



SGI TESTING SERVICES

A GEORGIA LIMITED LIABILITY COMPANY

14 March 2010

Mr. Gary Lenviel
E. Dillon & Company
P.O. Box 160
Swords Creek, VA 24649

Subject: Laboratory Test Results Transmittal
Block Shear Testing
6" Core, 6" Core Safer, 6" Solid, and 6" Solid Safer Blocks

Dear Mr. Lenviel,

SGI Testing Services, LLC (SGI) is pleased to present the attached test results for the above-mentioned testing program. The note section below addresses sample preparation, sample disposal and a disclosure statement.

SGI appreciates the opportunity to provide laboratory testing services to E. Dillon & Company. Should you have any questions regarding the attached document(s), or if you require additional information, please do not hesitate to contact the undersigned.

Sincerely,

Zehong Yuan, Ph.D., P.E.
Laboratory Manager

Attachments

NOTES:

- (1) Unless otherwise noted in the test results the sample(s)/specimen(s) were prepared in accordance with the applicable test standards or generally accepted sampling procedures.
- (2) Contaminated/chemical samples and all related laboratory generated waste (i.e., test liquids, PPE, absorbents, etc.) will be returned to the client or designated representative(s), at the client's cost, within 60 days following the completion of the testing program, unless special arrangements for proper disposal are made with SGI.
- (3) Materials that are not contaminated will be discarded after test specimens and archived specimens are obtained. Archived specimens will be discarded 30 days after the completion of the testing program, unless long-term storage arrangements are specifically made with SGI.
- (4) The reported results apply only to the materials and test conditions used in the laboratory testing program. The results do not necessarily apply to other materials or test conditions. The test results should not be used in engineering analysis unless the test conditions model the anticipated field conditions. The testing was performed in accordance with general engineering testing standards and requirements. The reported results are submitted for the exclusive use of the client to whom they are addressed.

SGI10014.REPORT.2010.01

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FACILITY LOCATION
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NORCROSS, GA 30093

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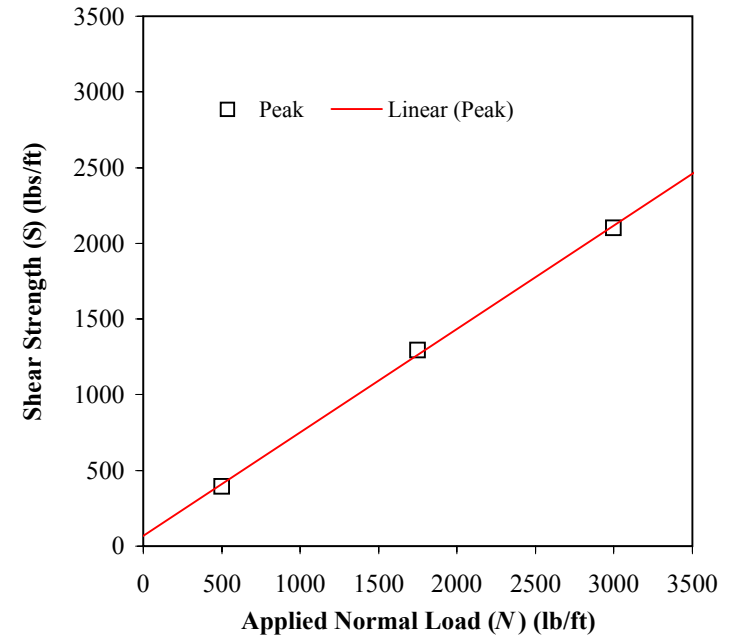
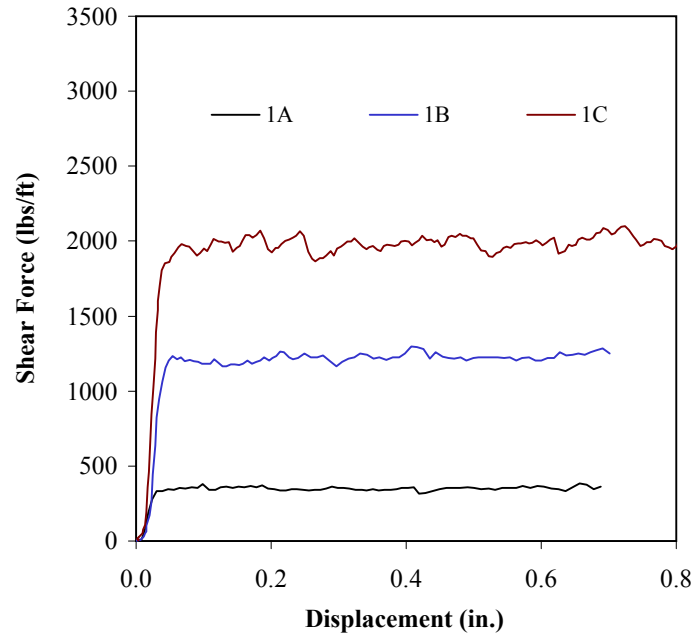
PHONE: 770.931.8222 FAX: 770.931.8240

ATTACHMENT A

BLOCK SHEAR TEST RESULTS

**E. DILLON & COMPANY
BLOCK SHEAR TESTING (ASTM D 6916)**

6" core block against 6" core blocks without No shear keys (lugs)



