Surfaces

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Racing Surfaces Committee

- Dr. Wayne McIlwraith (chair)
- Dr. Jeff Blea
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- Bill Casner
- Dan Coon
- Bob Elliston
- Dr. Rob Gillette
- Chris McCarron
- Dennis Moore
- Nick Nicholson
- Dr. Sue Stover
- Dr. Mick Peterson
- Steve Wood

Broad participation by stakeholders & researchers…

Recommendations of:

The Welfare and Safety of the Racehorse Summit

Keeneland Sales Pavilion
Lexington, Kentucky
March 17-18, 2008

RECOMMENDATION 1:

TRACK SURFACES

Primary Objective:

<u>Promote consistent and safe track surfaces conditions</u>

Causes of catastrophic injury

Surfaces have
improved over the
past ½ century

Surfaces Impact Safety

- Optimal Performance
- Fair and Consistent Racing Surface
- Can help extend careers

Surfaces will always be part of the solution

Issues in Musculoskeletal Disease

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

No disease no breakdown….

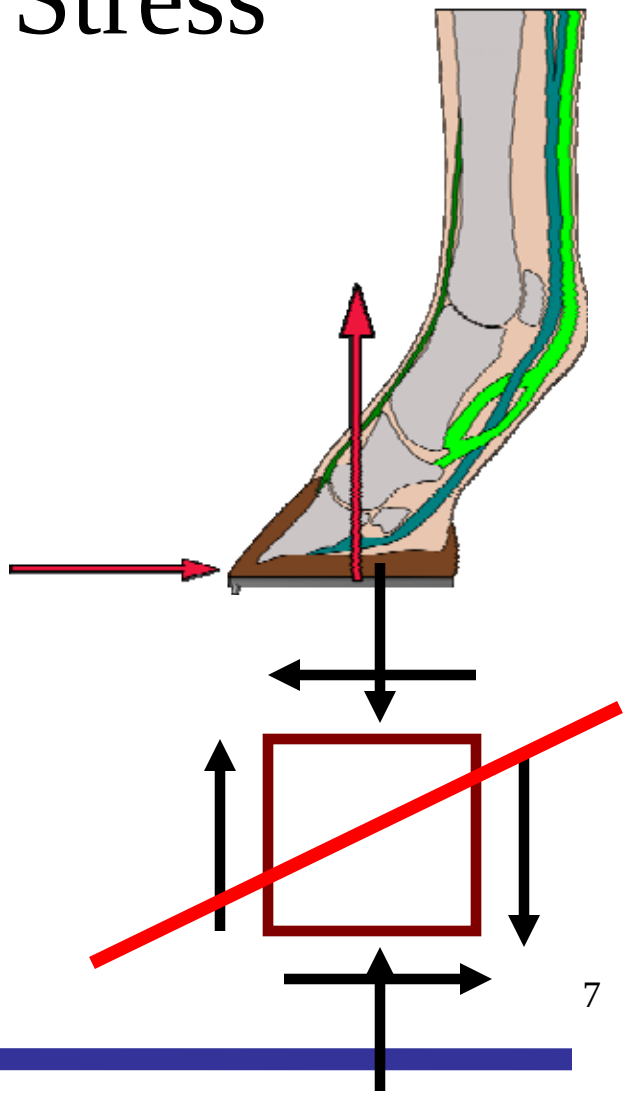
Tracks did not "cause" the problem, they CAN improve the situation

We Know the Basics
Need to Apply It: Clinical

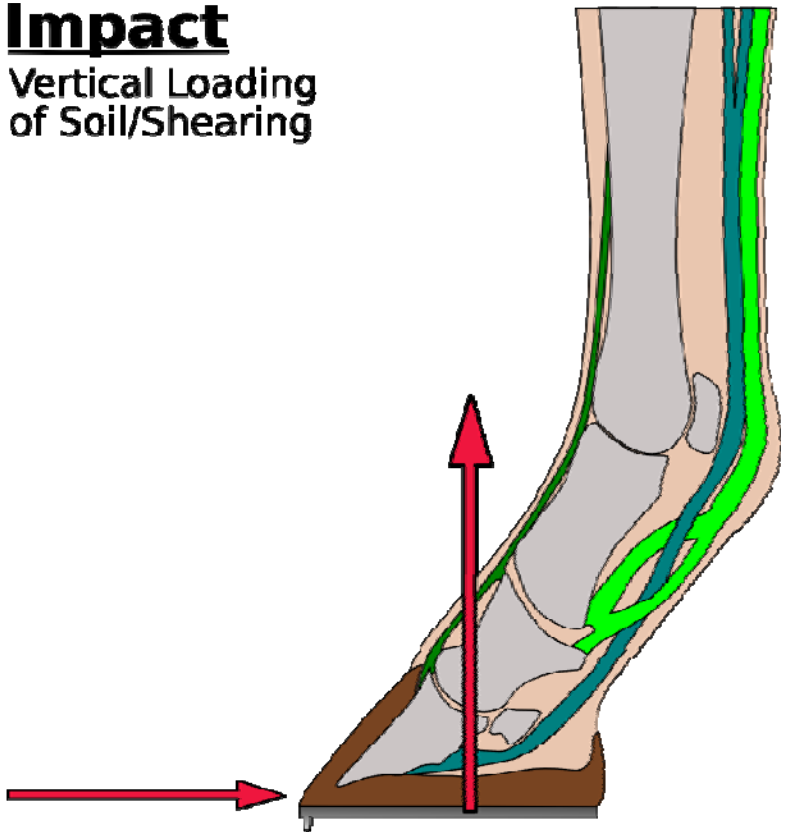
- Track Materials – Synthetic and Natural
  - Non-linear
    The more the material is loaded the higher the modulus
  - Strain rate dependent
    - Synthetic shows creep deformation
    - Dirt shows some dynamic softening (controlled by moisture content)

The Loading is Combined Normal Stress and Shear Stress

- Deceleration and propulsion produces shear in soil
- Weight produces normal stress in soil
- Failure along principal axis – shear in soil

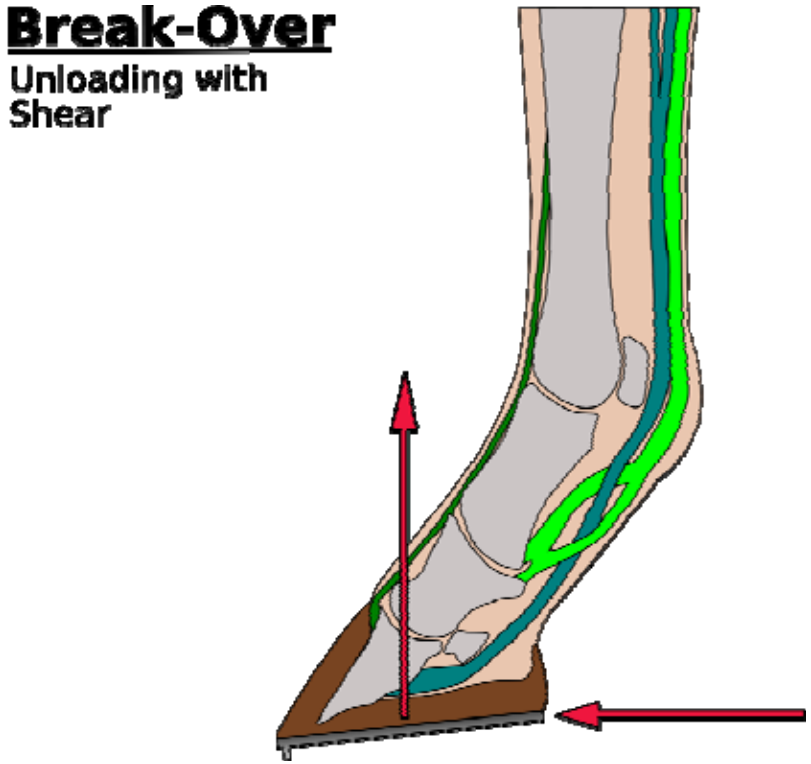


Surface has different function during phases of gait: Impact/loading

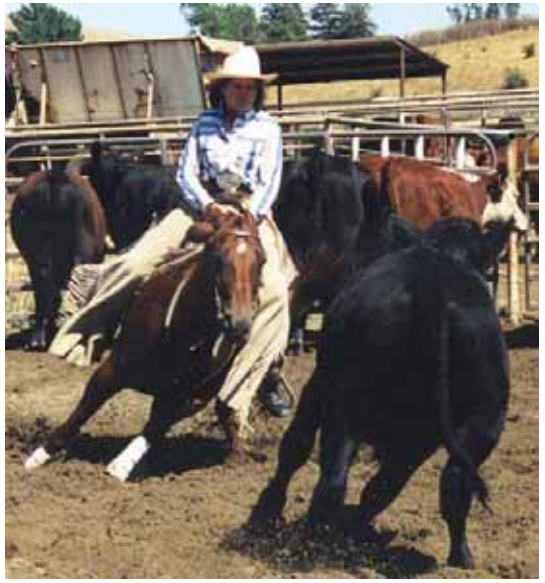


- Lower vertical modulus reduces strain rate and peak loads
- Shear failure reduces horizontal peak accelerations

