



**DiGeronimo/Mikula Associates, LLC.**

**Athletic Facilities**

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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 G<sub>max</sub> 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<sub>max</sub> registration unit ([www.triax2000.com](http://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<sub>max</sub> 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

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**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**

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