



Racing Surfaces
Testing Laboratory
Orono Maine USA



Surface Design and Maintenance

Start with the Horse

Goal: Reduce Musculoskeletal Disease
Consistency & Optimized Biomechanics



Key to Surface Safety: Good vs. Bad Years

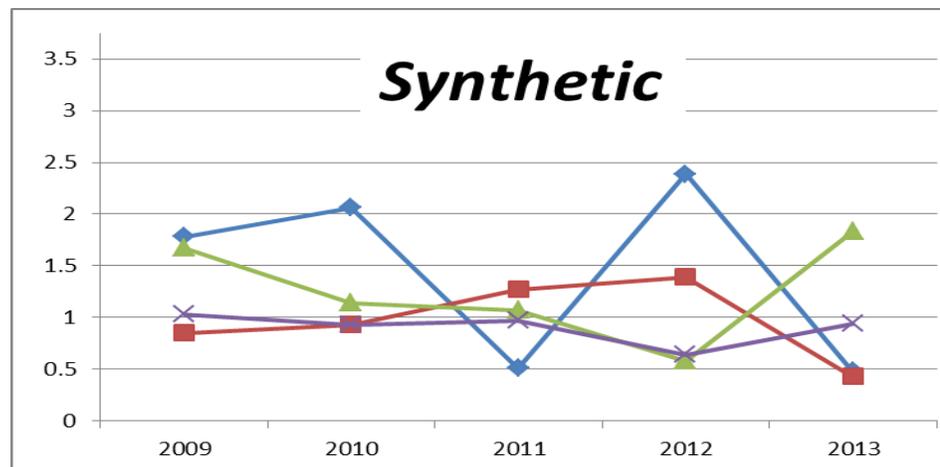


- Injury rates on synthetic tracks are consistently lower

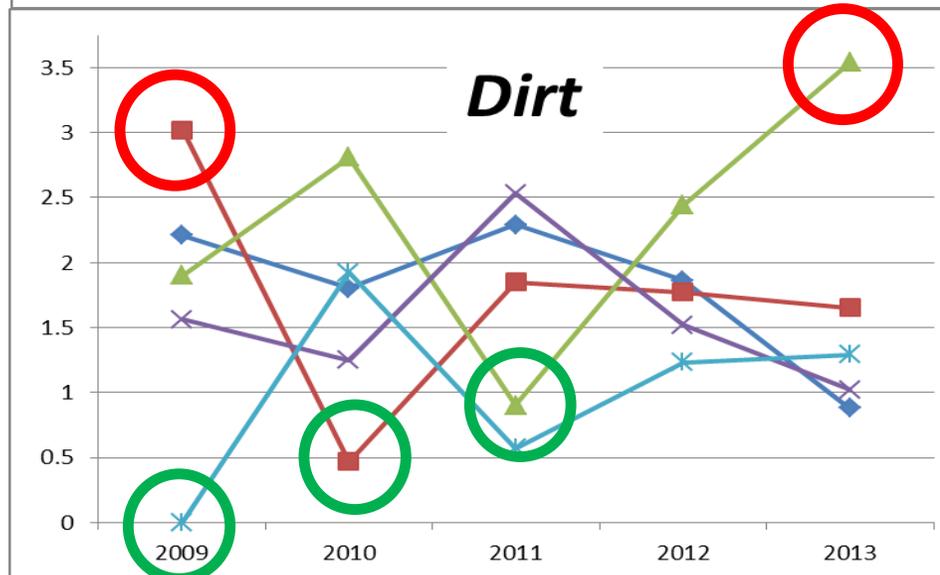
*Insensitive to
Moisture*

- Dirt tracks vary between years
 - Same people
 - Same methods

*Weather &
Response to
weather*



*Every year
a good
year*



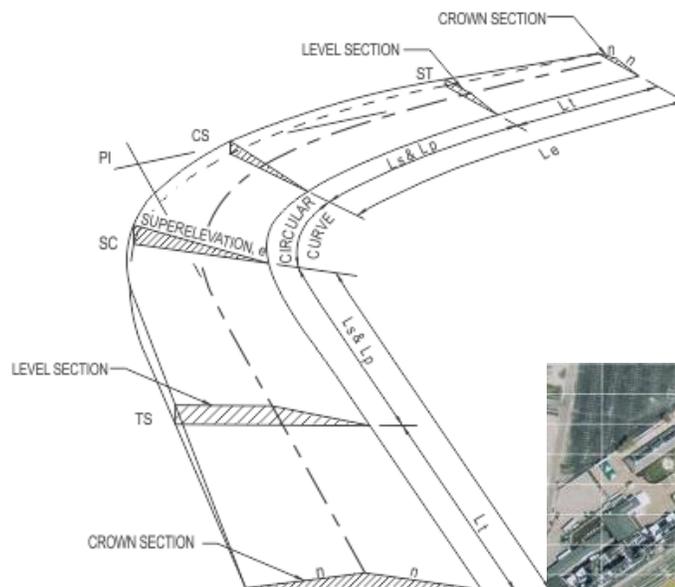
*Regardless
of weather*



Consistency: Maintenance Quality System



1. Design documentation
2. Pre-meet: ready for racing