Test No.	Test Specimen Width (in.)	Test Normal Stress (psi)	Normal Load (lb/ft)	Peak Shear Load (lbs)	Peak Strength (lb/ft)	Shear Strength Equation
1A	15.6	7.4	500	514	394	$S_{peak} = 70 + (N) \tan (34 ^{\circ})$
1B	15.6	25.9	1750	1687	1295	
1C	15.6	44.4	3000	2737	2102	

NOTES:

Nominal Dimensions of Block: 15-5/8 in. wide by 5-5/8 in. long and 7-5/8 in. high.
 Weight of Full-Size Block (lbs): 27
 Approximate Facing Unit Weight (pcf):
 Failure Mode of Block:

DATE REPORTED: 2/16/2010

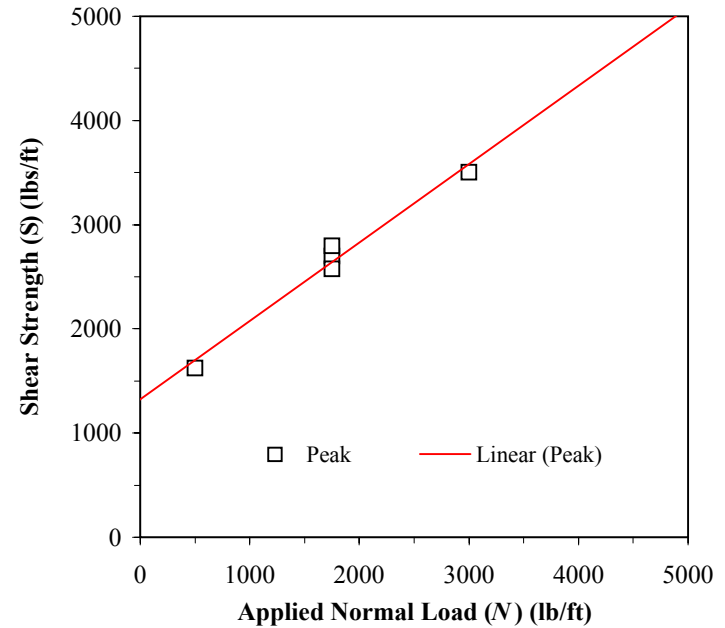
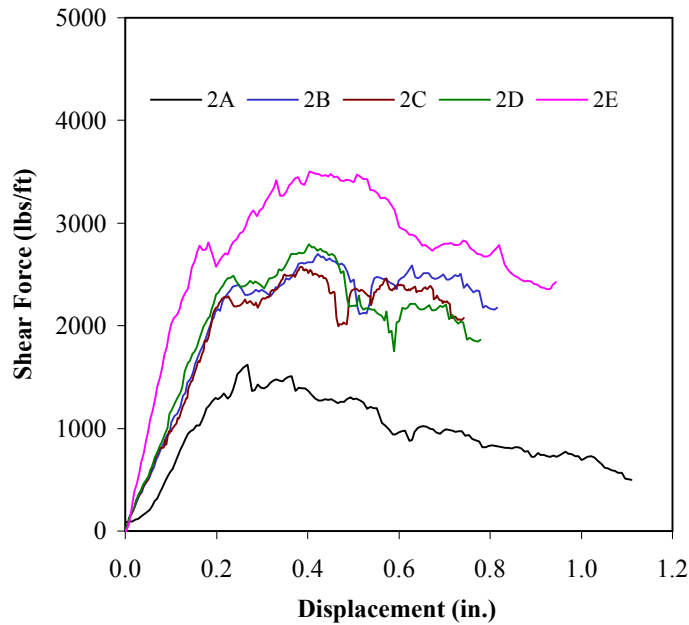


SGI TESTING SERVICES, LLC

FIGURE NO.	A-1
PROJECT NO.	SGI10014
DOCUMENT NO.	
FILE NO.	

**E. DILLON & COMPANY
BLOCK SHEAR TESTING (ASTM D 6916)**

6" Core Safer block against 6" Core Safer blocks with shear keys (lugs)



Test No.	Test Specimen Width (in.)	Test Normal Stress (psi)	Normal Load (lb/ft)	Peak Shear Load (lbs)	Peak Shear Strength (lb/ft)	Shear Strength Equation
2A	15.6	7.4	500	2110	1620	$S_{peak} = 1320 + (N) \tan (37^\circ)$
2B	15.6	25.9	1750	3515	2700	
2C	15.6	25.9	1750	3350	2573	
2D	15.6	25.9	1750	3638	2794	
2E	15.6	44.4	3000	4559	3502	

NOTES:

Nominal Dimensions of Block: 15-5/8 in. wide by 5-5/8 in. long and 7-5/8 in. high.
 Weight of Full-Size Block (lbs): 32
 Approximate Facing Unit Weight (pcf):
 Failure Mode of Block:

DATE REPORTEE 2/16/2010

FIGURE NO. A-2

PROJECT NO. SGI10014

DOCUMENT NO.

