APPENDIX 3

LOAD TEST RESULTS AT HOGBACK COUNTY GRAVEL PIT MONTROSE COUNTY SITE (SITE 3)

Hollow Bar Soil Nail Testing Research
Montrose County, Colorado
Schnabel Reference 07150064

FOR

ADSC

14180 Dallas Parkway, Pacific Center I, Dallas, TX 75254

February 4, 2009

PREPARED BY

Schnabel Engineering

510 East Gay Street, West Chester, Pennsylvania 19380
Phone (610) 696-6066 Fax (610) 696-7771

Schnabel Engineering, LLC

510 East Gay Street
West Chester, PA 19380

Phone: (610) 696-6066
Fax: (610) 696-7771
www.schnabel-eng.com

February 4, 2009

Mr. Scot Litke
ADSC
14180 Dallas Parkway
Pacific Center I
Dallas, TX 75254

Subject: **Project 07150064, Hollow Bar Soil Nail Testing Research – Load Test Results at Hogback County Gravel Pit, Montrose County, Colorado (Site 3)**

Dear Mr. Litke:

Schnabel Engineering, LLC (Schnabel), is pleased to present the data from pullout load tests performed at the Hogback County Gravel Pit, Sunset Mesa site in Montrose County, Colorado.

TEI Rock Drills in collaboration with Mountain Highwall Concrete (MHC) installed and tested eight soil nails as part of the load test matrix for the research program. The nail installation process was in general accordance with the installation methods indicated in the research test protocol. Personnel from Schnabel observed the installation of all the soil nails and the load testing. MHC attempted to install Soil Nail A1 following the protocol procedures; however, this soil nail could not be installed due to loss of casing.

Schnabel measured the axial movement of the test nail during loading and unloading using two dial gauges. Loads from a hydraulic jacking system were applied to the test nail through a steel plate. MHC monitored the loads using a calibrated jack-pressure dial gauge.

Appendix A summarizes the results from the load tests. Appendix B includes the load-movement and movement-time diagrams based on the test data. Appendix C includes the nail installation logs. Appendix D includes the results from grout compressive strength tests. Jack calibrations are included in Appendix E. Appendix F includes a geotechnical report and soil laboratory tests prepared by Buckhorn Geotech.

TEI Rock Drills exhumed soil nails. Appendix G presents pictures of the exhumed nails.

Sincerely,

SCHNABEL ENGINEERING, LLC

Javier Rodríguez, P.E.
Senior Engineer

Allen W. Cadden, P.E.
Principal

CJR:JEG:AWC:jlm

Appendix A: Summary of Load Test Results
Appendix B: Load-Movement and Movement-Time Diagrams
Appendix C: Soil Nail Installation Logs
Appendix D: Grout Compressive Strength
Appendix E: Jack Calibrations
Appendix F: Geotechnical Information
Appendix G: Observation of Exhumed Nails

Distribution:
ADSC (3)
Attn: Mr. Scot Litke

APPENDIX A

Summary of Load Test Results

SCHNABEL ENGINEERING

By Javier Rodríguez Date 11/20/2008 Sheet _____ of _____
Checked _____ Date _____ Job No 7150064
Subject Hollow Bar Soil Nail Research - Load Test Data Summary - Montrose, Colorado - Site 3

TABLE 1: LOAD TEST DATA SUMMARY

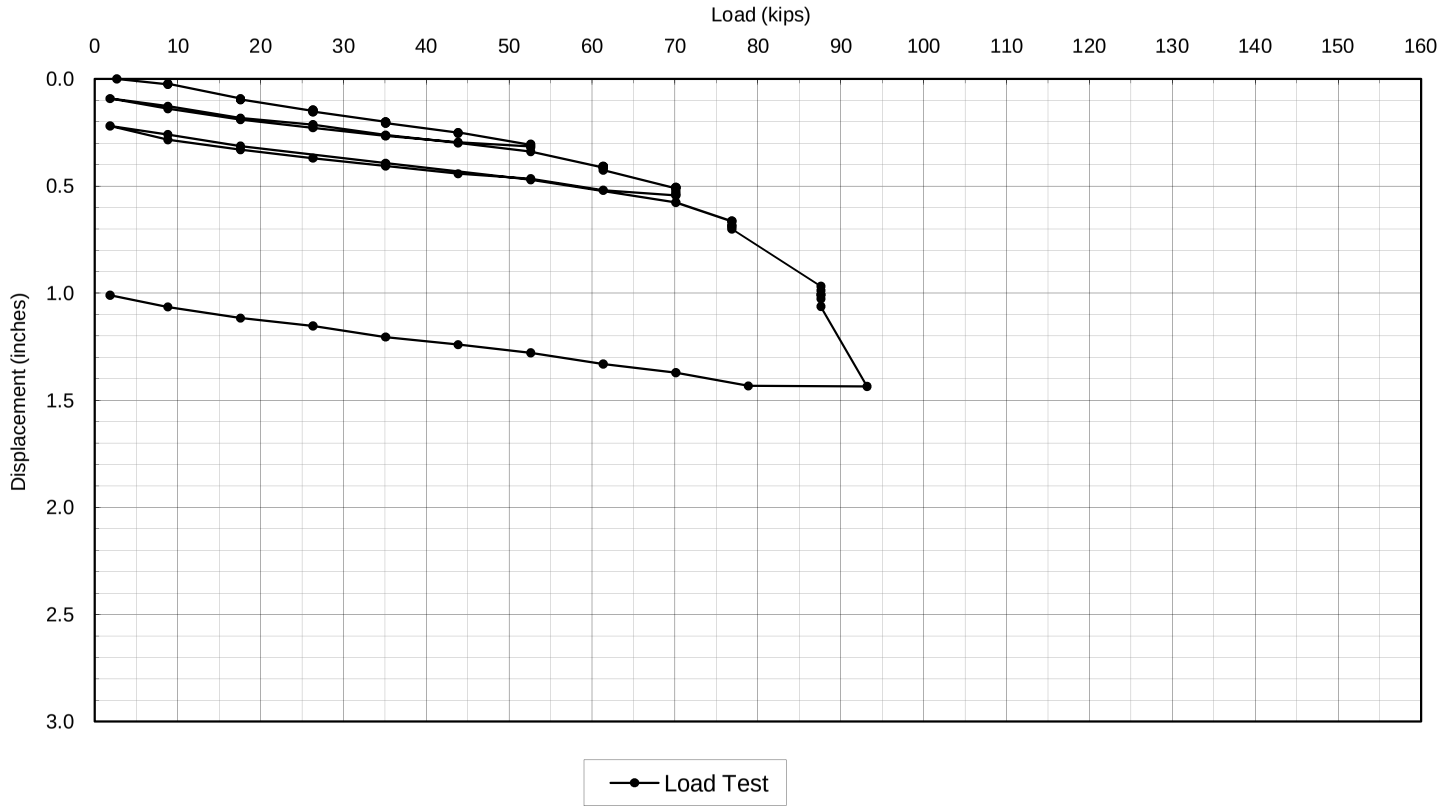
Nail ID	Installation Method	Design Test Load (kip)	Maximum Test Load (kip)	Maximum Movement (in)	Residual Movement (in)	Failure	Max Creep Rate (1)	Load at Creep Test (kip)	Unbonded Length (2) (ft)	Bond Length (ft)	Drill Bit / Casing Diameter (in)	Average Drilling Rate (3) (ft/min)	Estimated Average Bond Strength (psi) (4)	Soil Type Along Bond Zone
A2	A	35	93.2	1.436	1.010	YES	0.008	52.6	16.70	6.0	7.8	0.6	53.2	Poorly Graded Sand
A3	A	35	113.1	1.310	0.890	YES	0.0140	52.6	10.00	6.0	7.8	0.6	64.5	Poorly Graded Sand
B1	B	35	105.1	0.764	0.403	NO	0.011	52.6	12.60	6.0	5.1	1.9	91.1	Poorly Graded Sand
B2	B	35	119.0	1.497	0.982	YES	0.020	52.6	11.80	6.0	5.1	2.9	103.2	Poorly Graded Sand
B3	B	35	103.1	0.930	0.498	YES	0.019	52.6	12.00	6.0	5.1	1.5	89.4	Poorly Graded Sand
C1	C	35	135.1	0.454	0.093	NO	0.005	52.6	13.50	6.0	5.1	0.7	117.1	Poorly Graded Sand
C2	C	35	146.3	0.909	0.416	YES	0.002	52.6	13.20	6.0	5.1	2.0	126.8	Poorly Graded Sand
C3	C	35	134.9	0.680	0.211	NO	0.008	52.6	13.50	6.0	5.1	0.1	116.9	Poorly Graded Sand

Notes:
(1) Creep rate measured at the 6 to 60 minute interval.
(2) Unbonded length as measured to the top of jack at time of load test. The unbonded length reported in the installation logs refers to the total unbonded length at completion of drilling.
(3) Drilling rate along bond zone.
(4) Bond strength based on nominal drill bit diameter and bonded length.
(5) Soil nail A1 could not been installed due to lost of casing.

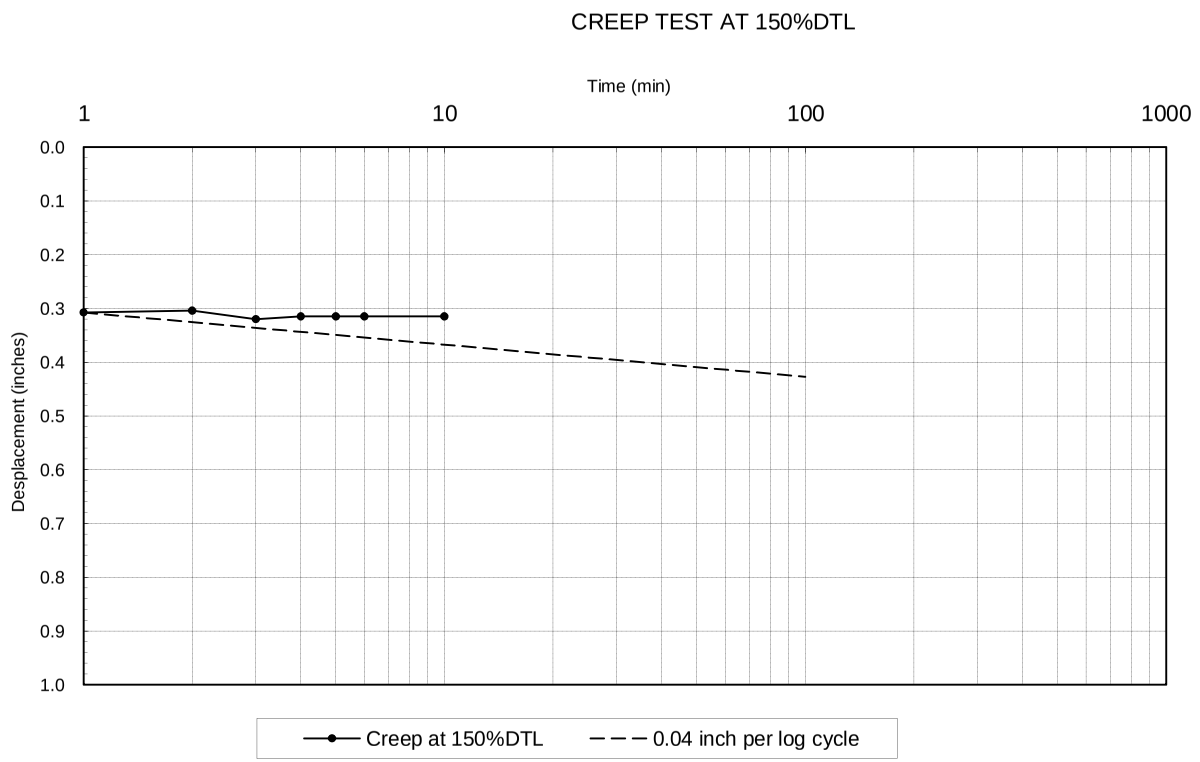
APPENDIX B

Load-Movement and Movement-Time Diagrams

VERIFICATION SOIL NAIL LOAD TEST
Hollow Core Bar Research - Montrose, Colorado



Type of Test: Verification	Bond: 6 ft Unbonded: 16.7 ft	Diameter: 7.75 in (nominal)	Test Nail: A2	**SCHNABEL ENGINEERING, LLC**	
				Verification Soil Nail Load Test	
Design Test Load (P) : 35 kip	Comments: Nail pulled out at approximately 93.2 kip.			Hollow Core Bar Soil Nail Research	
				Montrose, CO	
Maximum Test Load: 300% P = 105 kip				11/6/2008	07150064



Type of Test: Verification	Bond: 6 ft Unbonded: 16.7 ft	Diameter: 7.75 in (nominal)	Test Nail: A2	**SCHNABEL ENGINEERING, LLC** Verification Soil Nail Load Test
Design Test Load (P) : 35 kip	Comments: Nail pulled out at approximately 93.2 kip.			Hollow Core Bar Soil Nail Research Montrose, CO
Maximum Test Load: 300% P = 105 kip				11/6/2008 — 07150064

Soil Nail Verification Load Test Data

Schnabel Engineering

Project: Hollow Core Bar Soil Nail Research
Location: Montrose, CO
Client: ADSC

Performed: Mountain Highwall Concrete (Norm Parsons)
Observed: Schnabel Engineering (Andy Baxter)
Data by: Schnabel Engineering (Andy Baxter)

Soil Nail: A2
Date: 11/6/2008

Design Test Load (P): 35 kips **# Dials:** 2 **Jack Calibration:** Pressure = 50.26746244 X reading (kip) + 16.60102364 (psi)

