

Racetrack Turf Impact Measurements for Jockey Head Injury Risk Analysis

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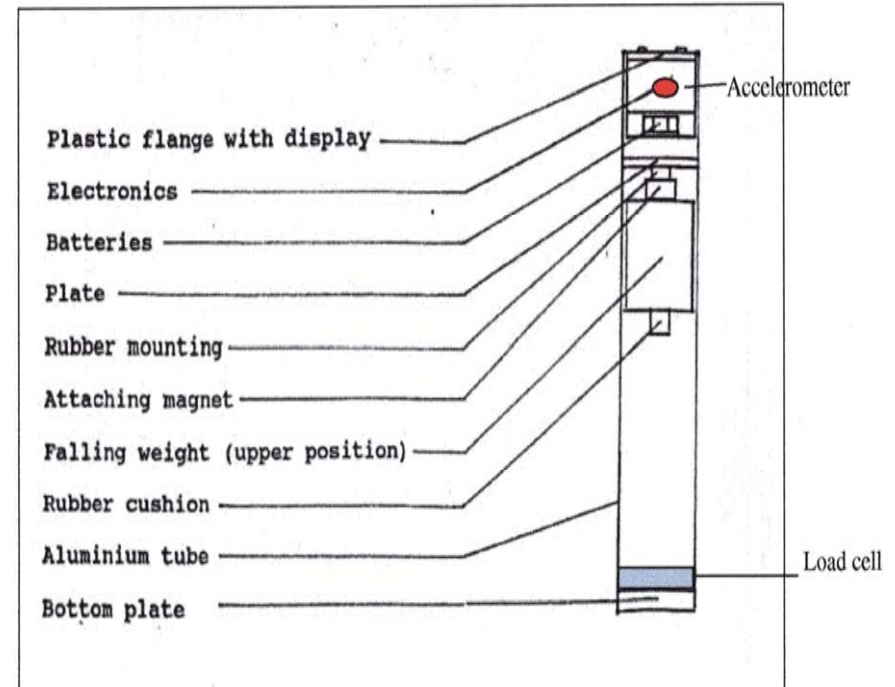
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Introduction

- Computer modelling approach to impact reconstruction.
 - Impact surface characterisation.
 - Multibody Dynamics.
 - Finite Element Modelling (FEM).
- Relevance to helmet design.
 - Common design approach is “worst case scenario”.
 - Head injuries are still very common in horse racing.
 - Concussions have been found to occur in “soft” impacts.

Racetrack Stiffness Assessment

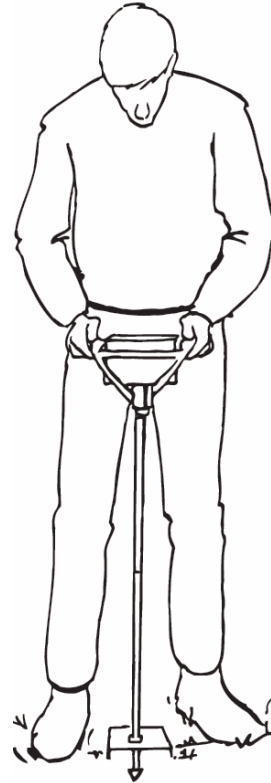
- Going Index:
 - Based on track foreman's experience
 - Heavy
 - Soft
 - Yielding
 - Good
 - Firm



- Falling Weight Deflectometer (FWD)
- Penetrometer.
- Racetrack penetrometers.