Surface has different function : Breakover/Propulsion

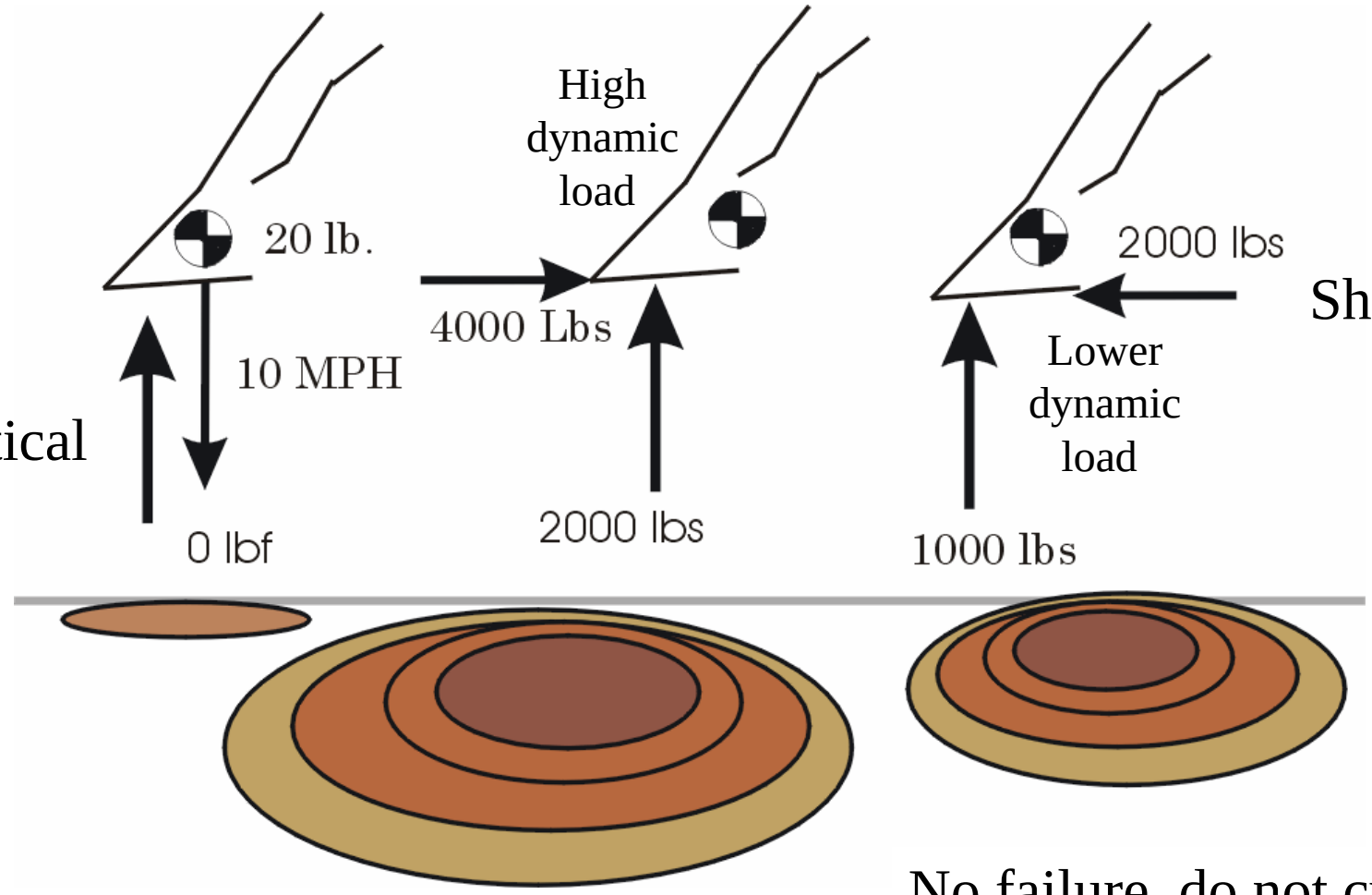


- Shear strength to support hoof during propulsion



http://www.wyammyranch.com/horses/sangria.jpg

The Ground Reaction



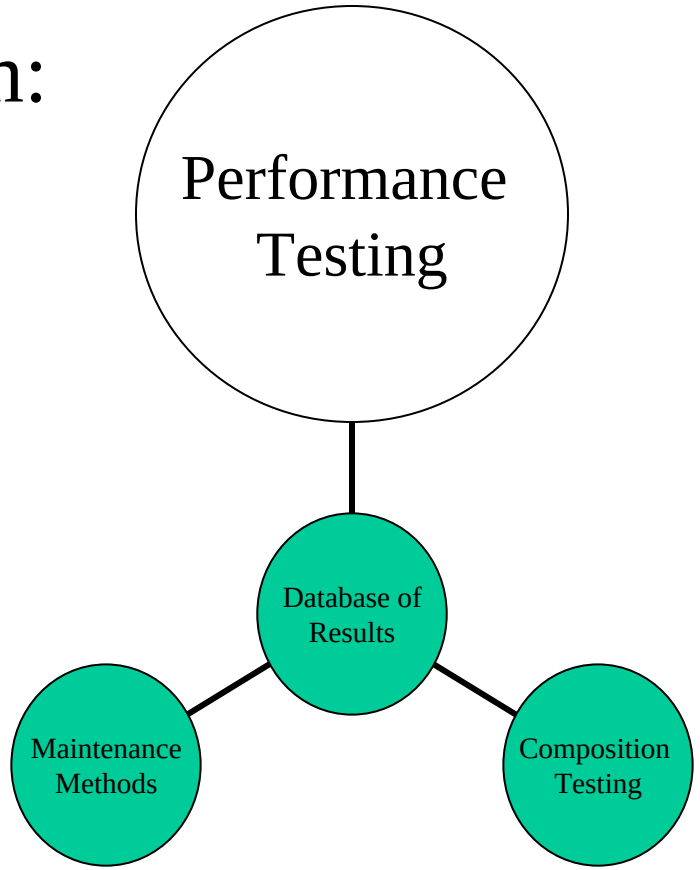
Vertical

Use shear failure, reduce accelerations

No failure, do not cup out

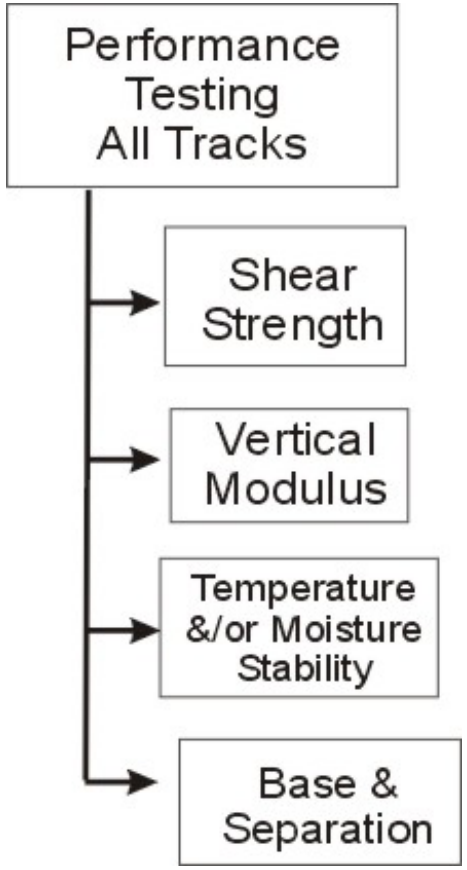
Track Support Program
Understand materials and do it right

- A comprehensive track support program:
  - Performance
  - Composition
  - Maintenance
- We care about the performance of the surface
  Proper shear strength & stiffness



Performance testing…

- On-site performance monitoring
  - Research must show that the measures relate to safety of the horse
  - Daily measurement of performance
  - Periodic measurement of composition



Do the research and determine which factors pose a risk

Our Research: Performance Based Track Evaluation

- Design test machine for evaluating tracks
- Match the accelerations, speeds and loads to simulate racing
- Test with a machine not an animal for consistency – a consistent horse
- Baseline on the best tracks and prepare to start thinking about what is a "***good track***"

