to provide optimal biomechanical conditions to the musculoskeletal system of the athletes with the aim to increase sprinting or running performance. Attempts to improve athletic running performances have mainly been focused on optimizing the energy storage and return characteristics of track systems (e.g. McMahon and Greene 1978, Stefanyshyn and Nigg 2003). The optimal use of the muscle tendon units as major contributor to sprint performance has insufficient been studied.
Optimal working and energy return characteristics might be different for certain populations of athletes (e.g. long distance vs. sprint runners) or might be varying even inside athletes performing in the same event due to different skill levels or anthropometric characteristics. The interaction of running track and the athletes' biological structures might be related to the running velocity and the acceleration of the runner. Speed and acceleration vary dramatically during the sprint race. Further, force application of the runner to the ground has been studied mostly in the vertical and anterio-posterior directions. Nonetheless, medio-lateral forces and frictional torques applied to the ground are of critical importance, in particular during the acceleration phase and in curved sprinting. To provide a better understanding of the individual interaction of track athletes and track surface mechanical characteristics, a complex testing scenario has been developed. This approach includes in a first step the analysis of the 3D running kinematics and kinetics using state of the art highspeed

motion analysis and force platform techniques. In the second step, measured ground reaction forces are simulated three dimensionally (incl. vertical torque component) using a customised material testing setup.

A limitation of this approach is that the material testing part currently needs to be performed ex situ, which does not allow for on-site testing of installed track systems.
The advantages of the novel approach are that it is possible to study the individual interaction of certain athletic populations with a specific track system at different speeds, accelerations of the athlete with the related force time histories. From this, optimal track characteristics for specific purpose tracks can be derived (e.g. for elite athletes or high school kids). The approach extends previous testing regimes by including the study of medio-lateral and frictional torque components. Further, the perfomance enhancing and injury potential characteristics of a surface can be based in addition to material testing results on joint kinematics and kinetics, which greatly enhances information content gathered for each tested track system.

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HydroChill™ - New Technology for Cooling Synthetic Turf

The evolution of synthetic turf from First Generation to Third Generation has overcome many of the player-surface interaction issues. Softer polyethylene fibers have reduced the abrasiveness of the surface to the skin of the athlete. The inclusion of infill materials have allowed the shock attenuation of the surface to be tailored to the needs of the players. However, the surface temperature of the turf on sunny days continues to be an issue.

Synthetic turf surface temperature can exceed 80 ^{o}C on sunny summer days. Skin contact with surfaces above 60 ^{o}C can cause skin burns. Heat transmitted through the shoes to the player's feet and radiated to the lower body extremities can create uncomfortable conditions for the athlete.

HydroChill™ is a technology that coats the infill particles with a polymeric material that holds water. The water in the infill is released when exposed to sunlight. The evaporative cooling cools the surface of the turf, preventing it from getting to uncomfortable temperatures. The performance properties of the hydrated HydroChill™ fields are not compromised by the treatment.

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U.S. bid and specification scenarios for artificial turf and track.

- Private bid
- Public bid:
- Purchasing organizations:
- Use of design professionals:
- Use of design-built process:
- Use of standards/guidelines:
- Influencing factors:
- Testing and acceptance:

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No. 1: Maintenance of Football Turf

Regular maintenance on synthetic turf is important to maintain aesthetics, safety, playing performance and longevity of a football turf pitch. The notion that artificial turf is maintenance-free has been demystified according to various international studies published recently. Adequate maintenance regimes for artificial turf have proven to protect the investment into sporting fields. Based on a short overview of the various synthetic turf systems, regular maintenance activities for owners and operators of third generation football fields will be outlined and less-frequent, specialist maintenance regimes will be summarized.

No. 2: Advances in Polyethylene Yarn Technology

Materials suitable for grass yarns need to meet a number of requirements like durability, softness and processibility. Important parameters in polymer technology will be reviewed and summarized.

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ISSS Round Robins - Results

In 2014, ISSS has organized international comparison testing (Round Robin), including the following test methods:

- Determination of rotational resistance - EN 15301-1
- Determination of particle size – sieving method - EN 933-1
- Determination of resistance to abrasion of non-filed synthetic turf - EN 13672:2004
- Determination of vertical ball behaviour - EN 12235
- Determination of tuft withdrawal force - ISO 4919
- Differential scanning calorimetry (DSC) - ISO 11357-3

During the presentation, the general results will be made public. The main focus will be drawn to the relative repeatability limit and relative reproducibility limit.

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Playground Surface Testing – Background Research

Playgrounds and playground equipment are involved in a large number of injuries to children, accounting for 13% of all injuries and 61-74% of injuries occurring in schools. A review of published injury surveys shows that 43% of these could be classified as "severe", involving limb bone fractures or head injury (Himmelsbach and Shorten, 2003). Falls onto the surface accounted for 21% of the reported deaths and most of these (~75%) involved catastrophic head injury.

Severe head injuries are relatively rare but are potentially can have life-changing or fatal consequences. As a result, existing playground surface performance standards typically emphasize the importance of impact attenuation and impact test methods (e.g. ASTM F1292 and EN1177) use test devices intended to simulate head impacts. Unlike many surface tests, these methods are intended to evaluate injury risk, rather than conformance to a preferred range of surface characteristics. However, the surface properties that we might link to injury rates (e.g. "impact attenuation", "traction") are not fundamental physical or mechanical properties, but system dynamic outcomes that depend on loading and initial conditions.

Currently, there is also concern about the long term consequences of mild traumatic brain injuries (MTBI – "concussions") which can occur at relatively low impact energies. It is improbable that such injuries can be prevented by a playground surface, and certainly not without compromising other desirable attributes of the surface.

The link between surface properties, test outcomes and head injury risk is not directly unknown, but performance criteria (i.e. g- max and HIC thresholds) can be established indirectly from other head injury studies (Shorten & Himmelsbach, 2003). Surface risk factors for other severe (and more common) injuries, such as long bone fractures, have yet to be established but ongoing research is promising.

References

Himmelsbach, J.A. and Shorten M.R. (2003) Playground surfacing and playground injuries. pp 71-88 in Sports Surfaces (Eds. B.M. Nigg, G.K. Cole, D.J. Stefanyshyn) Calgary, University of Calgary

Shorten M.R. & Himmelsbach, J.A. (2003) Sports surfaces and the risk of traumatic brain injury. pp 49-69 in Sports Surfaces (Eds. B.M. Nigg, G.K. Cole, D.J. Stefanyshyn) Calgary, University of Calgary