

Impact Response of Artificial Turf Surfaces with Brock Underlayment under Different Loading Conditions

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Summary

The purpose of this study was to investigate the hypothesis that the addition of Brock underlayment to an infilled artificial turf surface reduces head injury risk but does not significantly change the response of the surface to the loads produced by running.

Laboratory samples of Fieldturf, AstroPlay and Prestige surfaces on a flat concrete base were impact tested using standard methods mimicking (a) head impact on artificial turf (ASTM F-355A) (b) heel and forefoot impact during running (ASTM F1976). The tests were repeated with the addition of a 23.4 mm thick underlayment material (Brock JSP042005 SRL) and the results compared with the control condition.

- Under impact conditions carrying the risk of severe head injury, the Brock underlayment reduced peak impact shock (g-max) by an average of 32% and the Head Injury Criterion scores by 40%.
- Under the loading conditions produced by running athletes, heel impact was reduced by 9% and forefoot impact by 2%.

These findings support the hypothesis that the Brock underlayment reduces head injury risk without causing athletes running on the surface to experience excessive “softness”.

Test Samples

Brock Underlayment:

JSP042005 SRL 23.4 mm thick

Artificial Turf Surfaces:

AstroPlay	33.0 mm infill depth
Fieldturf	37.3 mm infill depth
Prestige	36.0 mm infill depth

Test Methods

ASTM F355-95 Standard Test Method for hock-Absorbing Properties of Playing Surface Systems

ASTM F1976-99 Standard Test Method for Cushioning Properties of Athletic Shoes Using an Impact Test¹

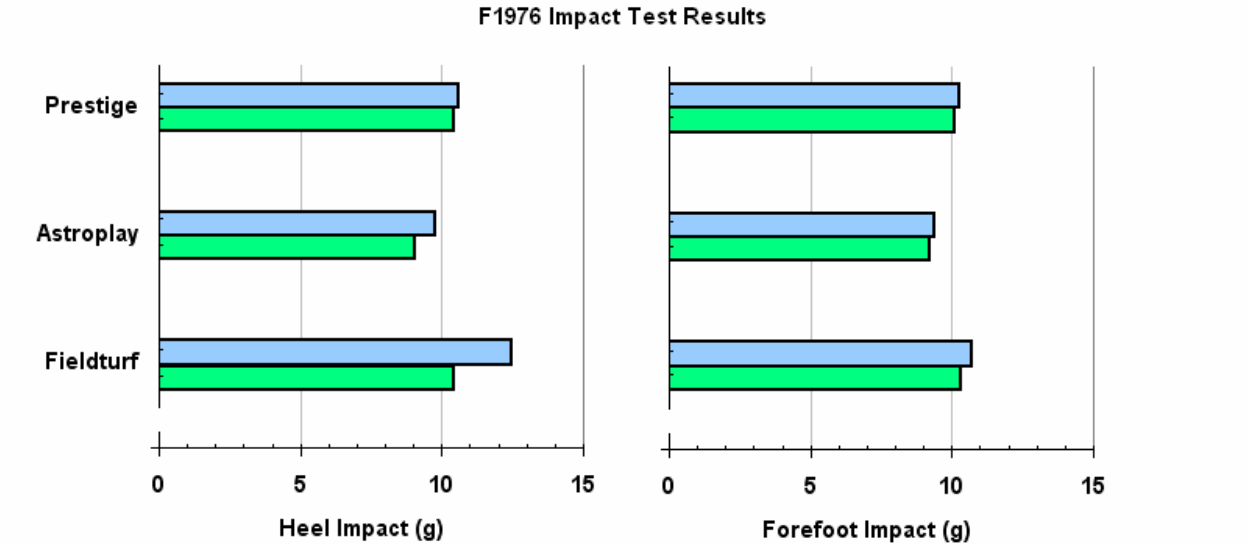
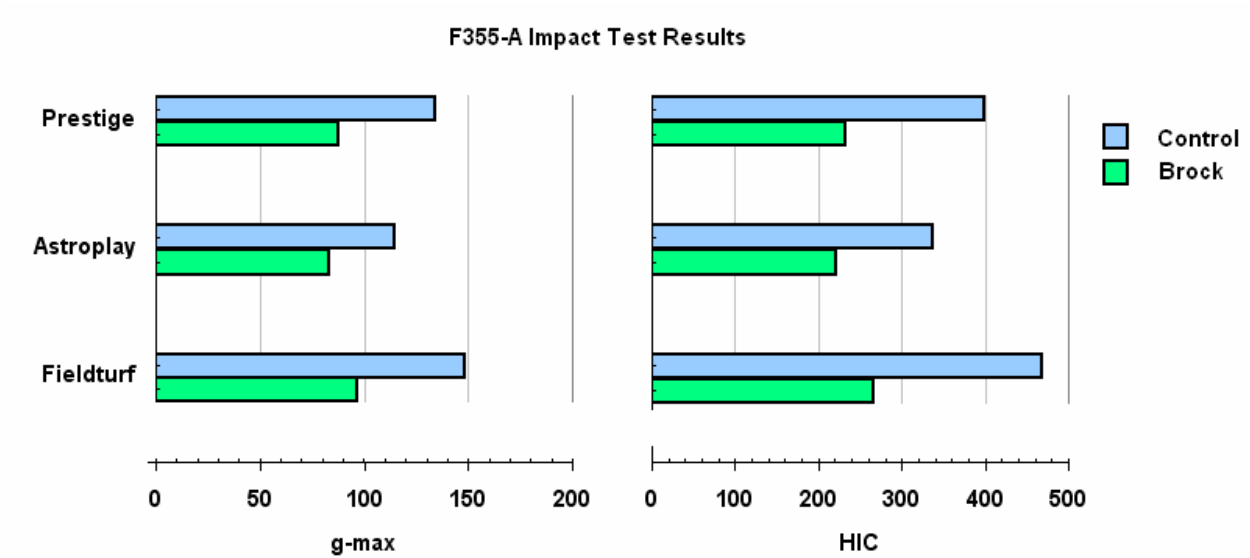
F1976 impact tests were conducted with a soccer shoe sole between the impactor and the surface under tests.

