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INDIANA UNIVERSITY

INDIANA
GEOLOGICAL SURVEY

INDIANA GEOLOGICAL SURVEY
Materials Testing Laboratory
Credentials

Mission -House Enrolled Act No. 1375, Section 22 IC 20-12-28-3 directs the Indiana Geological Survey to:

1.provide services to the state of Indiana that contribute to the wise stewardship of its energy, mineral, and ground-water resources;
2.and protect the health, safety, and welfare of its citizenry through the gathering and interpretation of relevant geological information.

This mission is carried out through a combination of the following activities:

A. geologic sample and data collection and storage;
B. information dissemination in the form of published maps, reports, and databases;
C. educational outreach programs;
D. focused research initiatives; and
E. cooperative investigations with governmental agencies, industries, and educational organizations.

The mission to the state fulfills a part of the public service mission of Indiana University by addressing Indiana's requirements for timely evaluation of its geological resources and hazards in light of complex and evolving economic and societal needs.

Under activity subpoint E, above, the Geological Survey provides geotechnical testing services to the Indiana Limestone Institute of America as part of an ongoing program to evaluate the physical properties of the Salem Limestone (Mississippian). Standard ASTM tests are performed on a request basis and these tests include: C-97, C-99, C-170, C-241, and C-880. Tests C-97, 99, 170, and 880 are performed in compliance with standard operating procedures detailed by ASTM using a Baldwin/SATEC, Model 60BTE press. This equipment is calibrated annually by SATEC Materials Testing Equipment. Certificates of Verification are available from the Geological Survey upon request. ASTM test C-241 is performed using an abrasion loss tester that was manufactured to ASTM specifications for the Geological Survey by an Indiana University instrument maker.

The technician who performs all of the physical tests formerly directed the Physical Testing Laboratory of the Division of Materials and Tests, Indiana Department of Transportation.

Geotechnical reports are provided by John R. Hill, Associate Director and Geologist, Indiana Geological Survey. When possible, reports comply fully with ASTM standards for reporting testing results. Exceptions to this statement can result when sample location information is unavailable or when sample orientation is unknown. A database of all physical test results is maintained by the Geological Survey and is available for purchase from the Survey's Publications Sales Office.

611 North Walnut Grove
Bloomington, Indiana
47405-2208

Fax: 812-855-2862

Indiana Geological Survey

Physical Testing Data Report

Report for: Bybee Stone Co.
P.O. Box 968
Bloomington, IN 47402

Report from: John R. Hill, Geologist and Associate Director

Sample-suite location: Independent Quarry

ASTM Test C-97 Absorption and Bulk Specific Gravity

Sample I.D.	Dry Wt.	Saturated Wt. in air	Saturated Wt. in H_20	Bulk Spec. Gravity	Percent Absorption	Comment
BZX1	141.86	148.81	86.37	2.27	4.9	
BZX2	147.2	154.3	89.73	2.28	4.8	
BZX3	146.49	153.45	89.28	2.28	4.8	
				2.28	**4.8**	**Mean**
BZY1	143.41	150.26	87.12	2.27	4.8	
BZY2	148.29	155.22	90.26	2.28	4.7	
BZY3	146.93	154.12	89.32	2.27	4.9	
				2.27	**4.8**	**Mean**

Indiana Geological Survey

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Report for: Bybee Stone Co.
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Report from: John R. Hill, Geologist
and Associate Director

Sample-suite location: Independent Quarry

ASTM Test C-241 Abrasion Resistance

Sample I.D.	Dry Wt.	Final Wt.	Wt. Loss	Avg. Wt.	Bulk Spg.	Abrasion Resist.	Comment
BZX1	141.86	137.74	4.12	139.80	2.27	5.9	Abrasion Perpindicular to Grain
BZX2	147.2	143.17	4.03	145.18	2.28	6.1	
BZX3	146.49	142.54	3.95	144.51	2.28	6.2	
						6.1	**Mean**
BZY1	143.41	139.86	3.55	141.64	2.27	6.8	Abrasion Parallel to Grain
BZY2	148.29	144.90	3.39	146.60	2.28	7.2	
BZY3	146.93	143.34	3.59	145.13	2.27	6.8	
						6.9	**Mean**

Indiana Geological Survey

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Report for: Bybee Stone Co.
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Report from: John R. Hill, Geologist
and Associate Director