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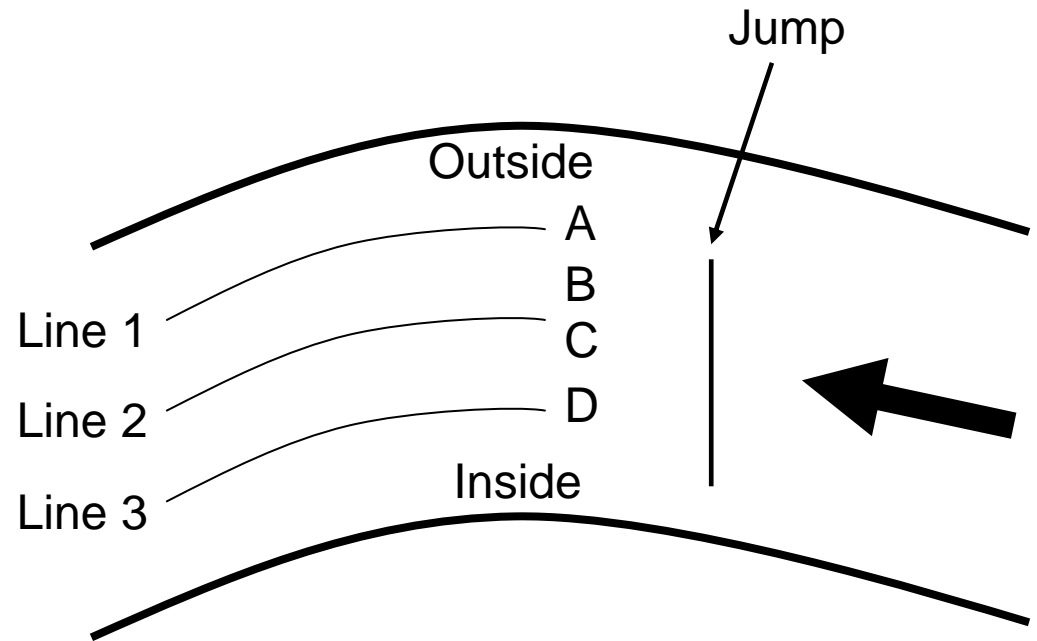
Materials and Methods

- Impact rig.
 - Designed impact with similar energy level of a riding jockey's head.

