Synthetic Turf Athletic Fields built using AirField Systems AirDrain consistently outperform fields built over stone, concrete or asphalt, by reducing the Gmax and shock attenuation an average of 18.9% and 14.7%, and helps keep it there, for the life of the field.

Multiple tests conducted by TSI Testing Services (an approved independent Test Laboratory by the Synthetic Turf Council) using ASTM F355-10a: Standard Test Methods for Shock-Absorbing Properties of Playing Surface Systems and Materials.

Gravel Subbase: with the use of the filter fabrics and AirDrain with infilled synthetic turf reduced Gmax attenuation 18.9% versus Gmax attenuation which employed just the turf + infill system using the same sub base.

Concrete Subbase: with the use of the filter fabrics and AirDrain with infilled synthetic turf reduced Gmax attenuation 14.7 % versus Gmax attenuation which employed just the turf + infill system using the same sub base.

Player Safety

The consistent Gmax and shock attenuation properties of AirDrain are a major contributor to the reduction of concussions and the safety of your players. Some factors that might influence a change in GMAX would be an inconsistency of the infill or wear of the synthetic turf fibers. Unlike traditional shock pads or e-layers the AirDrain is 1" high, has a 92% air void and a vertical and lateral drainage rate which cannot be matched by any other product in the industry.

Removal, Recovery, Reuse & Recycling

Once AirDrain has reached the end of its useful life, or “End of Life” (EOL) the owner may still benefit. AirDrain’s resins are of such high quality that most plastic recycling facilities will purchase the AirDrain panels on a per pound basis, thus benefiting the owner once more. AirField Systems can also help the owner in facilitating this process.

Benefits of an AirField system include:

- AirDrain creates and helps maintain a constant Gmax for Synthetic Turf
- Shock absorption reduces the strain on joints and ligaments
- AirDrain can be reused when the Synthetic Turf must be replaced
- Can help qualify for LEED and other green building credits
- A smaller carbon and development footprint with reduced site disturbance
- Water harvesting reclamation and reuse is possible
- AirDrain is a 100% recycled copolymer with the impact modifier metallocene qualifying it as a “No Break” plastic
- AirDrain can be made to the following specification “**Flammability UL 94, Flame Retardant, High Impact Polypropylene Copolymer, Black**” for Rooftop applications

TESTING SERVICES, INC.
817 SHOWALTER AVE. • P.O. BOX 2041
DALTON, GEORGIA 30722-2041
PHONE: (706) 226-1400 • FAX: (706) 226-6118

Test Report

CLIENT:	AirField Systems	**REPORT NUMBER**:	**56765**
	8028 N. May Avenue Suite 201	**LAB TEST NUMBER**:	2497-5010
	Oklahoma City, OK 73120	**DATE**:	November 30, 2012
		PAGE:	1 of 2

Synthetic Turf Description: 46 oz/yd² Monofilament/Slit Film Fiber
2.25" Pile Height Monofilament / 2.125" Pile Height Slit Film
9.25 oz/yd² 3 Layer Primary Backing
25.1 oz/yd² Secondary Urethane Backing

Infill System Installed: 3.0 lbs/ft² SBR Rubber Mixed with 1.25 lbs/ft² Silica Sand

Underlayment #1: 10 oz Filter Fabric (Between Sub Base and Drain System)

Drain System: Air Drain (Cups Down Against 10 oz Filter Fabric)

Underlayment #2 4 oz Filter Fabric (On top of Flat Surface Air Drain, Under Turf)

Sub Base: 2" Layer # 7 & # 81 Rock
1" Compacted Fines Layer

Discussion: Testing Services Inc was instructed to carry out testing on the sample supplied according to the following testing:

- Comparative Gmax or cushioning properties between the turf and sub base system vs. the turf + Air Drain + Filter Fabrics and sub base.

Material Received: 27 November 2012

Note: The above turf was selected from stock and its construction and infill properties are indicative a "typical" playing field for sports activity.

Approved By:

Erle Miles, Jr V.P., Testing Services Inc

TSi Accreditation: Our laboratory is accredited with US Dept of Commerce, National Institute of Standards and Technology: ISO/IEC 17025:2005. Our code # is NVLAP 100108-0. TSi is also recognized as an approved Independent Test Laboratory by the Synthetic Turf Council. However, it should be noted that some or all of the tests performed are not under our scope of accreditation due to the work not fully conforming to the standard, or it being outside the scope of our accreditation, or subcontracted.

