Orthopaedic Research Center

The University of Maine

MONITORING RACING SURFACES

Michael "Mick" Peterson PhD

– ***Racing Surfaces Testing Lab***

– ***University of Maine***

C. Wayne McIlwraith DVM, PhD

– ***Colorado State University***

Our Situation

- Racing is a challenging game
  - Training horses is competitive
  - Owners want answers
  - Not every horse is a winner (or is even sound)
- It is easy to blame the track (and it is occasionally true)

Surface not ALWAYS the problem, but is part of the solution

Orthopaedic Research Center

The University of Maine

Recommendations of:

The Welfare and Safety of the Racehorse Summit

Lexington, Kentucky
March 17-18, 2008

RECOMMENDATION 1:

TRACK SURFACES

Primary Objective:

Promote consistent and safe track surfaces conditions

Outcomes
2nd Welfare and Safety Summit

What has happened:

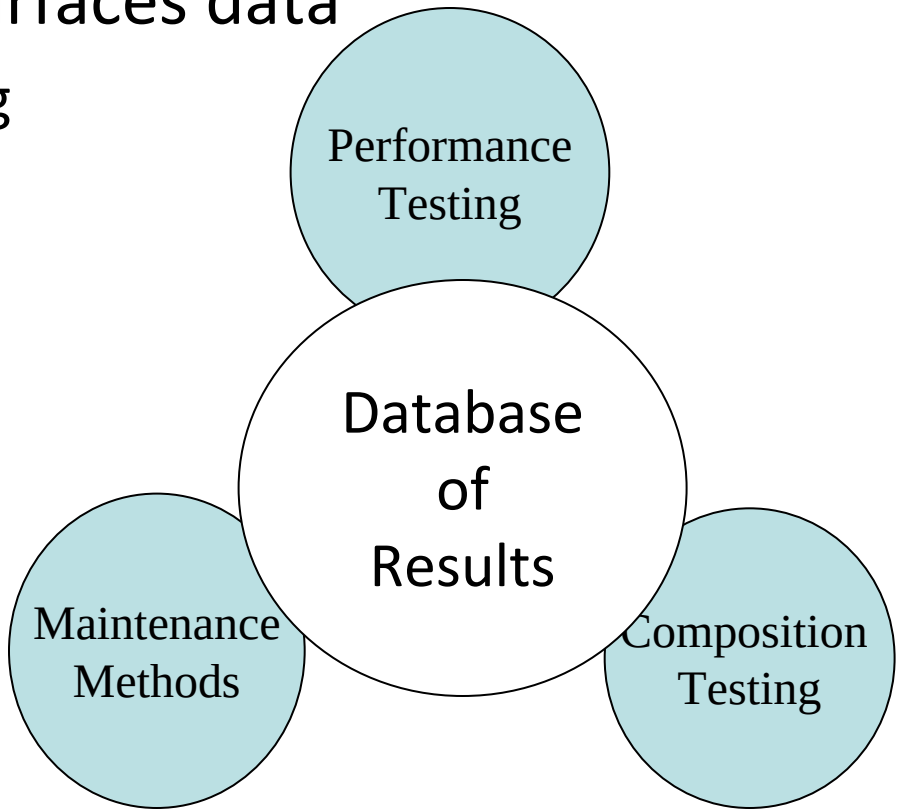
- Non-profit laboratory
  - Standard procedures
  - Goal, a single lab with consistent methods
  - Tests with split samples
  - Develop new tests
- Start of central database
  - Track composition
  - Weather/Maintenance

What has *NOT* happened

- No new "tool kit" to monitor the surface performance
  - Need daily info on track performance
  - Methods need to be based on science not tradition
- ***No generally accepted monitoring protocol***

What is Needed?

- Database to understand surfaces data
  - Reliable & consistent testing
  - Risk assessment data
  - Sharing of methods
- ***Different regional needs, Superintendent and track make decisions***
- More information, more consistent tracks
- Focus investments on protecting horses & riders



Need *OUTCOMES*

- Traditionally focused on ***INPUTS***
  - Composition - Wax - Design
  - Water - Maintenance - Banking
- Need tools for ***PERFORMANCE***
  - Permeability - Hardness/Modulus
  - Shear Strength - Energy absorption
- Track how we got there (maintenance, etc.)

Both in the lab and at the track!

Target: safer tracks for horses and riders

Basic Data on Conditions and Inputs
Maintenance ↔ Weather

- Weather data
  - Station at a standard track location
  - Weather logged to central database
- Water application
- Evaporation model
  - Weather and water truck, estimate moisture content
  - Established methods from precision farming
- First correlation to risk – moisture in track

Measure Moisture in Track
Use Off-the-Shelf Equipment if Available

- Time Domain Reflectometry
  - Works best at lower moisture
  - Less sensitive to composition, it still can give pretty big errors on a dirt track near rail
- FieldScout TDR 300 Soil -- $945
- GPS does not work reliably
- NOT FOR SYNTHETICS!!!
- We are big enough to address needs.