Sample-suite location: Independent Quarry

ASTM C-170 Compressive Strength

Sample ID	Dimensions (inches)	Area (sq. inches)	Max. Load (lbs.)	Comp. Strength (psi)	Comments
BZ41	1.95 X 1.97	3.84	31360	8200	Run Dry Loaded Parallel to Grain
BZ42	1.97 X 1.97	3.88	26130	6700	
BZ43	1.95 X 1.97	3.84	25490	6600	
BZ44	1.98 X 1.98	3.92	28450	7300	
BZ45	1.96 X 1.95	3.82	26000	6800	
				7100	**Mean**
BZ46	1.96 X 1.98	3.88	34390	8900	Run Dry Loaded Perpindicular to Grain
BZ47	1.97 X 2.00	3.94	32670	8300	
BZ48	1.98 X 1.98	3.92	38440	9800	
BZ49	2.00 X 2.00	4.00	25980	6500	
BZ50	2.00 X 2.00	4.00	33520	8400	
				8400	**Mean**

Sample ID	Dimensions (inches)	Area (sq. inches)	Max. Load (lbs.)	Comp. Strength (psi)	Comments
BZ51	1.97 X 1.99	3.92	17410	4400	Soaked 48 hours; Loaded Parallel to Grain
BZ52	1.96 X 1.97	3.86	21430	5600	
BZ53	2.00 X 2.00	4.00	23010	5800	
BZ54	1.95 X 1.97	3.84	25400	6600	
BZ55	1.98 X 1.98	3.92	18380	4700	
				5400	**Mean**
BZ56	2.00 X 2.00	4.00	27390	6800	Soaked 48 hours;
BZ57	1.98 X 1.98	3.92	29640	7600	
BZ58	1.99 X 1.98	3.94	30270	7700	
BZ59	1.97 X 2.00	3.94	28170	7100	
BZ60	1.98 X 2.00	3.96	25560	6500	
				7100	**Mean**

Indiana Geological Survey

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Report from: John R. Hill, Geologist and Associate Director

Sample-suite location: Independent Quarry

ASTM C-99 Modulus of Rupture

Sample ID	Span (in.)	Width (in.)	Thickness (in.)	Max. Load (lbs.)	Mod. Rupt. (psi)	Comments
BZ01	7.00	4.00	2.27	2630	1340	Run Dry, Loaded Parallel to Grain
BZ02	7.00	4.00	2.27	2520	1288	
BZ03	7.00	4.00	2.22	2530	1348	
BZ04	7.00	4.00	2.25	2580	1338	
BZ05	7.00	4.00	2.25	2720	1410	
					1345	**Mean**
BZ06	7.00	4.00	2.25	2440	1265	Run Dry, Loaded Perpendicular to Grain
BZ07	7.00	4.00	2.27	2360	1202	
BZ08	7.00	4.05	2.25	2740	1403	
BZ09	7.00	4.04	2.26	2870	1460	
BZ10	7.00	4.05	2.26	2700	1371	
					1340	Mean
BZ11	7.00	4.00	2.23	2400	1267	Soaked 48 hours, Loaded Parallel to Grain
BZ12	7.00	3.99	2.26	2430	1252	
BZ13	7.00	4.00	2.24	2350	1229	
BZ14	7.00	4.00	2.22	2170	1156	

Sample ID	Span (in.)	Width (in.)	Thickness (in.)	Max. Load (lbs.)	Mod. Rupt. (psi)	Comments
BZ15	7.00	4.01	2.30	2450	1213	
					1223	**Mean**
BZ16	7.00	4.00	2.27	2480	1263	Soaked 48 hours, Loaded Perpendicular to Grain
BZ17	7.00	4.00	2.26	2390	1228	
BZ18	7.00	4.05	2.25	2380	1219	
BZ19	7.00	4.02	2.28	2530	1271	
BZ20	7.00	4.01	2.25	2350	1215	
					1239	**Mean**

Indiana Geological Survey

Physical Testing Data Report

Report for: Bybee Stone Co.
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Report from: John R. Hill, Geologist and Associate Director