Uncertainty: We undertake all assignments for our clients on a best effort basis. Our findings and judgments are based on the information to us using the latest test methods available.

Testing Atmosphere: Unless otherwise noted, all testing was conducted under standard lab conditions of 20± 2ºC and 65 ± 4% r.h.

TESTING SERVICES, INC.
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DALTON, GEORGIA 30722-2041
PHONE: (706) 226-1400 • FAX: (706) 226-6118

Client: AirField Systems

Date of Test: 29 November 2012

Test Conditions: 61.5ºF 36% RH.

Procedure: **ASTM F355-10a:** *Standard Test Methods for Shock-Absorbing Properties of Playing Surface Systems and Materials (Procedure A)*

Data obtained from this test method are indicative of cushioning properties of the playing surface system and materials under the specific conditions selected. The playing system is impacted at a specified velocity with a missile of given mass and geometry to determine the maximum value of *G encountered during impact.*

The test set-up was positioned over the sub base with the clearview bumper II (gmax test equipment) placed level over the entire system. The missile was released, so as to impact the center of the assembly at a velocity of 3.43 m/s at a drop height of 24". Three drops were made at 3 minute intervals. TThe procedure was repeated in three different locations for a total of nine drops. The first drop at each location was for assembly conditioning and was not included in the average.

Test Data: Turf + Infill System Over Sub Base

Location	G-Max Read Drop #2	G-Max Reading Drop #3	Average G-Max Reading
1	93	95	94
2	96	101	99
3	89	92	91
OVERALL GMAX:			**95**

Test Data: Turf + Infill System + 4 oz Filter Fabric + AirDrain + 10 oz Filter Fabric Over Sub Base ↓

Location	G-Max Read Drop #2	G-Max Reading Drop #3	Average G-Max Reading
1	74	77	76
2	76	79	78
3	76	79	78
OVERALL GMAX:			**77**

Conclusion: Use of the filter fabrics and AirDrain with infilled synthetic turf reduced Gmax attenuation 18.9% verses Gmax attenuation which employed just the turf + infill system using the same sub base.

TESTING SERVICES, INC.
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DALTON, GEORGIA 30722-2041
PHONE: (706) 226-1400 • FAX: (706) 226-6118

Test Report

CLIENT:	AirField Systems	**REPORT NUMBER**:	**56765A**
	8028 N. May Avenue Suite 201	**LAB TEST NUMBER**:	2497-5010
	Oklahoma City, OK 73120	**DATE**:	December 7, 2012
		PAGE:	1 of 2

Synthetic Turf Description: 46 oz/yd² Monofilament/Slit Film Fiber
2.25" Pile Height Monofilament / 2.125" Pile Height Slit Film
9.25 oz/yd² 3 Layer Primary Backing
25.1 oz/yd² Secondary Urethane Backing

Infill System Installed: 3.0 lbs/ft² SBR Rubber Mixed with 1.25 lbs/ft² Silica Sand

Underlayment #1: 10 oz Filter Fabric (Between Sub Base and Drain System)

Drain System: Air Drain (Large Opening Up (Per Supplied Specs) Against 10 oz Filter Fabric)

Underlayment #2 4 oz Filter Fabric (On top of Flat Surface Air Drain, Under Turf)

Sub Base: Concrete

Discussion: Testing Services Inc was instructed to carry out testing on the sample supplied according to the following testing:

- Comparative Gmax or cushioning properties between the turf and sub base system vs. the turf + Air Drain + Filter Fabrics and sub base.

Material Received: 27 November 2012

Note: The above turf was selected from stock and its construction and infill properties are indicative a "typical" playing field for sports activity.

Approved By:

Erle Miles, Jr V.P., Testing Services Inc

TSi Accreditation: Our laboratory is accredited with US Dept of Commerce, National Institute of Standards and Technology: ISO/IEC 17025:2005. Our code # is NVLAP 100108-0. TSi is also recognized as an approved Independent Test Laboratory by the Synthetic Turf Council. However, it should be noted that some or all of the tests performed are not under our scope of accreditation due to the work not fully conforming to the standard, or it being outside the scope of our accreditation, or subcontracted.