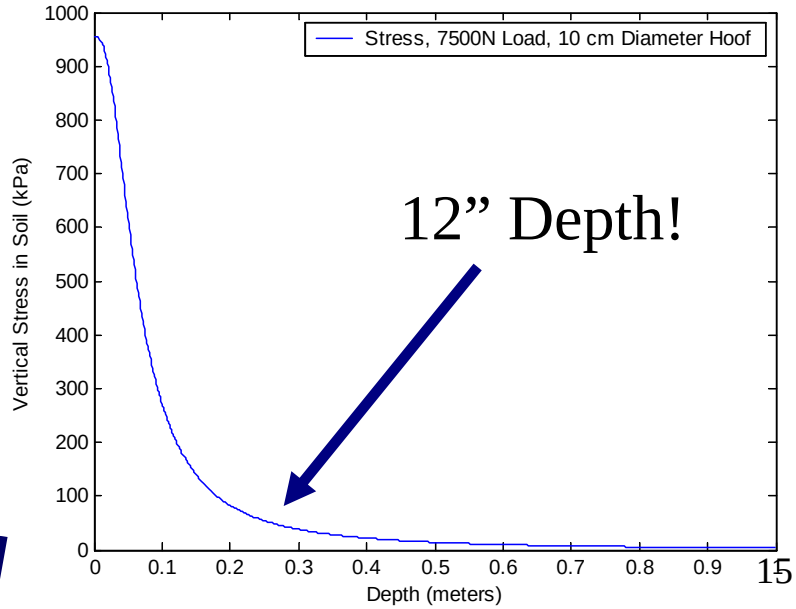
A *Perfect Horse* gait to load a *Perfect Track*

Biomechanical Hoof

- Design based on loads, speeds and angles from biomechanics
- Method is “mobile”,
- Automatically acquires data
- Utilized between races, during breaks (40 min)
- Simultaneously measure shear strength and hardness

Dynamic Response of Soil

System measures soil under by simulating the most extreme case, impact and loading

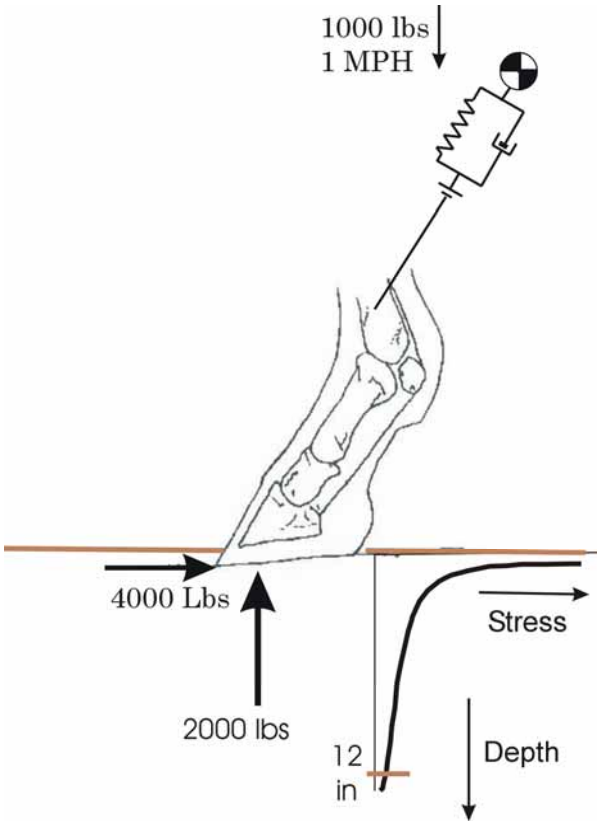


Simplified modeling:
The soil at 30 cm depth are loaded at 10% of peak load

The base IS the footing

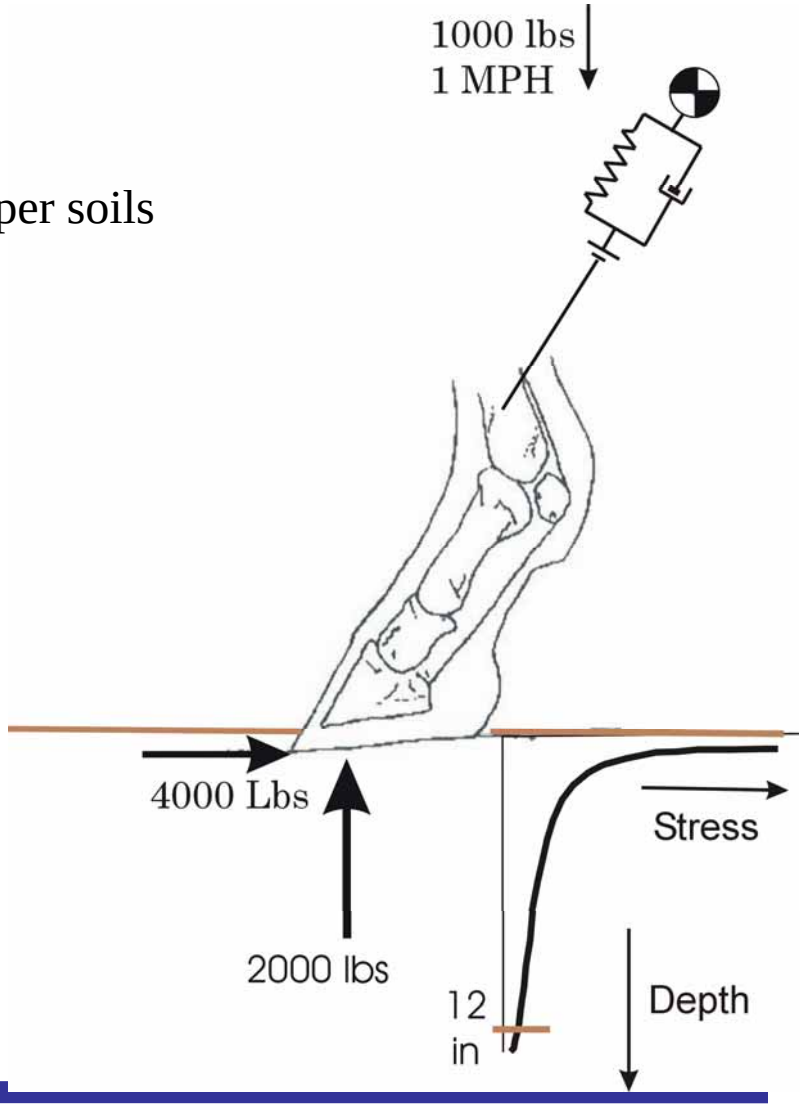
Biomechanical Hoof Tester

- Biomechanical Hoof Tester
  - Started in 2004, California Tracks
  - Comparison of 26 tracks
  - Includes data from 6 Synthetic Track installations

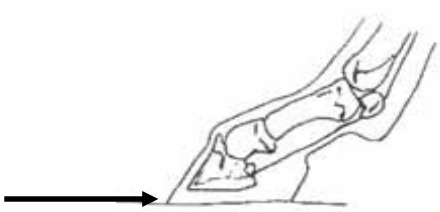


A New Test System….
Just for Horses

- Higher loads
  - Low loads – do not measure effect of deeper soils
  - Non-linear material
- Matching strain rate
  - Soil, especially wet, strain rate dependent
  - Synthetics, opposite strain effects!
- The net effect: a lot of load fast

