



1



Field Safety...

2

Evaluating the Biomechanical Impact of Standard Turf Testing Devices

Testing commonly used athletic field-testing devices over a force platform to determine ground reaction forces

3

Materials & Methods

CIST: A 2.25 kg missile that measures G_{max} when dropped 45.7 cm through a guide tube



ASTM F355-A: A 9.1 kg missile that measures G_{max} and velocity when dropped 60 cm through a leveled guide tube

ASTM F355-E: A 4.58 kg missile that measures G_{max} , HIC, velocity, and angle when dropped at a specified height

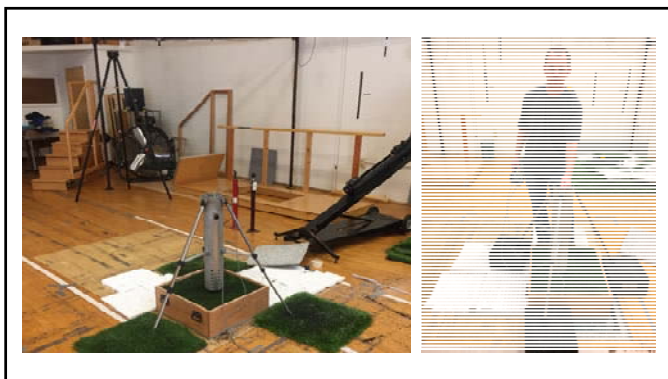
ASTM F3189: A 20 kg missile, equipped with a 0.8 kg steel, helical spring that measures force reduction, vertical deformation, and energy restitution when dropped from 5.5 cm

USGA Turf Firmness Meter: A 1.95 kg missile that measures surface penetration when dropped 68.6 cm

Human = Twelve healthy males with a minimum of three years American football, soccer, basketball, or volleyball experience (Qu et al., 2020)

4




5

Analysis of Variance for Treatment Effects

Treatments	GRF
Device	***
Pad	***
Device*Pad	***

6



Test Drop Height (cm)	GRF (N) without Shockpad	GRF (N) with Shockpad	% Change (w/ & w/o Shockpad)
F355-A (61)	11295	7695	32
CIST (46)	2084	1612	23
F355-E (60)	5517	4223	23
F355-E (100)	8386	6245	26
F355-E (130)*	10384	7739	25
AAA (5.5)	2742	2463	10
TruFirm (69)	781	752	4
Human Tests* (60)	1078	1025	5

Ground Reaction Force (N) for Individual Test Devices

- Human data obtained from Qu et al., 2020.