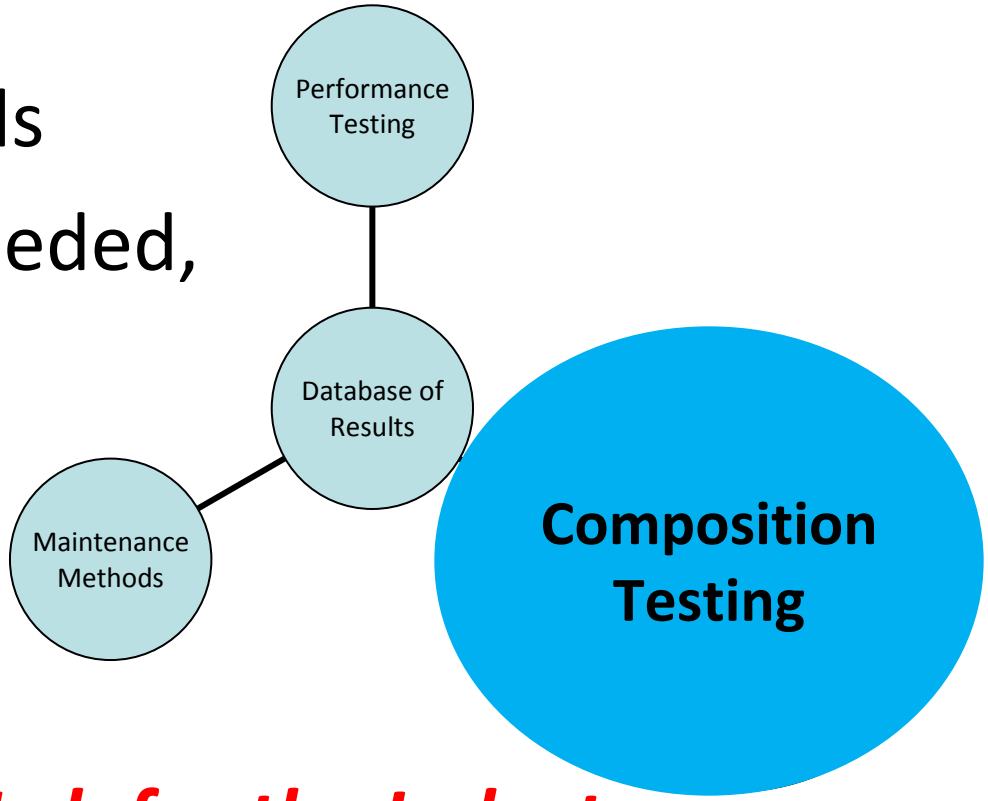
Track Composition Testing
A Critical Input

- Maintenance depends on:
  - Climate
  - Design (shallow sand track on hard base or pad with developed base layer)
  - Choice of materials
- Standard lab tests used for racing surfaces
- Response to maintenance and weather depends on design and materials

Track Composition

- Consistent test methods
- New methods when needed, standards if applicable
- Database of results

Open to all users:
Non-proprietary methods

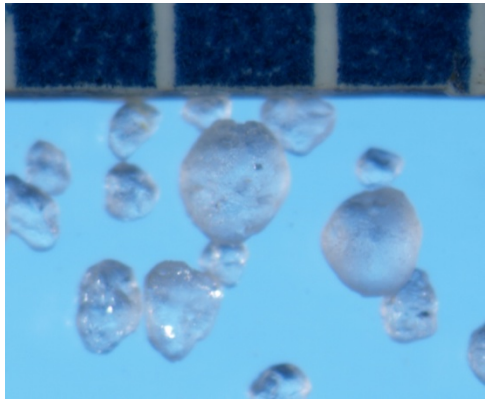


A Single Reliable Lab for the Industry
the Racing Surfaces Testing Laboratory

Basic Laboratory Composition

All Tracks

- Sieve separation
- Hydrometer
- Shape of the sand
- Fiber weight percentage
- Sand mineralogy



Dirt

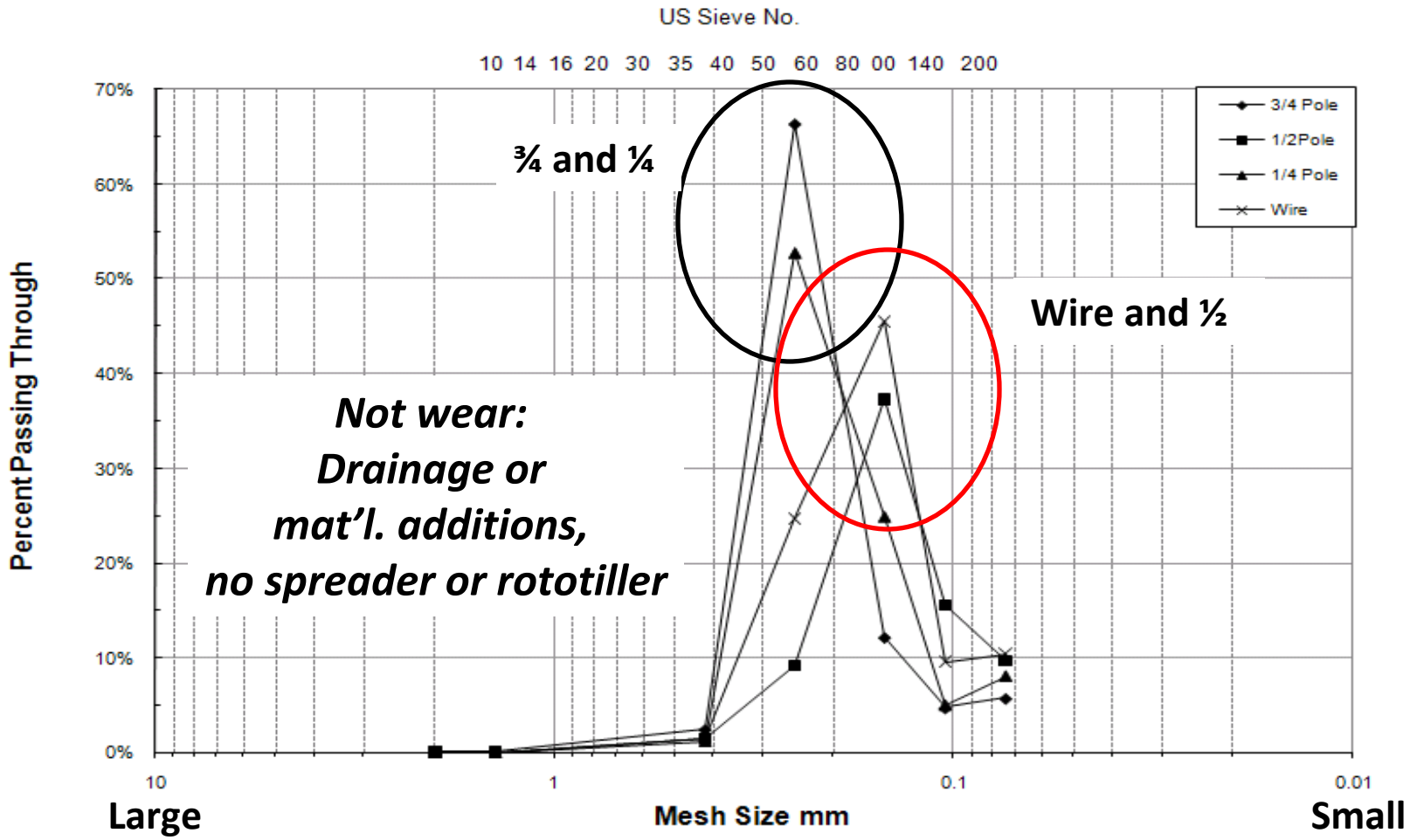
- Organic content
- Salt content
- Clay mineralogy (XRD)