Sequence of Loading	Estimated Load [kip]	Dial Load [psi]	Applied Pressure [psi]	Applied Load [kip]	Time [min]	Time of Test	Dial 1 Deformation [in.]	Dial 2 Deformation [in.]	Dial 3 Deformation [in.]	Dial 4 Deformation [in.]	Average Deformation [in.]	Comments:
AL	1.8	104.6	150.0	2.7	1	2:19 PM	0.000	0.000			0.000	
25%	8.8	456.4	460.0	8.8	1	2:20 PM	0.029	0.022			0.026	
	8.8	456.4	460.0	8.8	2	2:21 PM	0.026	0.020			0.023	
	8.8	456.4	460.0	8.8	3	2:22 PM	0.025	0.020			0.023	
	8.8	456.4	460.0	8.8	4	2:23 PM	0.025	0.020			0.023	
	8.8	456.4	460.0	8.8	5	2:24 PM	0.025	0.020			0.023	
	8.8	456.4	460.0	8.8	6	2:25 PM	0.025	0.020			0.023	
	8.8	456.4	460.0	8.8	10	2:29 PM	0.025	0.020			0.023	
50%	17.5	896.3	900.0	17.6	1	2:31 PM	0.098	0.086			0.092	
	17.5	896.3	900.0	17.6	2	2:32 PM	0.102	0.093			0.098	
	17.5	896.3	900.0	17.6	3	2:33 PM	0.102	0.093			0.098	
	17.5	896.3	900.0	17.6	4	2:34 PM	0.102	0.091			0.097	
	17.5	896.3	900.0	17.6	5	2:35 PM	0.101	0.091			0.096	
	17.5	896.3	900.0	17.6	6	2:36 PM	0.101	0.091			0.096	
	17.5	896.3	900.0	17.6	10	2:40 PM	0.101	0.091			0.096	
75%	26.3	1336.1	1340.0	26.3	1	2:41 PM	0.155	0.143			0.149	
	26.3	1336.1	1340.0	26.3	2	2:42 PM	0.152	0.141			0.147	
	26.3	1336.1	1340.0	26.3	3	2:43 PM	0.150	0.140			0.145	
	26.3	1336.1	1340.0	26.3	4	2:44 PM	0.150	0.140			0.145	
	26.3	1336.1	1340.0	26.3	5	2:45 PM	0.160	0.150			0.155	
	26.3	1336.1	1340.0	26.3	6	2:46 PM	0.160	0.150			0.155	
	26.3	1336.1	1340.0	26.3	10	2:50 PM	0.157	0.148			0.153	
100%	35.0	1776.0	1780.0	35.1	1	2:51 PM	0.203	0.199			0.201	
	35.0	1776.0	1780.0	35.1	2	2:52 PM	0.201	0.198			0.200	
	35.0	1776.0	1780.0	35.1	3	2:53 PM	0.201	0.198			0.200	
	35.0	1776.0	1780.0	35.1	4	2:54 PM	0.208	0.204			0.206	
	35.0	1776.0	1780.0	35.1	5	2:55 PM	0.205	0.201			0.203	
	35.0	1776.0	1780.0	35.1	6	2:56 PM	0.205	0.201			0.203	
	35.0	1776.0	1780.0	35.1	10	3:00 PM	0.208	0.204			0.206	
125%	43.8	2215.8	2220.0	43.8	1	2:58 PM	0.253	0.250			0.252	
	43.8	2215.8	2220.0	43.8	2	2:59 PM	0.253	0.250			0.252	
	43.8	2215.8	2220.0	43.8	3	3:00 PM	0.253	0.250			0.252	
	43.8	2215.8	2220.0	43.8	4	3:01 PM	0.253	0.250			0.252	
	43.8	2215.8	2220.0	43.8	5	3:02 PM	0.253	0.250			0.252	
	43.8	2215.8	2220.0	43.8	6	3:03 PM	0.253	0.255			0.254	
	43.8	2215.8	2220.0	43.8	10	3:07 PM	0.251	0.249			0.250	

Soil Nail Verification Load Test Data

Schnabel Engineering

Project: Hollow Core Bar Soil Nail Research
Location: Montrose, CO
Client: ADSC

Performed: Mountain Highwall Concrete (Norm Parsons)
Observed: Schnabel Engineering (Andy Baxter)
Data by: Schnabel Engineering (Andy Baxter)

Soil Nail: A2
Date: 11/6/2008

Design Test Load (P): 35 kips **# Dials:** 2 **Jack Calibration:** Pressure = 50.26746244 X reading (kip) + 16.60102364 (psi)

Sequence of Loading	Estimated Load [kip]	Dial Load [psi]	Applied Pressure [psi]	Applied Load [kip]	Time [min]	Time of Test	Dial 1 Deformation [in.]	Dial 2 Deformation [in.]	Dial 3 Deformation [in.]	Dial 4 Deformation [in.]	Average Deformation [in.]	Comments:
150%	52.5	2655.6	2660.0	52.6	1	3:08 PM	0.307	0.308			0.308	
	52.5	2655.6	2660.0	52.6	2	3:09 PM	0.303	0.305			0.304	
	52.5	2655.6	2660.0	52.6	3	3:10 PM	0.320	0.320			0.320	
	52.5	2655.6	2660.0	52.6	4	3:11 PM	0.315	0.315			0.315	
	52.5	2655.6	2660.0	52.6	5	3:12 PM	0.315	0.315			0.315	
	52.5	2655.6	2660.0	52.6	6	3:13 PM	0.315	0.315			0.315	
	52.5	2655.6	2660.0	52.6	10	3:17 PM	0.315	0.315			0.315	
	52.5	2655.6	2660.0	52.6	20	3:21 PM						
	52.5	2655.6	2660.0	52.6	30	3:25 PM						
	52.5	2655.6	2660.0	52.6	40	3:29 PM						
	52.5	2655.6	2660.0	52.6	50	3:33 PM						
	52.5	2655.6	2660.0	52.6	60	3:37 PM						
125%	43.8	2215.8	2220.0	43.8	1	3:17 PM	0.295	0.297			0.296	
100%	35.0	1776.0	1780.0	35.1	1	3:18 PM	0.265	0.268			0.267	
75%	26.3	1336.1	1340.0	26.3	0	3:18 PM	0.226	0.230			0.228	
50%	17.5	896.3	900.0	17.6	0	3:18 PM	0.187	0.194			0.191	
25%	8.8	456.4	460.0	8.8	0	3:18 PM	0.129	0.149			0.139	
AL	1.8	104.6	110.0	1.9	1	3:19 PM	0.074	0.110			0.092	
25%	8.8	456.4	460.0	8.8	0	3:19 PM	0.120	0.135			0.128	
50%	17.5	896.3	900.0	17.6	1	3:20 PM	0.180	0.186			0.183	
75%	26.3	1336.1	1340.0	26.3	0	3:20 PM	0.211	0.216			0.214	
100%	35.0	1776.0	1780.0	35.1	0	3:20 PM	0.260	0.264			0.262	
125%	43.8	2215.8	2220.0	43.8	0	3:20 PM	0.298	0.301			0.300	
150%	52.5	2655.6	2660.0	52.6	1	3:21 PM	0.338	0.340			0.339	
175%	61.3	3095.5	3100.0	61.3	1	3:22 PM	0.410	0.418			0.414	
	61.3	3095.5	3100.0	61.3	2	3:23 PM	0.408	0.416			0.412	
	61.3	3095.5	3100.0	61.3	3	3:24 PM	0.406	0.415			0.411	
	61.3	3095.5	3100.0	61.3	4	3:25 PM	0.405	0.414			0.410	
	61.3	3095.5	3100.0	61.3	5	3:26 PM	0.404	0.413			0.409	
	61.3	3095.5	3100.0	61.3	6	3:27 PM	0.402	0.412			0.407	
	61.3	3095.5	3100.0	61.3	10	3:31 PM	0.421	0.430			0.426	
200%	70.0	3535.3	3540.0	70.1	1	3:31 PM	0.504	0.517			0.511	
	70.0	3535.3	3540.0	70.1	2	3:32 PM	0.500	0.515			0.508	
	70.0	3535.3	3540.0	70.1	3	3:33 PM	0.499	0.514			0.507	
	70.0	3535.3	3540.0	70.1	4	3:34 PM	0.498	0.513			0.506	
	70.0	3535.3	3540.0	70.1	5	3:35 PM	0.517	0.533			0.525	
	70.0	3535.3	3540.0	70.1	6	3:36 PM	0.530	0.545			0.538	
	70.0	3535.3	3540.0	70.1	10	3:40 PM	0.536	0.551			0.544	
175%	61.3	3095.5	3100.0	61.3	1	3:43 PM	0.512	0.528			0.520	
150%	52.5	2655.6	2660.0	52.6	0	3:43 PM	0.438	0.494			0.466	
125%	43.8	2215.8	2220.0	43.8	0	3:43 PM	0.434	0.452			0.443	

Soil Nail Verification Load Test Data

Schnabel Engineering

Project: Hollow Core Bar Soil Nail Research
Location: Montrose, CO
Client: ADSC

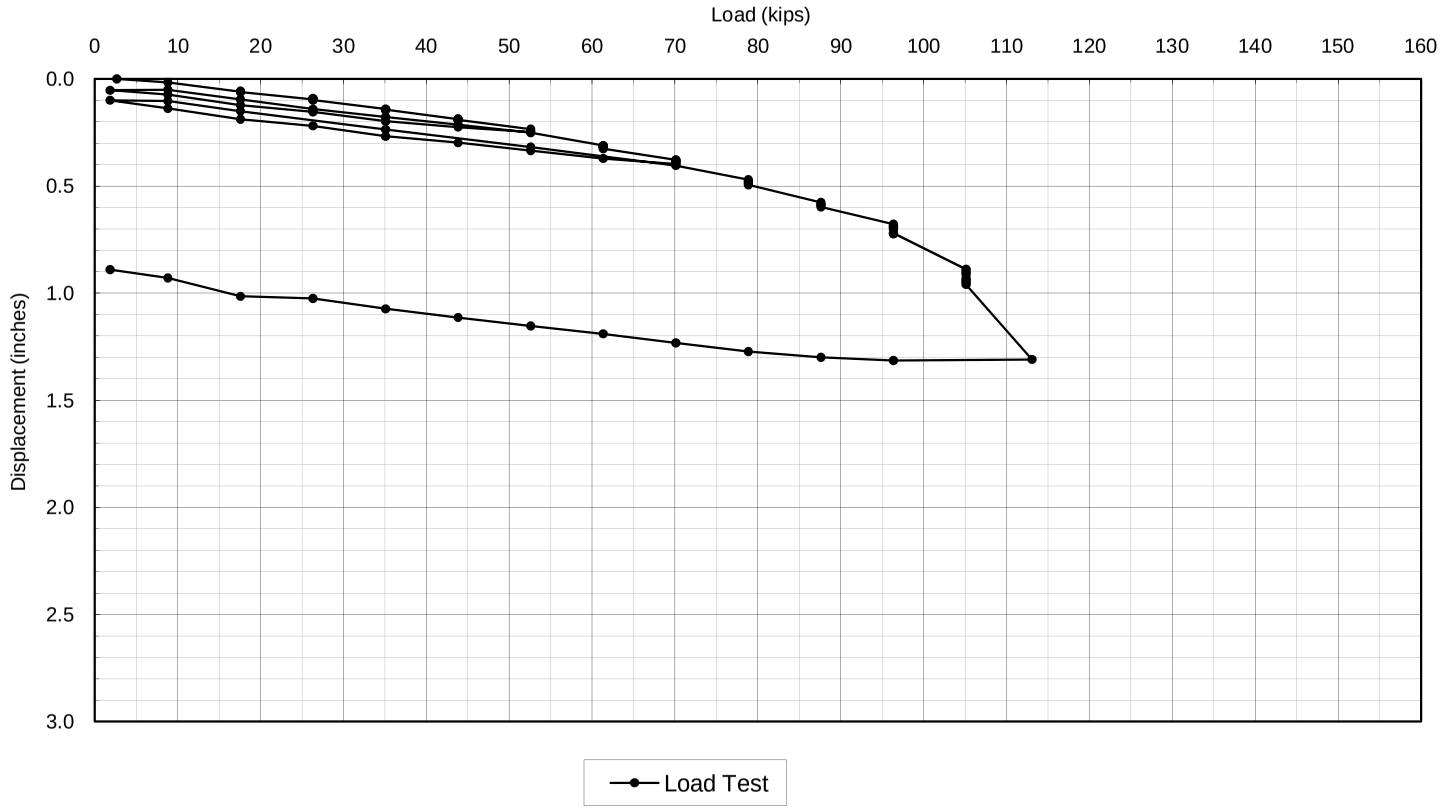
Performed: Mountain Highwall Concrete (Norm Parsons)
Observed: Schnabel Engineering (Andy Baxter)
Data by: Schnabel Engineering (Andy Baxter)

Soil Nail: A2
Date: 11/6/2008

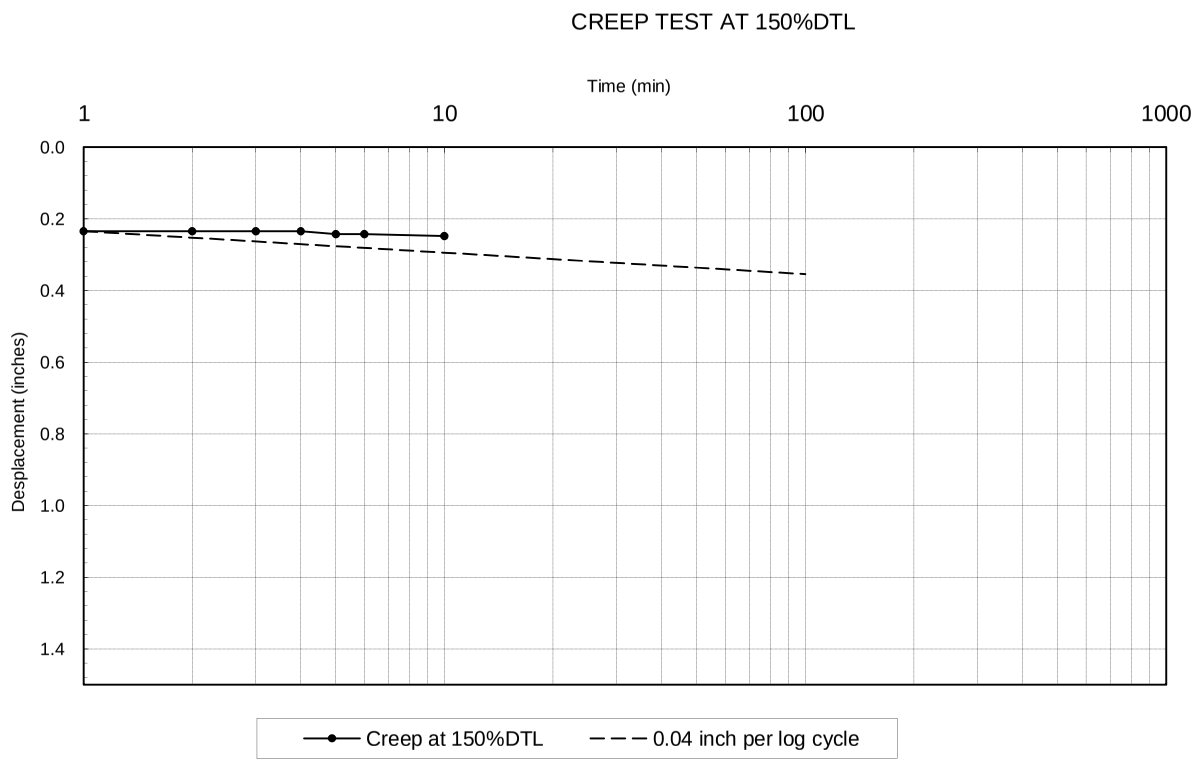
Design Test Load (P): 35 kips **# Dials:** 2 **Jack Calibration:** Pressure = 50.26746244 X reading (kip) + 16.60102364 (psi)