7

fLEX Testing Device


8




9

Progression of the testing device

• Alpha Version



• Beta Version



10



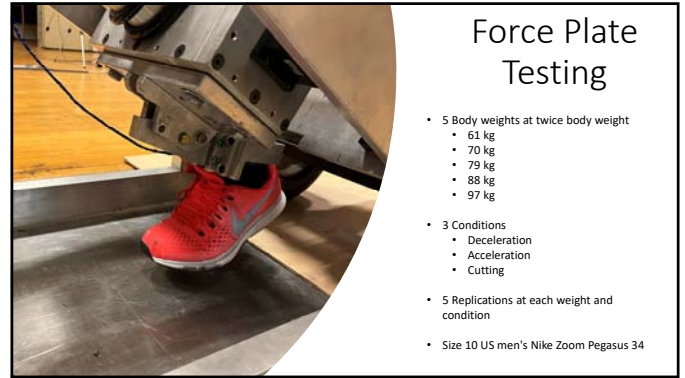
11



12



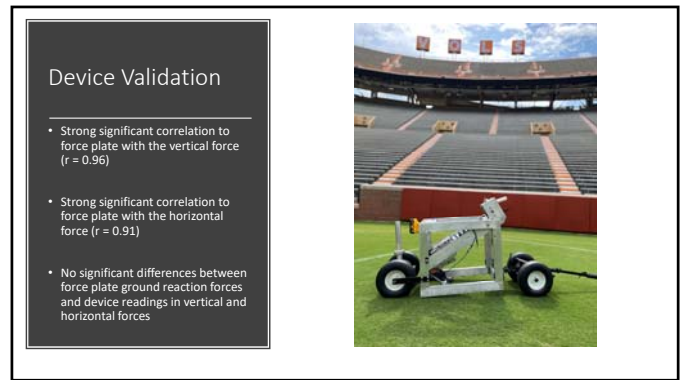
13



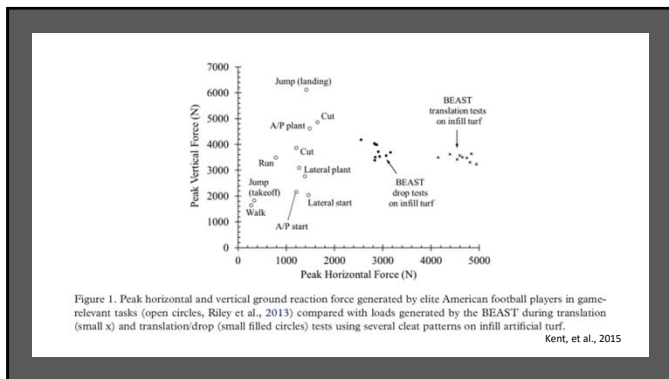
14



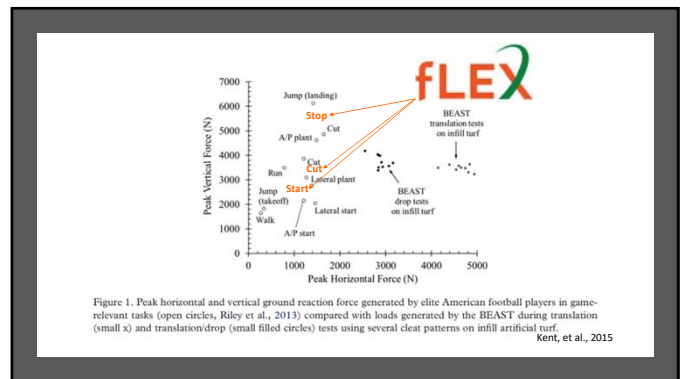
15



16



17



18

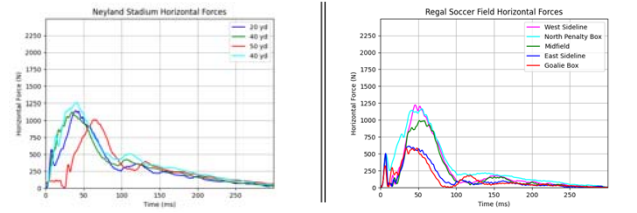
Testing different Locations

- Testing across a field
- Can be completed with one or two people



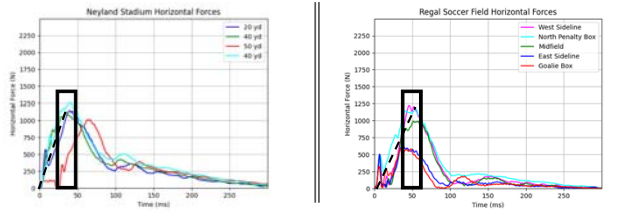
19

Differences Across a Field



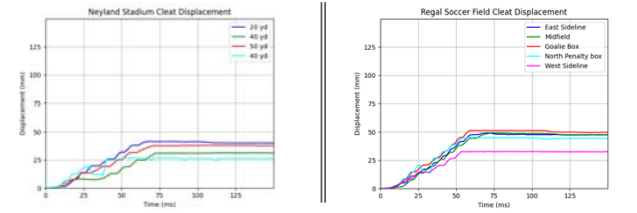
20

Differences Across a Field



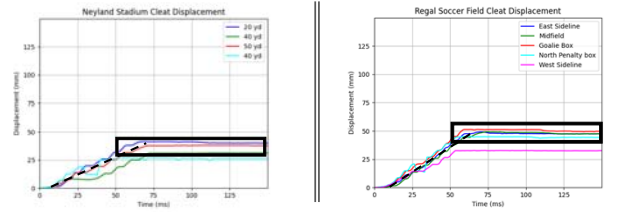
21

Differences Across a Field



22

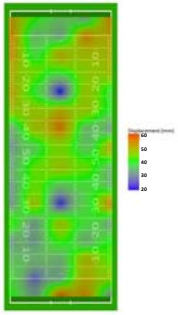
Differences Across a Field



23

Heat Maps

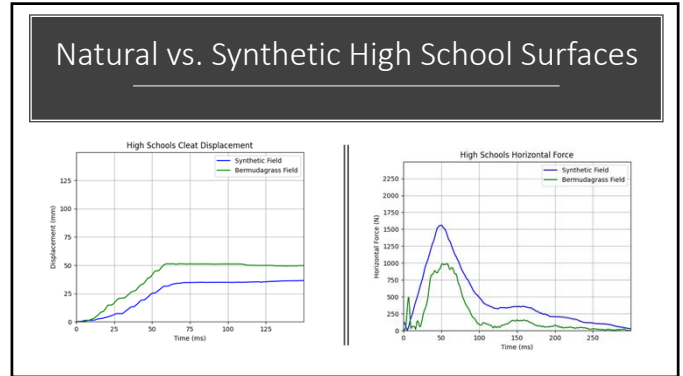
- Heat Mapping a field with the data
- Can be done in 50 locations
- Takes 30-45 mins to complete one condition