Synthetic

- Wax percentage
- Gas chromatography of wax
- Wax oil content
- characterization

Track testing and material receiving verification

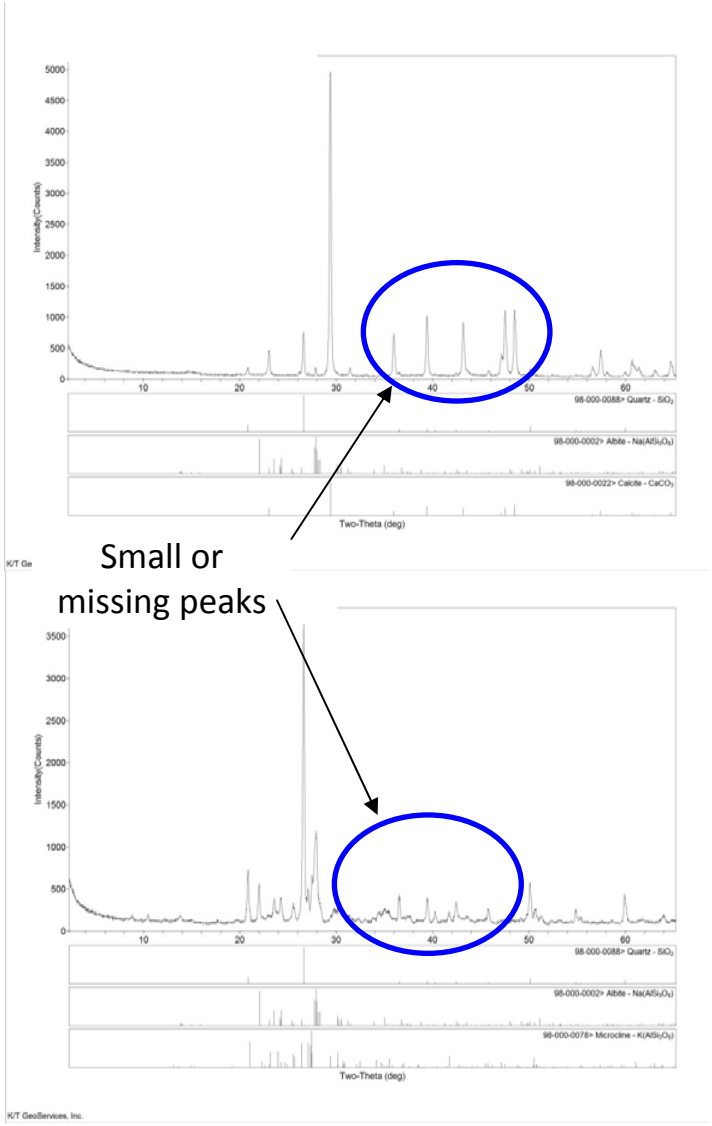
Inconsistent Material Addition?



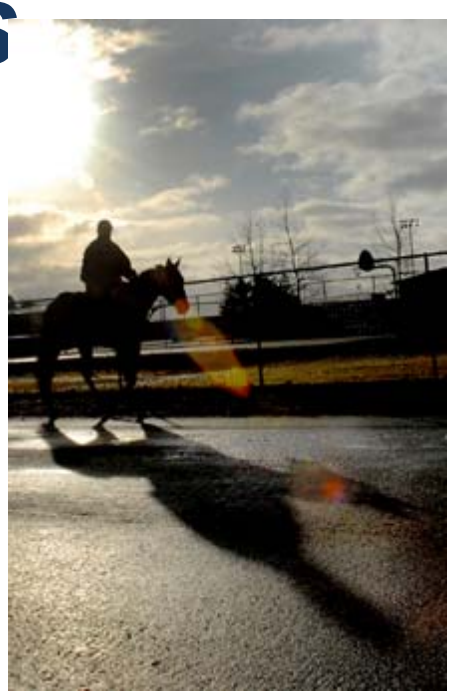
Implementation: X-Ray Diff. (XRD)

- Clay mineralogy
  - "East Coast" vs. "California"
  - "No" clay in most east coast tracks

Summary Mineralogy (Weight Percent)			
Quartz	8.6	32.8	
K-Feldspar	0	19.9	
Plagioclase	2	38.5	
Amphibole	0	2.5	
Calcite	87.4	0.5	
Aragonite	1.3	0	
Dolomite	0	0.8	
Illite & Mica	0	3	
Kaolinite	0.7	1	
Chlorite	0	1	
TOTAL	100	100	