Sequence of Loading	Estimated Load [kip]	Dial Load [psi]	Applied Pressure [psi]	Applied Load [kip]	Time [min]	Time of Test	Dial 1 Deformation [in.]	Dial 2 Deformation [in.]	Dial 3 Deformation [in.]	Dial 4 Deformation [in.]	Average Deformation [in.]	Comments:
100%	35.0	1776.0	1780.0	35.1	1	3:44 PM	0.397	0.416			0.407	
75%	26.3	1336.1	1340.0	26.3	0	3:44 PM	0.360	0.380			0.370	
50%	17.5	896.3	900.0	17.6	0	3:44 PM	0.320	0.341			0.331	
25%	8.8	456.4	460.0	8.8	1	3:45 PM	0.269	0.299			0.284	
AL	1.8	104.6	110.0	1.9	0	3:45 PM	0.199	0.240			0.220	
25%	8.8	456.4	460.0	8.8	1	3:46 PM	0.248	0.271			0.260	
50%	17.5	896.3	900.0	17.6	0	3:46 PM	0.306	0.322			0.314	
100%	35.0	1776.0	1780.0	35.1	0	3:46 PM	0.385	0.402			0.394	
150%	52.5	2655.6	2660.0	52.6	1	3:47 PM	0.464	0.478			0.471	
200%	70.0	3535.3	3540.0	70.1	0	3:47 PM	0.568	0.585			0.577	
219%	76.7	3873.1	3880.0	76.9	1	3:48 PM	0.655	0.675			0.665	
	76.7	3873.1	3880.0	76.9	2	3:49 PM	0.652	0.673			0.663	
	76.7	3873.1	3880.0	76.9	3	3:50 PM	0.652	0.673			0.663	
	76.7	3873.1	3880.0	76.9	4	3:51 PM	0.672	0.694			0.683	
	76.7	3873.1	3880.0	76.9	5	3:52 PM	0.672	0.694			0.683	
	76.7	3873.1	3880.0	76.9	6	3:53 PM	0.678	0.700			0.689	
	76.7	3873.1	3880.0	76.9	10	3:57 PM	0.689	0.712			0.701	
250%	87.5	4415.0	4420.0	87.6	1	4:00 PM	0.956	0.980			0.968	
	87.5	4415.0	4420.0	87.6	2	4:01 PM	0.974	1.001			0.988	
	87.5	4415.0	4420.0	87.6	3	4:02 PM	0.994	1.020			1.007	
	87.5	4415.0	4420.0	87.6	4	4:03 PM	0.994	1.020			1.007	
	87.5	4415.0	4420.0	87.6	5	4:04 PM	0.995	1.022			1.009	
	87.5	4415.0	4420.0	87.6	6	4:05 PM	1.013	1.040			1.027	
	87.5	4415.0	4420.0	87.6	10	4:09 PM	1.049	1.075			1.062	
266%	93.1	4696.5	4700.0	93.2	1	4:10 PM	1.475	1.396			1.436	
225%	78.8	3975.2	3980.0	78.8	1	4:11 PM	1.470	1.396			1.433	
200%	70.0	3535.3	3540.0	70.1	1	4:12 PM	1.358	1.384			1.371	
175%	61.3	3095.5	3100.0	61.3	1	4:13 PM	1.318	1.344			1.331	
150%	52.5	2655.6	2660.0	52.6	0	4:13 PM	1.265	1.293			1.279	
125%	43.8	2215.8	2220.0	43.8	0	4:13 PM	1.226	1.255			1.241	
100%	35.0	1776.0	1780.0	35.1	1	4:14 PM	1.190	1.220			1.205	
75%	26.3	1336.1	1340.0	26.3	0	4:14 PM	1.138	1.169			1.154	
50%	17.5	896.3	900.0	17.6	0	4:14 PM	1.100	1.133			1.117	
25%	8.8	456.4	460.0	8.8	1	4:15 PM	1.044	1.085			1.065	
AL	1.8	104.6	110.0	1.9	0	4:15 PM	0.990	1.030			1.010	

VERIFICATION SOIL NAIL LOAD TEST
Hollow Core Bar Research - Montrose, Colorado



Type of Test: Verification	Bond: 6 ft Unbonded: 16.7 ft	Diameter: 7.75 in (nominal)	Test Nail: A3	**SCHNABEL ENGINEERING, LLC**	
				Verification Soil Nail Load Test	
Design Test Load (P) : 35 kip	Comments: Nail pulled out at approximately 113.1 kip.			Hollow Core Bar Soil Nail Research	
				Montrose, CO	
Maximum Test Load: 323% P = 113.1 kip				11/6/2008	07150064



Type of Test: Verification	Bond: 6 ft Unbonded: 16.7 ft	Diameter: 7.75 in (nominal)	Test Nail: A3	**SCHNABEL ENGINEERING, LLC** Verification Soil Nail Load Test
Design Test Load (P) : 35 kip	Comments: Nail pulled out at approximately 113.1 kip.			Hollow Core Bar Soil Nail Research Montrose, CO
Maximum Test Load: 323% P = 113.1 kip				11/6/2008 — 07150064

Soil Nail Verification Load Test Data

Schnabel Engineering

Project: Hollow Core Bar Soil Nail Research
Location: Montrose, CO
Client: ADSC

Performed: Mountain Highwall Concrete (Norm Parsons)
Observed: Schnabel Engineering (Andy Baxter)
Data by: Schnabel Engineering (Andy Baxter)

Soil Nail: A3
Date: 11/6/2008

Design Test Load (P): 35 kips
 # Dials: 2
Jack Calibration: Pressure = 50.26746244 X reading (kip) + 16.60102364 (psi)

Sequence of Loading	Estimated Load [kip]	Dial Load [psi]	Applied Pressure [psi]	Applied Load [kip]	Time [min]	Time of Test	Dial 1 Deformation [in.]	Dial 2 Deformation [in.]	Dial 3 Deformation [in.]	Dial 4 Deformation [in.]	Average Deformation [in.]	Comments:
AL	1.8	104.6	150.0	2.7	1	8:30 AM	0.000	0.100			0.000	
25%	8.8	456.4	460.0	8.8	1	8:31 AM	0.015	0.118			0.017	
	8.8	456.4	460.0	8.8	2	8:32 AM	0.015	0.118			0.017	
	8.8	456.4	460.0	8.8	3	8:33 AM	0.015	0.118			0.017	
	8.8	456.4	460.0	8.8	4	8:34 AM	0.015	0.118			0.017	
	8.8	456.4	460.0	8.8	5	8:35 AM	0.015	0.118			0.017	
	8.8	456.4	460.0	8.8	6	8:36 AM	0.015	0.118			0.017	
	8.8	456.4	460.0	8.8	10	8:40 AM	0.015	0.118			0.017	
50%	17.5	896.3	900.0	17.6	1	8:41 AM	0.061	0.160			0.061	
	17.5	896.3	900.0	17.6	2	8:42 AM	0.058	0.156			0.057	
	17.5	896.3	900.0	17.6	3	8:43 AM	0.058	0.156			0.057	
	17.5	896.3	900.0	17.6	4	8:44 AM	0.058	0.156			0.057	
	17.5	896.3	900.0	17.6	5	8:45 AM	0.058	0.156			0.057	
	17.5	896.3	900.0	17.6	6	8:46 AM	0.058	0.156			0.057	
	17.5	896.3	900.0	17.6	10	8:50 AM	0.062	0.162			0.062	
75%	26.3	1336.1	1340.0	26.3	1	8:51 AM	0.101	0.191			0.096	
	26.3	1336.1	1340.0	26.3	2	8:52 AM	0.096	0.185			0.091	
	26.3	1336.1	1340.0	26.3	3	8:53 AM	0.103	0.192			0.098	
	26.3	1336.1	1340.0	26.3	4	8:54 AM	0.103	0.190			0.097	
	26.3	1336.1	1340.0	26.3	5	8:55 AM	0.100	0.190			0.095	
	26.3	1336.1	1340.0	26.3	6	8:56 AM	0.100	0.190			0.095	
	26.3	1336.1	1340.0	26.3	10	9:00 AM	0.104	0.193			0.099	
100%	35.0	1776.0	1780.0	35.1	1	9:01 AM	0.152	0.230			0.141	
	35.0	1776.0	1780.0	35.1	2	9:02 AM	0.156	0.232			0.144	
	35.0	1776.0	1780.0	35.1	3	9:03 AM	0.154	0.230			0.142	
	35.0	1776.0	1780.0	35.1	4	9:04 AM	0.154	0.230			0.142	
	35.0	1776.0	1780.0	35.1	5	9:05 AM	0.156	0.232			0.144	
	35.0	1776.0	1780.0	35.1	6	9:06 AM	0.156	0.232			0.144	
	35.0	1776.0	1780.0	35.1	10	9:10 AM	0.156	0.232			0.144	
125%	43.8	2215.8	2220.0	43.8	1	9:12 AM	0.206	0.272			0.189	
	43.8	2215.8	2220.0	43.8	2	9:13 AM	0.205	0.271			0.188	
	43.8	2215.8	2220.0	43.8	3	9:14 AM	0.204	0.270			0.187	
	43.8	2215.8	2220.0	43.8	4	9:15 AM	0.204	0.270			0.187	
	43.8	2215.8	2220.0	43.8	5	9:16 AM	0.211	0.276			0.194	
	43.8	2215.8	2220.0	43.8	6	9:17 AM	0.210	0.276			0.193	
	43.8	2215.8	2220.0	43.8	10	9:21 AM	0.210	0.274			0.192	
150%	52.5	2655.6	2660.0	52.6	1	9:22 AM	0.257	0.312			0.235	
	52.5	2655.6	2660.0	52.6	2	9:23 AM	0.257	0.312			0.235	
	52.5	2655.6	2660.0	52.6	3	9:24 AM	0.257	0.312			0.235	
	52.5	2655.6	2660.0	52.6	4	9:25 AM	0.257	0.312			0.235	
	52.5	2655.6	2660.0	52.6	5	9:26 AM	0.266	0.320			0.243	
	52.5	2655.6	2660.0	52.6	6	9:27 AM	0.266	0.320			0.243	
	52.5	2655.6	2660.0	52.6	10	9:31 AM	0.270	0.327			0.249	

Soil Nail Verification Load Test Data

Schnabel Engineering

Project: Hollow Core Bar Soil Nail Research
Location: Montrose, CO
Client: ADSC

Performed: Mountain Highwall Concrete (Norm Parsons)
Observed: Schnabel Engineering (Andy Baxter)
Data by: Schnabel Engineering (Andy Baxter)

Soil Nail: A3
Date: 11/6/2008

Design Test Load (P): 35 kips
 # Dials: 2
Jack Calibration: Pressure = 50.26746244 X reading (kip) + 16.60102364 (psi)

Sequence of Loading	Estimated Load [kip]	Dial Load [psi]	Applied Pressure [psi]	Applied Load [kip]	Time [min]	Time of Test	Dial 1 Deformation [in.]	Dial 2 Deformation [in.]	Dial 3 Deformation [in.]	Dial 4 Deformation [in.]	Average Deformation [in.]	Comments:
125%	43.8	2215.8	2220.0	43.8	1	9:34 AM	0.248	0.302			0.225	
100%	35.0	1776.0	1780.0	35.1	1	9:35 AM	0.221	0.275			0.198	
75%	26.3	1336.1	1340.0	26.3	1	9:35 AM	0.178	0.230			0.154	
50%	17.5	896.3	900.0	17.6	1	9:35 AM	0.145	0.200			0.123	
25%	8.8	456.4	460.0	8.8	1	9:36 AM	0.096	0.151			0.074	
AL	1.8	104.6	110.0	1.9	1	9:36 AM	0.055	0.151			0.053	
25%	8.8	456.4	460.0	8.8	1	9:36 AM	0.061	0.140			0.051	
50%	17.5	896.3	900.0	17.6	1	9:37 AM	0.118	0.173			0.096	
75%	26.3	1336.1	1340.0	26.3	1	9:37 AM	0.165	0.217			0.141	
100%	35.0	1776.0	1780.0	35.1	1	9:38 AM	0.203	0.253			0.178	
125%	43.8	2215.8	2220.0	43.8	1	9:38 AM	0.238	0.289			0.214	
150%	52.5	2655.6	2660.0	52.6	1	9:39 AM	0.279	0.324			0.252	
175%	61.3	3095.5	3100.0	61.3	1	9:40 AM	0.343	0.380			0.312	
	61.3	3095.5	3100.0	61.3	2	9:41 AM	0.348	0.385			0.317	
	61.3	3095.5	3100.0	61.3	3	9:42 AM	0.343	0.381			0.312	
	61.3	3095.5	3100.0	61.3	4	9:43 AM	0.348	0.385			0.317	
	61.3	3095.5	3100.0	61.3	5	9:44 AM	0.348	0.385			0.317	
	61.3	3095.5	3100.0	61.3	6	9:45 AM	0.348	0.385			0.317	
	61.3	3095.5	3100.0	61.3	10	9:49 AM	0.357	0.394			0.326	
200%	70.0	3535.3	3540.0	70.1	1	9:50 AM	0.414	0.442			0.378	
	70.0	3535.3	3540.0	70.1	2	9:51 AM	0.424	0.452			0.388	
	70.0	3535.3	3540.0	70.1	3	9:52 AM	0.418	0.447			0.383	
	70.0	3535.3	3540.0	70.1	4	9:53 AM	0.417	0.445			0.381	
	70.0	3535.3	3540.0	70.1	5	9:54 AM	0.430	0.454			0.392	
	70.0	3535.3	3540.0	70.1	6	9:55 AM	0.430	0.454			0.392	
	70.0	3535.3	3540.0	70.1	10	9:59 AM	0.434	0.460			0.397	
175%	61.3	3095.5	3100.0	61.3	1	10:00 AM	0.408	0.435			0.372	
150%	52.5	2655.6	2660.0	52.6	1	10:00 AM	0.372	0.398			0.335	
125%	43.8	2215.8	2220.0	43.8	1	10:01 AM	0.335	0.361			0.298	
100%	35.0	1776.0	1780.0	35.1	1	10:01 AM	0.304	0.332			0.268	
75%	26.3	1336.1	1340.0	26.3	1	10:02 AM	0.255	0.283			0.219	
50%	17.5	896.3	900.0	17.6	1	10:02 AM	0.224	0.253			0.189	
25%	8.8	456.4	460.0	8.8	1	10:02 AM	0.170	0.206			0.138	
AL	1.8	104.6	110.0	1.9	1	10:02 AM	0.112	0.187			0.100	
25%	8.8	456.4	460.0	8.8	1	10:03 AM	0.123	0.183			0.103	
50%	17.5	896.3	900.0	17.6	1	10:03 AM	0.183	0.218			0.151	
100%	35.0	1776.0	1780.0	35.1	1	10:04 AM	0.274	0.299			0.237	
150%	52.5	2655.6	2660.0	52.6	1	10:04 AM	0.357	0.380			0.319	
200%	70.0	3535.3	3540.0	70.1	1	10:05 AM	0.442	0.467			0.405	