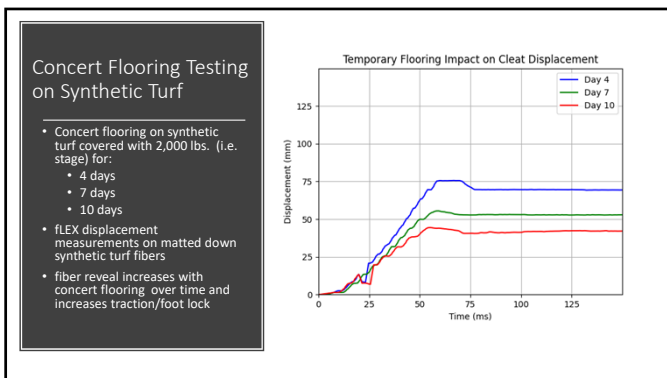
24



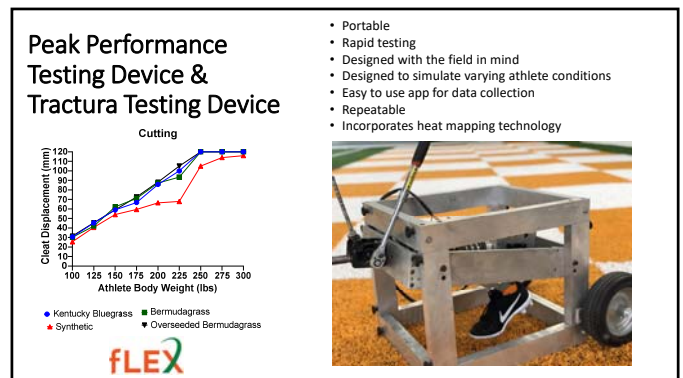
25



26



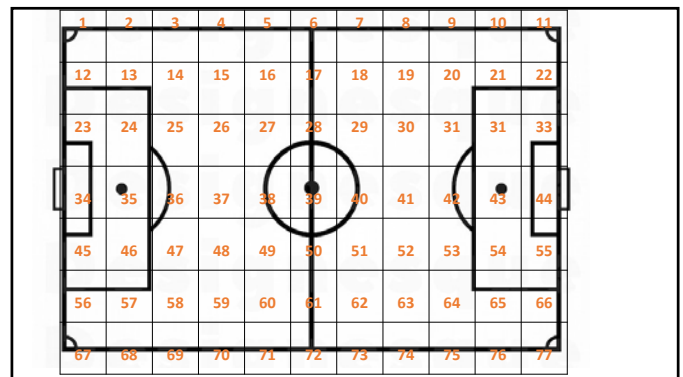
27



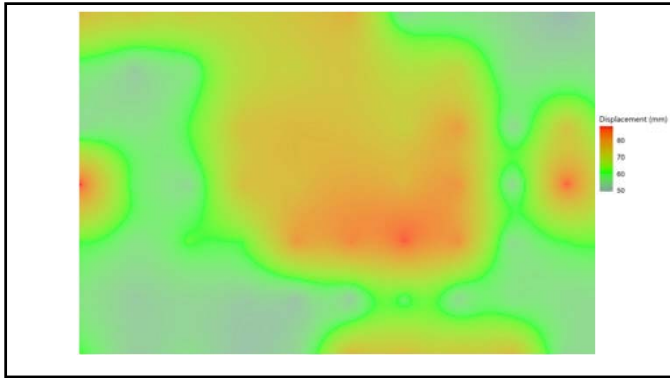
28



29



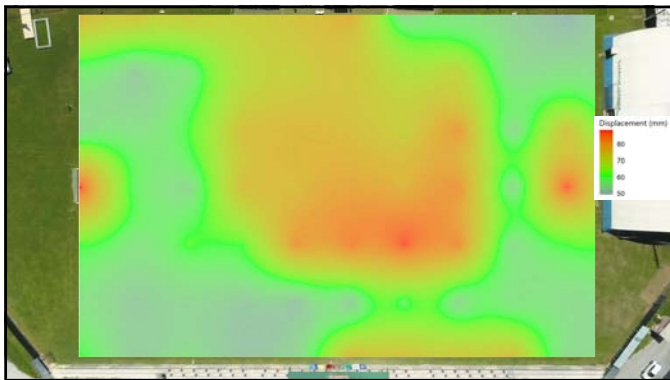
30