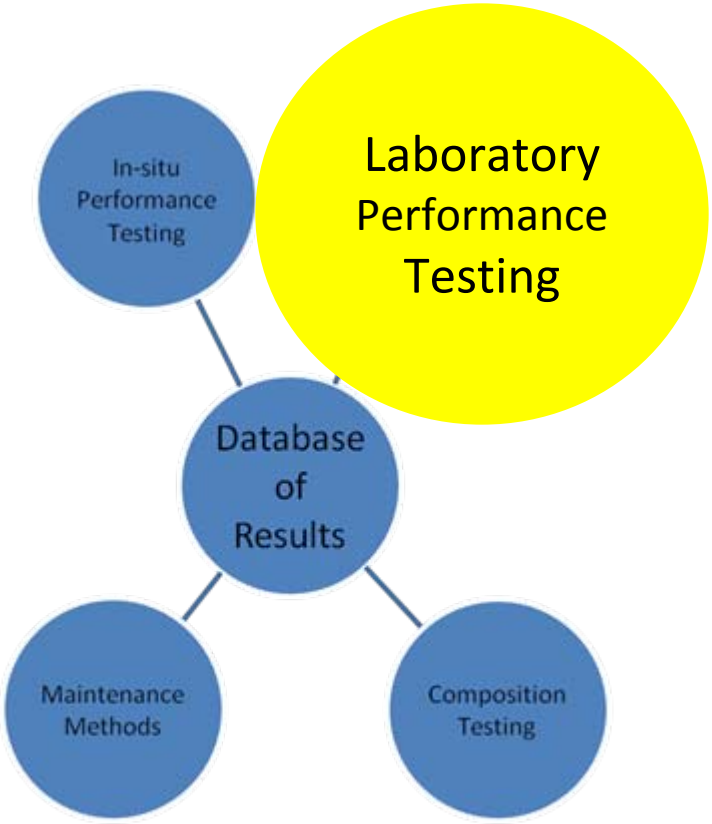
Track Inputs



- Broad participation
  - Existing material sampling and input tracking
  - Access to database of materials and consistent testing methods
- Measurement aspects of "***the silver plan***"
  - Weather monitoring to database
  - Documenting water and track configuration
  - Material composition testing

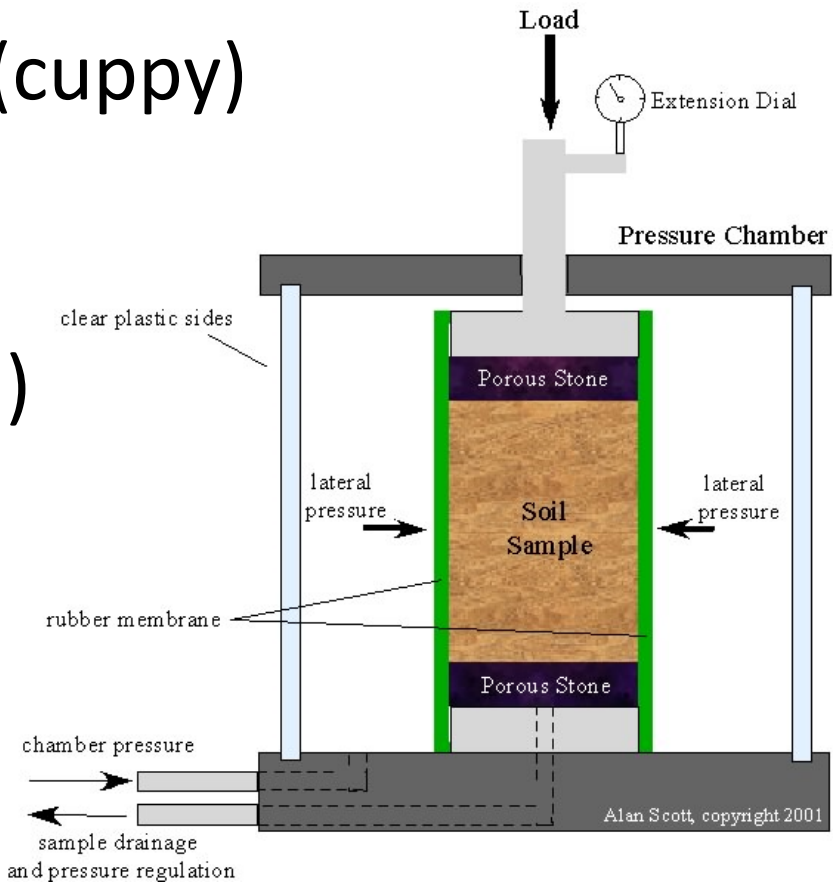
Beyond Inputs, Performance

- Need the right material,
  - Shear
  - Hardness
  - Energy absorption
- NOT THE WHOLE STORY
  - Maintenance
  - Design