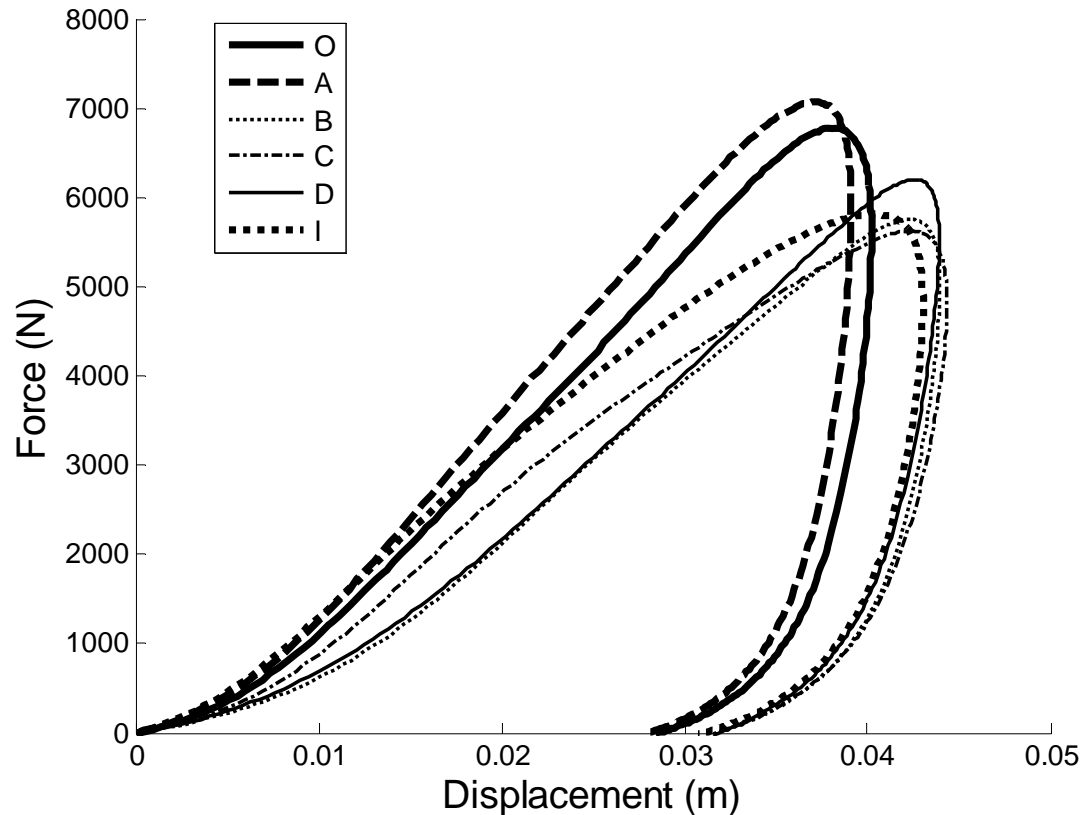


Materials and Methods

- Performed measurements.
 - 8 tracks.
 - Sports pitch.
 - Sand container.

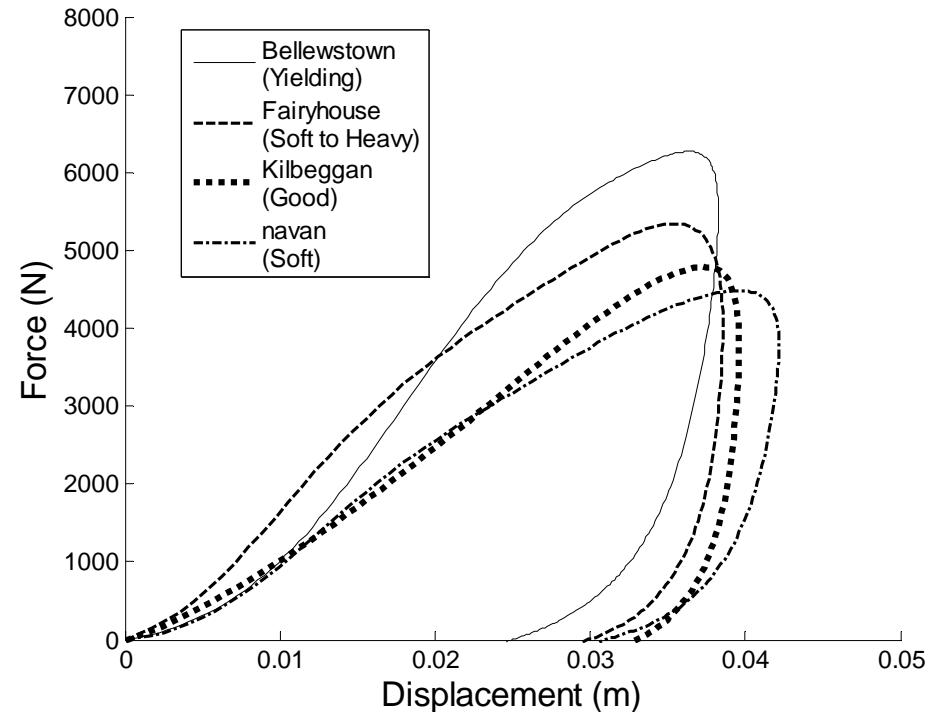
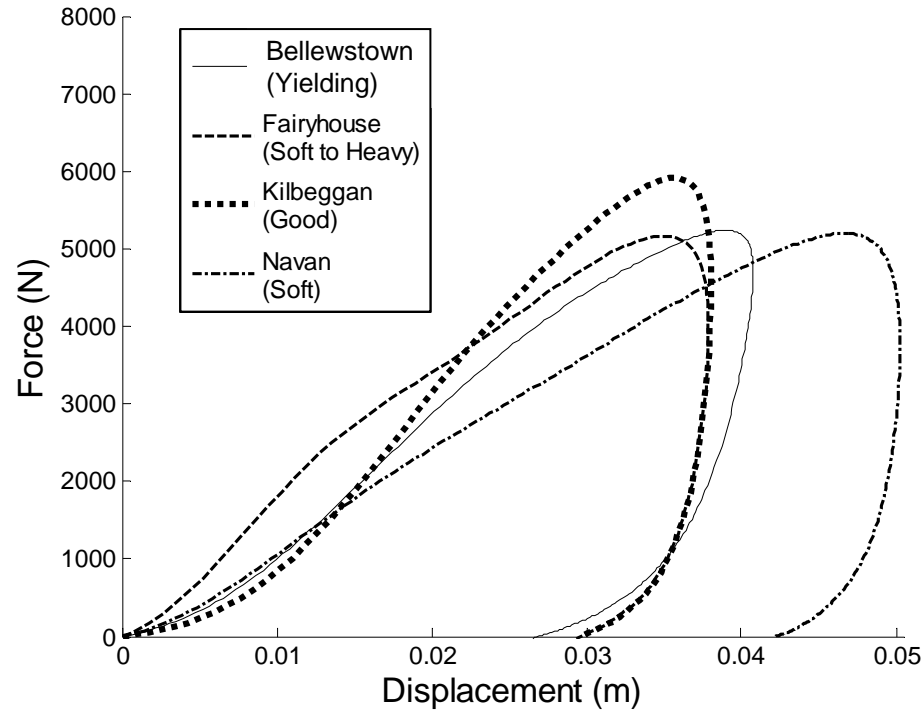


