



Penn State's

**Center for
Sports Surface Research**

2019 Football Cleat Models – Traction Comparison

August 2019

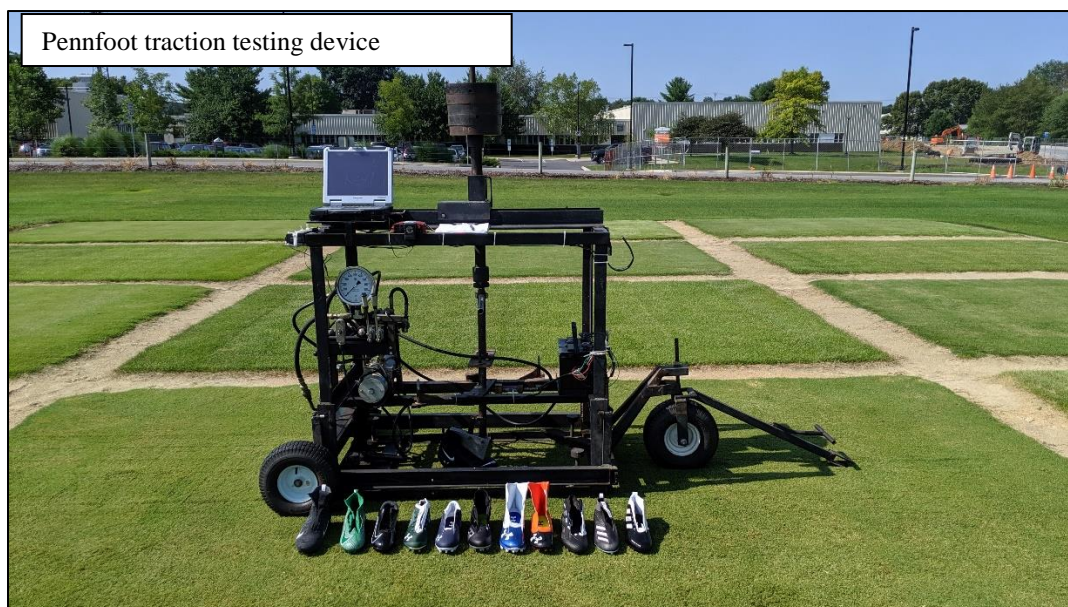
2019 Football Cleat Models – Traction Comparison

As an athlete accelerates, stops, and changes direction, numerous forces are transmitted to the lower extremities. The interaction between an athlete's shoe and the playing surface has been indicated as a factor in lower extremity injury risk. In particular, high rotational forces may result in increased injuries to the lower extremities due to the foot becoming "entrapped" in the playing surface during pivoting movements (Torg et al., 1974).

Rotational traction levels of various 2019 football cleat models were tested using Pennfoot (McNitt et al., 1997) at Penn State's Center for Sports Surface Research. Pennfoot is a portable device consisting of a framed steel leg-foot assembly which measures traction via hydraulic-induced movement of a foot placed on the test surface in a forefoot stance. The amount of force required to rotate the shoe 45 degrees was measured and peak values are shown in this report.

Rotational traction measured with mechanical devices such as Pennfoot allow for comparisons among shoe-types and playing surfaces; however, 'safe' and 'unsafe' traction levels have not been established in the scientific community, as this type of data has not been directly correlated with injury risk. Although researchers have yet to establish 'safe' threshold levels, it is generally accepted that low levels of rotational traction are desired over high levels from a lower extremity injury risk standpoint (Lambson et al., 1996). However, if traction is too low, playability may be reduced as athletes may be prone to slipping, thus increasing potential for other types of injuries.

Each shoe was tested on FieldTurf Revolution, bermudagrass, and Kentucky bluegrass. The FieldTurf Revolution test plot included a sand-rubber infill combination installed into 2.5" fibers. The test plot of bermudagrass was grown on a sand-based rootzone and the cultivar was Latitude 36. The mowing height was 0.75" and the plots contained 100% turf coverage. The test plot of Kentucky bluegrass was grown on a sand-based rootzone and included the following cultivars: 30% Everest, 30% Botique, 30% P105, and 10% Bewitched. The mowing height was 1.25" and the plot contained 100% turf coverage.