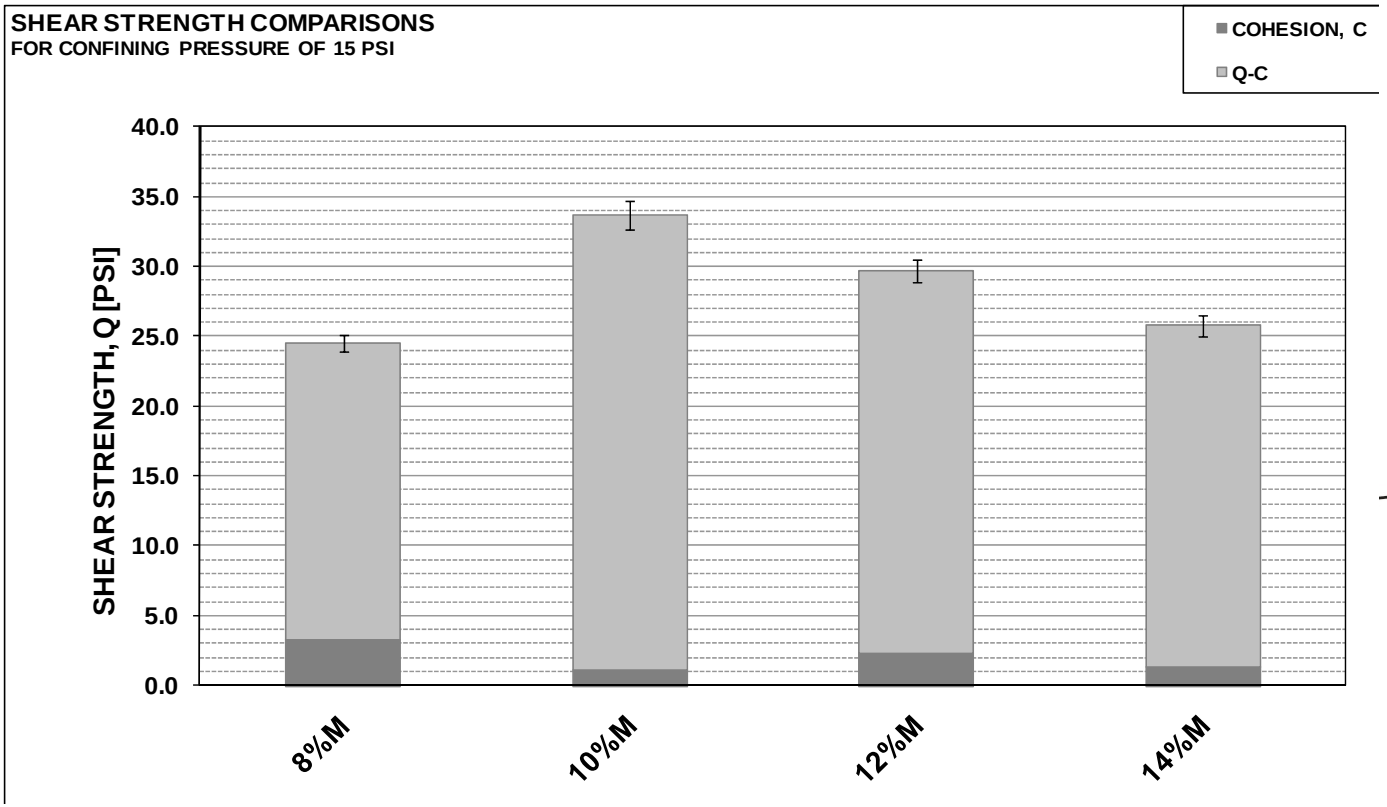


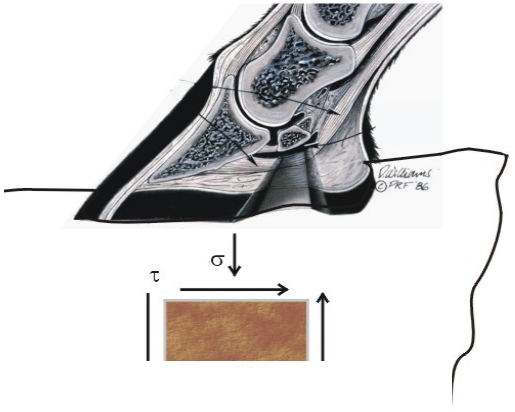
Basic Laboratory Performance Tests
Not what it is, but what it does

- Triaxial shear strength (cuppy)
  - Temperature
  - Moisture
- Tangent modulus (hard)
  - Temperature
  - Moisture
- Penetration resistance (forgiving/lively)



Lab Test: Strength vs. Water





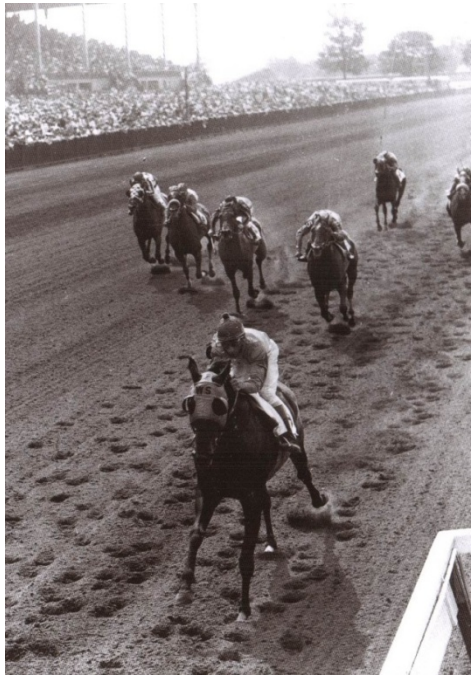
Moisture: 14% to 10%

Shear Strength: 24.6 to 33.7 psi

Laboratory Tests

- The material has changed…..

  But Does It Matter!



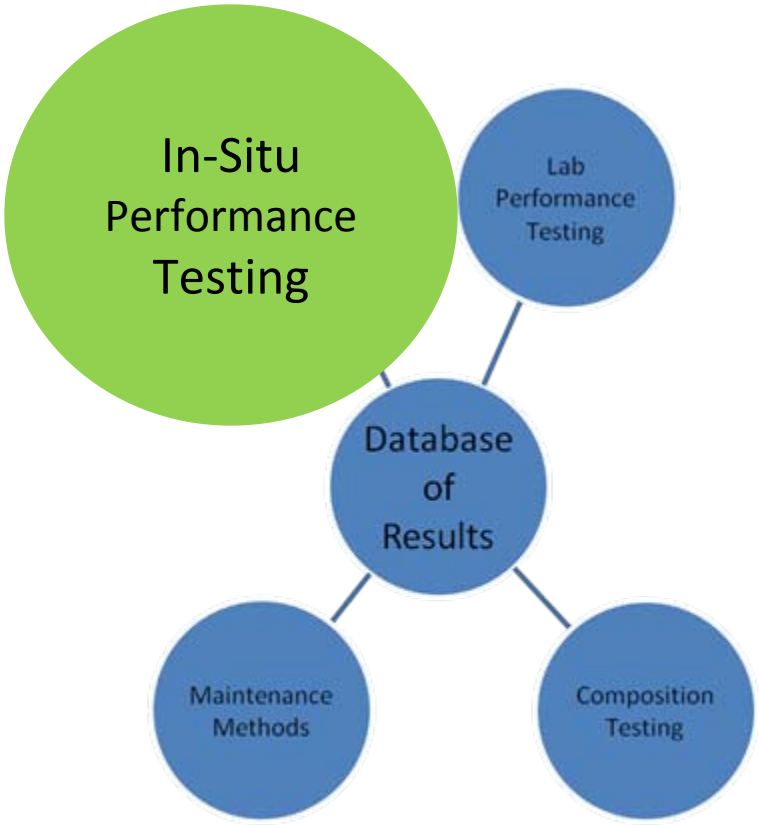
Link to epidemiological research

Database

Each data set is a piece of the puzzle

In-Situ Performance and Design

- Lab testing of materials ignores
  - Design
  - Maintenance
  - Weather
  - Wear
- Focus on the horse: expensive but most relevant tests