Results: Position on track



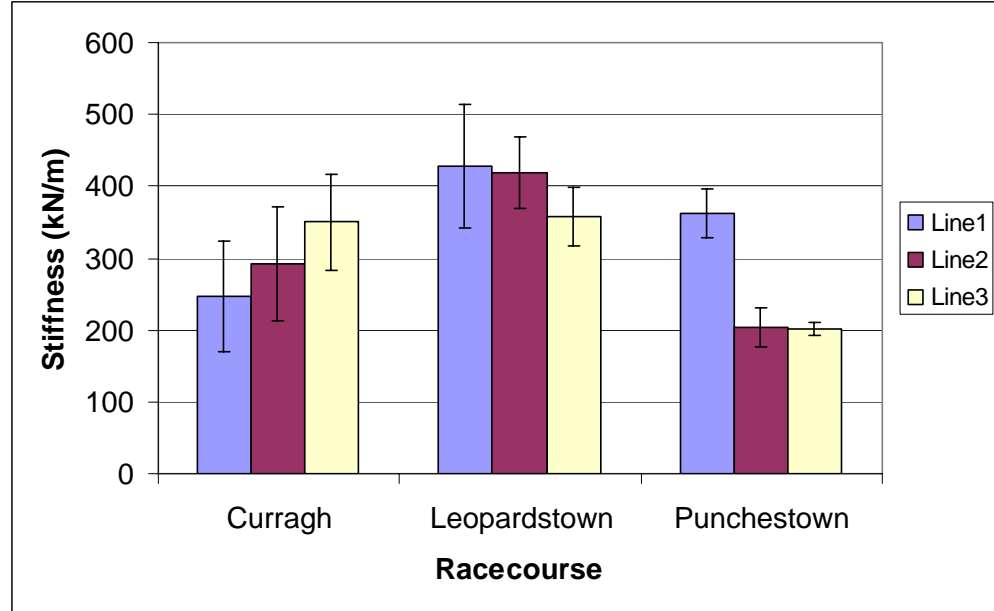
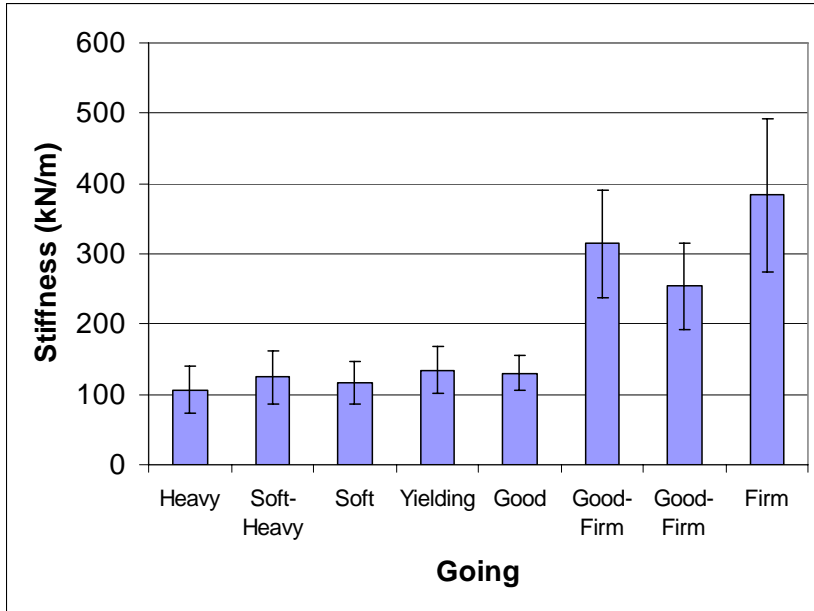
- The outside of the track seems to be stiffer than the rest of the track.
- This agrees with qualitative evaluations of the track foremen.