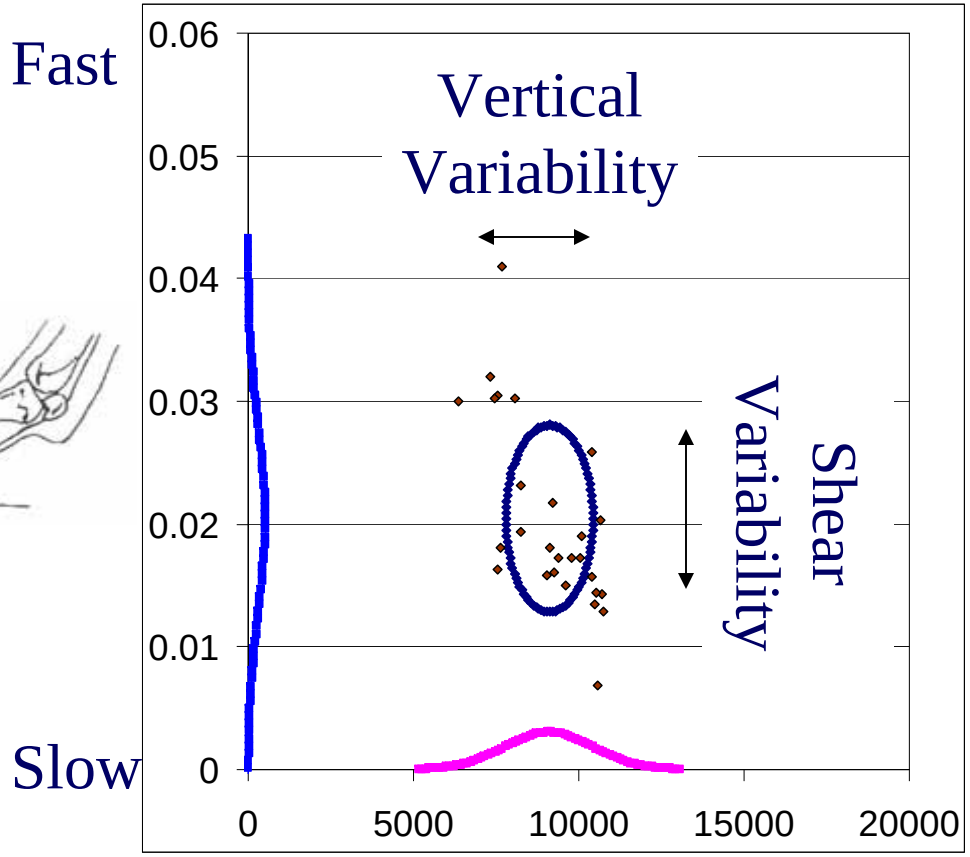


Surface Performance



- Location on the graph

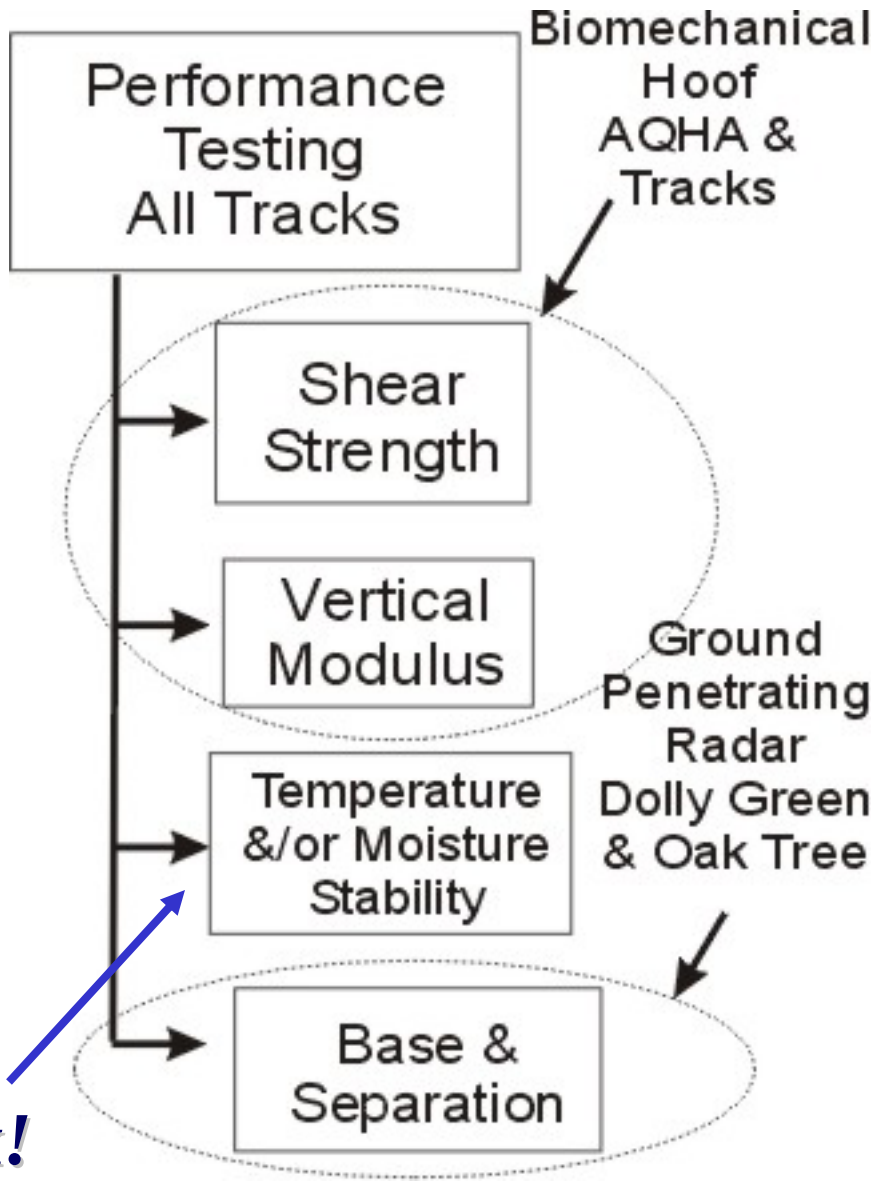
Amount of variability



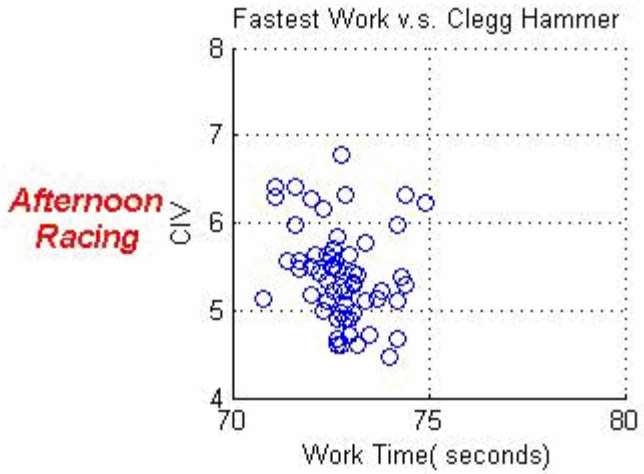
A Work In Progress

- Need to have standard methods used at all tracks
- Grayson-Jockey Club WSS Racing Surfaces Committee
- Industry wide support!

Needs work!