Uncertainty: We undertake all assignments for our clients on a best effort basis. Our findings and judgments are based on the information to us using the latest test methods available.

Testing Atmosphere: Unless otherwise noted, all testing was conducted under standard lab conditions of 20± 2ºC and 65 ± 4% r.h.

TESTING SERVICES, INC.
817 SHOWALTER AVE. • P.O. BOX 2041
DALTON, GEORGIA 30722-2041
PHONE: (706) 226-1400 • FAX: (706) 226-6118

Client: AirField Systems

Date of Test: 7 December 2012

Test Conditions: 68ºF 42% RH.

Procedure: **ASTM F355-10a:** *Standard Test Methods for Shock-Absorbing Properties of Playing Surface Systems and Materials (Procedure A)*

Data obtained from this test method are indicative of cushioning properties of the playing surface system and materials under the specific conditions selected. The playing system is impacted at a specified velocity with a missile of given mass and geometry to determine the maximum value of *G encountered during impact.*

The test set-up was positioned over the sub base with the clearview bumper II (gmax test equipment) placed level over the entire system. The missile was released, so as to impact the center of the assembly at a velocity of 3.43 m/s at a drop height of 24". Three drops were made at 3 minute intervals. This procedure was repeated in three different locations for a total of nine drops. The first drop at each location was for assembly conditioning and was not included in the average.

Test Data: Turf + Infill System Over Sub Base

Location	G-Max Read Drop #2	G-Max Reading Drop #3	Average G-Max Reading
1	102	105	104
2	110	112	111
3	110	112	111
OVERALL GMAX:			**109**

Test Data: Turf + Infill System + 4 oz Filter Fabric + AirDrain + 10 oz Filter Fabric Over Sub Base ↓

Location	G-Max Read Drop #2	G-Max Reading Drop #3	Average G-Max Reading
1	90	93	92
2	91	95	93
3	92	96	94
OVERALL GMAX:			**93**

Conclusion: Use of the filter fabrics and AirDrain with infilled synthetic turf reduced Gmax attenuation 14.7 % verses Gmax attenuation which employed just the turf + infill system using the same sub base.

DiGeronimo/Mikula Associates, LLC.
Athletic Facilities
Cranbury, New Jersey (609) 306-5091, Fax: (609) 655-0114
Sturbridge, Massachusetts 01566 Tel: (508) 347-5184, Fax: (508) 347-5911

May 18, 2010

Attn: Brad Burgner
Bomel Construction
8195 East Kaiser Boulevard,
Anaheim, CA

Test Location: Los Angeles City College
805 North Vermont Ave
Los Angeles, CA

RE: Drain matt Testing at Los Angeles City College – Rooftop Athletic Field, Los Angeles CA

Mr. Burgner:

On May 18, 2010, DiGeronimo-Mikula Associates, L.L.C. (DMA) personnel conducted field testing of three selected drain matt products installed at the above athletic field project location. The purpose of the tests was to evaluate the shock absorbing characteristics of the synthetic grass field and compare the GMAX values of each drain matt product installed with the existing synthetic turf overlaying each system.

The Standard Test Method for Shock-Absorbing Properties of Playing Surface Systems and Materials (ASTM F1936-98 American Football Field) testing locations and procedure were preformed. The tests were performed using a Triax 2000 A-1 Missile, tripod mounted G_{max} registration unit (www.triax2000.com). This report presents background information on the test procedures, existing conditions, test results and observations.

Background

The ASTM F-355-95 and ASTM 1936-98 test methods covers the measurement of certain shock-absorbing characteristics, impact force-time relationships and rebound properties of playing surface systems. The test procedure utilized involves dropping a 20 lb. missile three times at the same location under a controlled consistent height of 24 inches. The G_{max} testing was developed by NASA in association with the automotive industry to determine the magnitude of sustained force the human body (in particular, the head) could withstand before serious effects would occur.

The G force, or acceleration of the mass that is applying the force, is correlated with the sustained duration of the force. As an example, a fighter pilot may be subject to G forces of as much as 8 times normal gravitational force (8 Gs) for up to several minutes at which time unconsciousness (a blackout) could occur. Relative to athletic fields, a player will encounter G forces of 100 to 200 G's over a period of less than 10 milliseconds. It has been determined that a G force of 200 over a period of at least 10 milliseconds is considered concussion level. This is for a single encounter. It has been shown by studies conducted by the AMA, that repetitive blows or encounters of up to four to five during an event reduces the needs to 160 G's.