Results: Going conditions



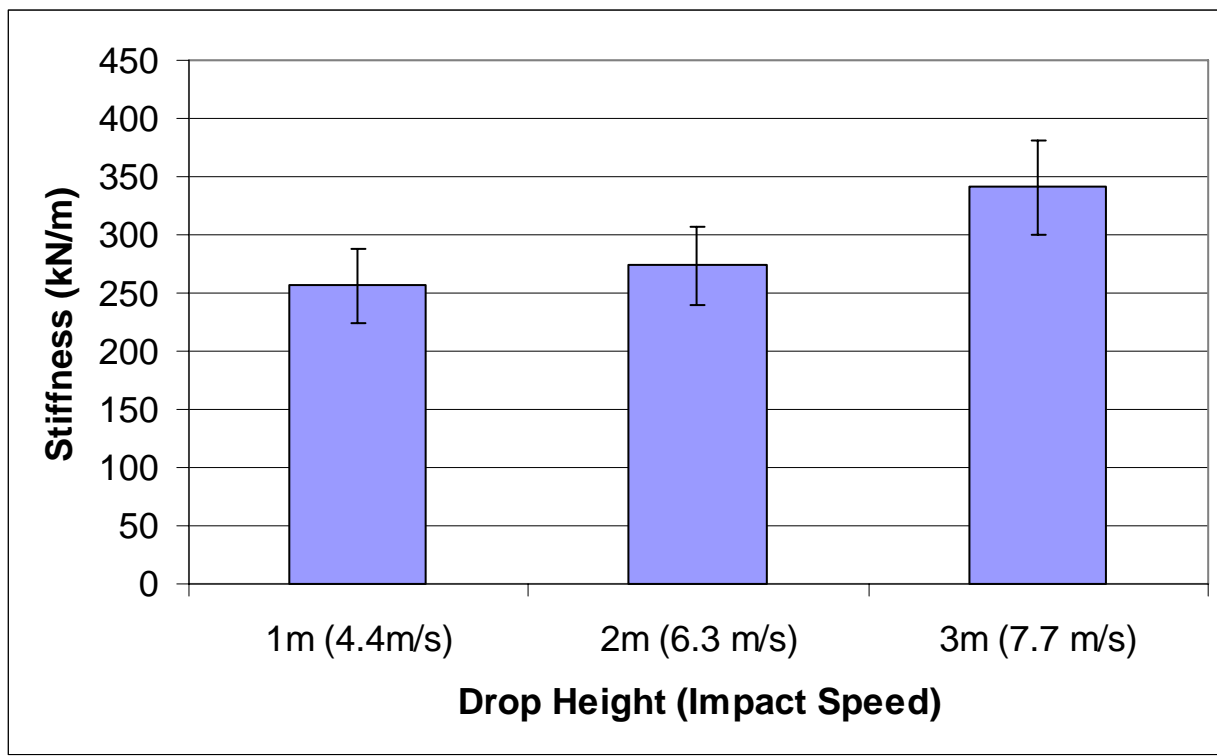
- High variability between racetracks and within each racetrack.
- Different soil compositions could be a cause for this.