Rotational traction was measured with the shoes shown below



- 1) Nike Force Savage 2 Shark
- 2) Nike Alpha Menace Elite 2
- 3) Nike Vapor Untouchable Pro 3
- 4) Nike Vapor Untouchable Varsity 3 TD
- 5) Under Armour Spotlight MC
- 6) Under Armour Nitro Low MC
- 7) Under Armour C1N MC
- 8) Under Armour Highlight RM
- 9) Under Armour Highlight MC
- 10) Adidas Freak Carbon Mid
- 11) Adidas adizero 8.0
- 12) Adidas Freak Ghost

Additional pictures of each shoe are shown at the end of this report

Results

Tables 1 and 2 show the same data in different formats. As a reminder, high rotational forces may result in increased injuries to the lower extremities due to the foot becoming "entrapped" in the playing surface during pivoting movements (Torg et al., 1974). The Under Armour C1N MC shoe produced the largest differences across surfaces with traction levels of 69.3, 73.4, and 78.9 Nm on FieldTurf Revolution, bermudagrass, and Kentucky bluegrass, respectively. The range in rotational traction values for shoes on FieldTurf Revolution was 65.9 to 76.3 Nm. On Kentucky bluegrass, traction levels ranged from 70.6 to 78.9 Nm and the range on bermudagrass was 70.8 to 77.0 Nm. These traction values can be compared to other shoes tested at Penn State's Center for Sports Surface Research. The database of traction values is available under the "Traction Database" section of our website (ssrc.psu.edu).

Table 1. Traction levels for each shoe on FieldTurf Revolution bermudagrass, and Kentucky bluegrass