Soil Nail Verification Load Test Data

Schnabel Engineering

Project: Hollow Core Bar Soil Nail Research
Location: Montrose, CO
Client: ADSC

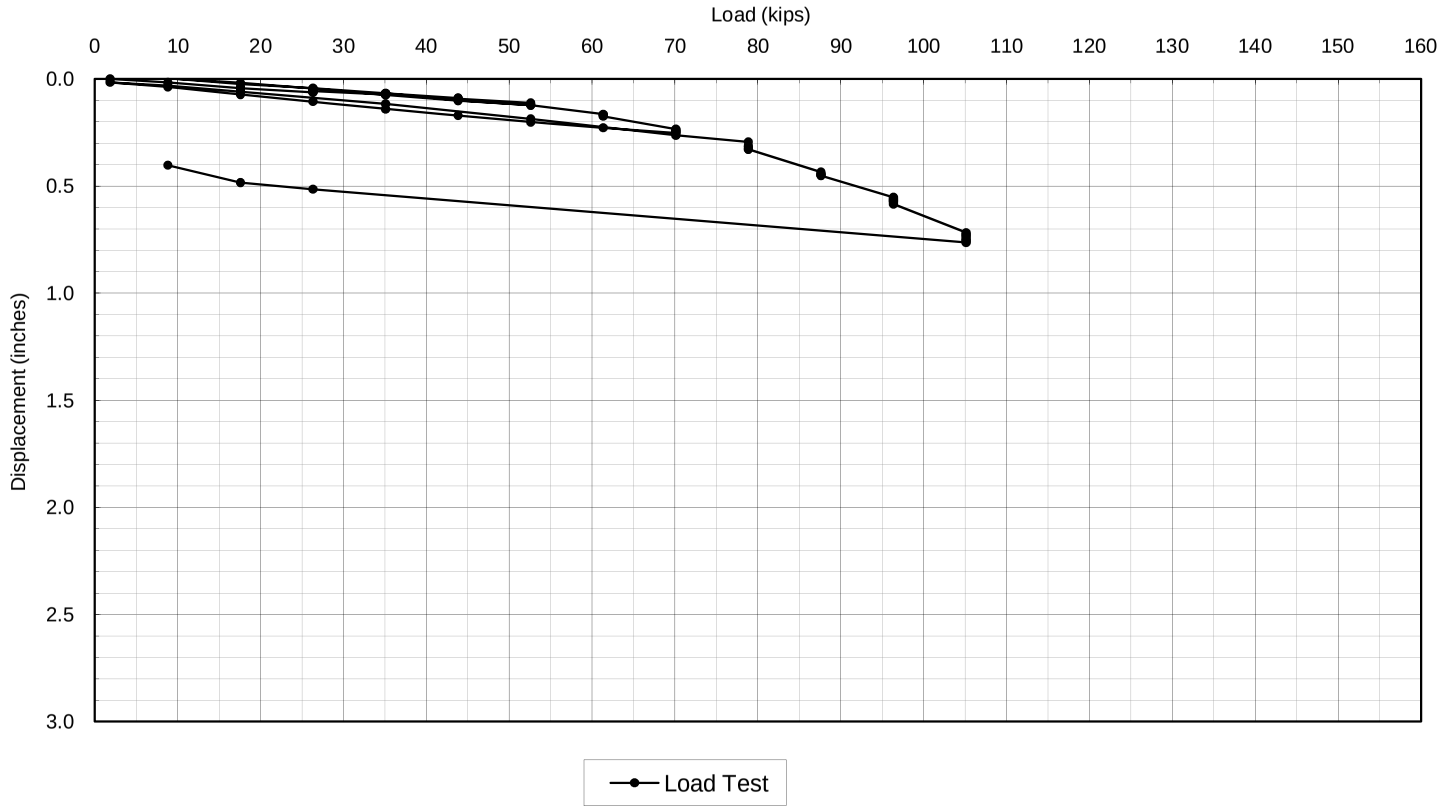
Performed: Mountain Highwall Concrete (Norm Parsons)
Observed: Schnabel Engineering (Andy Baxter)
Data by: Schnabel Engineering (Andy Baxter)

Soil Nail: A3
Date: 11/6/2008

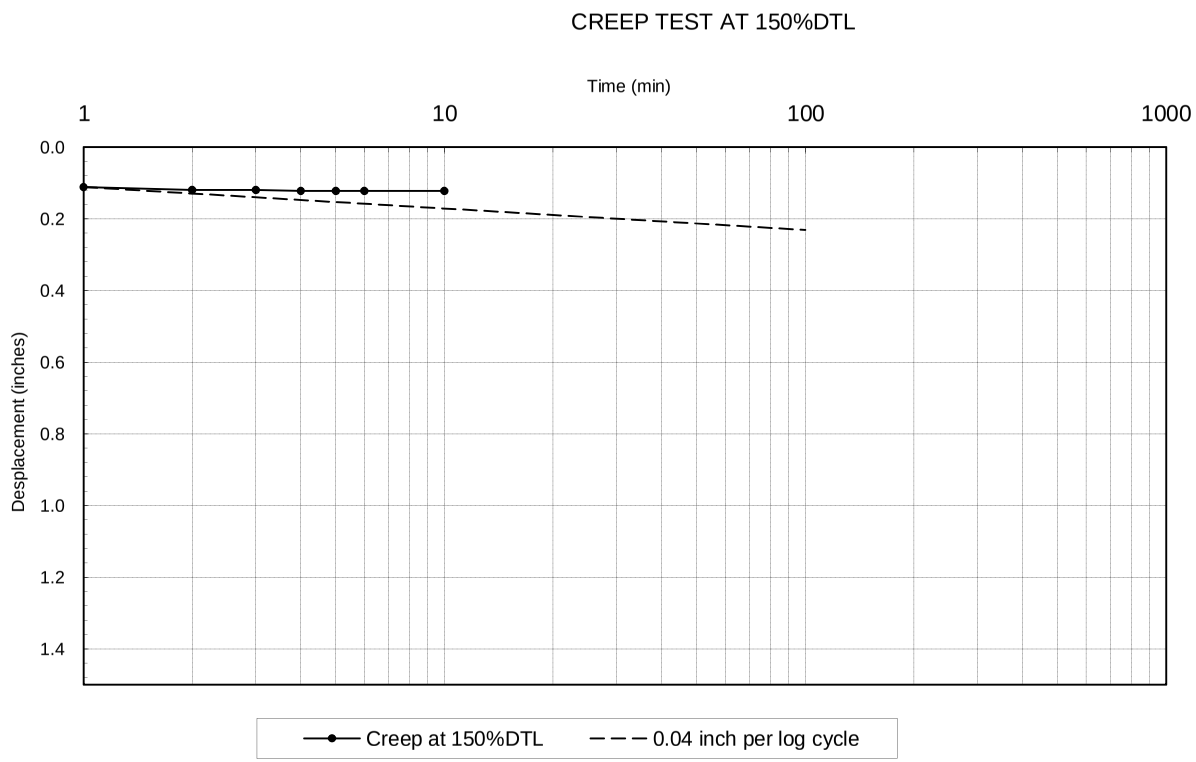
Design Test Load (P): 35 kips
 # Dials: 2
Jack Calibration: Pressure = 50.26746244 X reading (kip) + 16.60102364 (psi)

Sequence of Loading	Estimated Load [kip]	Dial Load [psi]	Applied Pressure [psi]	Applied Load [kip]	Time [min]	Time of Test	Dial 1 Deformation [in.]	Dial 2 Deformation [in.]	Dial 3 Deformation [in.]	Dial 4 Deformation [in.]	Average Deformation [in.]	Comments:
225%	78.8	3975.2	3980.0	78.8	1	10:06 AM	0.511	0.530			0.471	
	78.8	3975.2	3980.0	78.8	2	10:07 AM	0.518	0.535			0.477	
	78.8	3975.2	3980.0	78.8	3	10:08 AM	0.525	0.545			0.485	
	78.8	3975.2	3980.0	78.8	4	10:09 AM	0.520	0.540			0.480	
	78.8	3975.2	3980.0	78.8	5	10:10 AM	0.520	0.540			0.480	
	78.8	3975.2	3980.0	78.8	6	10:11 AM	0.529	0.550			0.490	
	78.8	3975.2	3980.0	78.8	10	10:15 AM	0.536	0.553			0.495	
250%	87.5	4415.0	4420.0	87.6	1	10:07 AM	0.628	0.625			0.577	
	87.5	4415.0	4420.0	87.6	2	10:08 AM	0.633	0.635			0.584	
	87.5	4415.0	4420.0	87.6	3	10:09 AM	0.640	0.642			0.591	
	87.5	4415.0	4420.0	87.6	4	10:10 AM	0.640	0.642			0.591	
	87.5	4415.0	4420.0	87.6	5	10:11 AM	0.640	0.642			0.591	
	87.5	4415.0	4420.0	87.6	6	10:12 AM	0.638	0.638			0.588	
	87.5	4415.0	4420.0	87.6	10	10:16 AM	0.648	0.648			0.598	
275%	96.3	4854.8	4860.0	96.4	1	10:27 AM	0.729	0.728			0.679	
	96.3	4854.8	4860.0	96.4	2	10:28 AM	0.726	0.822			0.724	
	96.3	4854.8	4860.0	96.4	3	10:29 AM	0.745	0.738			0.692	
	96.3	4854.8	4860.0	96.4	4	10:30 AM	0.742	0.735			0.689	
	96.3	4854.8	4860.0	96.4	5	10:31 AM	0.755	0.746			0.701	
	96.3	4854.8	4860.0	96.4	6	10:32 AM	0.755	0.746			0.701	
	96.3	4854.8	4860.0	96.4	10	10:36 AM	0.776	0.763			0.720	
300%	105.0	5294.7	5300.0	105.1	1	10:41 AM	0.945	0.932			0.889	
	105.0	5294.7	5300.0	105.1	2	10:42 AM	0.960	0.943			0.902	
	105.0	5294.7	5300.0	105.1	3	10:43 AM	0.971	0.953			0.912	
	105.0	5294.7	5300.0	105.1	4	10:44 AM	0.991	0.973			0.932	
	105.0	5294.7	5300.0	105.1	5	10:45 AM	1.001	0.982			0.942	
	105.0	5294.7	5300.0	105.1	6	10:46 AM	1.008	0.990			0.949	
	105.0	5294.7	5300.0	105.1	10	10:50 AM	1.020	1.000			0.960	
323%	112.9	5690.5	5700.0	113.1	1	10:55 AM	1.371	1.348			1.310	
275%	96.3	4854.8	4860.0	96.4	1		1.377	1.352			1.315	
250%	87.5	4415.0	4420.0	87.6	1		1.362	1.337			1.300	
225%	78.8	3975.2	3980.0	78.8	1		1.334	1.311			1.273	
200%	70.0	3535.3	3540.0	70.1	1		1.294	1.270			1.232	
175%	61.3	3095.5	3100.0	61.3	1		1.250	1.230			1.190	
150%	52.5	2655.6	2660.0	52.6	1		1.214	1.192			1.153	
125%	43.8	2215.8	2220.0	43.8	1		1.176	1.152			1.114	
100%	35.0	1776.0	1780.0	35.1	1		1.134	1.112			1.073	
75%	26.3	1336.1	1340.0	26.3	1		1.086	1.064			1.025	
50%	17.5	896.3	900.0	17.6	1		1.105	1.025			1.015	
25%	8.8	456.4	460.0	8.8	1		0.984	0.975			0.930	
AL	1.8	104.6	110.0	1.9	1		0.930	0.950			0.890	

VERIFICATION SOIL NAIL LOAD TEST
Hollow Core Bar Research - Montrose, Colorado



Type of Test: Verification	Bond: 6 ft Unbonded: 12.6 ft	Diameter: 5.1 in (130 mm) (nominal)	Test Nail: B1	**SCHNABEL ENGINEERING, LLC** Verification Soil Nail Load Test
Design Test Load (P) : 35 kip	Comments: Nail did not pulled out.			Hollow Core Bar Soil Nail Research Montrose, CO
Maximum Test Load: 300% P = 105 kip				11/5/2008 — 07150064



Type of Test: Verification	Bond: 6 ft Unbonded: 12.6 ft	Diameter: 5.1 in (130 mm) (nominal)	Test Nail: B1	**SCHNABEL ENGINEERING, LLC** Verification Soil Nail Load Test
Design Test Load (P) : 35 kip	Comments: Nail did not pulled out.			Hollow Core Bar Soil Nail Research Montrose, CO
Maximum Test Load: 300% P = 105 kip				11/5/2008 — 07150064

Soil Nail Verification Load Test Data

Schnabel Engineering

Project: Hollow Core Bar Soil Nail Research
Location: Montrose, CO
Client: ADSC

Performed: Mountain Highwall Concrete (Norm Parsons)
Observed: Schnabel Engineering (Andy Baxter)
Data by: Schnabel Engineering (Andy Baxter)

Soil Nail: B1
Date: 11/5/2008

Design Test Load (P): 35 kips
 # Dials: 2
Jack Calibration: Pressure = 50.26746244 X reading (kip) + 16.60102364 (psi)

Sequence of Loading	Estimated Load [kip]	Dial Load [psi]	Applied Pressure [psi]	Applied Load [kip]	Time [min]	Time of Test	Dial 1 Deformation [in.]	Dial 2 Deformation [in.]	Dial 3 Deformation [in.]	Dial 4 Deformation [in.]	Average Deformation [in.]	Comments:
AL	1.8	104.6	110.0	1.9	1	2:42 PM	0.000	0.000			0.000	
25%	8.8	456.4	460.0	8.8	1	2:43 PM	0.018	0.015			0.017	
	8.8	456.4	460.0	8.8	2	2:44 PM	0.018	0.015			0.017	
	8.8	456.4	460.0	8.8	3	2:45 PM	0.018	0.015			0.017	
	8.8	456.4	460.0	8.8	4	2:46 PM	0.018	0.015			0.017	
	8.8	456.4	460.0	8.8	5	2:47 PM	0.018	0.015			0.017	
	8.8	456.4	460.0	8.8	6	2:48 PM	0.018	0.015			0.017	
	8.8	456.4	460.0	8.8	10	2:52 PM	0.018	0.015			0.017	
50%	17.5	896.3	900.0	17.6	1	2:53 PM	0.044	0.042			0.043	
	17.5	896.3	900.0	17.6	2	2:54 PM	0.047	0.044			0.046	
	17.5	896.3	900.0	17.6	3	2:55 PM	0.043	0.041			0.042	
	17.5	896.3	900.0	17.6	4	2:56 PM	0.043	0.041			0.042	
	17.5	896.3	900.0	17.6	5	2:57 PM	0.043	0.041			0.042	
	17.5	896.3	900.0	17.6	6	2:58 PM	0.043	0.041			0.042	
	17.5	896.3	900.0	17.6	10	3:02 PM	0.043	0.043			0.043	
75%	26.3	1336.1	1340.0	26.3	1	3:05 PM	0.068	0.058			0.063	
	26.3	1336.1	1340.0	26.3	2	3:06 PM	0.065	0.056			0.061	
	26.3	1336.1	1340.0	26.3	3	3:07 PM	0.065	0.056			0.061	
	26.3	1336.1	1340.0	26.3	4	3:08 PM	0.056	0.048			0.052	
	26.3	1336.1	1340.0	26.3	5	3:09 PM	0.063	0.053			0.058	
	26.3	1336.1	1340.0	26.3	6	3:10 PM	0.063	0.053			0.058	
	26.3	1336.1	1340.0	26.3	10	3:14 PM	0.060	0.053			0.057	
100%	35.0	1776.0	1780.0	35.1	1	3:13 PM	0.084	0.062			0.073	
	35.0	1776.0	1780.0	35.1	2	3:14 PM	0.080	0.058			0.069	
	35.0	1776.0	1780.0	35.1	3	3:15 PM	0.078	0.056			0.067	
	35.0	1776.0	1780.0	35.1	4	3:16 PM	0.077	0.057			0.067	
	35.0	1776.0	1780.0	35.1	5	3:17 PM	0.082	0.061			0.072	
	35.0	1776.0	1780.0	35.1	6	3:18 PM	0.078	0.058			0.068	
	35.0	1776.0	1780.0	35.1	10	3:22 PM	0.078	0.058			0.068	
125%	43.8	2215.8	2220.0	43.8	1	3:23 PM	0.108	0.072			0.090	
	43.8	2215.8	2220.0	43.8	2	3:24 PM	0.110	0.075			0.093	
	43.8	2215.8	2220.0	43.8	3	3:25 PM	0.108	0.072			0.090	
	43.8	2215.8	2220.0	43.8	4	3:26 PM	0.108	0.072			0.090	
	43.8	2215.8	2220.0	43.8	5	3:27 PM	0.108	0.072			0.090	
	43.8	2215.8	2220.0	43.8	6	3:28 PM	0.112	0.075			0.094	
	43.8	2215.8	2220.0	43.8	10	3:32 PM	0.112	0.075			0.094	
150%	52.5	2655.6	2660.0	52.6	1	3:33 PM	0.135	0.088			0.112	
	52.5	2655.6	2660.0	52.6	2	3:34 PM	0.144	0.095			0.120	
	52.5	2655.6	2660.0	52.6	3	3:35 PM	0.144	0.095			0.120	
	52.5	2655.6	2660.0	52.6	4	3:36 PM	0.147	0.098			0.123	
	52.5	2655.6	2660.0	52.6	5	3:37 PM	0.147	0.098			0.123	
	52.5	2655.6	2660.0	52.6	6	3:38 PM	0.147	0.098			0.123	
	52.5	2655.6	2660.0	52.6	10	3:42 PM	0.147	0.098			0.123	

