



Penn State's

**Center for
Sports Surface Research**

2017 Football Cleat Models – Traction Comparison

September 2017

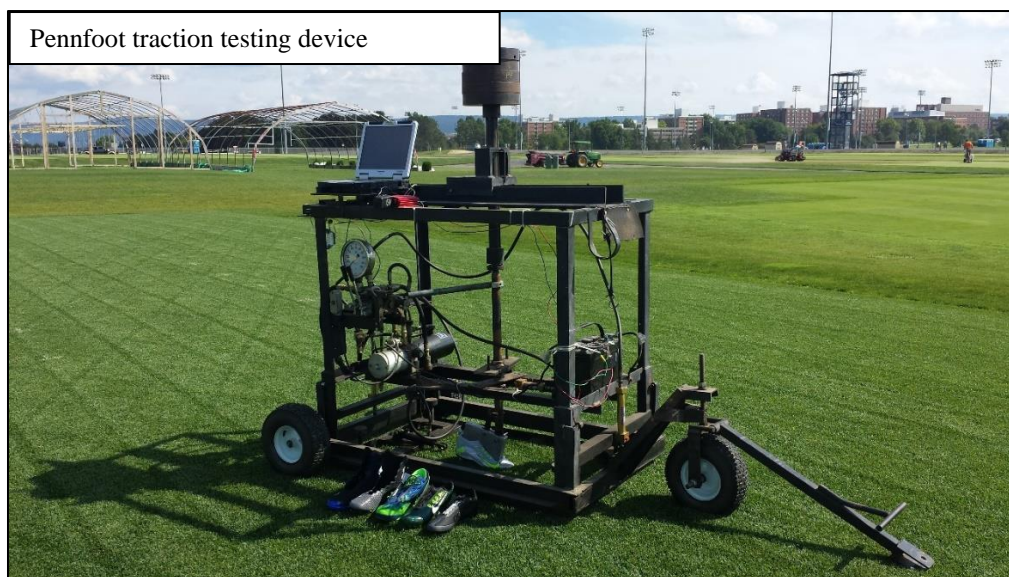
2017 Football Cleat Models – Traction Comparison

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 2017 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 Vapor Speed 2 TD
- 2) Nike Alpha Menace Varsity Mid
- 3) Nike Vapor Untouchable Pro
- 4) Nike Alpha Sensory Turf
- 5) Nike Force Savage Elite TD
- 6) Nike RW Alpha Menace Elite
- 7) Under Armour Highlight Lux MC
- 8) Under Armour Highlight Lux RM
- 9) Under Armour Nitro Select Low MC
- 10) Adidas Freak x Carbon Low
- 11) Adidas adizero 5-star 6.0

Results

For the majority of shoes tested, rotational traction levels were generally similar on all three surfaces. The Nike Force Savage Elite TD and the Under Armour Highlight Lux RM produced the largest traction differences among surfaces. For example, the Nike Force Savage Elite TD produced a traction level of 89.6 Nm on bermudagrass while its traction level on Kentucky bluegrass was 75.7 Nm. The range in rotational traction values for shoes on FieldTurf Revolution was 57.3 to 85.6 Nm. On Kentucky bluegrass, traction levels ranged from 59.0 to 75.7 Nm and the range on bermudagrass was 62.7 to 89.6 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).

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

Rotational Traction Value of Each Shoe on FieldTurf, K. Bluegrass, and Bermudagrass