Sample-suite location: Independent Quarry

ASTM C-880 Flexural Strength

Sample ID	Span (in.)	Width (in.)	Depth (in.)	Max. Load (lbs.)	Flex. Strength (PSI)	Comments
BZ21	12.50	4.00	1.24	825	1258	Run Dry, Loaded Parallel to Grain
BZ22	12.50	3.99	1.25	780	1173	
BZ23	12.50	3.99	1.24	836	1278	
BZ24	12.50	3.99	1.27	826	1203	
BZ25	12.50	3.99	1.23	804	1249	
					1232	**Mean**
BZ26	12.50	4.06	1.26	947	1377	Run Dry, Loaded Perpendicular to Grain
BZ27	12.50	4.05	1.27	968	1389	
BZ28	12.50	4.02	1.25	926	1382	
BZ29	12.50	4.04	1.27	967	1391	
BZ30	12.50	4.05	1.27	1029	1477	
					1403	**Mean**
BZ31	12.50	3.99	1.20	611	997	Soaked 48 hours, Loaded Parallel to Grain
BZ32	12.50	3.98	1.22	612	969	
BZ33	12.50	3.98	1.25	691	1042	
BZ34	12.50	4.00	1.23	634	982	

Sample ID	Span (in.)	Width (in.)	Depth (in.)	Max. Load (lbs.)	Flex. Strength (PSI)	Comments
BZ35	12.50	4.00	1.27	714	1038	
					1005	**Mean**
BZ36	12.50	4.06	1.28	760	1071	Soaked 48 hours, Loaded Perpendicular to Grain
BZ37	12.50	4.02	1.28	764	1087	
BZ38	12.50	4.07	1.28	814	1144	
BZ39	12.50	4.03	1.25	729	1085	
BZ40	12.50	4.04	1.25	715	1062	
					1090	**Mean**

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Jeff Leisz

Bybee Stone Co.

The Indiana Geological Survey performed ASTM tests C97 Absorption and Bulk Specific Gravity, C99 Modulus of Rupture, C170 Compressive Strength, C880 Flexural Strength of Dimension Stone, and C241 Standard Test for Abrasion Resistance of Stone on specimens of Salem limestone known as Indiana Standard Gray, originating from Bybee Stone Co. Analysis was completed on April 5, 2016

Tests C99, C170, and C880 were completed with a model 60 BTE Baldwin-Satec hydraulic press using the required fixtures and procedures for these tests. ASTM standard E-4 is used to calibrate the press yearly. The resulting values for these tests are included below.

Sincerely,

Drew M. Packman

Materials Testing Coordinator

Indiana Geological Survey

Indiana Standard Grey

C-97	*Mean Values*		
	Absorption (%)	Bulk Specific Gravity	
001	5.47	2.26	
002	5.60	2.25	
003	5.53	2.26	
004	5.25	2.26	
005	5.14	2.27	
006	5.31	2.26	
AVG	5.38	2.26	
LOW	5.14	2.25	
HIGH	5.60	2.27	
C-241	*Mean Values*		
Parallel	Abrasion Resistance%		

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001	13.7
002	13.1
003	12.5

Parallel	Abrasion Resistance%
004	9.4
005	9.5
006	9.5

C-99	Mean Values
	Wet Perpendicular (psi)
001	1185
002	1075
003	1001
004	1170
005	1098
AVG	1106
	Wet Parallel (psi)
006	1151
007	1156
008	1263
009	1200
010	1174
AVG	1189

	Dry Perpendicular (psi)
011	1672

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012	1672
013	1498
014	1433
015	1433
AVG	1549

Dry Parallel (psi)

016	1483
017	1679
018	1590
019	1545
020	1475
AVG	1555

C170 *Mean Values*

Wet Perpendicular (psi)

001	4717
002	4762
003	3071
004	5827
005	4974
AVG	4670

Wet Parallel (psi)

006	4787
007	5248
008	4415
009	5415
010	3072
AVG	4587

Dry Perpendicular (psi)

011	6025

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012	4762
013	4860
014	6040
015	4293
AVG	5196

Dry Parallel (psi)

016	5932
017	6505
018	4964
019	5657
020	6974
AVG	6006

C880 *Mean Values*

Wet Perpendicular (psi)

001	982
002	1032
003	853
004	1014
005	864
AVG	949

Wet Parallel (psi)

006	935
007	1001
008	1043
009	1012
010	918
AVG	982

Dry Perpendicular (psi)

011	1293

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012	1371
013	1177
014	1300
015	1221
AVG	1273

	Dry Parallel (psi)
016	1262
017	1333
018	1286
019	1282
020	936
AVG	1220

Flammability Rating

Health Rating

Reactivity Rating

HAZARD RATING
Please rate consistent with NFPA code

MATERIAL SAFETY DATA SHEET

SECTION I NAME AND PRODUCT

MANUFACTURER'S NAME: Bybee Stone Company, Inc	CONTACT: Will Bybee
ADDRESS (STREET, CITY, STATE AND ZIP CODE): 6293 North Matthews Dr, Ellettsville, IN 47429	EMERGENCY TELEPHONE NO.: (812)876-2215
TRADE NAME, COMMON NAME OR SPECIFICATION: Indiana Limestone	APPROVED BY: ILI
CHEMICAL FAMILY OR PRODUCT TYPE: Limestone	DATE: May 28,1986