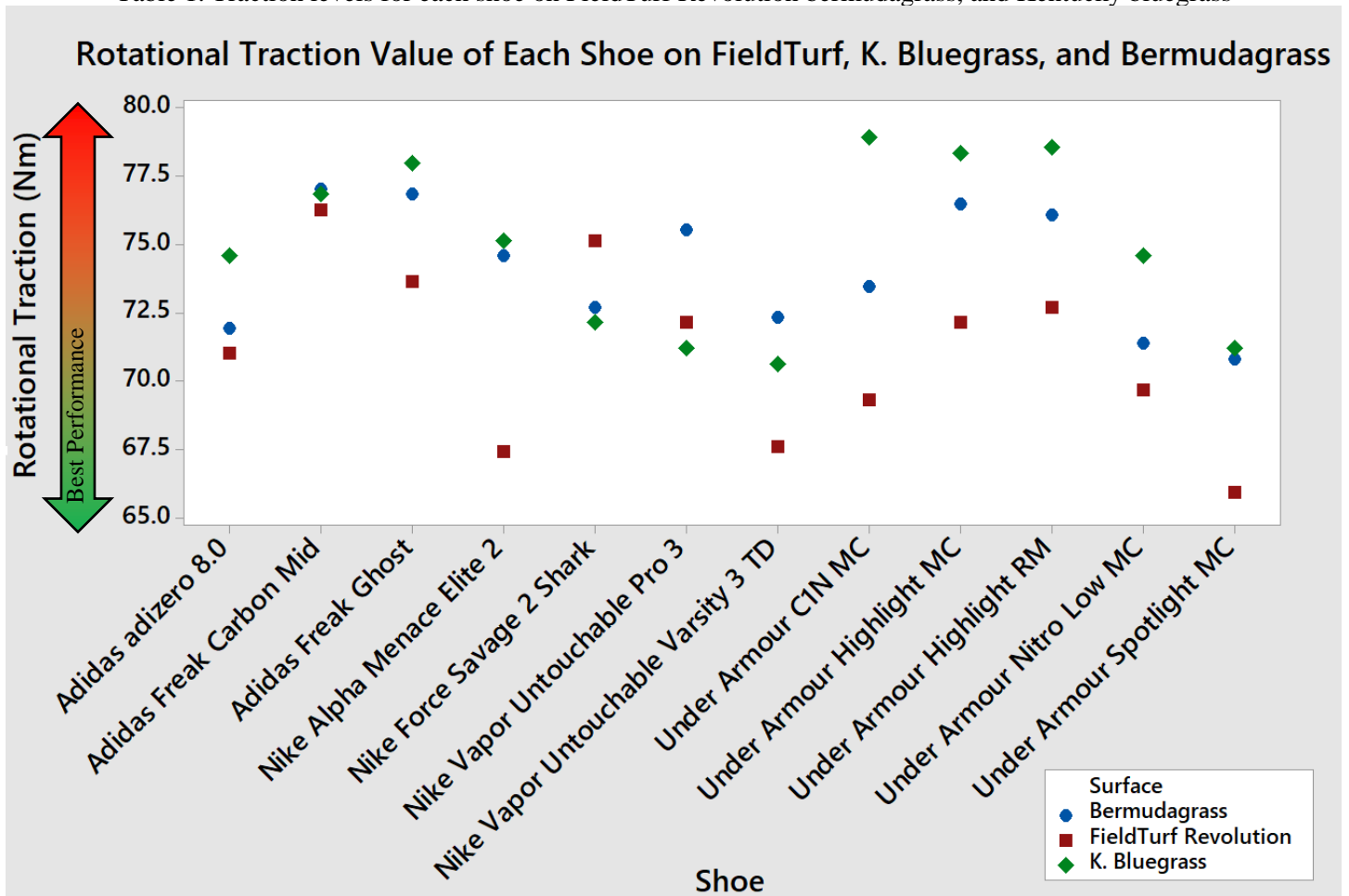
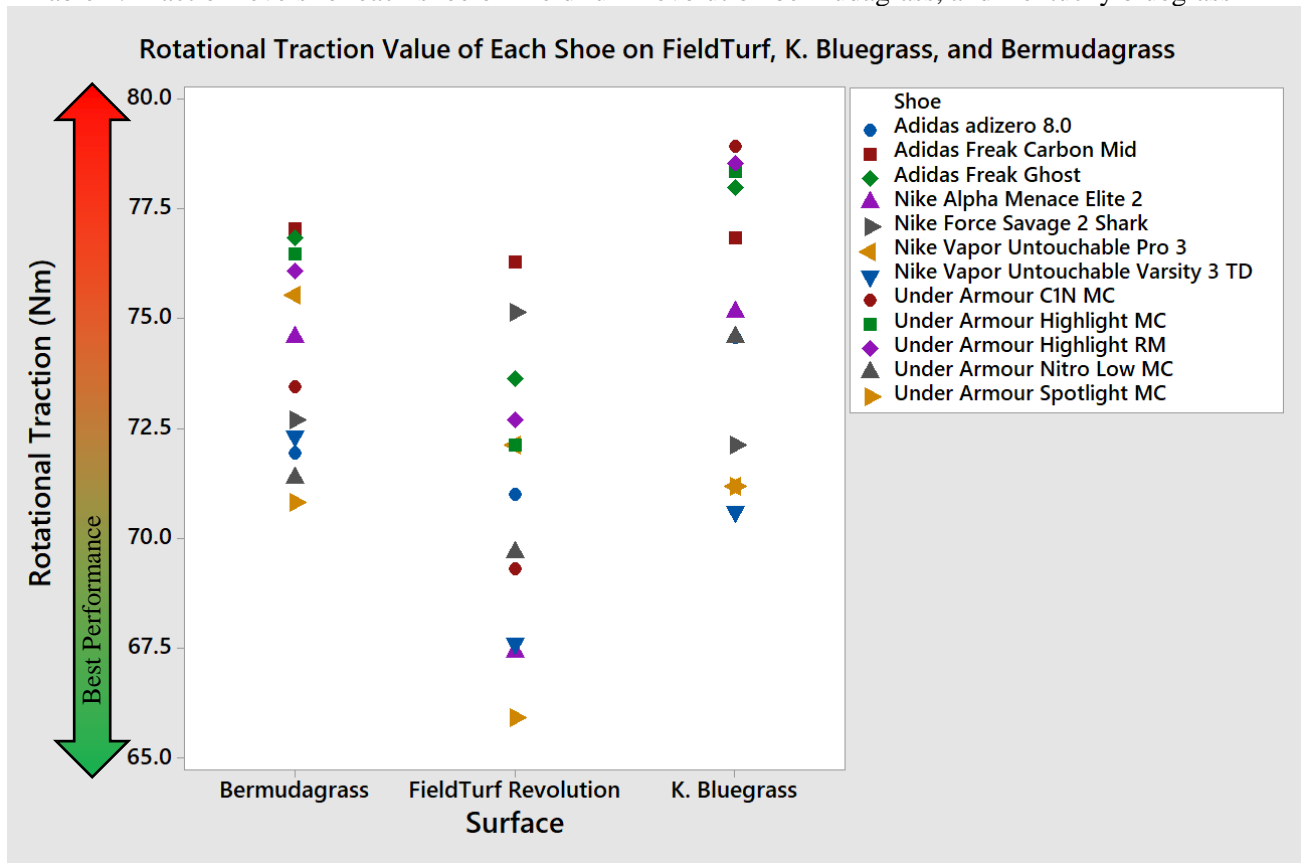


Table 2. Traction levels for each shoe on FieldTurf Revolution bermudagrass, and Kentucky bluegrass



References

- Lambson, R.B., B.S. Barnhill, and R.W. Higgins. 1996. Football cleat design and its effect on anterior cruciate ligament injuries. A three-year prospective study. *Am. J. Sports Med* 24(2):155–159
- McNitt, A.S., R.O. Middour, and D. V Waddington. 1997. Development and evaluation of a method to measure traction on turfgrass surfaces. *J. Test. Eval* 25(1):99–107.
- Torg, J.S., T.C. Quedenfeld, and S. Landau. 1974. The shoe-surface interface and its relationship to football knee injuries. *J. Sports Med.* 2(5):261–269.