 - Biomechanical Testing
 - Ground Penetrating Radar
3. Every day
 - Weather station
 - Maintenance documentation
 - Measure moisture and cushion





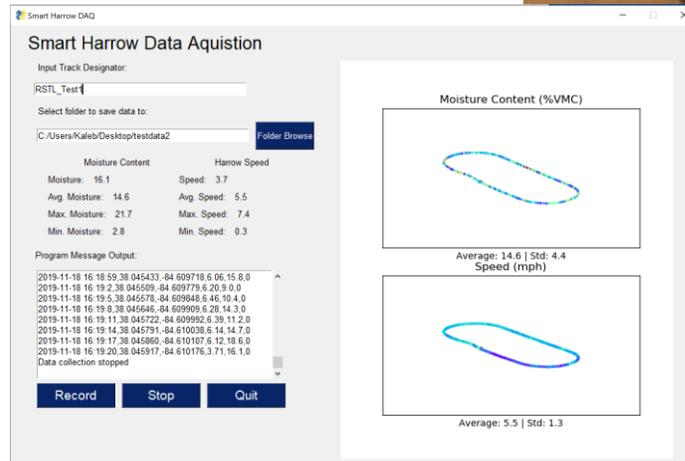
Daily Measures: Automate & Quality



- Weather station, with distributed sensors
- New measurement tool: moisture and cushion in one step
- Automated moisture and equipment tracking



Average MC: 13.5 / Std: 4.2 / Std. Error: 0.2



TURF RESEARCH



Next: Get a GOOD Surface (Consistently)



- What do the horse and rider feel:

Performance

- What matters to the *musculo-skeletal* system:

Safety

- THE FIVE FUNCTIONAL PROPERTIES:

Characterize how the footing affects the horse:

**Cushioning, Firmness, Grip,
Responsiveness and Consistency**

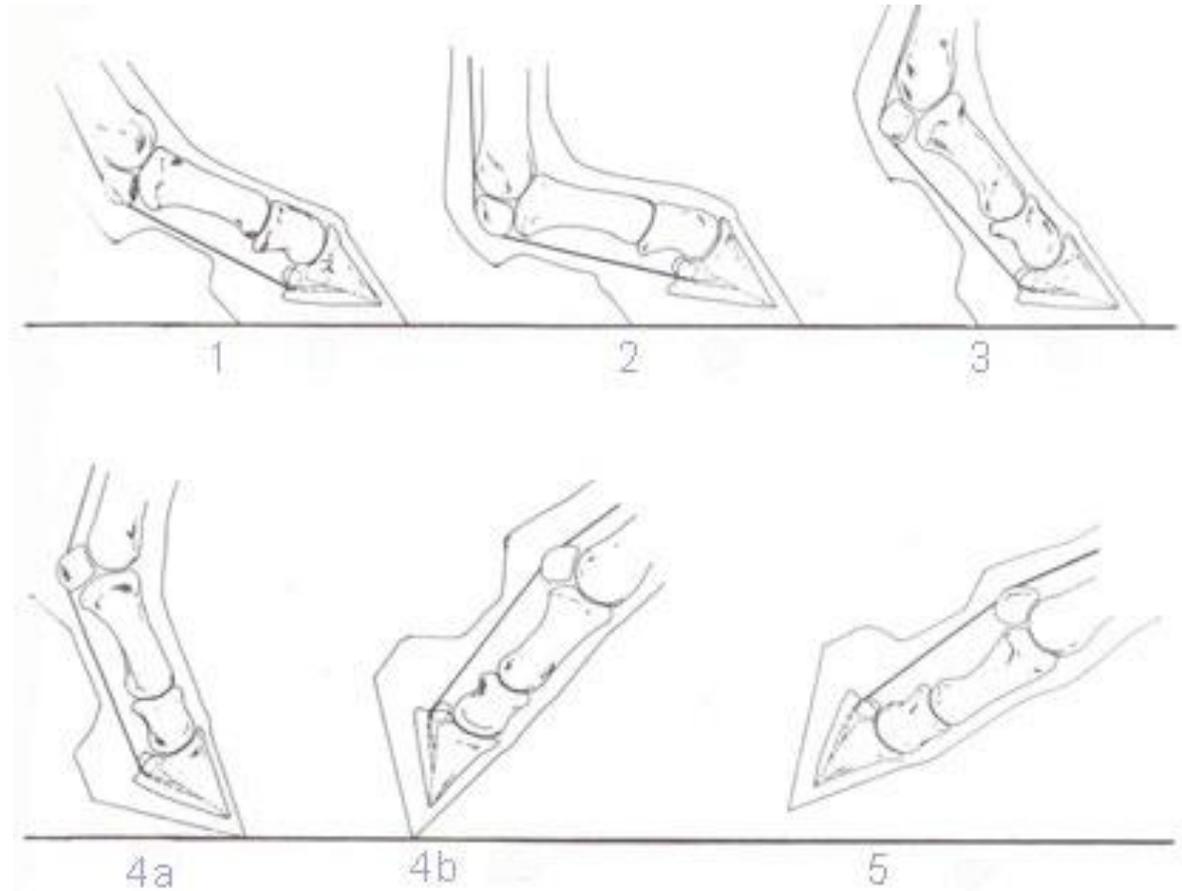
Sarah Jane Hobbs, Alison J. Northrop, Christie Mahaffey, Jaime H. Martin, Hilary M. Clayton, Rachel Murray, Lars Roepstorff, Michael “Mick” Peterson Equine Surfaces White Paper, <http://www.fei.org/fei/about-fei/publications/fei-books>



Biomechanics: Phases of Gait



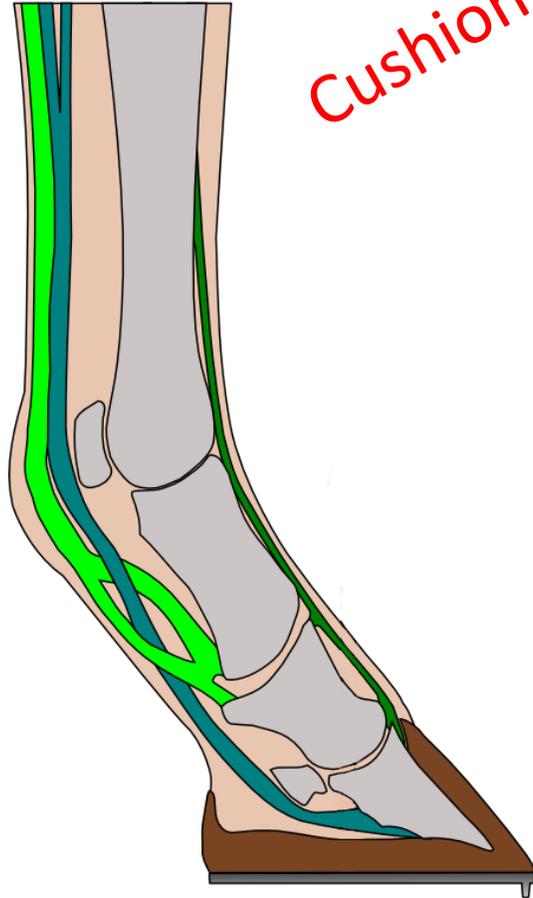
- Stance phase:
 - Initial ground contact
Heel first contacts
occur more frequent:
high-speed
 - Secondary impact
High speed, low load
 - Loading phase
Low speed, high load
 - Breakover.
- Flight