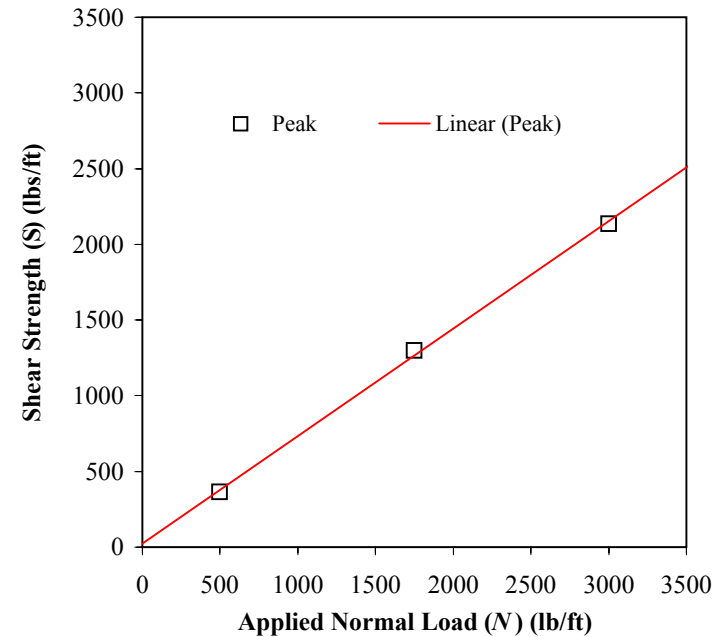
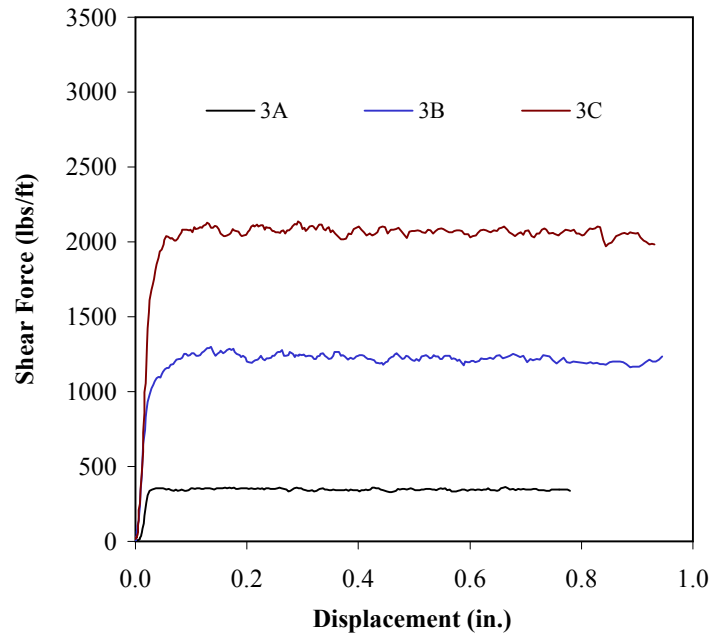
FILE NO.



SGI TESTING SERVICES, LLC

**E. DILLON & COMPANY
BLOCK SHEAR TESTING (ASTM D 6916)**

6" solid block against 6" solid blocks without shear keys (lugs)



Test No.	Test Specimen Width (in.)	Test Normal Stress (psi)	Normal Load (lb/ft)	Peak Shear Load (lbs)	Peak Strength (lb/ft)	Shear Strength Equation
3A	15.6	5.5	500	471	362	$S_{peak} = 25 + (N) \tan (35 ^\circ)$
3B	15.6	19.1	1750	1691	1299	
3C	15.6	32.8	3000	2780	2135	

NOTES:

Nominal Dimensions of Block: 15-5/8 in. wide by 7-5/8 in. long and 5-5/8 in. high.
 Weight of Full-Size Block (lbs): 49
 Approximate Facing Unit Weight (pcf):
 Failure Mode of Block:

DATE REPORTED: 2/17/2010

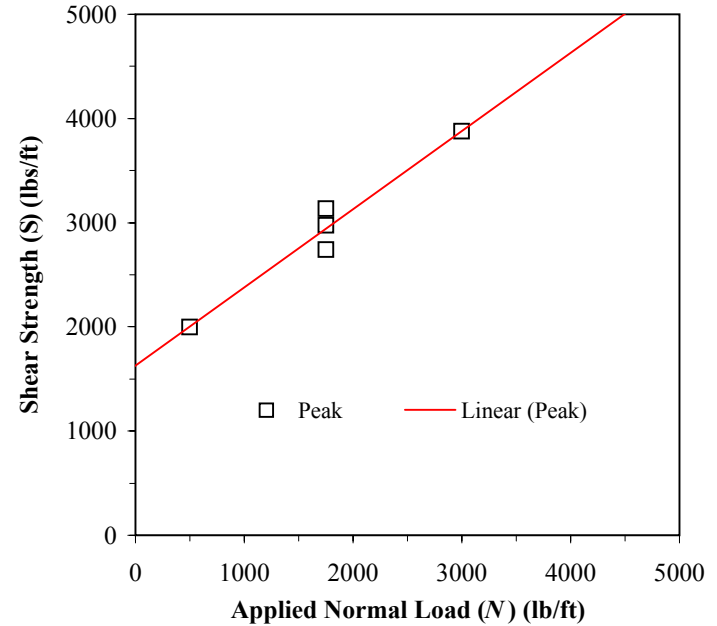
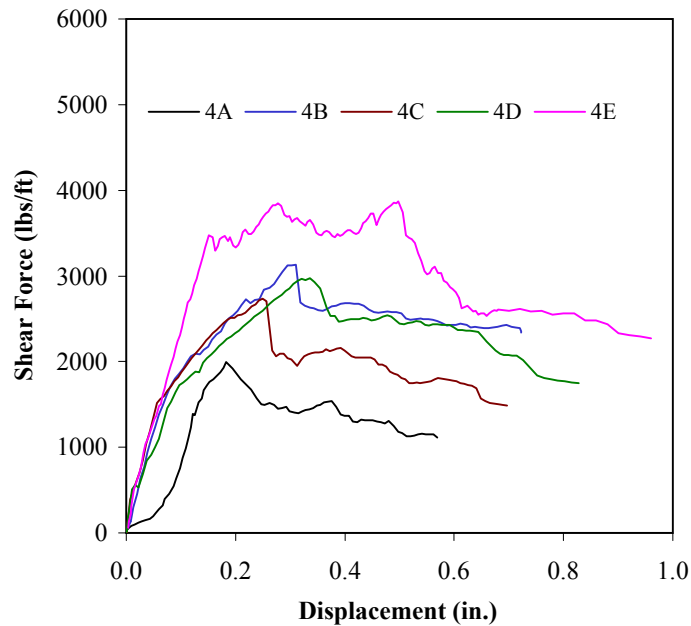


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FIGURE NO.	A-3
PROJECT NO.	SGI10014
DOCUMENT NO.	
FILE NO.	

**E. DILLON & COMPANY
BLOCK SHEAR TESTING (ASTM D 6916)**

6" Solid Safer block against 6" Solid Safer blocks with shear keys (lugs)



Test No.	Test Specimen Width (in.)	Test Normal Stress (psi)	Normal Load (lb/ft)	Peak Shear Load (lbs)	Peak Shear Strength (lb/ft)	Shear Strength Equation
4A	15.6	5.5	500	2598	1995	$S_{peak} = 1625 + (N) \tan (37^\circ)$
4B	15.6	19.1	1750	4080	3133	
4C	15.6	19.1	1750	3566	2738	
4D	15.6	19.1	1750	3868	2971	
4E	15.6	32.8	3000	5043	3873	

NOTES:

Nominal Dimensions of Block: 15-5/8 in. wide by 7-5/8 in. long and 6 in. high.
 Weight of Full-Size Block (lbs): 53
 Approximate Facing Unit Weight (pcf):
 Failure Mode of Block:

DATE REPORTEE 2/20/2010

FIGURE NO. A-4

PROJECT NO. SGI10014

DOCUMENT NO.

FILE NO.

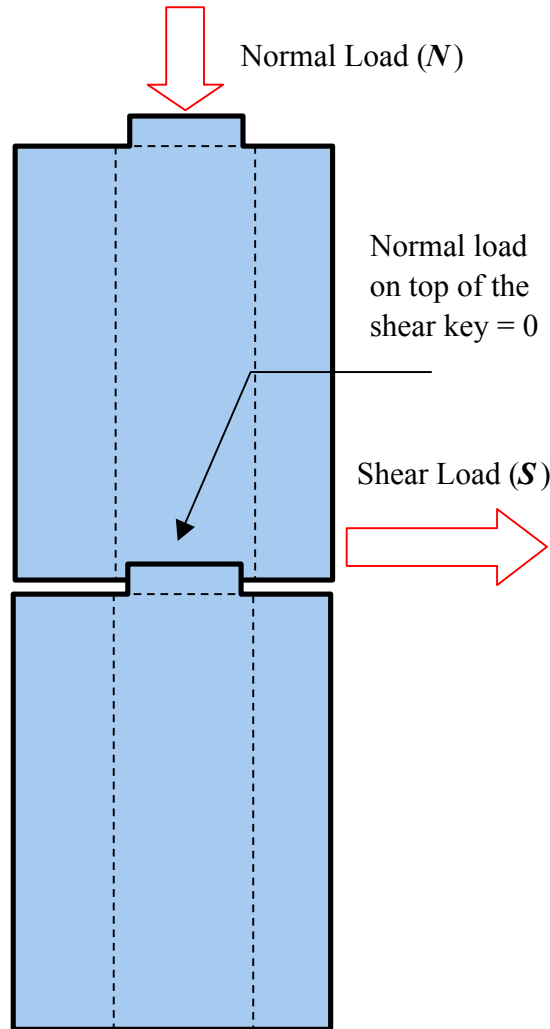


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ATTACHMENT B

**COMPARISON
BLOCK SHEAR TEST RESULTS
6" CORE BLOCK AND 6" CORE SAFER BLOCK**

**SCHEMATIC DIAGRAM
BLOCK SHEAR TEST SETUP - 6" CORE SAFER BLOCKS**



(NOTE: NOT TO SCALE)

The shear strength between two courses of 6" Core Safer Blocks is the sum of frictional force and mobilized shear strength of shear key (adhesion) as described by the following equation:

$$S = N \tan \delta + a$$

where:

- S = shear strength (lbs/ft)*
- N = normal load (lbs/ft)*
- δ = friction angle (degree)*
- a = adhesion (lbs/ft)*

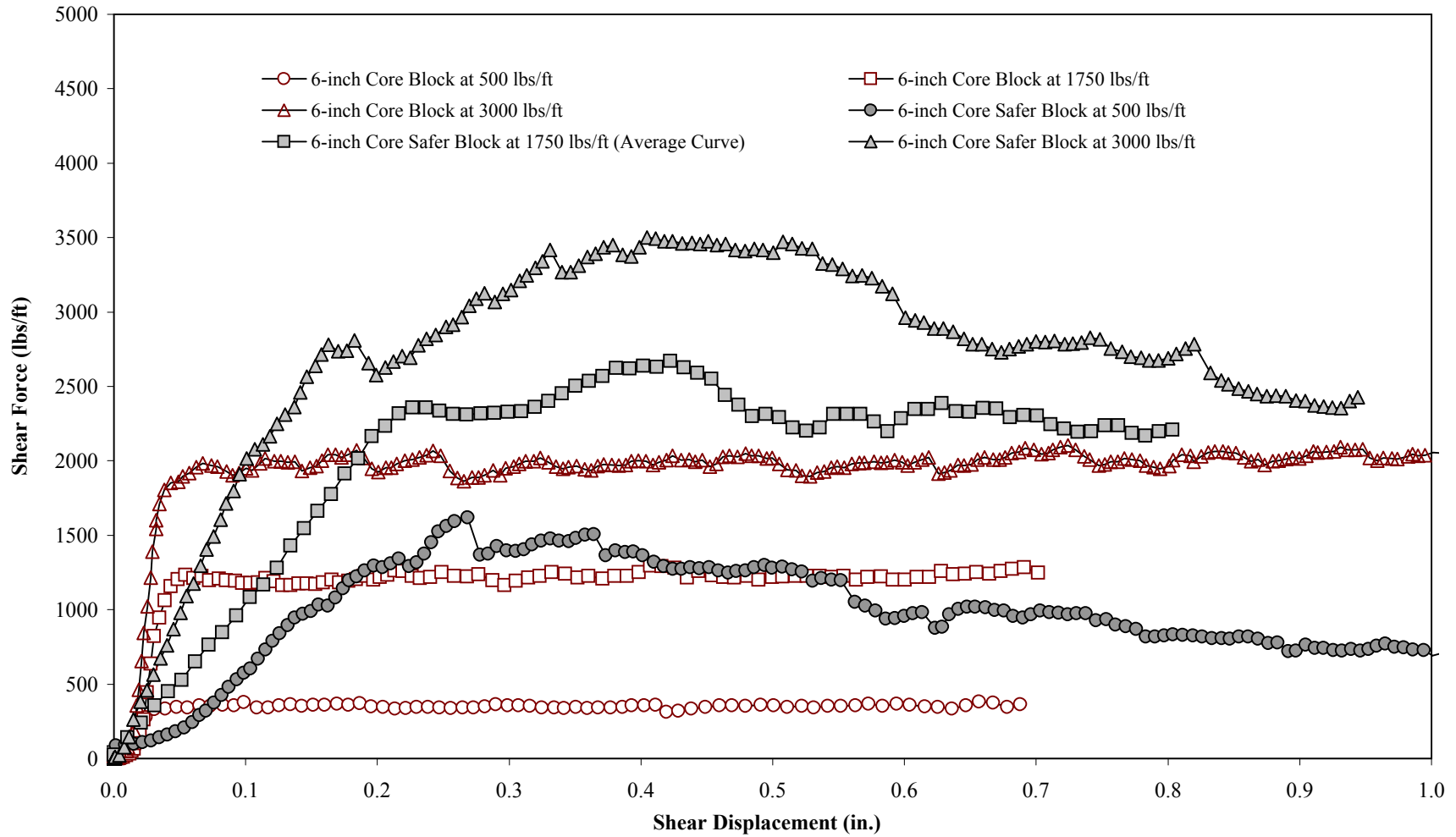
The frictional force between two flat-surface concrete blocks is approximately the linear function of normal load with little adhesion. Physically the adhesion measures the mobilized shear strength of shear keys.



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DATE REPORTED:	3/1/2010
FIGURE NO.	B-1
PROJECT NO.	SGI10014
DOCUMENT NO.	
FILE NO.	