Impact Test Parameters

Parameter		F355-A	F1976 Heel	F1976 Forefoot
Missile Shape		Cylindrical	Cylindrical	Cylindrical
Missile Mass	kg	9.1	8.5	8.5
Missile diameter	mm	128	45	45
Drop Height	m	0.61	0.05	0.03
Impact Energy	J	54	4.2	2.5

¹ F1976 impact tests were conducted with a soccer shoe sole between the impactor and the surface under tests.

Impact Test Results



Impact Test Results

g-max : Peak impact shock produced by the impact, expressed in gravitational acceleration units (g)

HIC : Head Injury Criterion – an integral of the impact that can be related to the risk of head injury

Δ : Difference in scores between surfaces with and without Brock underlayment

Δ% : Percentage differences in scores produced by surfaces with and without Brock underlayment

Surface		ASTM F355-A Head Impact			ASTM F355-A Head impact			ASTM F1976 Heel Impact			ASTM F1976 Forefoot Impact		
		gmax g	Δ	Δ %	HIC	Δ	Δ %	gmax g	Δ	Δ%	gmax g	Δ	Δ%
Fieldturf	+Brock	96.8	51.5	35%	266	201.6	43%	10.4	1.1	15.7	10.3	0.4	5.0
Fieldturf		148.3			468			11.5			10.7		
Astroplay	+Brock	82.8	31.8	28%	221	117.4	35%	9.0	0.7	8.9	9.2	0.2	1.9
Astroplay		114.6			338			9.7			9.4		
Prestige	+Brock	88.0	46.4	35%	232	167.9	42%	9.6	1.0	13.9	10.1	0.2	2.3
Prestige		134.4			400			10.6			10.3		
Average	Brock	89.2	43.2	32%	240	162.3	40%	9.7	0.9	11.4	9.9	0.2	2.3
	Control	132.4			402			10.6			10.1		



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