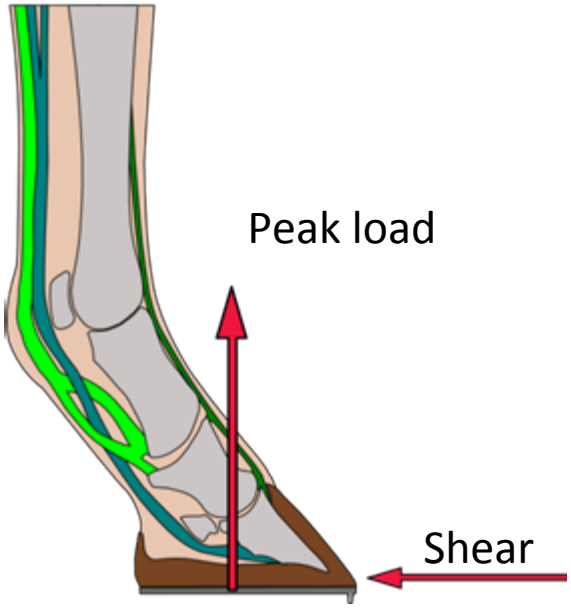


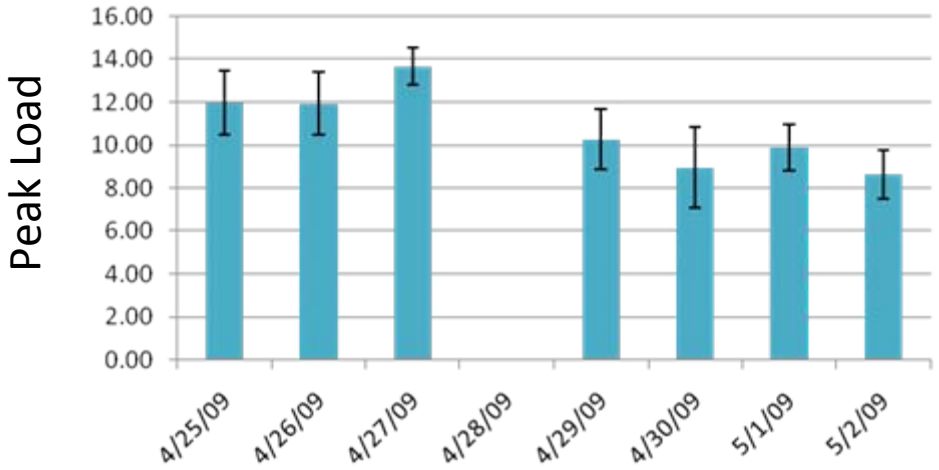
A Tool to Test the Track

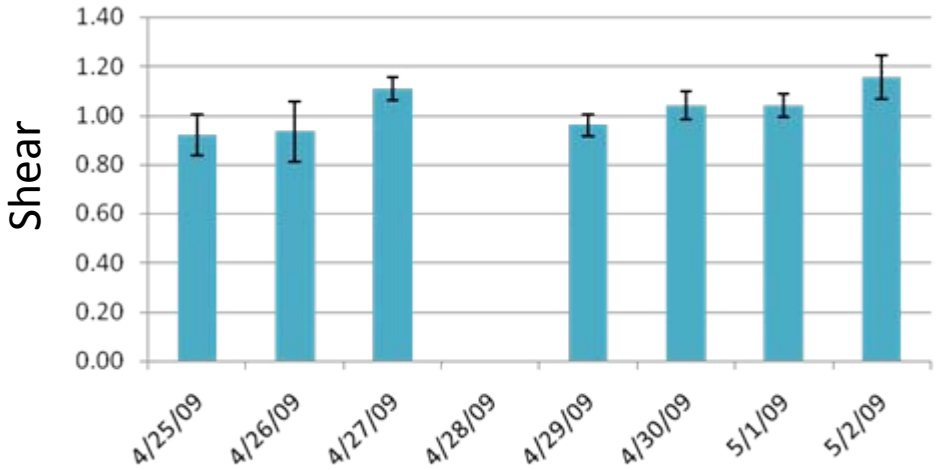
- Biomechanical Hoof Tester
  - Matches speed
  - Matches load
  - Periodic testing: All Churchill Downs Tracks & California
- More frequent testing approach?

Churchill Downs monitoring, Derby Week, on track support Arlington, set up synthetic before start of meet