http://theorythursday.com/images/stride_phases.jpg

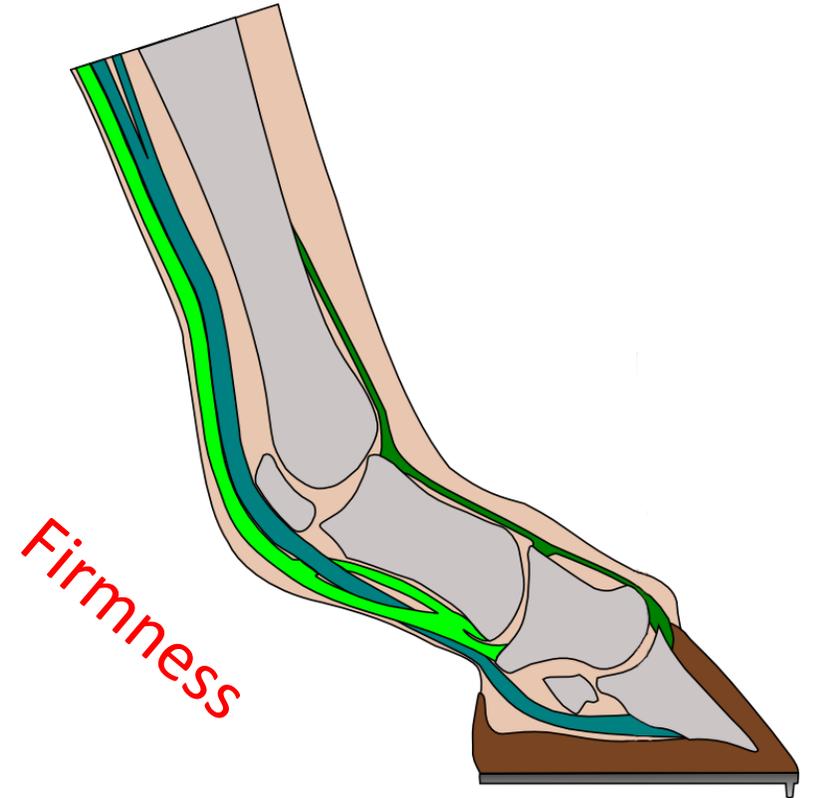


Initial Loading May Be Critical



Cushioning

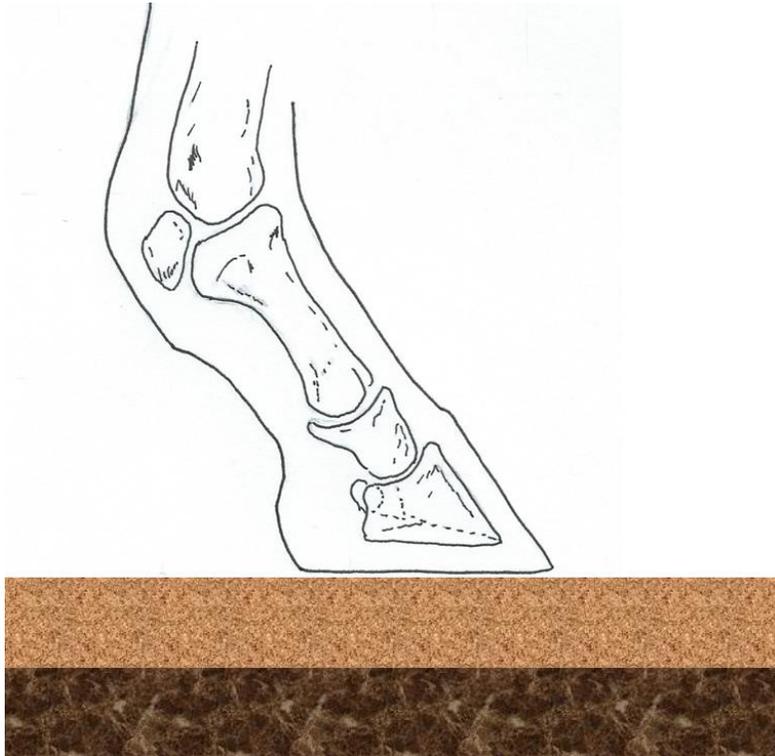
- Initial ground contact: Need a surface to slow the hoof
- Secondary Impact -- Rotation of fetlock: Need a surface that will support the leg and return energy



