Track Surface Optimisation

A data driven approach

Presented to GRV

13 March 2019

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What do we want?

What is a ‘good’ track surface?

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Minimise Risk of Injury

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Maximise Performance

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Maintain Consistency

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What are we doing now?

Current practices and metrics for track surface assessment

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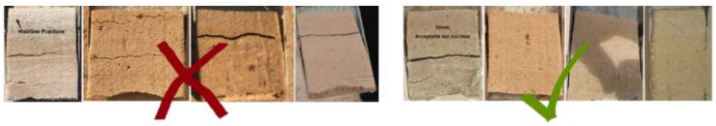

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Less than 10
10 - 25
25 - 50
50 - 70
Over 70
HEAVY
SOFT
GOOD
FIRM
HARD
Track Profile requires urgent attention
Unsafe to Race
Consistent Profile but requiring consolidation
Optimum Racing Conditions
Layers will be present in profile and will require deeper harrowing
Track Profile requires urgent attention
Unsafe to Race
Safe to Race with Attention

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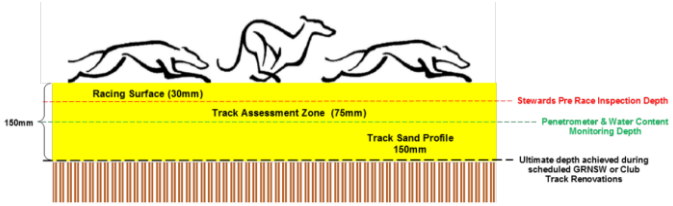

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Track Minimum Standards Specification

- 1.2.2 (12-24hrs Pre-Race):
  - 4x sand profiles
  - 12x penetrometer readings
  - 200+ points surveyed for water content
  - Inclinometer grades checked
- 1.2.3 (2hrs Pre-Race):
  - Same as 1.2.2 but without grade check
- 1.2.4 (Mid-Race):
  - Same as 1.2.3 but with reduced 50 point water content survey
- 1.2.5 (Pre-Trial):
  - Same as 1.2.3

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Does it work?

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Who Knows?

- Lack of evidence to support current track profile specifications
- Lack of evidence to support current penetrometer specifications
- Lack of evidence to support current water content specifications
- Surface grades currently under investigation
- Inconsistent measurement practices
- Inconsistent measurement equipment

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A New Method

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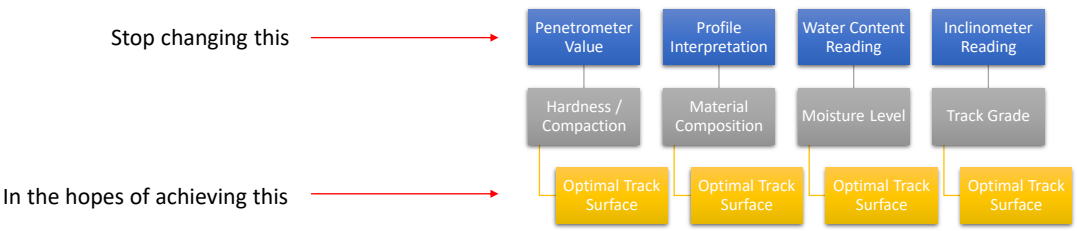
Invert the Approach



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Invert the Approach

Objectives

- Minimise risk of injury
- Maximise performance
- Maintain consistency

Purpose
(Hint: It's not about the track)

Metric
(How we quantify performance)

Variables
(How we affect our metric)

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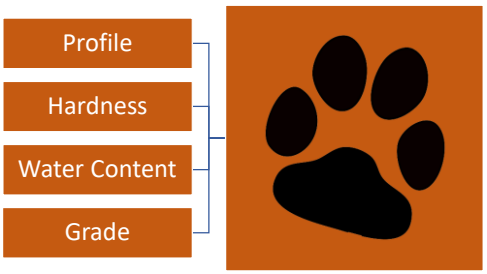
One Metric to Rule Them All



- Informative:
  - Depth of print -> Hardness
  - Shape of print -> Profile
  - Angle of print -> Grade
  - Print integrity -> Water Content
- Available
- Direct association to both track AND greyhound
- Confirmed by experience

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How does it work?