Biomechanical Hoof Data





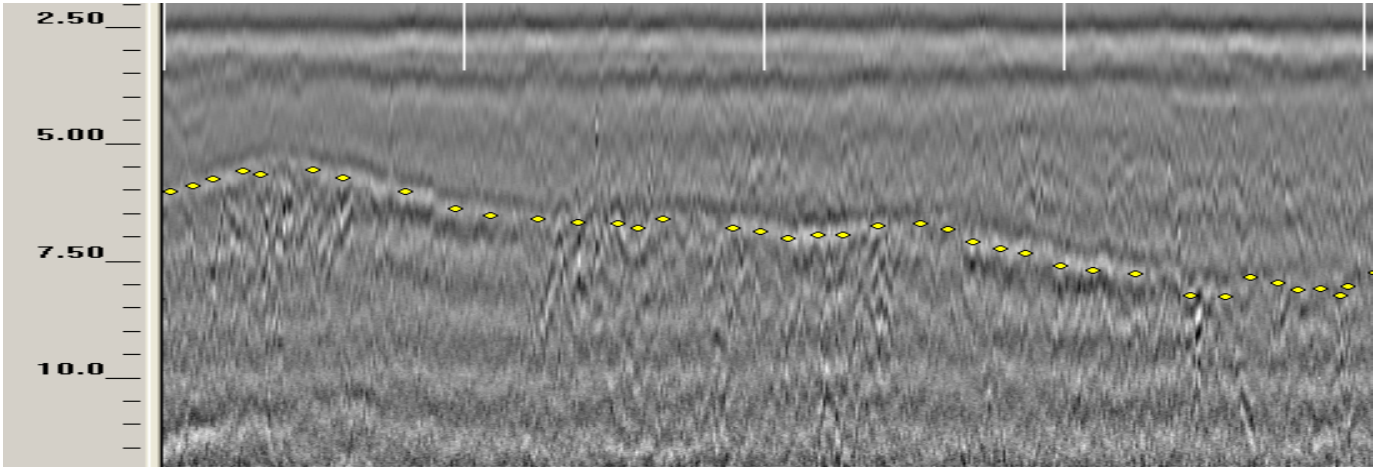


Design Evaluation

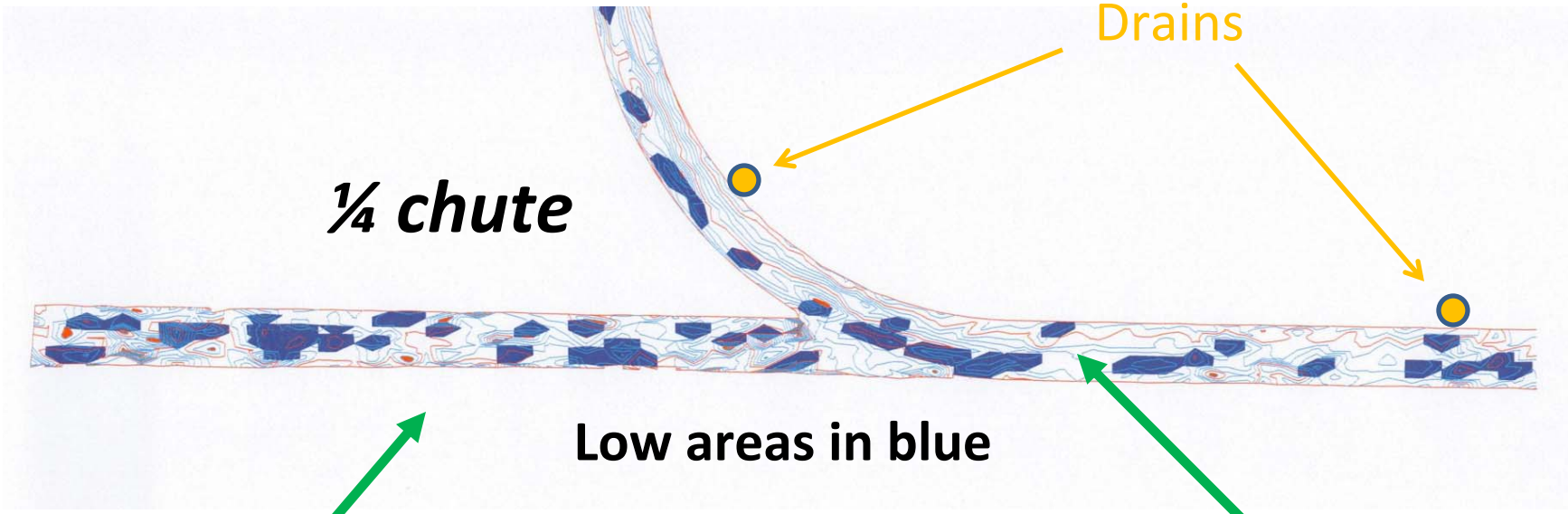
- Banking/transitions
  - GPS
  - Laser
- Evaluation of drainage
  - GPS
  - Ground Penetrating Radar
- Cushion using a probe or radar, based on design
- Monitor gaps, traffic, cushion, drainage

Ground Penetrating Radar

- Detect variation in the base and depth of cushion: Holes in the base, Separation of materials, Loss of fines – drainage
- Identify issues before a problem arises.



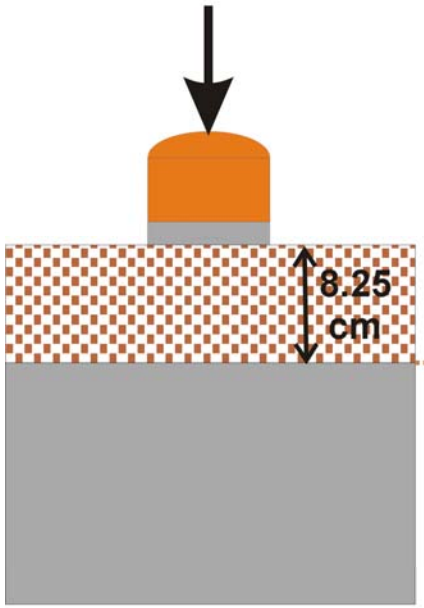
GPS Mapping Support for Grading



Cushion Depth and Base

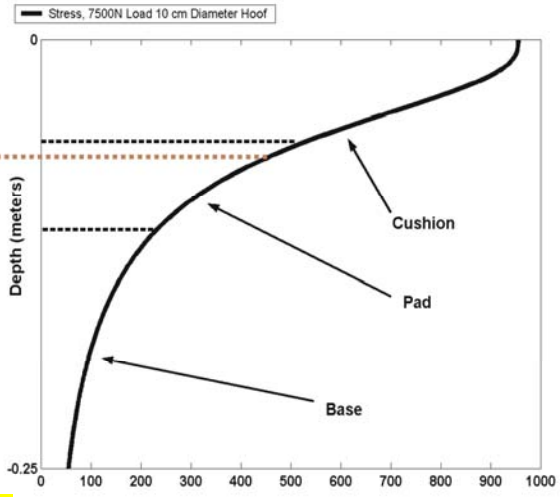
East Coast Style Track

Dynamic Load
2 ½ times Body Weight



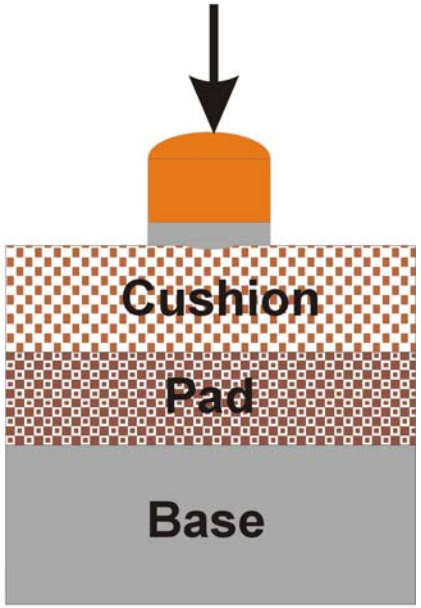
Theoretical Normal Stress in the Soil (kN)