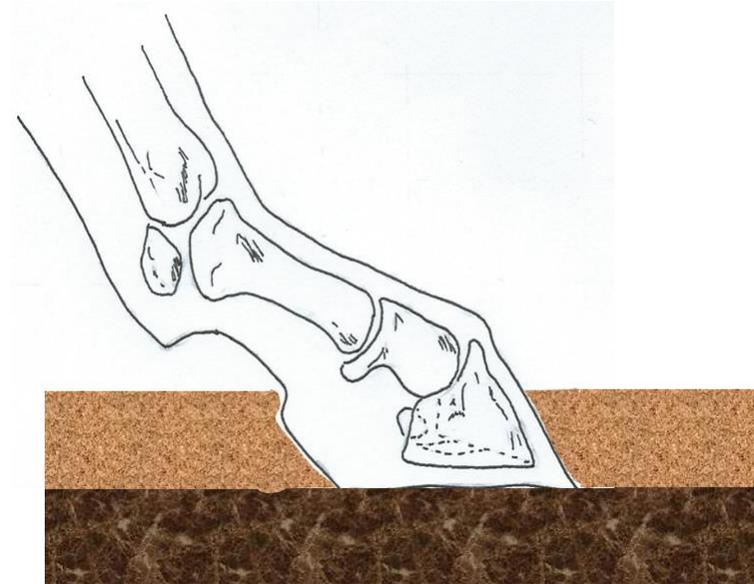
Firmness



Surfaces Have Adapted



**Harrowed Top Cushion
Slows the Hoof**



**Compacted Lower Layer Supports
Hoof and Provides Traction**

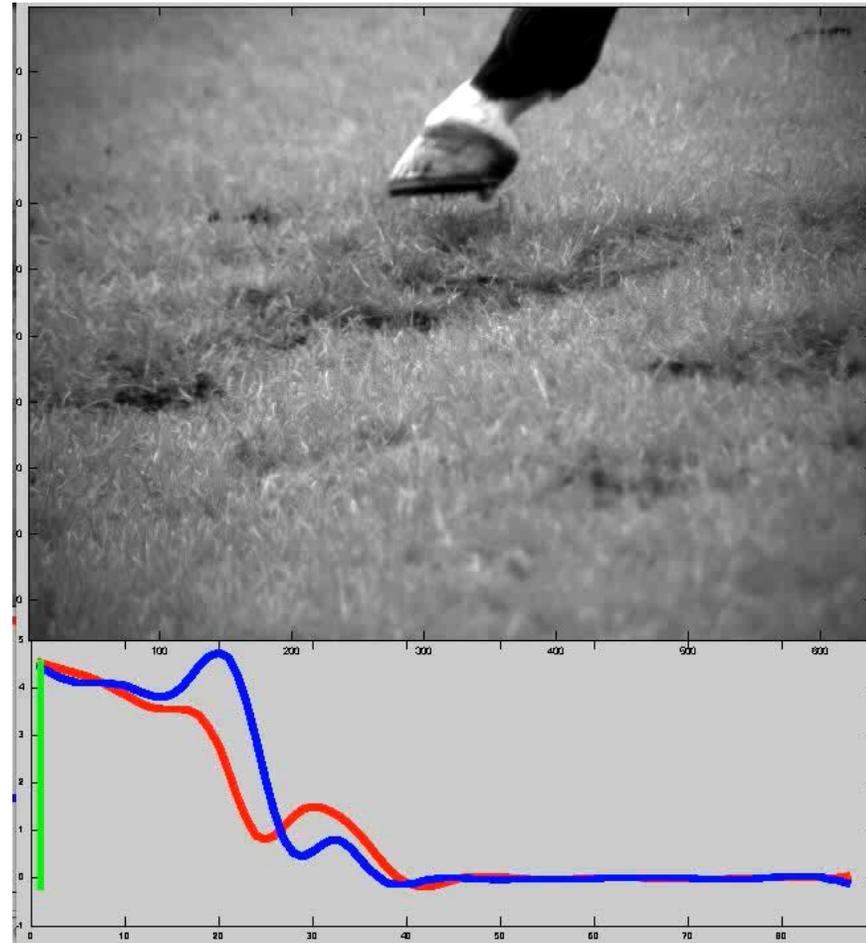
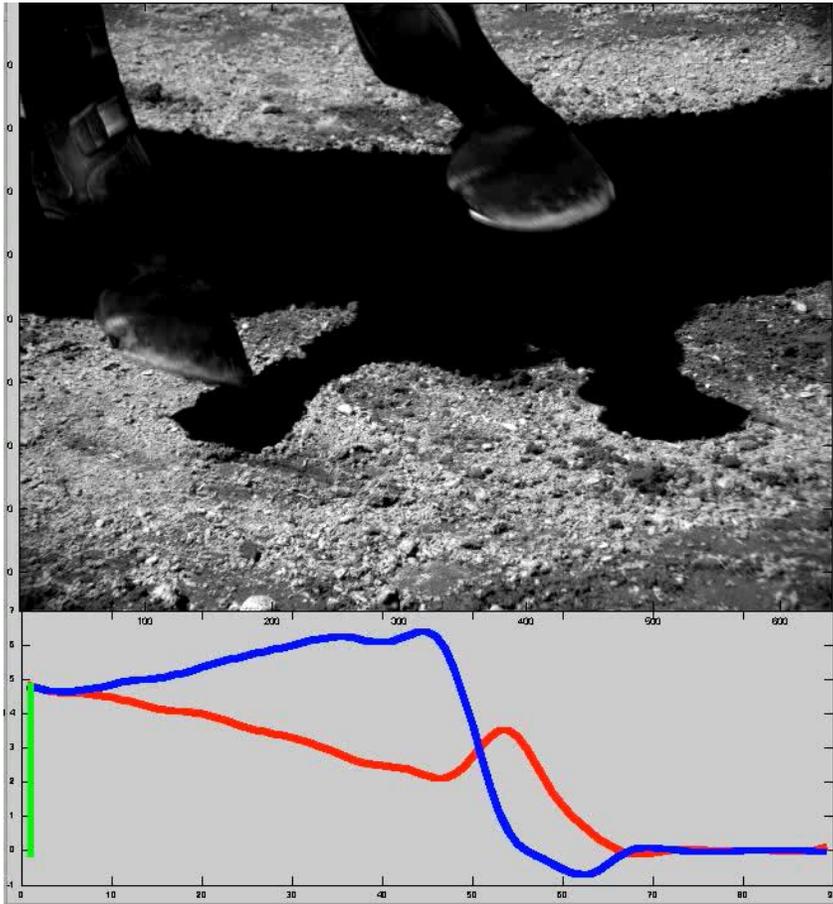


**The same layers that
a turf course provides
naturally**

**Reduce Turf
Variability**



Turf, Dirt and Synthetic are Different!



**Need to
develop a
surface with
consistency
of synthetics**

**Biomechanics
of turf and
dirt**