Soil Nail Verification Load Test Data

Schnabel Engineering

Project: Hollow Core Bar Soil Nail Research
Location: Montrose, CO
Client: ADSC

Performed: Mountain Highwall Concrete (Norm Parsons)
Observed: Schnabel Engineering (Andy Baxter)
Data by: Schnabel Engineering (Andy Baxter)

Soil Nail: B1
Date: 11/5/2008

Design Test Load (P): 35 kips **# Dials:** 2 **Jack Calibration:** Pressure = 50.26746244 X reading (kip) + 16.60102364 (psi)

Sequence of Loading	Estimated Load [kip]	Dial Load [psi]	Applied Pressure [psi]	Applied Load [kip]	Time [min]	Time of Test	Dial 1 Deformation [in.]	Dial 2 Deformation [in.]	Dial 3 Deformation [in.]	Dial 4 Deformation [in.]	Average Deformation [in.]	Comments:
125%	43.8	2215.8	2220.0	43.8	1	3:43 PM	0.127	0.077			0.102	
100%	35.0	1776.0	1780.0	35.1	1	3:43 PM	0.098	0.051			0.075	
75%	26.3	1336.1	1340.0	26.3	1	3:44 PM	0.068	0.023			0.046	
50%	17.5	896.3	900.0	17.6	1	3:45 PM	0.041	-0.004			0.019	
25%	8.8	456.4	460.0	8.8	1	3:45 PM	0.008	-0.014			-0.003	
AL	1.8	104.6	110.0	1.9	1	3:46 PM	-0.010	-0.014			-0.012	
25%	8.8	456.4	460.0	8.8	1	3:46 PM	0.009	-0.014			-0.003	
50%	17.5	896.3	900.0	17.6	1	3:46 PM	0.044	0.003			0.024	
75%	26.3	1336.1	1340.0	26.3	1	3:47 PM	0.065	0.022			0.044	
100%	35.0	1776.0	1780.0	35.1	1	3:47 PM	0.091	0.045			0.068	
125%	43.8	2215.8	2220.0	43.8	1	3:48 PM	0.125	0.074			0.100	
150%	52.5	2655.6	2660.0	52.6	1	3:48 PM	0.150	0.096			0.123	
175%	61.3	3095.5	3100.0	61.3	1	3:49 PM	0.200	0.130			0.165	
	61.3	3095.5	3100.0	61.3	2	3:50 PM	0.202	0.133			0.168	
	61.3	3095.5	3100.0	61.3	3	3:51 PM	0.202	0.133			0.168	
	61.3	3095.5	3100.0	61.3	4	3:52 PM	0.202	0.133			0.168	
	61.3	3095.5	3100.0	61.3	5	3:53 PM	0.202	0.133			0.168	
	61.3	3095.5	3100.0	61.3	6	3:54 PM	0.210	0.139			0.175	
	61.3	3095.5	3100.0	61.3	10	3:58 PM	0.210	0.139			0.175	
200%	70.0	3535.3	3540.0	70.1	1	4:00 PM	0.278	0.192			0.235	
	70.0	3535.3	3540.0	70.1	2	4:01 PM	0.288	0.202			0.245	
	70.0	3535.3	3540.0	70.1	3	4:02 PM	0.282	0.195			0.239	
	70.0	3535.3	3540.0	70.1	4	4:03 PM	0.294	0.205			0.250	
	70.0	3535.3	3540.0	70.1	5	4:04 PM	0.294	0.205			0.250	
	70.0	3535.3	3540.0	70.1	6	4:05 PM	0.294	0.205			0.250	
	70.0	3535.3	3540.0	70.1	10	4:09 PM	0.296	0.208			0.252	
175%	61.3	3095.5	3100.0	61.3	1	4:11 PM	0.272	0.184			0.228	
150%	52.5	2655.6	2660.0	52.6	1	4:12 PM	0.246	0.159			0.203	
125%	43.8	2215.8	2220.0	43.8	1	4:13 PM	0.213	0.128			0.171	
100%	35.0	1776.0	1780.0	35.1	1	4:13 PM	0.182	0.100			0.141	
75%	26.3	1336.1	1340.0	26.3	1	4:13 PM	0.146	0.065			0.106	
50%	17.5	896.3	900.0	17.6	1	4:14 PM	0.112	0.034			0.073	
25%	8.8	456.4	460.0	8.8	1	4:14 PM	0.076	0.000			0.038	
AL	1.8	104.6	110.0	1.9	1	4:14 PM	0.043	-0.011			0.016	
25%	8.8	456.4	460.0	8.8	1	4:15 PM	0.064	-0.002			0.031	
50%	17.5	896.3	900.0	17.6	1	4:15 PM	0.096	0.024			0.060	
100%	35.0	1776.0	1780.0	35.1	1	4:15 PM	0.156	0.078			0.117	
150%	52.5	2655.6	2660.0	52.6	1	4:16 PM	0.230	0.143			0.187	
200%	70.0	3535.3	3540.0	70.1	1	4:17 PM	0.312	0.215			0.264	

Soil Nail Verification Load Test Data

Schnabel Engineering

Project: Hollow Core Bar Soil Nail Research
Location: Montrose, CO
Client: ADSC

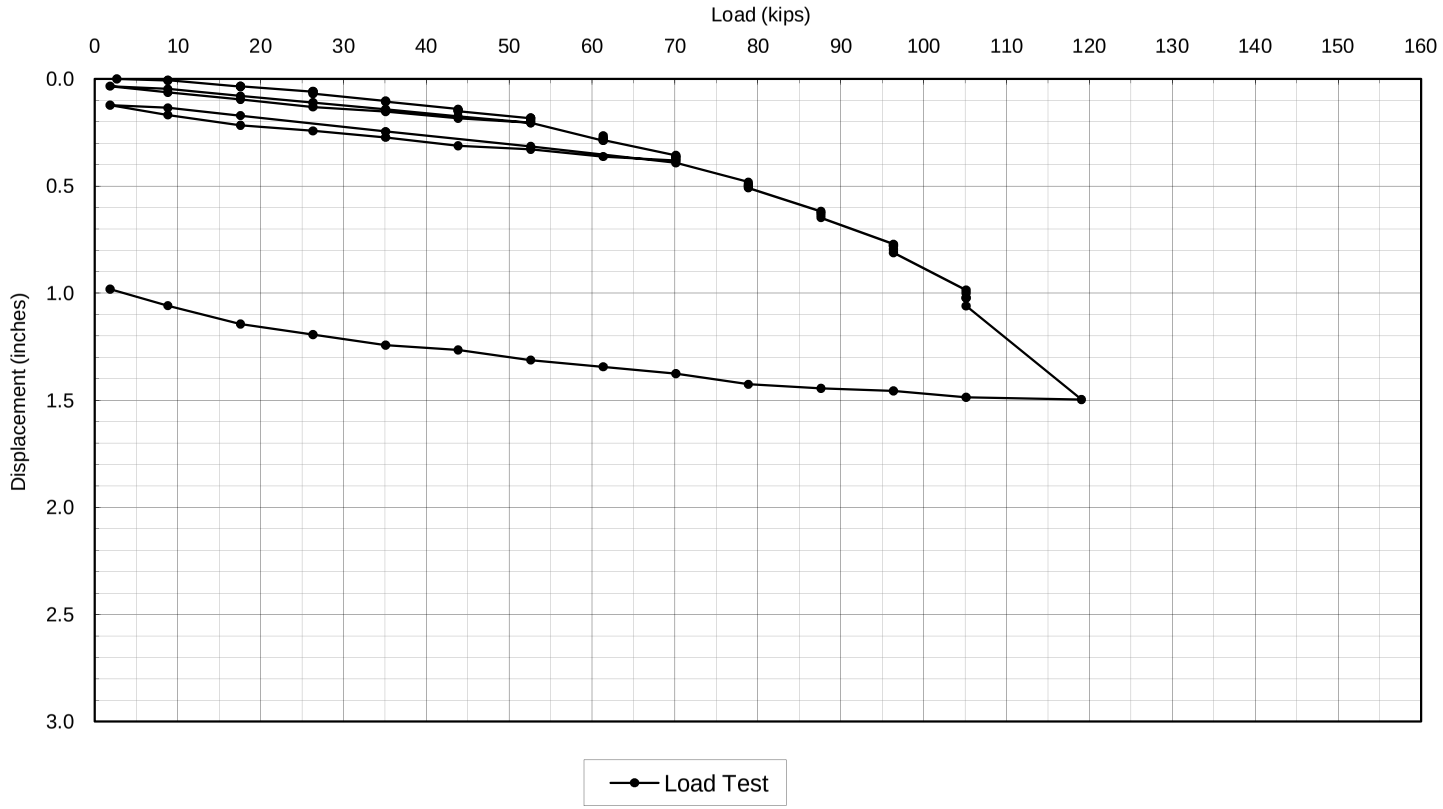
Performed: Mountain Highwall Concrete (Norm Parsons)
Observed: Schnabel Engineering (Andy Baxter)
Data by: Schnabel Engineering (Andy Baxter)

Soil Nail: B1
Date: 11/5/2008

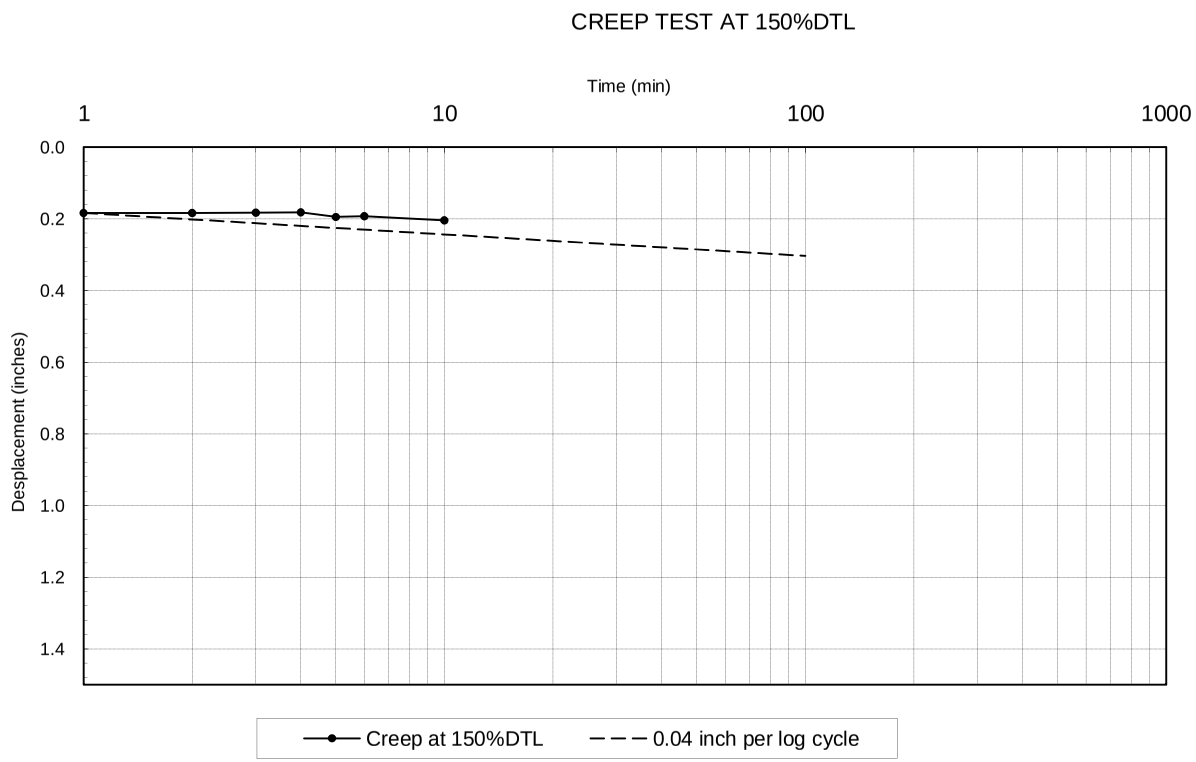
Design Test Load (P): 35 kips
 # Dials: 2
Jack Calibration: Pressure = 50.26746244 X reading (kip) + 16.60102364 (psi)

Sequence of Loading	Estimated Load [kip]	Dial Load [psi]	Applied Pressure [psi]	Applied Load [kip]	Time [min]	Time of Test	Dial 1 Deformation [in.]	Dial 2 Deformation [in.]	Dial 3 Deformation [in.]	Dial 4 Deformation [in.]	Average Deformation [in.]	Comments:
225%	78.8	3975.2	3980.0	78.8	1	4:18 PM	0.345	0.243			0.294	
	78.8	3975.2	3980.0	78.8	2	4:19 PM	0.364	0.261			0.313	
	78.8	3975.2	3980.0	78.8	3	4:20 PM	0.370	0.265			0.318	
	78.8	3975.2	3980.0	78.8	4	4:21 PM	0.380	0.275			0.328	
	78.8	3975.2	3980.0	78.8	5	4:22 PM	0.380	0.275			0.328	
	78.8	3975.2	3980.0	78.8	6	4:23 PM	0.380	0.275			0.328	
	78.8	3975.2	3980.0	78.8	10	4:27 PM	0.382	0.276			0.329	
250%	87.5	4415.0	4420.0	87.6	1	4:29 PM	0.495	0.375			0.435	
	87.5	4415.0	4420.0	87.6	2	4:30 PM	0.497	0.373			0.435	
	87.5	4415.0	4420.0	87.6	3	4:31 PM	0.508	0.382			0.445	
	87.5	4415.0	4420.0	87.6	4	4:32 PM	0.505	0.378			0.442	
	87.5	4415.0	4420.0	87.6	5	4:33 PM	0.513	0.387			0.450	
	87.5	4415.0	4420.0	87.6	6	4:34 PM	0.510	0.385			0.448	
	87.5	4415.0	4420.0	87.6	10	4:38 PM	0.515	0.387			0.451	
275%	96.3	4854.8	4860.0	96.4	1	4:41 PM	0.625	0.480			0.553	
	96.3	4854.8	4860.0	96.4	2	4:42 PM	0.631	0.487			0.559	
	96.3	4854.8	4860.0	96.4	3	4:43 PM	0.638	0.492			0.565	
	96.3	4854.8	4860.0	96.4	4	4:44 PM	0.648	0.499			0.574	
	96.3	4854.8	4860.0	96.4	5	4:45 PM	0.648	0.500			0.574	
	96.3	4854.8	4860.0	96.4	6	4:46 PM	0.643	0.495			0.569	
	96.3	4854.8	4860.0	96.4	10	4:50 PM	0.659	0.510			0.585	
300%	105.0	5294.7	5300.0	105.1	1	4:51 PM	0.805	0.630			0.718	
	105.0	5294.7	5300.0	105.1	2	4:52 PM	0.815	0.639			0.727	
	105.0	5294.7	5300.0	105.1	3	4:53 PM	0.821	0.644			0.733	
	105.0	5294.7	5300.0	105.1	4	4:54 PM	0.834	0.654			0.744	
	105.0	5294.7	5300.0	105.1	5	4:55 PM	0.841	0.663			0.752	
	105.0	5294.7	5300.0	105.1	6	4:56 PM	0.848	0.668			0.758	
	105.0	5294.7	5300.0	105.1	10	5:00 PM	0.848	0.680			0.764	
75%	26.3	1336.1	1340.0	26.3	1	5:03 PM	0.600	0.430			0.515	
50%	17.5	896.3	900.0	17.6	1	5:04 PM	0.582	0.386			0.484	
25%	8.8	456.4	460.0	8.8	1	5:04 PM	0.480	0.326			0.403	