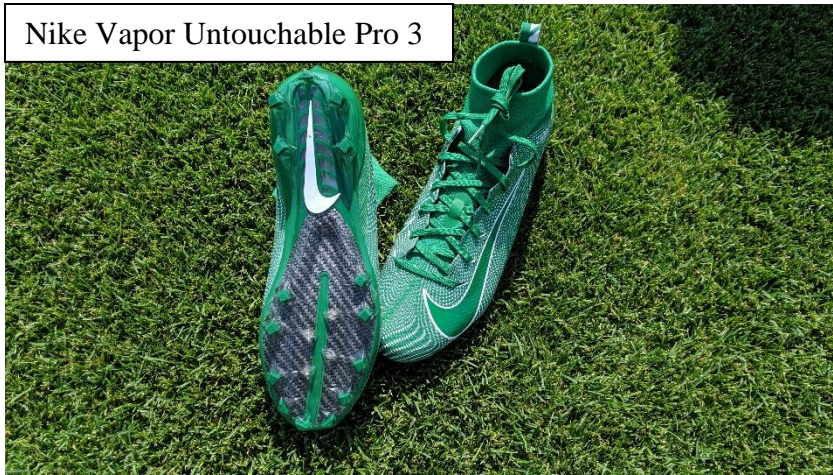
Nike Force Savage 2 Shark



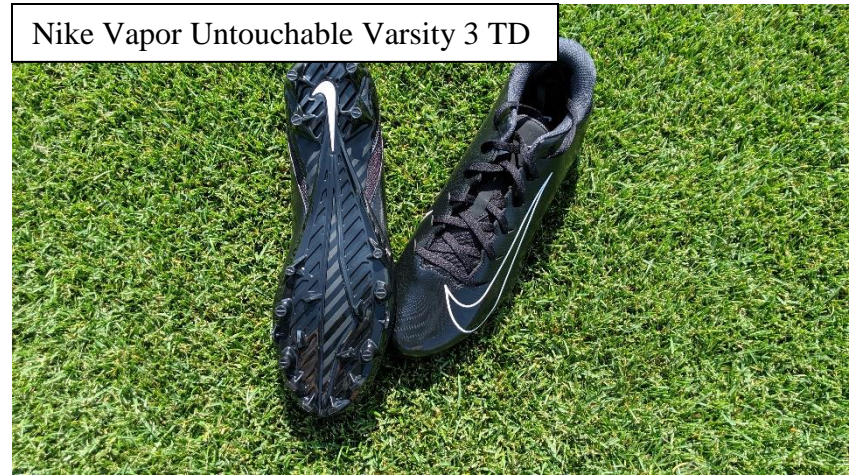
Nike Alpha Menace Elite 2



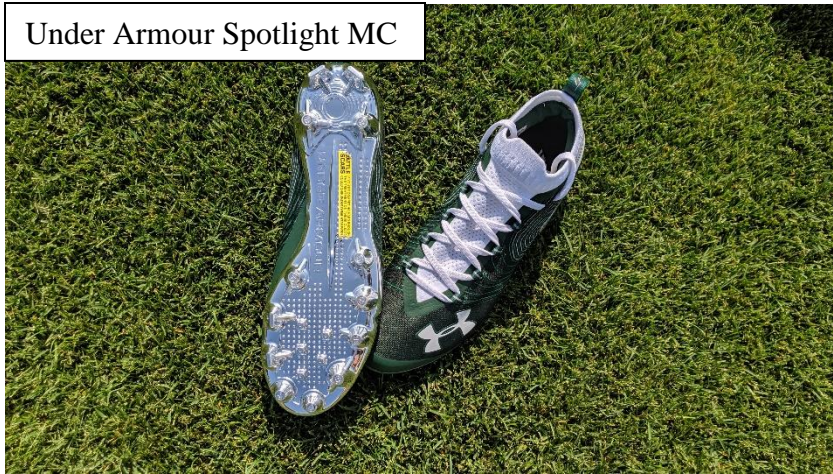
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