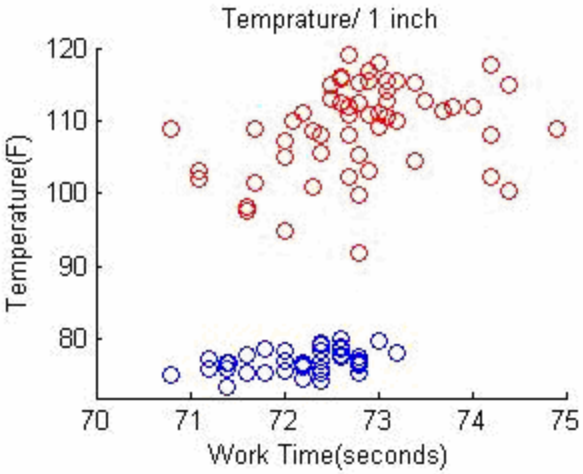


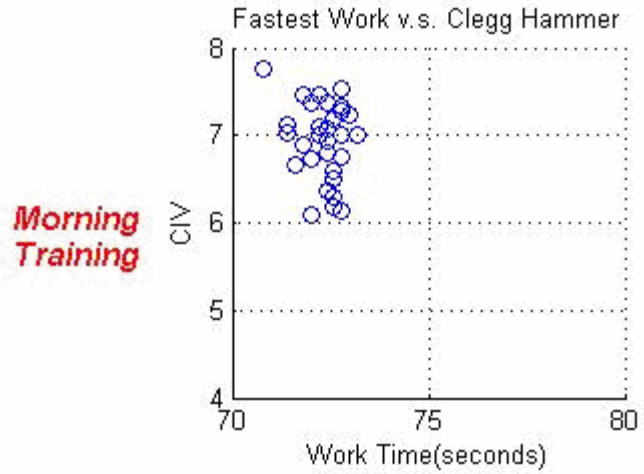
Need Simpler Tests…



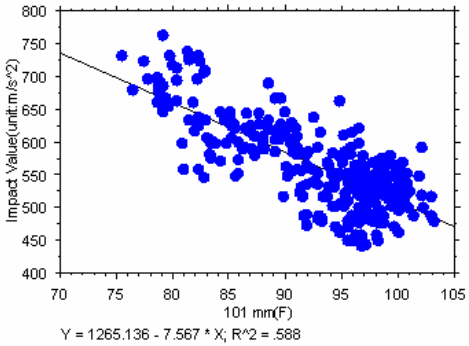
Fast Time

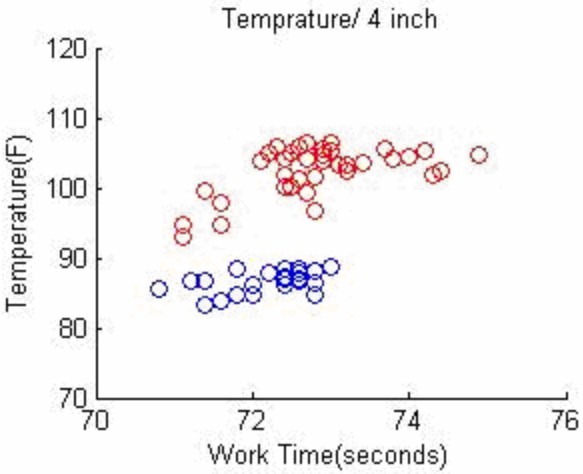
Not too simple





Clegg





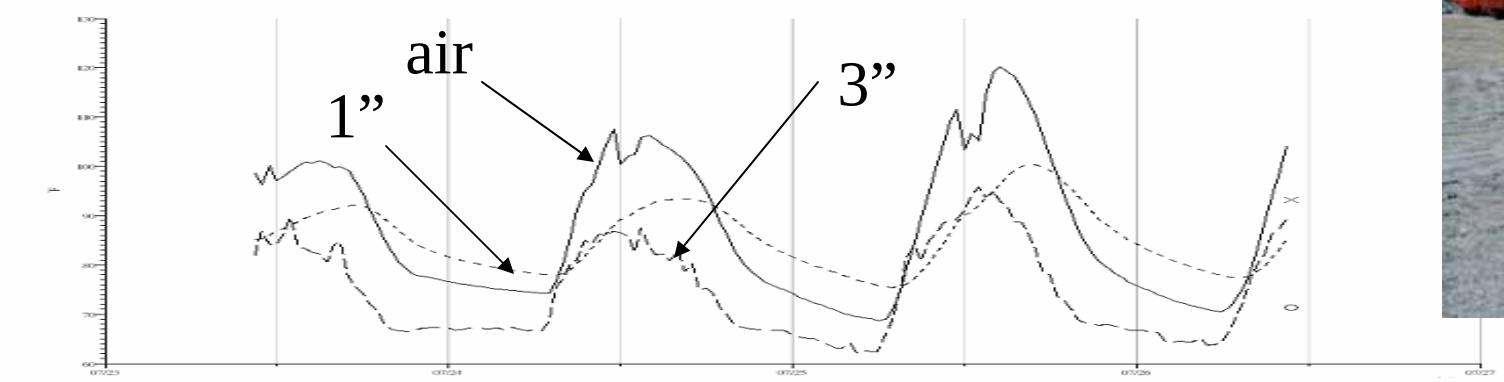
Temp.

Not trying to sell anything

Tests to Consider!

- Clegg Hammer – Heavier Version!
- Shear Vane
- Australian Penetrometer (not British or US!)
- Double Ring Infiltrometer

- Thermometer
- Moisture Sensors –
  somebody must make a decent one!



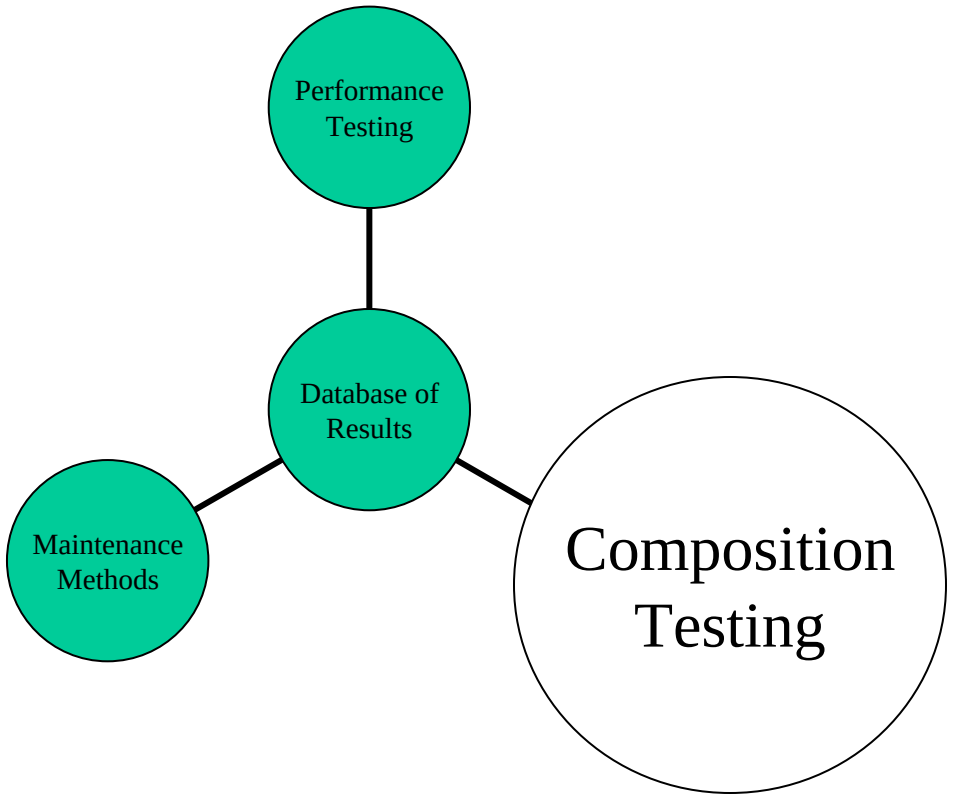
Current … Just Started ... Work

Grayson Jockey Club Research Foundation
(Peterson ,McIlwraith)

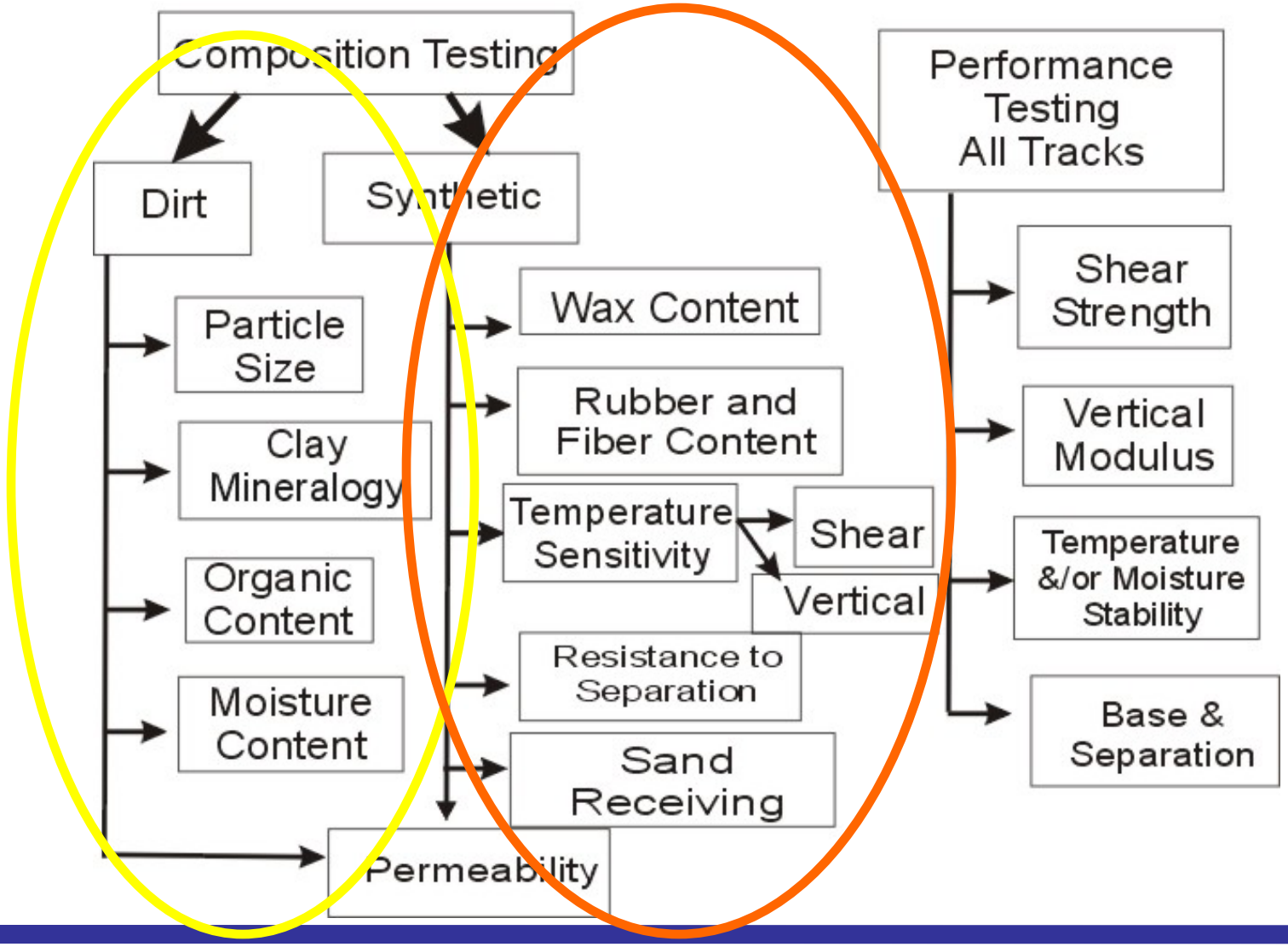
- Study…throw everything we got at a track
  - – couple weeks…
  - – dirt
  - – synthetic
- See what correlates and see what is usable

Cannot Stop at Good & Bad Need to Provide Guidance

- Need to understand changes and how to them
- Composition testing (materials testing) is needed by tracks
- Understand what to add (or remove)!