VERIFICATION SOIL NAIL LOAD TEST
Hollow Core Bar Research - Montrose, Colorado



Type of Test: Verification	Bond: 6 ft Unbonded: 11.8 ft	Diameter: 5.1 in (130 mm) (nominal)	Test Nail: B2	**SCHNABEL ENGINEERING, LLC**	
				Verification Soil Nail Load Test	
Design Test Load (P) : 35 kip	Comments: Nail pulled out at approximately 119 kip.			Hollow Core Bar Soil Nail Research	
				Montrose, CO	
Maximum Test Load: 340% P = 119 kip				11/7/2008	07150064



Type of Test: Verification	Bond: 6 ft Unbonded: 11.8 ft	Diameter: 5.1 in (130 mm) (nominal)	Test Nail: B2	**SCHNABEL ENGINEERING, LLC** Verification Soil Nail Load Test
Design Test Load (P) : 35 kip	Comments: Nail pulled out at approximately 119 kip.			Hollow Core Bar Soil Nail Research Montrose, CO
Maximum Test Load: 340% P = 119 kip				11/7/2008 — 07150064

Soil Nail Verification Load Test Data

Schnabel Engineering

Project: Hollow Core Bar Soil Nail Research
Location: Montrose, CO
Client: ADSC

Performed: Mountain Highwall Concrete (Norm Parsons)
Observed: Schnabel Engineering (Andy Baxter)
Data by: Schnabel Engineering (Andy Baxter)

Soil Nail: B2
Date: 11/7/2008

Design Test Load (P): 35 kips **# Dials:** 2 **Jack Calibration:** Pressure = 50.26746244 X reading (kip) + 16.6010236 (psi)

Sequence of Loading	Estimated Load [kip]	Dial Load [psi]	Applied Pressure [psi]	Applied Load [kip]	Time [min]	Time of Test	Dial 1 Deformation [in.]	Dial 2 Deformation [in.]	Dial 3 Deformation [in.]	Dial 4 Deformation [in.]	Average Deformation [in.]	Comments:
AL	1.8	104.6	150.0	2.7	1	11:30 AM	0.000	0.000			0.000	
25%	8.8	456.4	460.0	8.8	1	11:31 AM	0.010	0.005			0.008	
	8.8	456.4	460.0	8.8	2	11:32 AM	0.010	0.005			0.008	
	8.8	456.4	460.0	8.8	3	11:33 AM	0.008	0.003			0.006	
	8.8	456.4	460.0	8.8	4	11:34 AM	0.008	0.003			0.006	
	8.8	456.4	460.0	8.8	5	11:35 AM	0.008	0.003			0.006	
	8.8	456.4	460.0	8.8	6	11:36 AM	0.008	0.003			0.006	
	8.8	456.4	460.0	8.8	10	11:40 AM	0.008	0.003			0.006	
50%	17.5	896.3	900.0	17.6	1	11:41 AM	0.042	0.030			0.036	
	17.5	896.3	900.0	17.6	2	11:42 AM	0.040	0.028			0.034	
	17.5	896.3	900.0	17.6	3	11:43 AM	0.039	0.028			0.034	
	17.5	896.3	900.0	17.6	4	11:44 AM	0.043	0.031			0.037	
	17.5	896.3	900.0	17.6	5	11:45 AM	0.040	0.029			0.035	
	17.5	896.3	900.0	17.6	6	11:46 AM	0.040	0.029			0.035	
	17.5	896.3	900.0	17.6	10	11:50 AM	0.040	0.029			0.035	
75%	26.3	1336.1	1340.0	26.3	1	11:51 AM	0.068	0.052			0.060	
	26.3	1336.1	1340.0	26.3	2	11:52 AM	0.065	0.050			0.058	
	26.3	1336.1	1340.0	26.3	3	11:53 AM	0.070	0.050			0.060	
	26.3	1336.1	1340.0	26.3	4	11:54 AM	0.070	0.050			0.060	
	26.3	1336.1	1340.0	26.3	5	11:55 AM	0.070	0.050			0.060	
	26.3	1336.1	1340.0	26.3	6	11:56 AM	0.070	0.050			0.060	
	26.3	1336.1	1340.0	26.3	10	12:00 PM	0.077	0.060			0.069	
100%	35.0	1776.0	1780.0	35.1	1	12:01 PM	0.112	0.094			0.103	
	35.0	1776.0	1780.0	35.1	2	12:02 PM	0.115	0.097			0.106	
	35.0	1776.0	1780.0	35.1	3	12:03 PM	0.115	0.097			0.106	
	35.0	1776.0	1780.0	35.1	4	12:04 PM	0.115	0.097			0.106	
	35.0	1776.0	1780.0	35.1	5	12:05 PM	0.115	0.097			0.106	
	35.0	1776.0	1780.0	35.1	6	12:06 PM	0.115	0.097			0.106	
	35.0	1776.0	1780.0	35.1	10	12:10 PM	0.115	0.098			0.107	
125%	43.8	2215.8	2220.0	43.8	1	12:11 PM	0.153	0.129			0.141	
	43.8	2215.8	2220.0	43.8	2	12:12 PM	0.156	0.134			0.145	
	43.8	2215.8	2220.0	43.8	3	12:13 PM	0.156	0.134			0.145	
	43.8	2215.8	2220.0	43.8	4	12:14 PM	0.160	0.136			0.148	
	43.8	2215.8	2220.0	43.8	5	12:15 PM	0.160	0.136			0.148	
	43.8	2215.8	2220.0	43.8	6	12:16 PM	0.158	0.135			0.147	
	43.8	2215.8	2220.0	43.8	10	12:20 PM	0.163	0.140			0.152	

Soil Nail Verification Load Test Data

Schnabel Engineering

Project: Hollow Core Bar Soil Nail Research
Location: Montrose, CO
Client: ADSC

Performed: Mountain Highwall Concrete (Norm Parsons)
Observed: Schnabel Engineering (Andy Baxter)
Data by: Schnabel Engineering (Andy Baxter)

Soil Nail: B2
Date: 11/7/2008

Design Test Load (P): 35 kips **# Dials:** 2 **Jack Calibration:** Pressure = 50.26746244 X reading (kip) + 16.6010236 (psi)

Sequence of Loading	Estimated Load [kip]	Dial Load [psi]	Applied Pressure [psi]	Applied Load [kip]	Time [min]	Time of Test	Dial 1 Deformation [in.]	Dial 2 Deformation [in.]	Dial 3 Deformation [in.]	Dial 4 Deformation [in.]	Average Deformation [in.]	Comments:
150%	52.5	2655.6	2660.0	52.6	1	12:21 PM	0.196	0.172			0.184	
	52.5	2655.6	2660.0	52.6	2	12:22 PM	0.196	0.172			0.184	
	52.5	2655.6	2660.0	52.6	3	12:23 PM	0.195	0.171			0.183	
	52.5	2655.6	2660.0	52.6	4	12:24 PM	0.194	0.170			0.182	
	52.5	2655.6	2660.0	52.6	5	12:25 PM	0.208	0.182			0.195	
	52.5	2655.6	2660.0	52.6	6	12:26 PM	0.205	0.181			0.193	
	52.5	2655.6	2660.0	52.6	10	12:30 PM	0.217	0.192			0.205	
125%	43.8	2215.8	2220.0	43.8	1	12:31 PM	0.197	0.172			0.185	
100%	35.0	1776.0	1780.0	35.1	0	12:31 PM	0.165	0.140			0.153	
75%	26.3	1336.1	1340.0	26.3	1	12:32 PM	0.143	0.119			0.131	
50%	17.5	896.3	900.0	17.6	0	12:32 PM	0.108	0.084			0.096	
25%	8.8	456.4	460.0	8.8	0	12:32 PM	0.074	0.053			0.064	
AL	1.8	104.6	110.0	1.9	1	12:33 PM	0.039	0.029			0.034	
25%	8.8	456.4	460.0	8.8	0	12:33 PM	0.055	0.039			0.047	
50%	17.5	896.3	900.0	17.6	1	12:34 PM	0.090	0.070			0.080	
75%	26.3	1336.1	1340.0	26.3	0	12:34 PM	0.122	0.100			0.111	
100%	35.0	1776.0	1780.0	35.1	0	12:34 PM	0.154	0.130			0.142	
125%	43.8	2215.8	2220.0	43.8	1	12:35 PM	0.188	0.163			0.176	
150%	52.5	2655.6	2660.0	52.6	0	12:35 PM	0.218	0.192			0.205	
175%	61.3	3095.5	3100.0	61.3	1	12:36 PM	0.282	0.294			0.288	
	61.3	3095.5	3100.0	61.3	2	12:37 PM	0.280	0.250			0.265	
	61.3	3095.5	3100.0	61.3	3	12:38 PM	0.292	0.262			0.277	
	61.3	3095.5	3100.0	61.3	4	12:39 PM	0.292	0.262			0.277	
	61.3	3095.5	3100.0	61.3	5	12:40 PM	0.292	0.262			0.277	
	61.3	3095.5	3100.0	61.3	6	12:41 PM	0.294	0.265			0.280	
	61.3	3095.5	3100.0	61.3	10	12:45 PM	0.300	0.272			0.286	
200%	70.0	3535.3	3540.0	70.1	1	12:47 PM	0.373	0.341			0.357	
	70.0	3535.3	3540.0	70.1	2	12:48 PM	0.381	0.350			0.366	
	70.0	3535.3	3540.0	70.1	3	12:49 PM	0.379	0.348			0.364	
	70.0	3535.3	3540.0	70.1	4	12:50 PM	0.391	0.360			0.376	
	70.0	3535.3	3540.0	70.1	5	12:51 PM	0.391	0.360			0.376	
	70.0	3535.3	3540.0	70.1	6	12:52 PM	0.391	0.360			0.376	
	70.0	3535.3	3540.0	70.1	10	12:56 PM	0.397	0.365			0.381	
175%	61.3	3095.5	3100.0	61.3	1	12:57 PM	0.378	0.347			0.363	
150%	52.5	2655.6	2660.0	52.6	0	12:57 PM	0.345	0.313			0.329	
125%	43.8	2215.8	2220.0	43.8	1	12:58 PM	0.327	0.297			0.312	
100%	35.0	1776.0	1780.0	35.1	0	12:58 PM	0.288	0.258			0.273	
75%	26.3	1336.1	1340.0	26.3	1	12:59 PM	0.257	0.228			0.243	

Soil Nail Verification Load Test Data

Schnabel Engineering

Project: Hollow Core Bar Soil Nail Research
Location: Montrose, CO
Client: ADSC

Performed: Mountain Highwall Concrete (Norm Parsons)
Observed: Schnabel Engineering (Andy Baxter)
Data by: Schnabel Engineering (Andy Baxter)

Soil Nail: B2
Date: 11/7/2008

Design Test Load (P): 35 kips **# Dials:** 2 **Jack Calibration:** Pressure = 50.26746244 X reading (kip) + 16.6010236 (psi)

Sequence of Loading	Estimated Load [kip]	Dial Load [psi]	Applied Pressure [psi]	Applied Load [kip]	Time [min]	Time of Test	Dial 1 Deformation [in.]	Dial 2 Deformation [in.]	Dial 3 Deformation [in.]	Dial 4 Deformation [in.]	Average Deformation [in.]	Comments:
50%	17.5	896.3	900.0	17.6	0	12:59 PM	0.230	0.203			0.217	
25%	8.8	456.4	460.0	8.8	1	1:00 PM	0.180	0.157			0.169	
AL	1.8	104.6	110.0	1.9	0	1:00 PM	0.130	0.116			0.123	
25%	8.8	456.4	460.0	8.8	0	1:00 PM	0.144	0.126			0.135	
50%	17.5	896.3	900.0	17.6	0	1:00 PM	0.183	0.160			0.172	
100%	35.0	1776.0	1780.0	35.1	1	1:01 PM	0.260	0.231			0.246	
150%	52.5	2655.6	2660.0	52.6	0	1:01 PM	0.330	0.300			0.315	
200%	70.0	3535.3	3540.0	70.1	1	1:02 PM	0.408	0.376			0.392	
225%	78.8	3975.2	3980.0	78.8	1	1:03 PM	0.498	0.465			0.482	
	78.8	3975.2	3980.0	78.8	2	1:04 PM	0.510	0.478			0.494	
	78.8	3975.2	3980.0	78.8	3	1:05 PM	0.508	0.475			0.492	
	78.8	3975.2	3980.0	78.8	4	1:06 PM	0.518	0.484			0.501	
	78.8	3975.2	3980.0	78.8	5	1:07 PM	0.515	0.482			0.499	
	78.8	3975.2	3980.0	78.8	6	1:08 PM	0.522	0.488			0.505	
	78.8	3975.2	3980.0	78.8	10	1:12 PM	0.526	0.492			0.509	
250%	87.5	4415.0	4420.0	87.6	1	1:13 PM	0.636	0.601			0.619	
	87.5	4415.0	4420.0	87.6	2	1:14 PM	0.642	0.608			0.625	
	87.5	4415.0	4420.0	87.6	3	1:15 PM	0.652	0.620			0.636	
	87.5	4415.0	4420.0	87.6	4	1:16 PM	0.652	0.620			0.636	
	87.5	4415.0	4420.0	87.6	5	1:17 PM	0.652	0.620			0.636	
	87.5	4415.0	4420.0	87.6	6	1:18 PM	0.652	0.620			0.636	
	87.5	4415.0	4420.0	87.6	10	1:22 PM	0.664	0.632			0.648	
275%	96.3	4854.8	4860.0	96.4	1	1:24 PM	0.788	0.755			0.772	
	96.3	4854.8	4860.0	96.4	2	1:25 PM	0.788	0.765			0.777	
	96.3	4854.8	4860.0	96.4	3	1:26 PM	0.796	0.764			0.780	
	96.3	4854.8	4860.0	96.4	4	1:27 PM	0.796	0.764			0.780	
	96.3	4854.8	4860.0	96.4	5	1:28 PM	0.812	0.779			0.796	
	96.3	4854.8	4860.0	96.4	6	1:29 PM	0.812	0.779			0.796	
	96.3	4854.8	4860.0	96.4	10	1:33 PM	0.828	0.795			0.812	
300%	105.0	5294.7	5300.0	105.1	1	1:34 PM	1.002	0.969			0.986	
	105.0	5294.7	5300.0	105.1	2	1:35 PM	1.015	0.983			0.999	
	105.0	5294.7	5300.0	105.1	3	1:36 PM	1.015	0.983			0.999	
	105.0	5294.7	5300.0	105.1	4	1:37 PM	1.039	1.005			1.022	
	105.0	5294.7	5300.0	105.1	5	1:38 PM	1.038	1.006			1.022	
	105.0	5294.7	5300.0	105.1	6	1:39 PM	1.039	1.006			1.023	
	105.0	5294.7	5300.0	105.1	10	1:43 PM	1.076	1.043			1.060	
340%	118.9	5991.4	6000.0	119.0	1	1:45 PM	1.514	1.479			1.497	
300%	105.0	5294.7	5300.0	105.1	1	1:45 PM	1.504	1.469			1.487	
275%	96.3	4854.8	4860.0	96.4	1	1:46 PM	1.474	1.439			1.457	
250%	87.5	4415.0	4420.0	87.6	0	1:46 PM	1.462	1.427			1.445	
225%	78.8	3975.2	3980.0	78.8	0	1:46 PM	1.443	1.408			1.426	
200%	70.0	3535.3	3540.0	70.1	1	1:47 PM	1.394	1.357			1.376	
175%	61.3	3095.5	3100.0	61.3	0	1:47 PM	1.362	1.326			1.344	