E. DILLON & COMPANY
COMPARISON OF SHEAR LOAD-DISPLACEMENT CURVES
6" CORE BLOCK AND 6" CORE SAFER BLOCK



DATE REPORTED: 3/1/2010

FIGURE NO. B-2

PROJECT NO. SGI10014

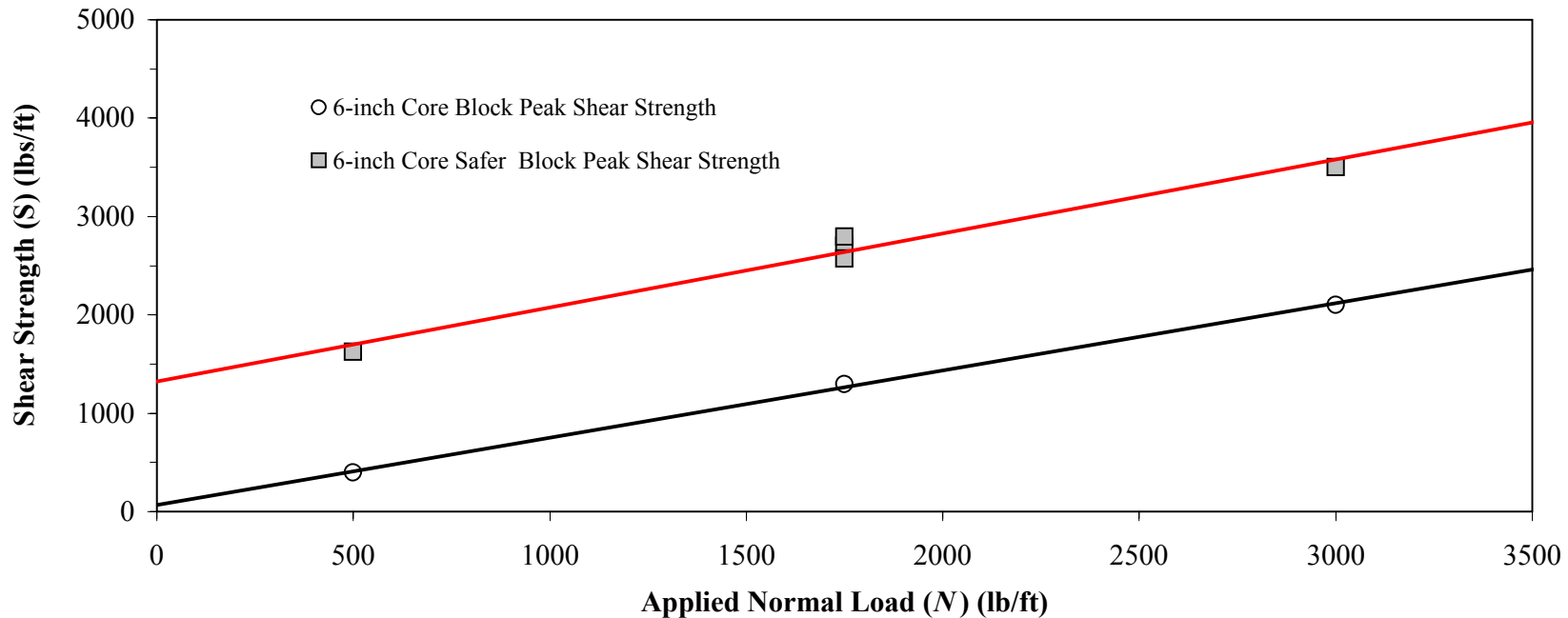
DOCUMENT NO.

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SGI TESTING SERVICES, LLC

**E. DILLON & COMPANY
COMPARISON OF SHEAR STRENGTH ENVELOPES
6" CORE BLOCK AND 6" CORE SAFER BLOCK**



6" Core Safer Block™ versus 6" Core block

The 6" Core Safer blocks are designed to interlock through shear keys (lugs) to provide higher shear strength against shear loads as may be experienced in coal mines due to pressure changes from roof falls and explosions. In addition to interlocking, the design makes the block self-aligning as they are dry stacked in the mine.

Two shear test series were conducted under the normal load ranging from 500 to 3,000 lbs/ft. The normal loads were selected to simulate vertical loading typical to stoppings once installed.

The test results show that the shear strength between two courses of 6" Core Safer blocks is significantly higher than that between two courses of 6" standard Core blocks.

At 500, 1750, and 3000 lbs/ft normal loads, the peak shear strengths between two courses of 6" Core Safer blocks increased 311%, 108%, and 67%, respectively.



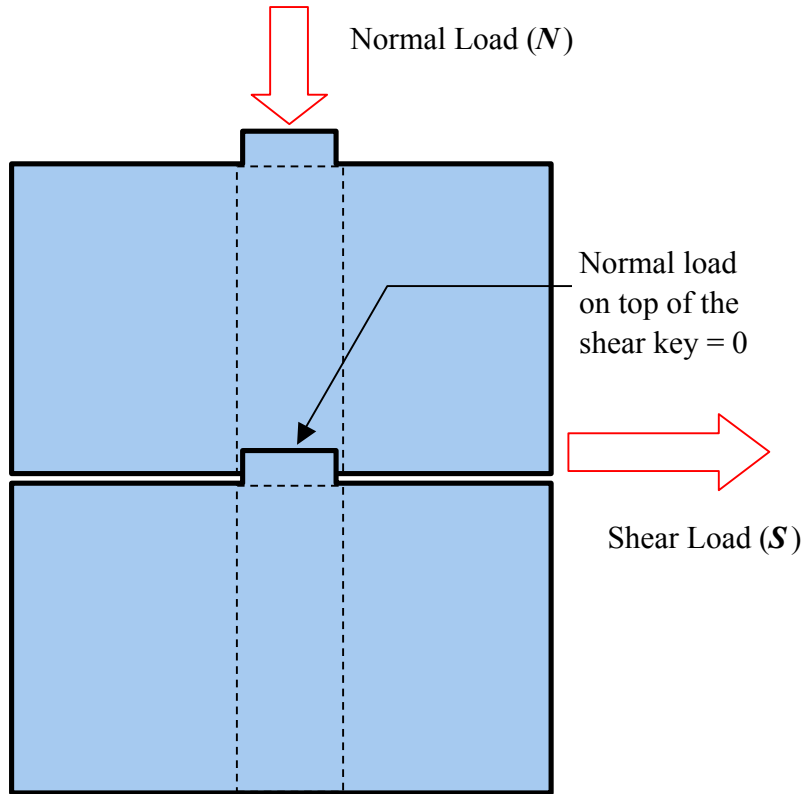
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DATE REPORTED:	3/1/2010
FIGURE NO.	B-3
PROJECT NO.	SGI10014
DOCUMENT NO.	
FILE NO.	