Results: Stiffness comparisons



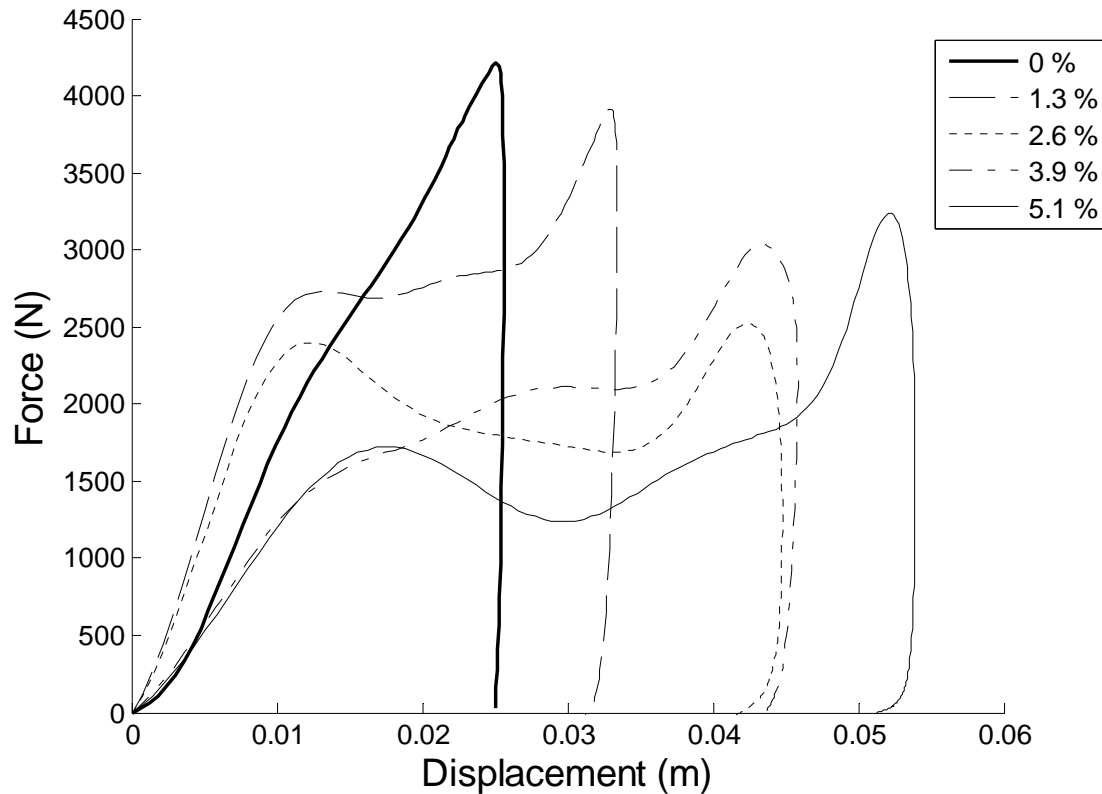
- Similar stiffness values for different goings except for high stiffness.
- Track appears stiffer in the outside for most cases.

Results: Influence of impact speed



- Stiffness value increases significantly for 3 m drop height.
- For 1 and 2 m drop heights the difference is not significant.

Results: Measurements on sand



- The addition of water allows for more yielding of the sand-water mixture.
- Initial stiffness values are influenced by water content.
- The results found for sand-water show that there could be interesting implications in regards to turf.

Conclusions and Further Work

- Force-displacement curves were obtained for impact modelling.
- Going index seems to be highly dependent on racetrack ground composition.
- Turf irregularities generate high variability on measurements.
- Impact speed seems to affect measured ground stiffness.
- Detailed studies on the influence of water content on racetrack turf are suggested.
- More precise and practical methods of performing impact tests should be devised.