How do we measure paw prints on the track without using Plaster of Paris?

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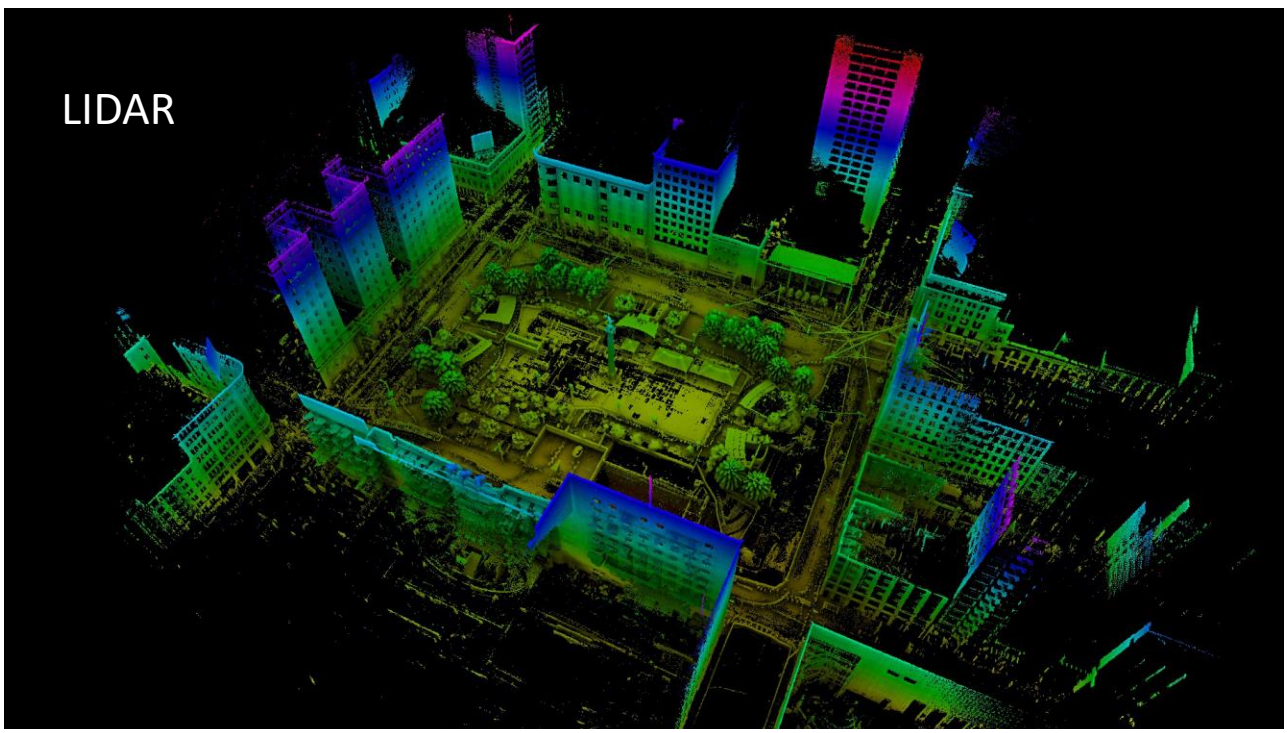

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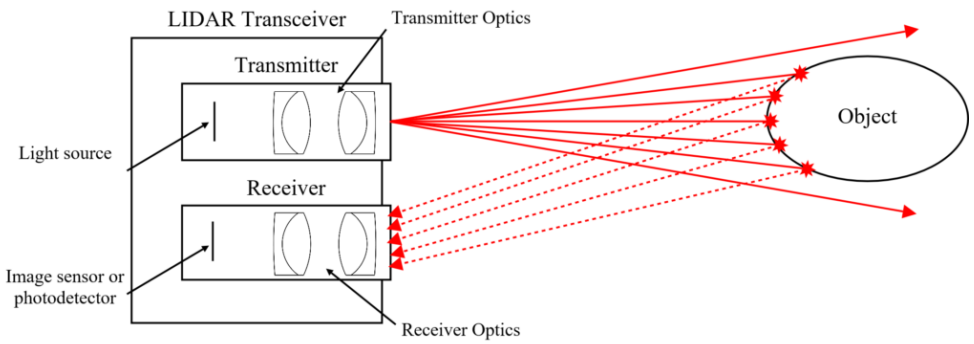
LIDAR (Light Detection and Ranging)