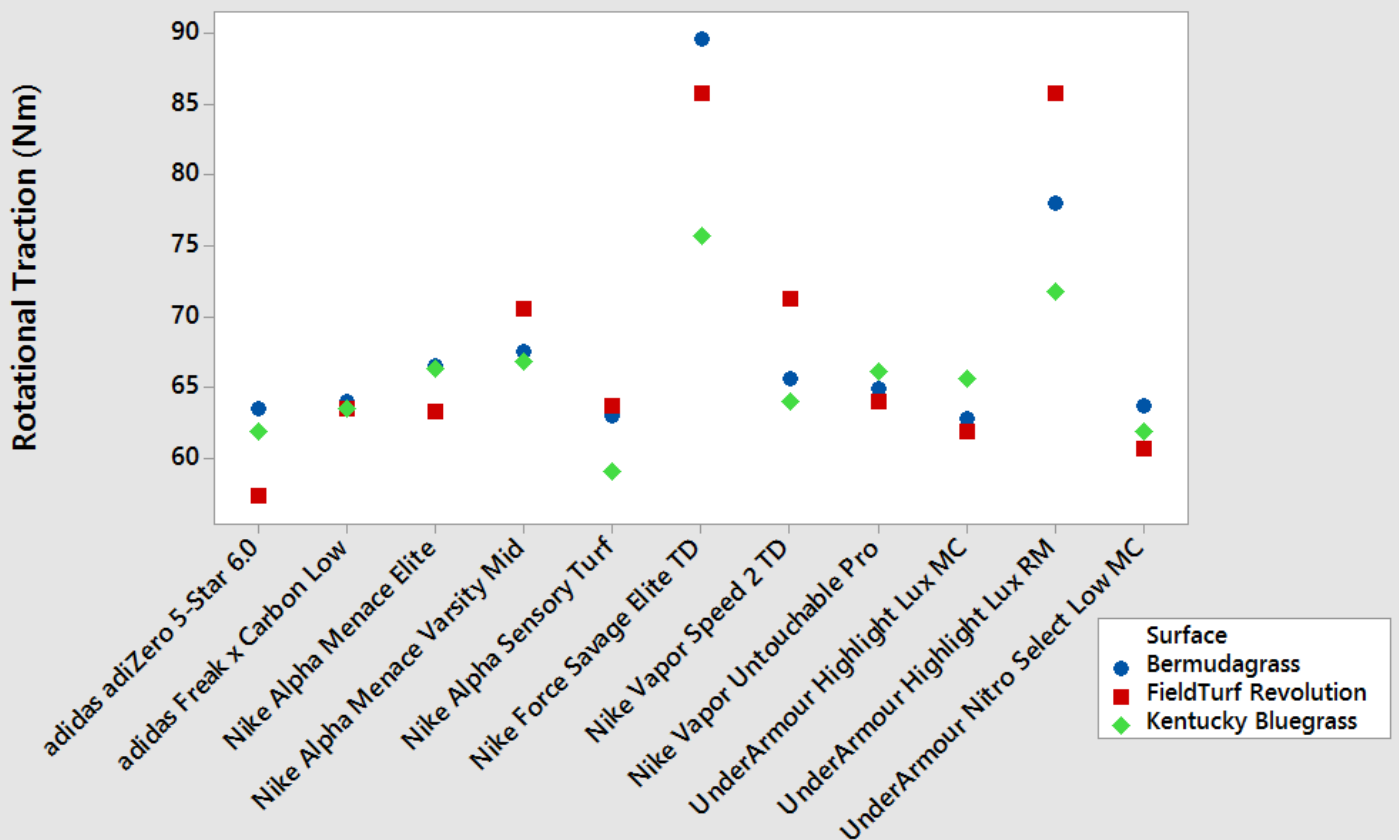


Table 1. Traction levels for each shoe on FieldTurf Revolution, Kentucky bluegrass, and bermudagrass

Surface & Shoe	Mean	Grouping
Bermudagrass Nike Force Savage Elite TD	89.6	A
FieldTurf Revolution Under Armour Highlight Lux RM	85.6	A B
FieldTurf Revolution Nike Force Savage Elite TD	85.6	A B
Bermudagrass Under Armour Highlight Lux RM	78.0	B C
Kentucky Bluegrass Nike Force Savage Elite TD	75.7	C D
Kentucky Bluegrass Under Armour Highlight Lux RM	71.6	C D E
FieldTurf Revolution Nike Vapor Speed 2 TD	71.2	C D E F
FieldTurf Revolution Nike Alpha Menace Varsity Mid	70.5	C D E F G
Bermudagrass Nike Alpha Menace Varsity Mid	67.4	D E F G H
Kentucky Bluegrass Nike Alpha Menace Varsity Mid	66.7	E F G H
Bermudagrass Nike Alpha Menace Elite	66.5	E F G H
Kentucky Bluegrass Nike Alpha Menace Elite	66.5	E F G H
Kentucky Bluegrass Nike Vapor Untouchable Pro	66.0	E F G H I
Bermudagrass Nike Vapor Speed 2 TD	65.5	E F G H I
Kentucky Bluegrass Under Armour Highlight Lux MC	65.5	E F G H I
Bermudagrass Nike Vapor Untouchable Pro	64.8	E F G H I
FieldTurf Revolution Nike Vapor Untouchable Pro	63.9	E F G H I
Kentucky Bluegrass Nike Vapor Speed 2 TD	63.9	E F G H I
Bermudagrass Adidas Freak x Carbon Low	63.9	E F G H I
FieldTurf Revolution Nike Alpha Sensory Turf	63.6	E F G H I
Bermudagrass Under Armour Nitro Select Low MC	63.6	E F G H I
FieldTurf Revolution Adidas Freak x Carbon Low	63.4	E F G H I
Bermudagrass Adidas adiZero 5-Star 6.0	63.4	E F G H I
Kentucky Bluegrass Adidas Freak x Carbon Low	63.4	E F G H I
FieldTurf Revolution Nike Alpha Menace Elite	63.2	E F G H I
Bermudagrass Nike Alpha Sensory Turf	62.9	E F G H I
Bermudagrass Under Armour Highlight Lux MC	62.7	F G H I
FieldTurf Revolution Under Armour Highlight Lux MC	61.7	G H I
Kentucky Bluegrass Under Armour Nitro Select Low MC	61.7	G H I
Kentucky Bluegrass Adidas adiZero 5-Star 6.0	61.7	G H I
FieldTurf Revolution Under Armour Nitro Select Low MC	60.6	H I
Kentucky Bluegrass Nike Alpha Sensory Turf	59.0	H I
FieldTurf Revolution Adidas adiZero 5-Star 6.0	57.3	I

Means that do not share a letter are significantly different.

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.