SECTION II COMPOSITION

CHEMICAL NAME		COMMON NAME	REG.* (Y/N)	CAS #	OSHA PERMISSIVE EXPOSURE LIMIT	ACGIH TLV	CARCINOGEN* (Y/N)
Calcium Carbonate ($CaCO_3$)		Limestone		1317-65-3*	Not Applicable	See Sec. VI	N
				*EPA TSCA Inventory			

*Materials are regulated by OSHA 29 CFR 1910.1200, Hazard Communication Standard, and/or the Massachusetts General Law Chapter 111F, Right To Know Regulations.

SECTION III PHYSICAL AND CHEMICAL DATA

BOILING POINT: Not Applicable	MELTING POINT: Not Applicable	SPECIFIC GRAVITY: 2.15 to 2.40
VAPOR PRESSURE: Not Applicable	PERCENT VOLATILE BY VOL.: Not Applicable	VAPOR DENSITY: Not Applicable
EVAPORATION RATE: Not Applicable	SOLUBILITY IN WATER: Not Applicable	SOLUBILITY IN ALCOHOL: Not Applicable
SOLUBILITY IN OTHER SOLVENT: Not Applicable	APPEARANCE AND ODOR: Various sizes and shapes; gray to buff color; slight "earthy" odor.	

SECTION IV FIRE AND EXPLOSION HAZARD DATA

FLASH POINT: Not Flammable (METHOD USED) FLAMMABLE LIMITS LEL UEL

EXTINGUISHING MEDIA: Not Applicable

SPECIAL FIRE FIGHTING PROCEDURES: Not Applicable

EXPLOSION POTENTIAL: None Known

SECTION V HEALTH, FIRST AID AND MEDICAL DATA

PRIMARY ROUTE(S) OF ENTRY	ACUTE AND CHRONIC HEALTH EFFECTS AND EFFECTS OF OVEREXPOSURE	FIRST AID AND MEDICAL INFORMATION
INHALATION	None. Product is benign. (Note that certain regulations address the control of "nuisance level" dust, and list TLVs.)	Remove to clear atmosphere.
INGESTION	Not Applicable	Not Applicable
SKIN CONTACT & ABSORPTION	Not Applicable	Not Applicable
EYE	None. Dust may cause minor irritation in some individuals.	Flush with potable water.
OTHER POTENTIAL HEALTH RISKS	None	Not Applicable

SECTION VI CORROSIVITY AND REACTIVITY DATA

STABILITY UNSTABLE ! ! STABLE X

POLYMERIZATION MAY OCCUR ! ! WILL NOT OCCUR X

INCOMPATIBILITY (MATERIALS TO AVOID)

NONE KNOWN

DECOMPOSITION PRODUCTS

NONE KNOWN

CONDITIONS TO BE AVOIDED

NONE KNOWN

SECTION VII STORAGE, HANDLING AND USE PROCEDURES

NORMAL STORAGE AND HANDLING

NO KNOWN CHEMICAL HAZARDS

NORMAL USE

NO KNOWN CHEMICAL HAZARDS

STEPS TO BE TAKEN IN CASE OF LEAKS OR SPILLS

NOT APPLICABLE

WASTE DISPOSAL METHOD

NOT APPLICABLE

SECTION VIII PERSONAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (SPECIFY TYPE) Approved respirators or dust masks.

VENTILATION	
LOCAL	YES
MECHANICAL (GENERAL)	YES
OTHER	

PROTECTIVE GLOVES Optional

EYE PROTECTION Goggles Optional

OTHER EQUIPMENT Safety-toe Shoes

MEASURES TO BE TAKEN DURING REPAIR AND MAINTENANCE OF CONTAMINATED EQUIPMENT THAT HAS BEEN IN CONTACT WITH THIS MATERIAL

NONE NEEDED

SECTION IX SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE NOT APPLICABLE

OTHER PRECAUTIONS

ADDITIONAL INFORMATION

See "calcium"; $CaCO_3$; or limestone, in **Dangerous Properties of Industrial Materials**, 3rd Ed. (N. Irving Sax. Ed.)