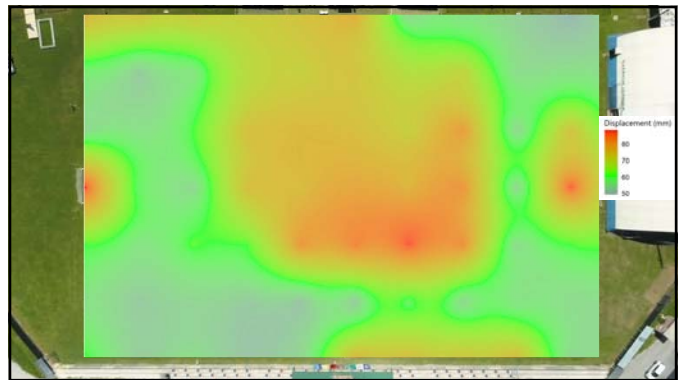
31



32



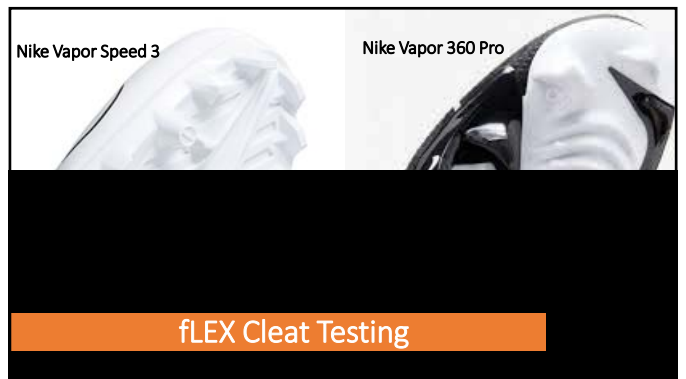
33



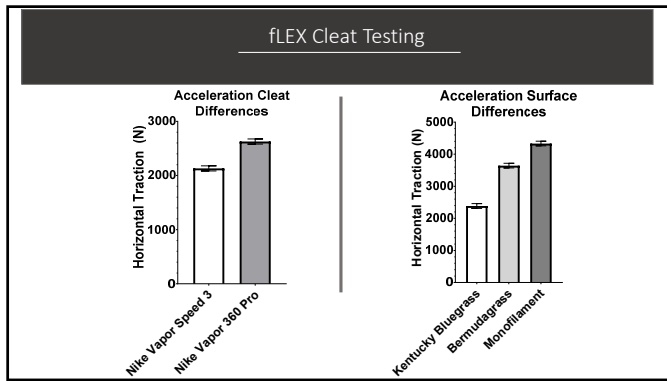
34



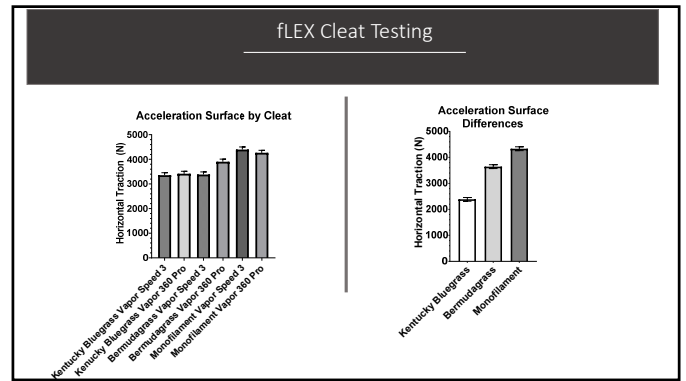
35



36



37




38

—

Thank You!

sorochan@utk.edu

@Sorochan



39