ATTACHMENT C

**COMPARISON
BLOCK SHEAR TEST RESULTS
6" SOLID BLOCK AND 6" SOLID SAFER BLOCK**

**SCHEMATIC DIAGRAM
BLOCK SHEAR TEST SETUP - 6" SOLID SAFER BLOCKS**



The shear strength between two courses of 6" Solid Safer Blocks is the sum of frictional force and mobilized shear strength of shear key (adhesion) as described by the following equation:

$$S = N \tan(\delta) + a$$

where:

- S = shear strength (lbs/ft)*
- N = normal load (lbs/ft)*
- d = friction angle (degree)*
- a = adhesion (lbs/ft)*

The frictional force between two flat-surface concrete blocks is approximately the linear function of normal load with little adhesion. Physically the adhesion measures the mobilized shear strength of shear keys.

(NOTE: NOT TO SCALE)

DATE REPORTED: 3/1/2010

FIGURE NO. C-1

PROJECT NO. SGI10014

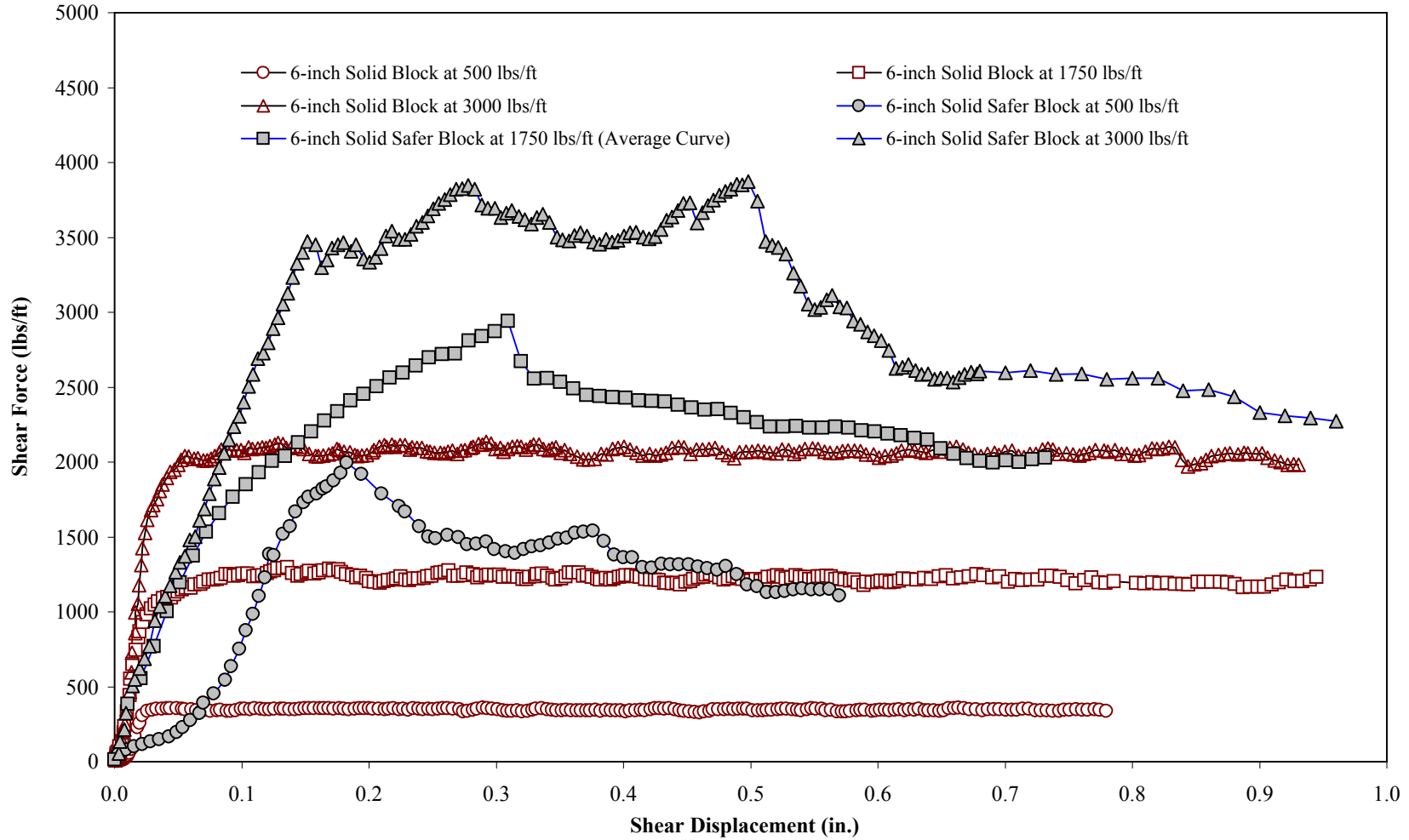
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FILE NO.