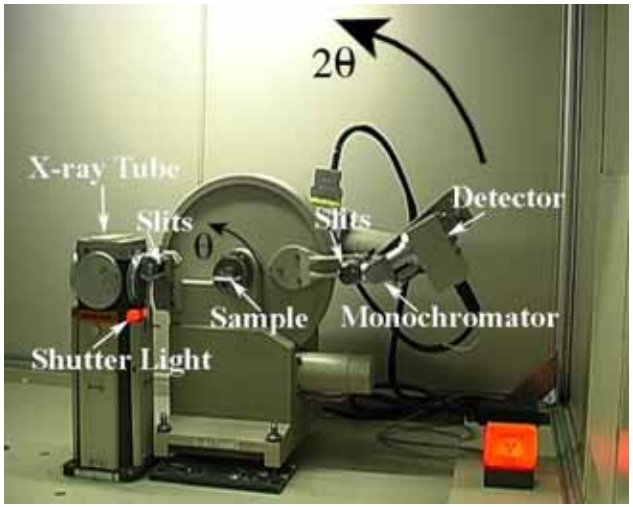


Engineered Surfaces

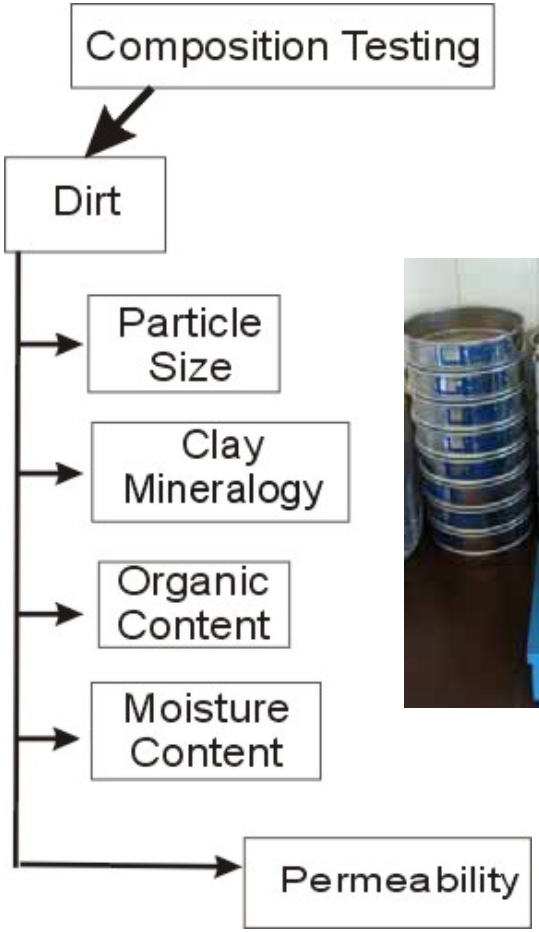


Measurement Methods:
Dirt Composition

- Most tools exist, need to be applied
- Clay mineralogy (X-ray diffraction)



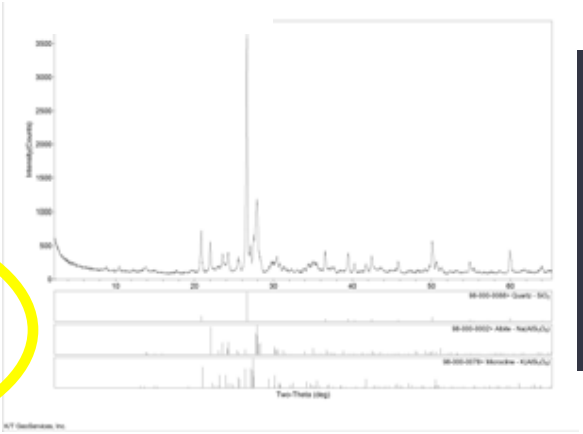
http://stars.sci.ibaraki.ac.jp



Implementation: X-Ray Diffraction & …

- Used to characterize clay mineralogy
  - Base line on 5 tracks of both “East Coast” and “California” design
  - Results consistent with maintenance "traditions”

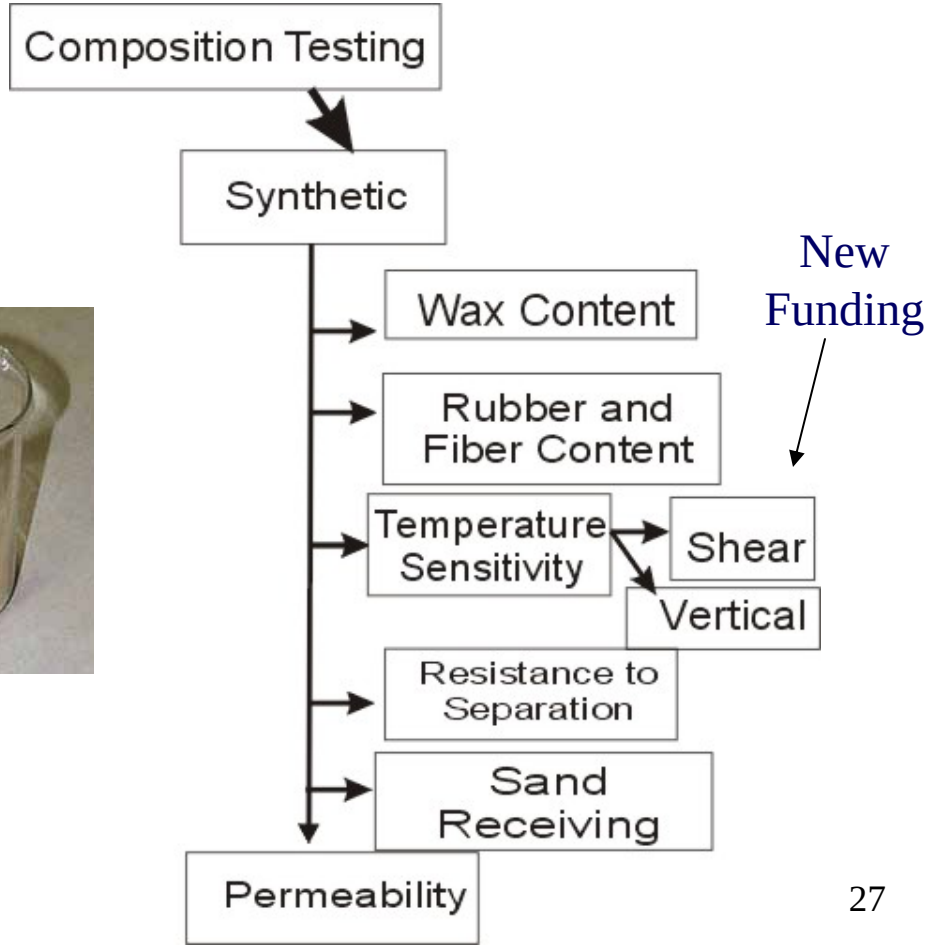
Summary Mineralogy (Weight Percent)			
Quartz	8.6	32.8	
K-Feldspar	0	19.9	
Plagioclase	2	38.5	
Amphibole	0	2.5	
Calcite	87.4	0.5	
Aragonite	1.3	0	
Dolomite	0	0.8	
Illite & Mica	0	3	
Kaolinite	0.7	1	
Chlorite	0	1	
TOTAL	100	100	



More Research…Measurement Methods:

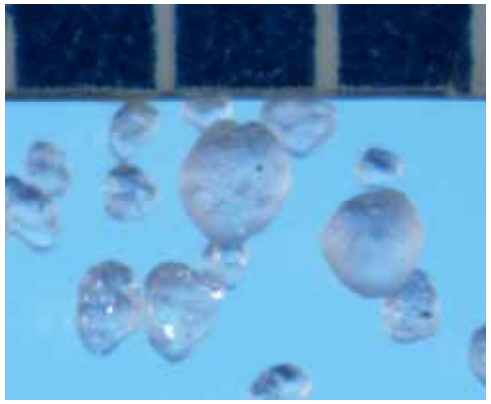
Synthetic Composition

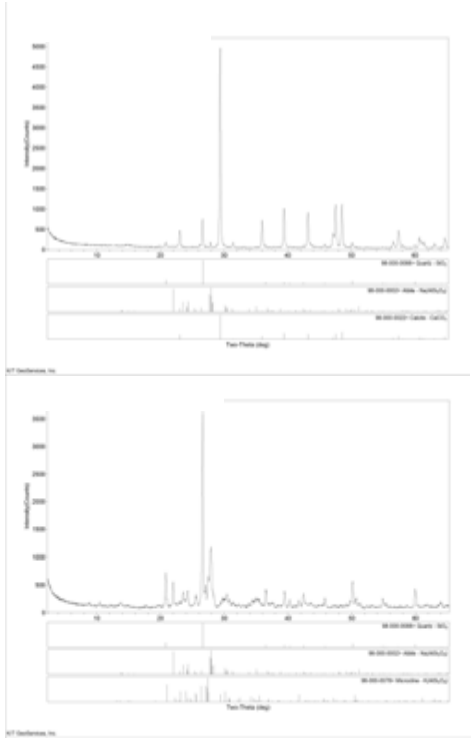
- Wax composition
- Temperature sensitivity



Research on track materials

- Some data makes sense ..
  - – Sand and clay mineralogy –
  - – No real clay in “East Coast” track
- Sand Matters…