Soil Nail Verification Load Test Data

Schnabel Engineering

Project: Hollow Core Bar Soil Nail Research
Location: Montrose, CO
Client: ADSC

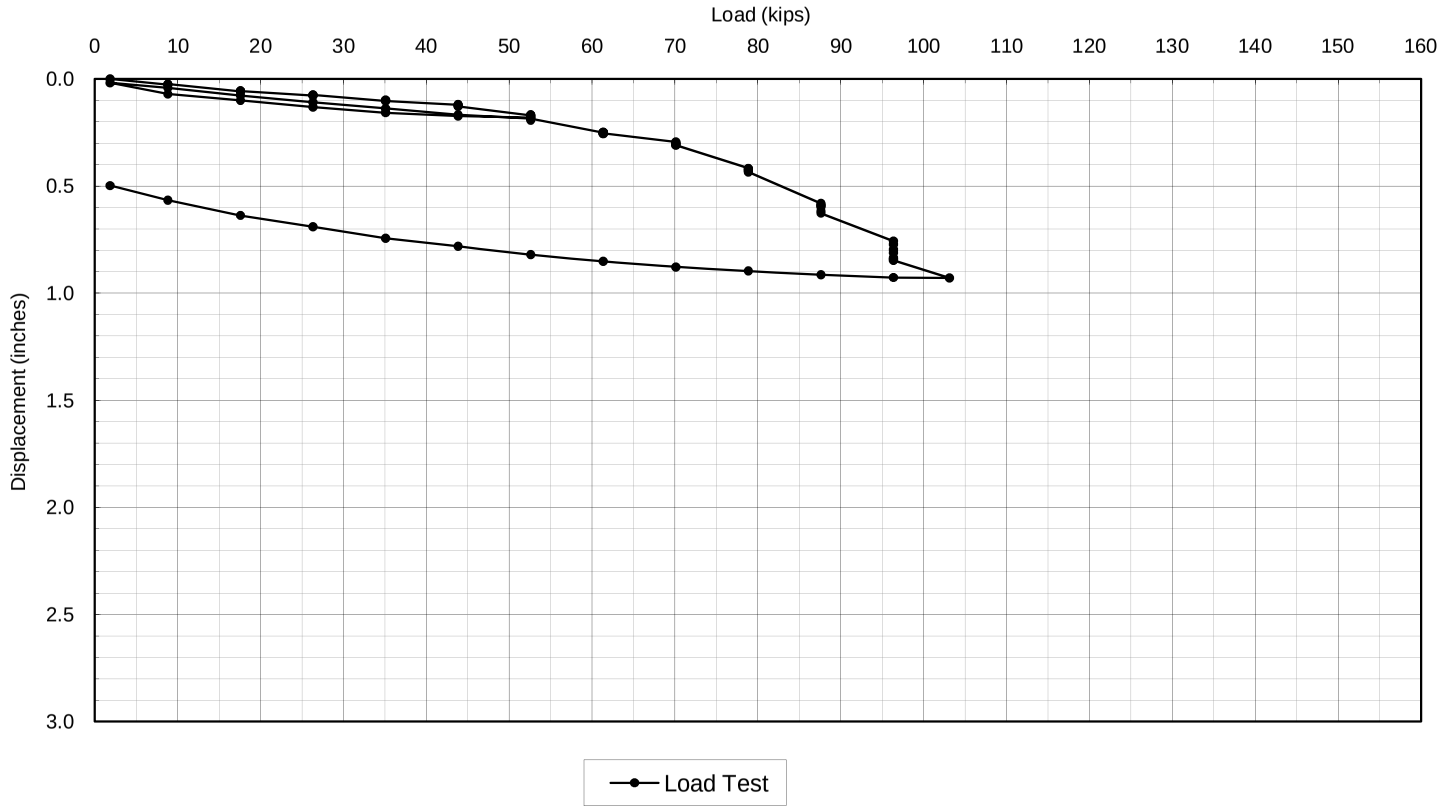
Performed: Mountain Highwall Concrete (Norm Parsons)
Observed: Schnabel Engineering (Andy Baxter)
Data by: Schnabel Engineering (Andy Baxter)

Soil Nail: B2
Date: 11/7/2008

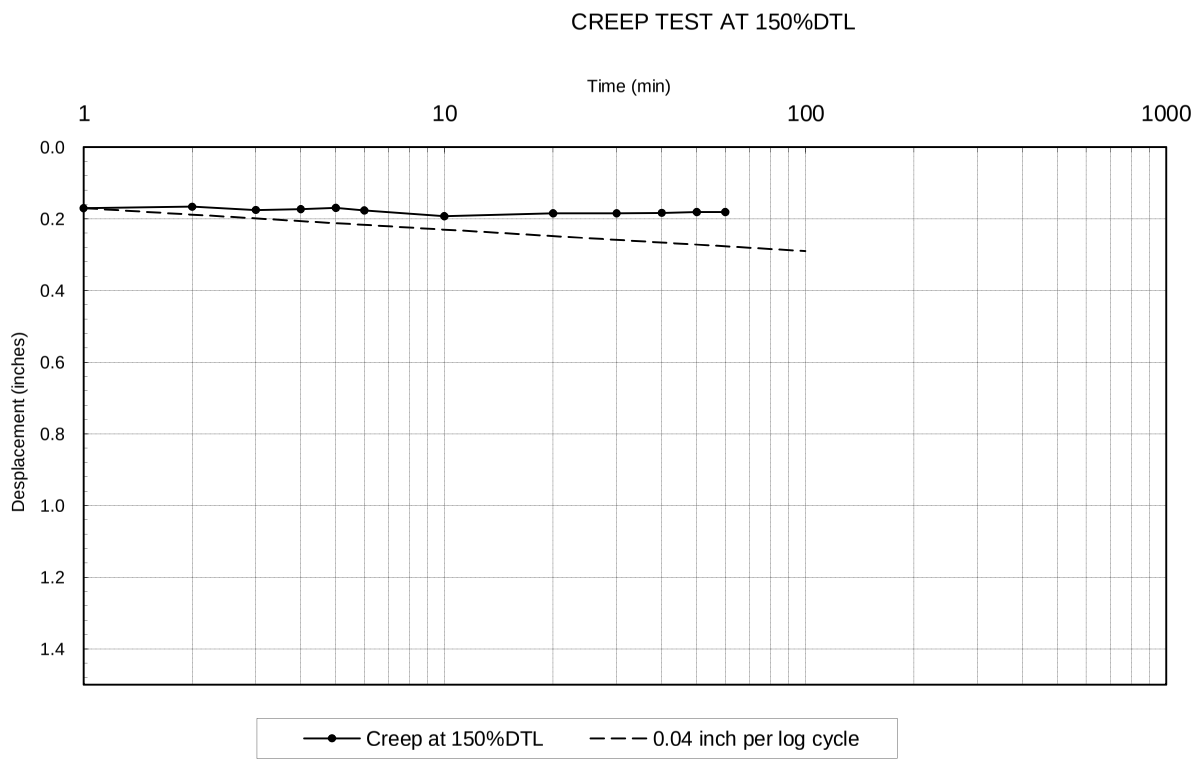
Design Test Load (P): 35 kips
 # Dials: 2
Jack Calibration: Pressure = 50.26746244 X reading (kip) + 16.6010236 (psi)

Sequence of Loading	Estimated Load [kip]	Dial Load [psi]	Applied Pressure [psi]	Applied Load [kip]	Time [min]	Time of Test	Dial 1 Deformation [in.]	Dial 2 Deformation [in.]	Dial 3 Deformation [in.]	Dial 4 Deformation [in.]	Average Deformation [in.]	Comments:
150%	52.5	2655.6	2660.0	52.6	1	1:48 PM	1.330	1.295			1.313	
125%	43.8	2215.8	2220.0	43.8	1	1:49 PM	1.283	1.248			1.266	
100%	35.0	1776.0	1780.0	35.1	0	1:49 PM	1.260	1.225			1.243	
75%	26.3	1336.1	1340.0	26.3	1	1:50 PM	1.210	1.177			1.194	
50%	17.5	896.3	900.0	17.6	1	1:51 PM	1.160	1.128			1.144	
25%	8.8	456.4	460.0	8.8	0	1:51 PM	1.072	1.045			1.059	
AL	1.8	104.6	110.0	1.9	1	1:52 PM	1.040	0.923			0.982	

VERIFICATION SOIL NAIL LOAD TEST
Hollow Core Bar Research - Montrose, Colorado



Type of Test: Verification	Bond: 6 ft Unbonded: 12 ft	Diameter: 5.1 in (130 mm) (nominal)	Test Nail: B3	**SCHNABEL ENGINEERING, LLC**	
				Verification Soil Nail Load Test	
Design Test Load (P) : 35 kip	Comments: Nail pulled out at approximately 103.1 kip.			Hollow Core Bar Soil Nail Research	
				Montrose, CO	
Maximum Test Load: 300% P = 105 kip				11/5/2008	07150064



Type of Test: Verification	Bond: 6 ft Unbonded: 12 ft	Diameter: 5.1 in (130 mm) (nominal)	Test Nail: B3	**SCHNABEL ENGINEERING, LLC** Verification Soil Nail Load Test
Design Test Load (P) : 35 kip	Comments: Nail pulled out at approximately 103.1 kip.			Hollow Core Bar Soil Nail Research Montrose, CO
Maximum Test Load: 300% P = 105 kip				11/5/2008 | 07150064

Soil Nail Verification Load Test Data

Schnabel Engineering

Project: Hollow Core Bar Soil Nail Research
Location: Montrose, CO
Client: ADSC

Performed: Mountain Highwall Concrete (Norm Parsons)
Observed: Schnabel Engineering (Andy Baxter)
Data by: Schnabel Engineering (Andy Baxter)

Soil Nail: B3
Date: 11/5/2008

Design Test Load (P): 35 kips **# Dials:** 2 **Jack Calibration:** Pressure = 50.26746244 X reading (kip) + 16.6010236 (psi)

Sequence of Loading	Estimated Load [kip]	Dial Load [psi]	Applied Pressure [psi]	Applied Load [kip]	Time [min]	Time of Test	Dial 1 Deformation [in.]	Dial 2 Deformation [in.]	Dial 3 Deformation [in.]	Dial 4 Deformation [in.]	Average Deformation [in.]	Comments:
AL	1.8	104.6	110.0	1.9	1	11:29 AM	0.000	0.000			0.000	
25%	8.8	456.4	460.0	8.8	1	11:30 AM	0.031	0.022			0.027	
	8.8	456.4	460.0	8.8	2	11:31 AM	0.030	0.021			0.026	
	8.8	456.4	460.0	8.8	3	11:32 AM	0.030	0.021			0.026	
	8.8	456.4	460.0	8.8	4	11:33 AM	0.029	0.020			0.025	
	8.8	456.4	460.0	8.8	5	11:34 AM	0.029	0.020			0.025	
	8.8	456.4	460.0	8.8	6	11:35 AM	0.029	0.020			0.025	
	8.8	456.4	460.0	8.8	10	11:29 AM	0.029	0.020			0.025	
50%	17.5	896.3	900.0	17.6	1	11:34 AM	0.067	0.050			0.059	
	17.5	896.3	900.0	17.6	2	11:35 AM	0.063	0.047			0.055	
	17.5	896.3	900.0	17.6	3	11:36 AM	0.067	0.050			0.059	
	17.5	896.3	900.0	17.6	4	11:37 AM	0.067	0.048			0.058	
	17.5	896.3	900.0	17.6	5							
	17.5	896.3	900.0	17.6	6							
	17.5	896.3	900.0	17.6	10							
75%	26.3	1336.1	1340.0	26.3	1	11:37 AM	0.088	0.068			0.078	
	26.3	1336.1	1340.0	26.3	2	11:38 AM	0.086	0.067			0.077	
	26.3	1336.1	1340.0	26.3	3	11:39 AM	0.086	0.067			0.077	
	26.3	1336.1	1340.0	26.3	4	11:40 AM	0.085	0.065			0.075	
	26.3	1336.1	1340.0	26.3	5							
	26.3	1336.1	1340.0	26.3	6							
	26.3	1336.1	1340.0	26.3	10							
100%	35.0	1776.0	1780.0	35.1	1	11:40 AM	0.114	0.091			0.103	
	35.0	1776.0	1780.0	35.1	2	11:41 AM	0.108	0.088			0.098	
	35.0	1776.0	1780.0	35.1	3	11:42 AM	0.108	0.088			0.098	
	35.0	1776.0	1780.0	35.1	4	11:43 AM	0.108	0.088			0.098	
	35.0	1776.0	1780.0	35.1	5	11:44 AM	0.114	0.091			0.103	
	35.0	1776.0	1780.0	35.1	6							
	35.0	1776.0	1780.0	35.1	10							
125%	43.8	2215.8	2220.0	43.8	1	11:44 AM	0.133	0.110			0.122	
	43.8	2215.8	2220.0	43.8	2	11:45 AM	0.131	0.109			0.120	
	43.8	2215.8	2220.0	43.8	3	11:46 AM	0.141	0.115			0.128	
	43.8	2215.8	2220.0	43.8	4	11:47 AM	0.135	0.110			0.123	
	43.8	2215.8	2220.0	43.8	5	11:48 AM	0.141	0.115			0.128	
	43.8	2215.8	2220.0	43.8	6							
	43.8	2215.8	2220.0	43.8	10							

Soil Nail Verification Load Test Data

Schnabel Engineering

Project: Hollow Core Bar Soil Nail Research
Location: Montrose, CO
Client: ADSC

Performed: Mountain Highwall Concrete (Norm Parsons)
Observed: Schnabel Engineering (Andy Baxter)
Data by: Schnabel Engineering (Andy Baxter)

Soil Nail: B3
Date: 11/5/2008

Design Test Load (P): 35 kips **# Dials:** 2 **Jack Calibration:** Pressure = 50.26746244 X reading (kip) + 16.6010236 (psi)