SGI TESTING SERVICES, LLC

E. DILLON & COMPANY
COMPARISON OF SHEAR LOAD-DISPLACEMENT CURVES
6" SOLID BLOCK AND 6" SOLID SAFER BLOCK



DATE REPORTED: 3/1/2010

FIGURE NO. C-2

PROJECT NO. SGI10014

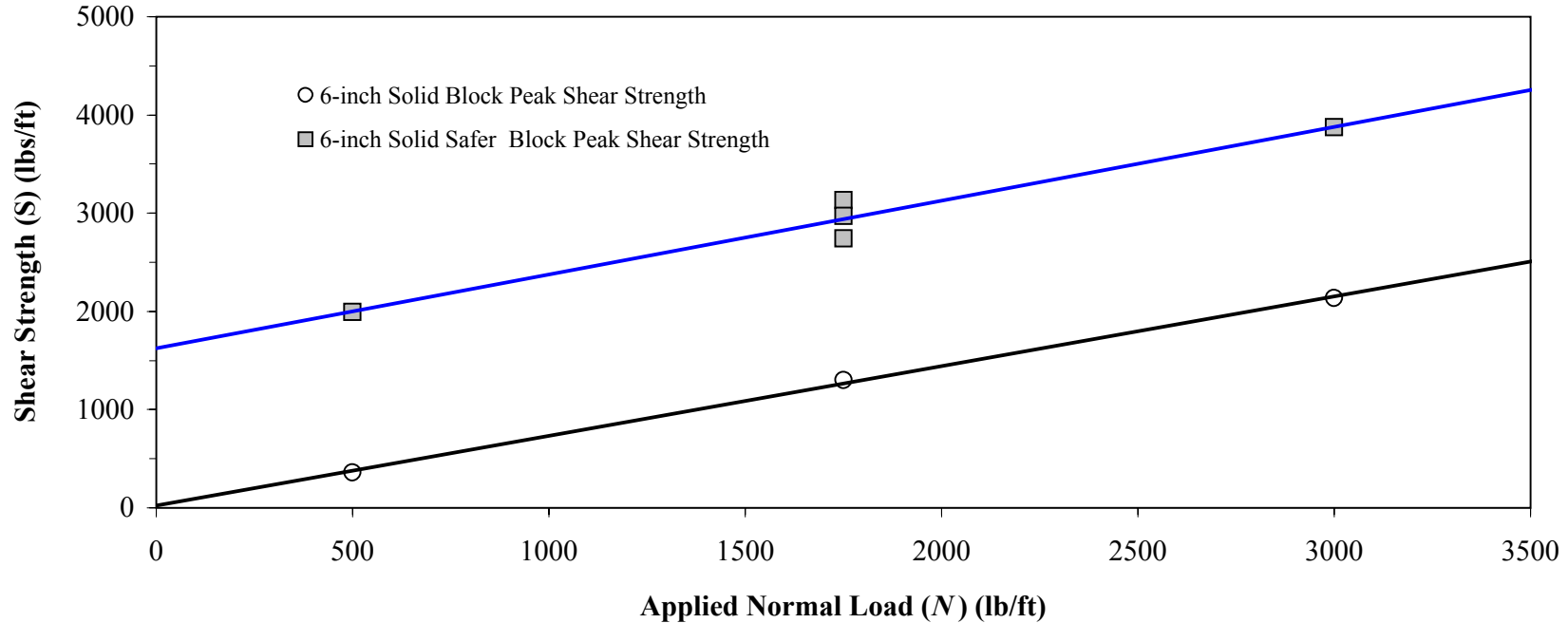
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SGI TESTING SERVICES, LLC

**E. DILLON & COMPANY
COMPARISON OF SHEAR STRENGTH ENVELOPES
6" SOLID BLOCK AND 6" SOLID SAFER BLOCK**



6" Solid Safer Block™ versus 6" Solid block

The 6" Solid Safer blocks are designed to interlock through shear keys (lugs) to provide higher shear strength against shear loads as may be experienced in coal mines due to pressure changes from roof falls and explosions. In addition to interlocking, the design makes the block self-aligning as they are dry stacked in the mine.

Two shear test series were conducted under the normal load ranging from 500 to 3,000 lbs/ft. The normal loads were selected to simulate vertical loading typical to stoppings once installed.

The test results show that the shear strength between two courses of 6" Solid Safer blocks is significantly higher than that between two courses of 6" standard solid blocks.

At 500, 1750, and 3000 lbs/ft normal loads, the peak shear strengths between two courses of 6" Solid Safer blocks increased 452%, 127%, and 81%, respectively.



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DATE REPORTED: 3/1/2010

FIGURE NO. C-3

PROJECT NO. SGI10014

DOCUMENT NO.

FILE NO.