In the early 70's, the artificial turf companies started to use this standard (G < 200) to determine the safety of their carpet systems. The artificial turf needed to stay inside this envelope, so it was determined by the turf manufacturers that a drop height of 24-inches should be the standard. This particular drop height was established because the artificial turf systems would exceed the maximum allowable G_{max} (> 200 G's) with a drop of 30-inches or more.

As the industry has grown in sports surfacing and playground safety surfacing, so has the performance of these synthetics. Playground surfaces are now required to meet shock absorbancy standards from minimum drop heights of 36-inches to as much as 8-feet.

In addition, the old carpet systems were directly accountable for sports injuries related to the carpet itself. Injuries such as turf toe and foot lock, and ankle, knee and shoulder sprains and breaks occurred, along with carpet burns and abrasions that were season long. The new synthetic grass systems offer much better results; achieving G_{max} values of less than 200 from drop heights as much as 48-inches.

Existing Conditions

- Turf - 2 1/2" Slit Film, in filled with 50% Green Rubber Infill and 50% Silica Sand.
- Drain matt #1 – Sport Drain Max by 3R Recycled Foam.
- Drain matt #2 - DBS Shock pad and Drainage System.
- Drain matt #3 – Airfield Drainage Systems.

All Three drainage/shock pads and turfs underlying substrate consist of a concrete deck/rooftop, coated with waterproof membrane and 10 millimeter geo-textile cloth.

Test Summary

Three consecutive drops were made at each location for each 24" drop height, at roughly 1.5 - 4 minute intervals. The results of the products and turf combination tested are outline in the attached report (pg 3).

All three combinations of drain matt and synthetic turf are within the range stated within the ASTM F1936-98 specification. The data for the Head Injury Criterion (HIC) and P_{max}, the velocity at impact (ft/sec) of the missile, are also shown on the table.

DMA is here to assist you from evaluation of products through engineering design, testing and construction oversight to achieve a successful project.

Yours truly,

DIGERONIMO-MIKULA ASSOCIATES, L.L.C.

David J DiGeronimo, STC, ASTM
Field Operations

William J. Mikula, PE
Principal

Attachments

DMA /DiGeronimo-Mikula Associates, LLC

Sports Facilities Testing and Consulting

5 Apple Hill Road, Sturbridge, MA 01566 (508)-347-5184 - Fax: (508)-347-5911

Project: Los Angeles City College - Drain Matt Testing

Report Date: 05/18/2010 Field Testing Date: 05/18/10 Air Temperature: 62F, Surface Temp 62-F, Drizzle

TRIAX 2000 - Data Acquisition and Analysis Report

Test Methods **ASTM F 1936-98 Procedure A**

Test #	*Drop No.*	*Drainmatt Tested*	*Ft. / Sec.*	*H.I.C*	*Peak/Gmax*	*Avg./Loc.*	*Drainmatt Average*
1	1	Sport Drain MAX Drop 1	11.7	204	84		
	2		11.7	236	90		
	3		11.7	241	95	**92.5**	
2	4	Sport Drain MAX Drop 1	11.7	223	87		**Average of Two 94.75**
	5		11.7	262	96		
	6		11.7	270	98	**97**	
3	7	DBS Drop 1	11.7	166	71		
	8		11.7	172	73		
	9		11.7	174	73	**73**	
4	10	DBS Drop 2	11.7	172	77		
	11		11.7	208	85		
	12		11.7	217	88	**86.5**	
5	13	DBS Drop 3	11.7	169	71		**Average of all Three 78.833**
	14		11.7	187	76		
	15		11.7	195	78	**77**	
6	16	AIRFIELD Drop 1	11.7	222	89		
	17		11.7	289	105		
	18		11.7	292	106	**105.5**	
7	19	AIRFIELD Drop 2	11.7	215	87		
	20		11.7	275	101		
	21		11.7	294	105	**103**	
8	22	AIRFIELD Drop 3	11.7	249	97		**Average of all Three 107.166**
	23		11.7	308	109		
	24		11.7	333	117	**113**	