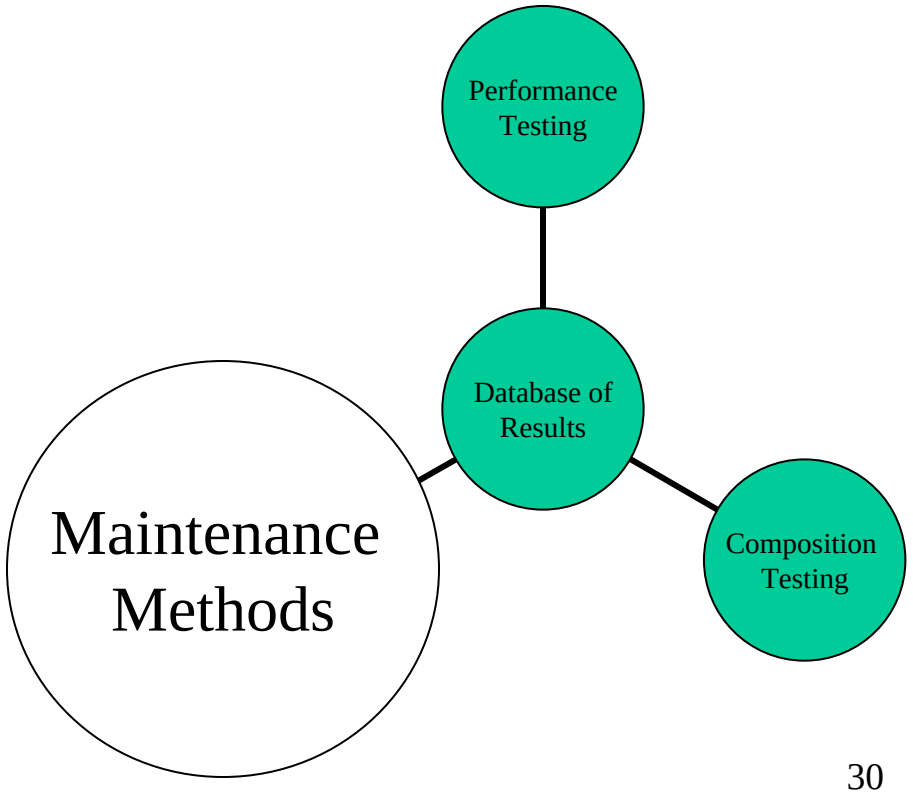
Would you expect the same result?

Laboratory for Analysis of Track Materials

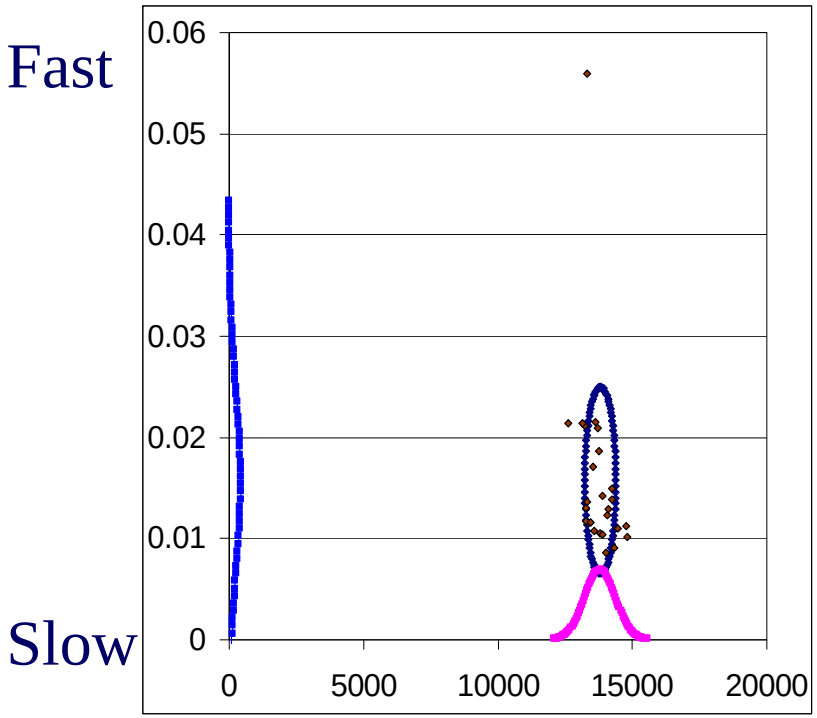
- A central lab to compare between tracks
- Data linked to epidemiology
- Responsible for developing new tests of materials

Maintenance Matters

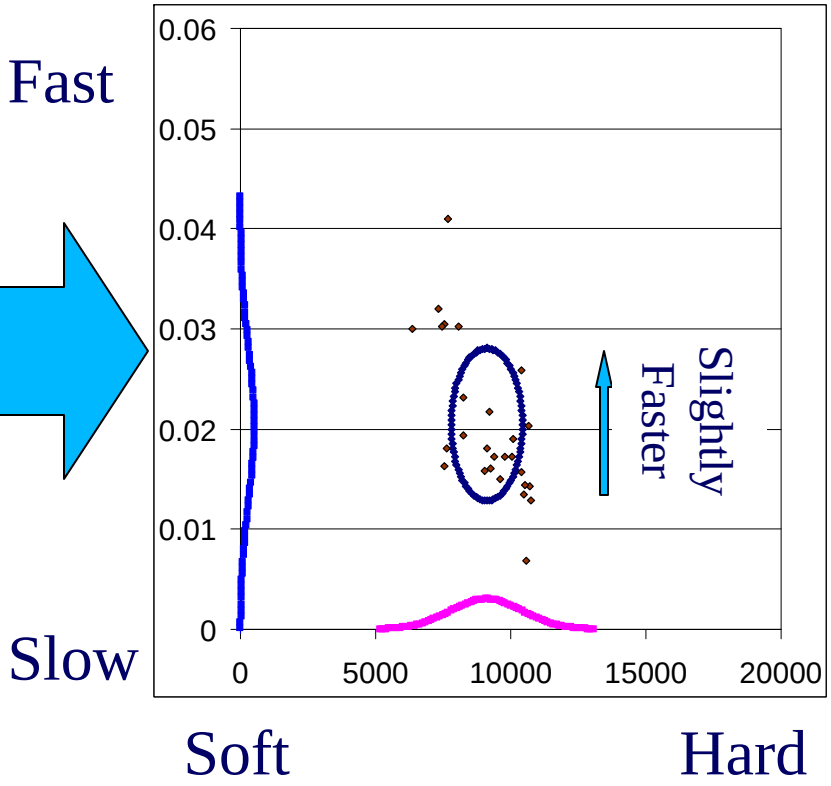
- Different tracks do things differently
- Reasons may be valid
  - Weather
  - Design
  - Usage
- Develop best practices



Example: What Happens? Rip, Till and then Set a Racetrack?



Softer & More Variable



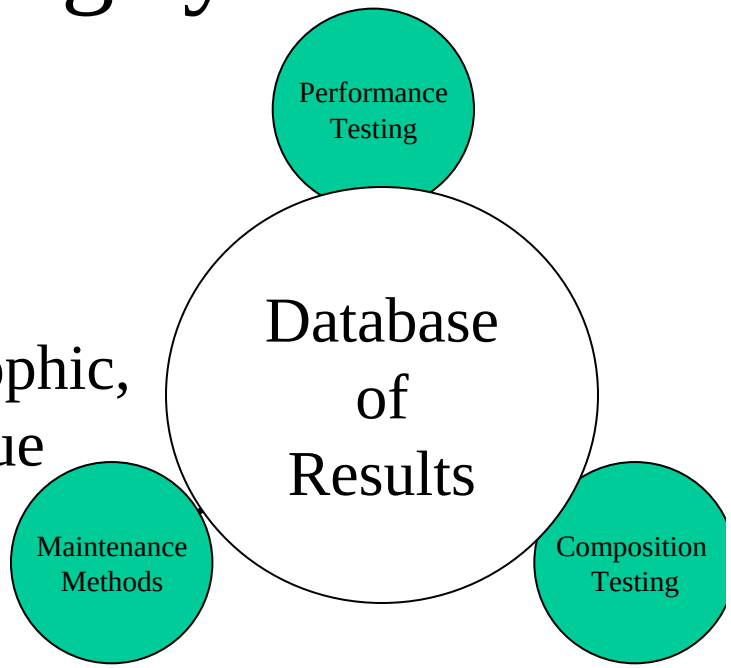
A hard track is not necessarily low shear

Lab results & performance results
Maintenance reporting system

Start simple,
research leads to expansion…

The model – start simple and expand
- Mary Scollay's On-Track Injury…catastrophic,
- Jeff Blea & Wayne McIlwraith … soft tissue