7500 N Load
on a 10 cm Hoof



California Style Track

Dynamic Load
2 ½ times Body Weight

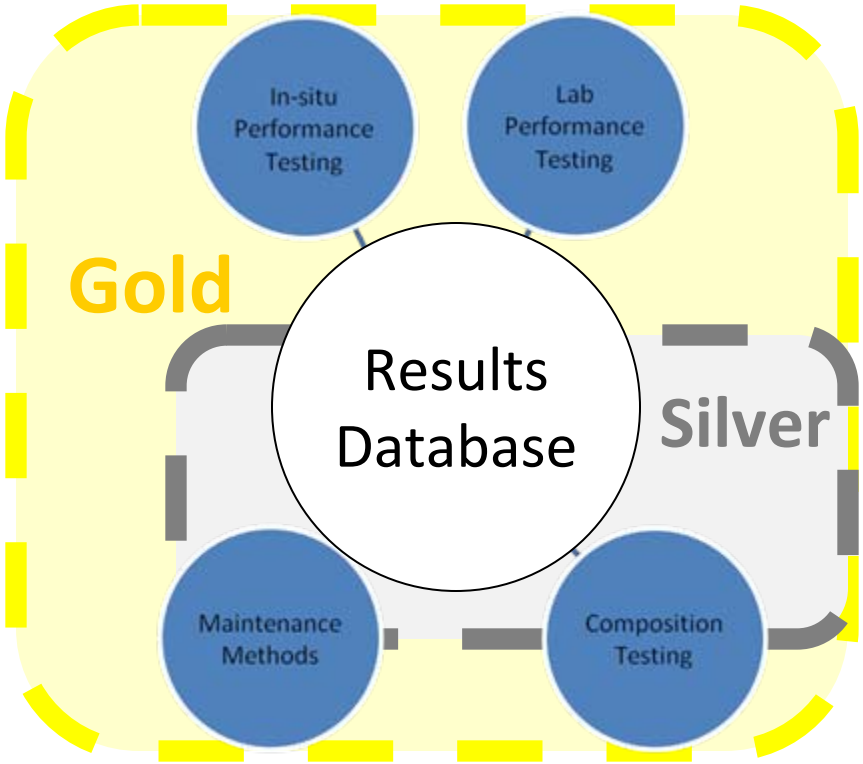


Test with a Probe

Ground Penetrating Radar

All Data: Central Database

- Central data repository
  - Maintenance methods
  - Performance testing
  - Track composition
- Data can be tied to outcomes
  - Injuries to horses and jockeys
  - Effectiveness of maintenance methods
  - Equipment & labor expenditures



Tracks did not "cause" the problem, they CAN improve the situation

No disease no breakdown….

Issues in Musculoskeletal Disease

- Conformation
- Individual predisposition
- Pre-existing disease
- Shoeing
- Training
- Track surfaces
- Multi-factorial risk

Outside the Box

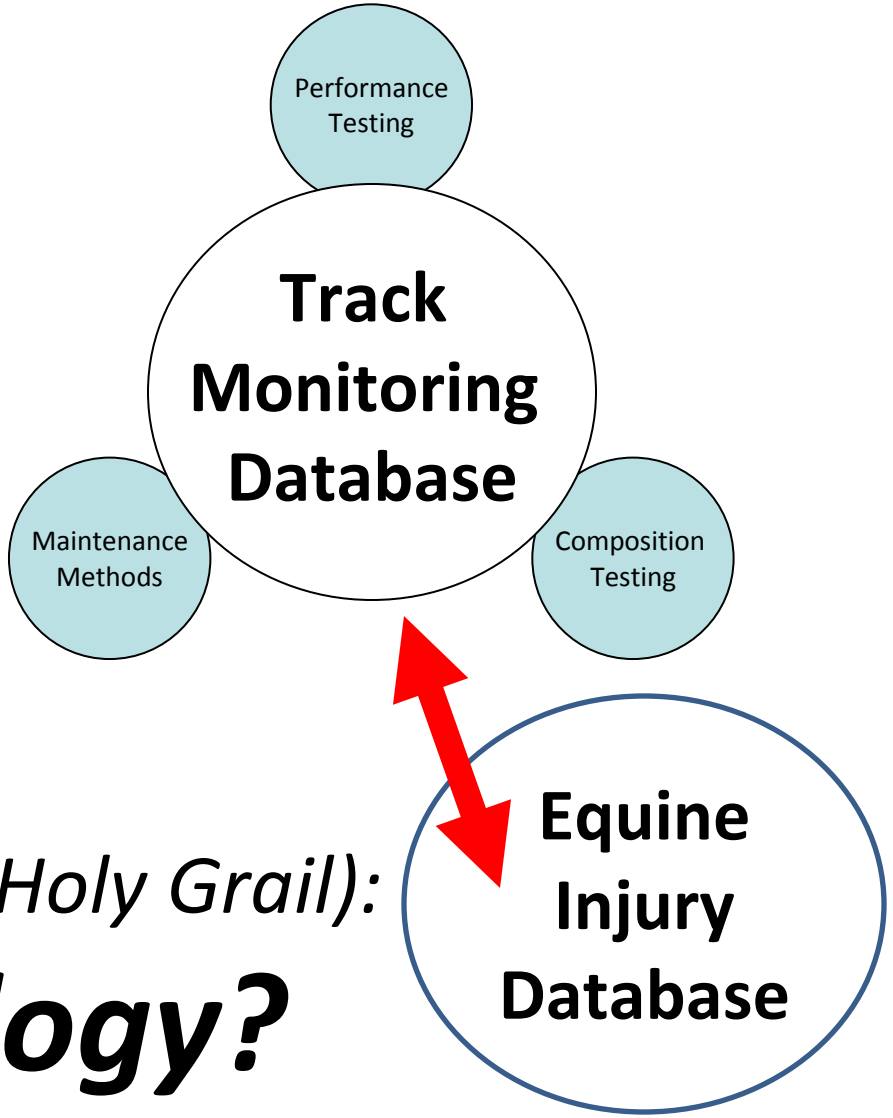
Moisture

#1 uncontrollable variable on turf and dirt

Churchill Downs Inc., Research Project…

The Advanced Water Truck……

Improved tracks can make racing better, even if they did not CAUSE the problem



The critical question (the Holy Grail):

Epidemiology?

What track characteristics protect horses and riders