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Challenges

- Hardware
  - Scale of print
  - Scale of track
  - Collection speed
  - Sensor automation
- Data
  - Correlation of prints with track variables
  - Correlation of prints with injuries
  - Impact of greyhound variability

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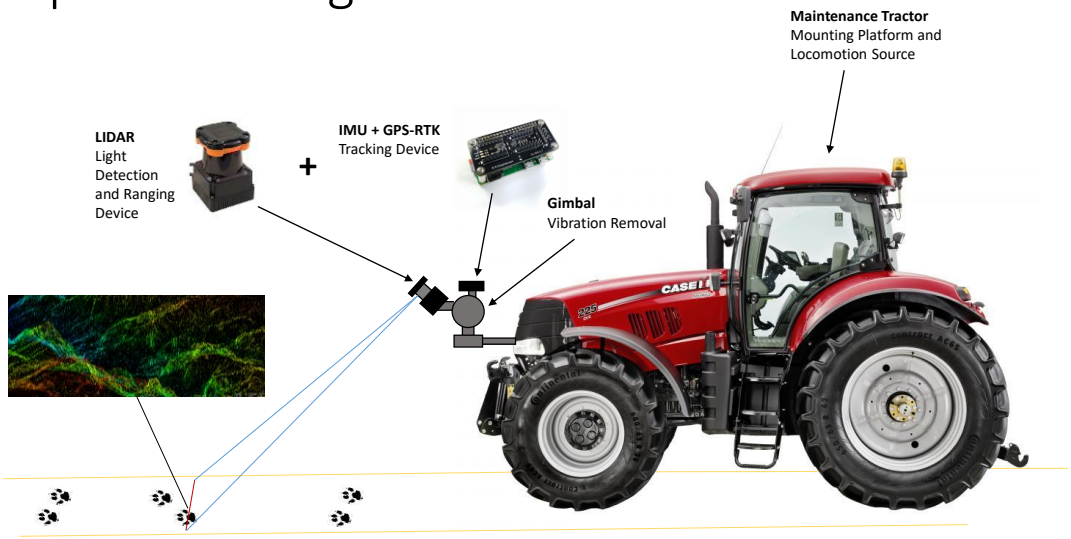
Proposed Configuration



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Operating Principle

- As the tractor moves forward the LIDAR will make several 2D scans per second
- These scans are then reconstructed as a 3D point cloud
- Print reconstructions are collated into datasets for AI training and visual analysis
- Final result is provided to track maintenance staff in real-time as a table of track properties and recommended corrective actions

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Property	Observed Value	Target Value	Remedial Action	Justification
Water Content	20%	15%	Postpone Irrigation	Collapsed print integrity
Hardness	70	30	Immediate Harrow	Peak print depth too shallow
Grade	7%	10%	Increase grade angle by 3% between locations x and y.	Unstable depth distribution

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In Support of a Data-Driven Approach

- In 2019 our most accurate instrument shouldn't be "tap your foot a few times"
- Injury analyses can only be effective if track conditions are equalised across the state(s)
- Evidence based specifications lead to industry standardisation
- Reduce the experiential knowledge required
- Increase the accuracy (if we *can* be accurate then why aren't we?)

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Looking Forward

- Automation of repeatable maintenance tasks (e.g. irrigation)
- Interconnection of field sensors for total and complete track condition monitoring – know the condition of any track at any time
- Greater understanding of greyhound gait dynamics and a sharpened focus on injury mechanisms
- International standardisation of track maintenance procedures
- Introduction of GPR for substrate analysis

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Q & A

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