Current best practices…
Turfway maintenance document



	Training	1st Post	Last Post	Precipitation	RT (Hours)	Depth	PH (Hours)	Depth	Water	Training	Out Riders	Racing
WE 1/27/07	Temp	Temp	Temp	Inches	RotoTill	RT	Power Harr	PH	(Gallons)	Eval	Eval	Eval
Sunday21	26	NA	NA	3" Snow	5Hrs	3"	2	3"	0	Deep	Snow	No Races
Monday22	35	NA	NA	Overcast	0	0	0	0	0	Good	Good	NA
Tuesday23	28	NA	NA	LightSnow	0	0	5HRS	3.5"	0	Good	Good	NA
Wednesday	30	28/18	25/12	1" Snow	5 Hrs	5"	0	0	0	Snow/Stichy	Deep	Good
Thursday25	26/9	26/13	19/6	LightSnow	0	0	4	3.5"	0	Outside Hard	Good	Good
Friday26	19	37	41	Sunny	4	4.5"	0	0	16,000	Little Hard	Good	Excellent
Saturday27	39	41	41	Overcast	0	0	0	0	20,000	Excellent	Good	

Expanded System…

- **Basic Information:**
  - **All Tracks at the Start of each meet and periodically as changes occur**
- **All Tracks one line per day**
  - **Like current system**
- **Class I Monitoring – Need track resources**
  - **Temperature, moisture, track depth, Clegg hammer and possibly shear vane or dynamic penetrometer**
  - **Done Each Day – three times**
- **Weather data acquired**
- **Injury & performance data linked or logged**

Research Approach

- Initial funding, American Quarter Horse Association
- Newly Funded (2008) Grayson Jockey Club
- Goal, to look at the full suite of tests
  - Find correlations between existing and new tests
  - Develop a basic and refined protocol for characterizing surfaces

Philosophy

- Need to provide a common set of measures
- Primary measures should be based on biomechanics as well as on “inputs” and procedures
- Need to continue to understand why the behaviour is different on some surfaces (climate, composition?)
- Provide tools & lab support to evaluate materials

Surface Certification
A Investment for the Horses

How to Move Forward

- Share ideas
- Work openly
- Push vendors, recognize their needs

- Agree on some basic tests (performance)… everyone does them the same, then see the results!

Different Approaches

- All track need to maintain shear and not be too hard
- More than one way to skin a cat

Acknowledgements

- Initial support & encouragement, Dan Fick AQHA Racing
- Continued research funding: Grayson Jockey Club Research Foundation, Polytrack, Del Mar, Keeneland, Santa Anita, CARF, TOC, Fairplex, Dolly Green Foundation, Oak Tree Racing Association

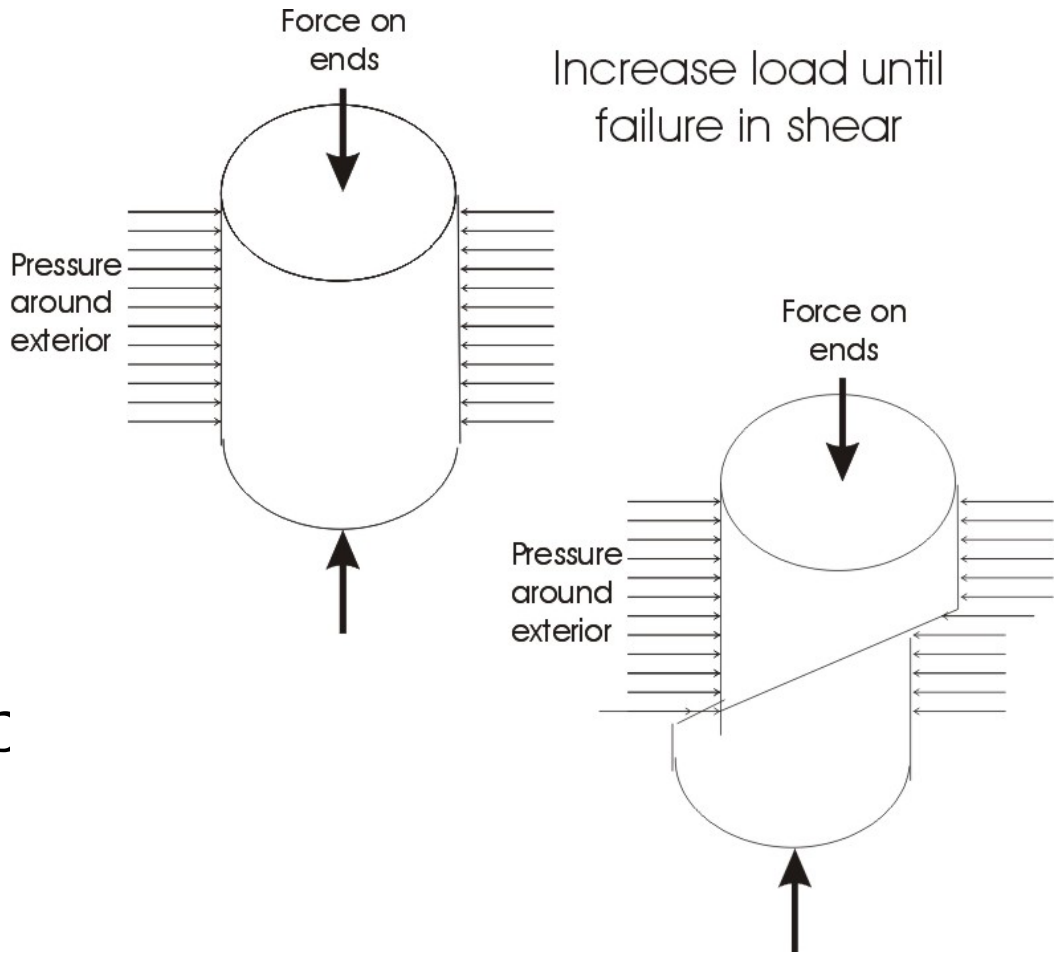
The remaining question:

Epidemiology?

It only matters is we help horses and riders

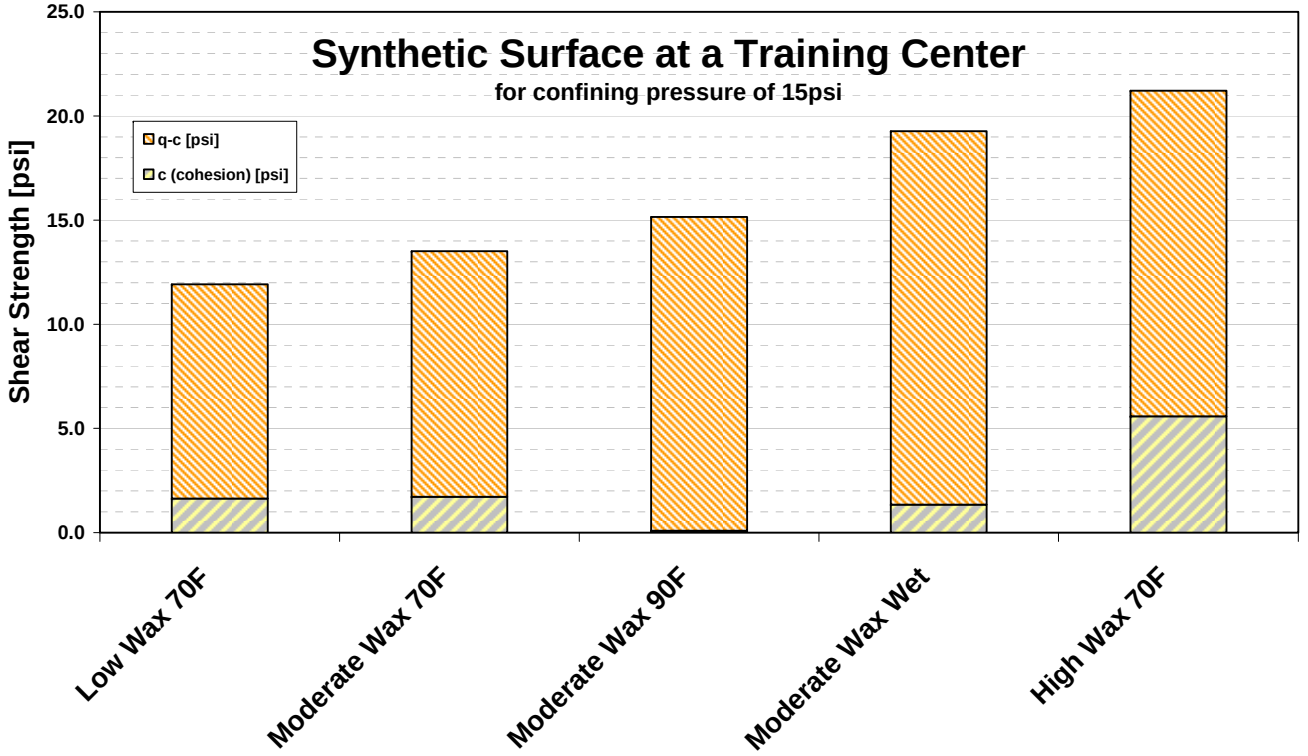
Triaxial Shear

- Currently used in labs for material strength
- Confining pressure uses water where temperature can b controlled



Data Needs to be Explored

Yes the data is repeatable!



Is this wax surface sensitive to moisture not temperature?