Sequence of Loading	Estimated Load [kip]	Dial Load [psi]	Applied Pressure [psi]	Applied Load [kip]	Time [min]	Time of Test	Dial 1 Deformation [in.]	Dial 2 Deformation [in.]	Dial 3 Deformation [in.]	Dial 4 Deformation [in.]	Average Deformation [in.]	Comments:
150%	52.5	2655.6	2660.0	52.6	1	11:49 AM	0.187	0.154			0.171	
	52.5	2655.6	2660.0	52.6	2	11:50 AM	0.183	0.150			0.167	
	52.5	2655.6	2660.0	52.6	3	11:51 AM	0.192	0.159			0.176	
	52.5	2655.6	2660.0	52.6	4	11:52 AM	0.190	0.157			0.174	
	52.5	2655.6	2660.0	52.6	5	11:53 AM	0.186	0.153			0.170	
	52.5	2655.6	2660.0	52.6	6	11:54 AM	0.193	0.160			0.177	
	52.5	2655.6	2660.0	52.6	10	11:58 AM	0.204	0.182			0.193	
	52.5	2655.6	2660.0	52.6	20	12:08 PM	0.195	0.175			0.185	
	52.5	2655.6	2660.0	52.6	30	12:18 PM	0.195	0.175			0.185	
	52.5	2655.6	2660.0	52.6	40	12:28 PM	0.194	0.173			0.184	
	52.5	2655.6	2660.0	52.6	50	12:38 PM	0.192	0.170			0.181	
	52.5	2655.6	2660.0	52.6	60	12:48 PM	0.192	0.170			0.181	
125%	43.8	2215.8	2220.0	43.8	1	12:50 PM	0.186	0.162			0.174	
100%	35.0	1776.0	1780.0	35.1	1	12:51 PM	0.170	0.146			0.158	
75%	26.3	1336.1	1340.0	26.3	1	12:52 PM	0.143	0.120			0.132	
50%	17.5	896.3	900.0	17.6	1	12:53 PM	0.116	0.084			0.100	
25%	8.8	456.4	460.0	8.8	1	12:54 PM	0.082	0.060			0.071	
AL	1.8	104.6	110.0	1.9	1	12:54 PM	0.025	0.012			0.019	
25%	8.8	456.4	460.0	8.8	1	12:55 PM	0.052	0.032			0.042	
50%	17.5	896.3	900.0	17.6	1	12:55 PM	0.090	0.066			0.078	
75%	26.3	1336.1	1340.0	26.3	1	12:55 PM	0.120	0.098			0.109	
100%	35.0	1776.0	1780.0	35.1	1	12:55 PM	0.150	0.126			0.138	
125%	43.8	2215.8	2220.0	43.8	1	12:56 PM	0.180	0.155			0.168	
150%	52.5	2655.6	2660.0	52.6	1	12:56 PM	0.198	0.172			0.185	
175%	61.3	3095.5	3100.0	61.3	1	12:57 PM	0.265	0.236			0.251	
	61.3	3095.5	3100.0	61.3	2	12:58 PM	0.263	0.236			0.250	
	61.3	3095.5	3100.0	61.3	3	12:59 PM	0.262	0.235			0.249	
	61.3	3095.5	3100.0	61.3	4	1:00 PM	0.264	0.237			0.251	
	61.3	3095.5	3100.0	61.3	5	1:01 PM	0.267	0.239			0.253	
	61.3	3095.5	3100.0	61.3	6	1:02 PM	0.270	0.242			0.256	
	61.3	3095.5	3100.0	61.3	10	1:06 PM	0.268	0.241			0.255	
200%	70.0	3535.3	3540.0	70.1	1	1:07 PM	0.308	0.281			0.295	
	70.0	3535.3	3540.0	70.1	2	1:08 PM	0.313	0.286			0.300	
	70.0	3535.3	3540.0	70.1	3	1:09 PM	0.318	0.290			0.304	
	70.0	3535.3	3540.0	70.1	4	1:10 PM	0.321	0.292			0.307	
	70.0	3535.3	3540.0	70.1	5	1:11 PM	0.321	0.292			0.307	
	70.0	3535.3	3540.0	70.1	6	1:12 PM	0.321	0.292			0.307	
	70.0	3535.3	3540.0	70.1	10	1:16 PM	0.325	0.295			0.310	

Soil Nail Verification Load Test Data

Schnabel Engineering

Project: Hollow Core Bar Soil Nail Research
Location: Montrose, CO
Client: ADSC

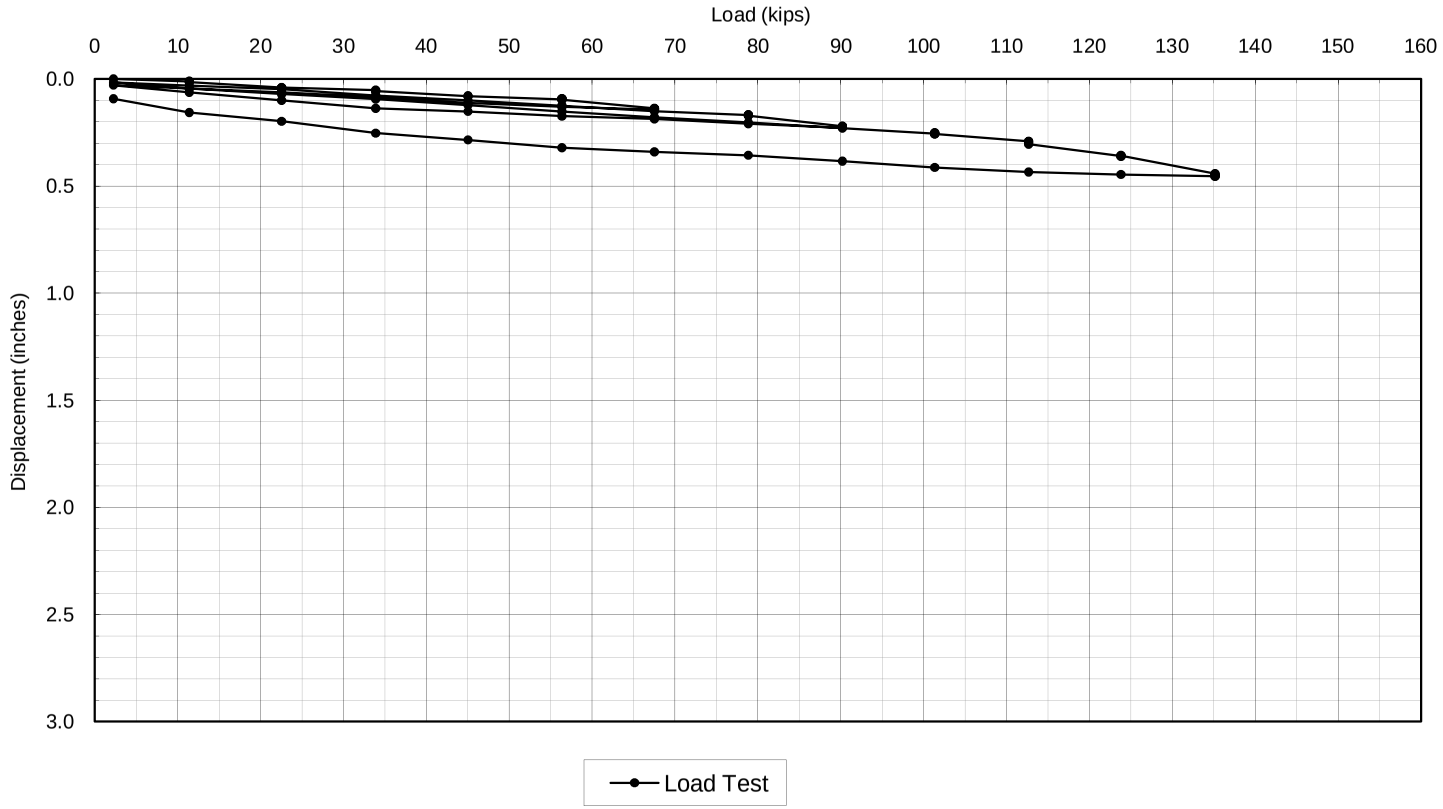
Performed: Mountain Highwall Concrete (Norm Parsons)
Observed: Schnabel Engineering (Andy Baxter)
Data by: Schnabel Engineering (Andy Baxter)

Soil Nail: B3
Date: 11/5/2008

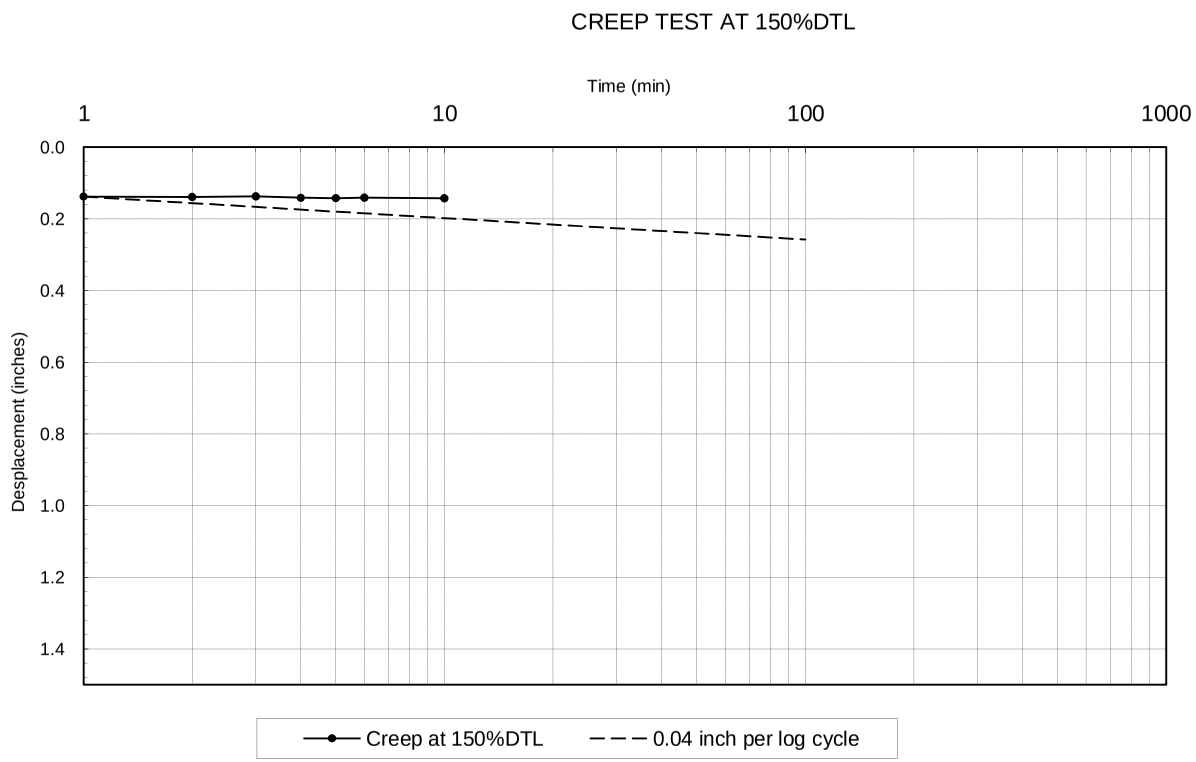
Design Test Load (P): 35 kips **# Dials:** 2 **Jack Calibration:** Pressure = 50.26746244 X reading (kip) + 16.6010236 (psi)

Sequence of Loading	Estimated Load [kip]	Dial Load [psi]	Applied Pressure [psi]	Applied Load [kip]	Time [min]	Time of Test	Dial 1 Deformation [in.]	Dial 2 Deformation [in.]	Dial 3 Deformation [in.]	Dial 4 Deformation [in.]	Average Deformation [in.]	Comments:
225%	78.8	3975.2	3980.0	78.8	1	1:16 PM	0.433	0.402			0.418	
	78.8	3975.2	3980.0	78.8	2	1:17 PM	0.433	0.405			0.419	
	78.8	3975.2	3980.0	78.8	3	1:18 PM	0.437	0.405			0.421	
	78.8	3975.2	3980.0	78.8	4	1:19 PM	0.440	0.410			0.425	
	78.8	3975.2	3980.0	78.8	5	1:20 PM	0.444	0.414			0.429	
	78.8	3975.2	3980.0	78.8	6	1:21 PM	0.445	0.416			0.431	
	78.8	3975.2	3980.0	78.8	10	1:25 PM	0.451	0.420			0.436	
250%	87.5	4415.0	4420.0	87.6	1	1:25 PM	0.596	0.566			0.581	
	87.5	4415.0	4420.0	87.6	2	1:26 PM	0.602	0.571			0.587	
	87.5	4415.0	4420.0	87.6	3	1:27 PM	0.607	0.575			0.591	
	87.5	4415.0	4420.0	87.6	4	1:28 PM	0.610	0.578			0.594	
	87.5	4415.0	4420.0	87.6	5	1:29 PM	0.614	0.581			0.598	
	87.5	4415.0	4420.0	87.6	6	1:30 PM	0.633	0.599			0.616	
	87.5	4415.0	4420.0	87.6	10	1:34 PM	0.633	0.621			0.627	
275%	96.3	4854.8	4860.0	96.4	1	1:34 PM	0.776	0.738			0.757	
	96.3	4854.8	4860.0	96.4	2	1:35 PM	0.790	0.755			0.773	
	96.3	4854.8	4860.0	96.4	3	1:36 PM	0.815	0.778			0.797	
	96.3	4854.8	4860.0	96.4	4	1:37 PM	0.831	0.792			0.812	
	96.3	4854.8	4860.0	96.4	5	1:38 PM	0.855	0.815			0.835	
	96.3	4854.8	4860.0	96.4	6	1:39 PM	0.861	0.821			0.841	
	96.3	4854.8	4860.0	96.4	10	1:43 PM	0.866	0.828			0.847	
295%	103.1	5200.0	5200.0	103.1	1	1:44 AM	0.954	0.905			0.930	
275%	96.3	4854.8	4860.0	96.4	1	1:45 AM	0.952	0.902			0.927	
250%	87.5	4415.0	4420.0	87.6	1	1:45 AM	0.935	0.894			0.915	
225%	78.8	3975.2	3980.0	78.8	1	1:46 AM	0.917	0.875			0.896	
200%	70.0	3535.3	3540.0	70.1	1	1:47 AM	0.900	0.857			0.879	
175%	61.3	3095.5	3100.0	61.3	1	1:47 PM	0.872	0.831			0.852	
150%	52.5	2655.6	2660.0	52.6	1	1:48 PM	0.840	0.800			0.820	
125%	43.8	2215.8	2220.0	43.8	1	1:49 PM	0.801	0.762			0.782	
100%	35.0	1776.0	1780.0	35.1	1	1:50 PM	0.763	0.725			0.744	
75%	26.3	1336.1	1340.0	26.3	1	1:50 PM	0.708	0.672			0.690	
50%	17.5	896.3	900.0	17.6	1	1:51 PM	0.655	0.620			0.638	
25%	8.8	456.4	460.0	8.8	1	1:51 PM	0.582	0.550			0.566	
AL	1.8	104.6	110.0	1.9	1	1:52 PM	0.506	0.490			0.498	

VERIFICATION SOIL NAIL LOAD TEST
Hollow Core Bar Research - Montrose, Colorado



Type of Test: Verification	Bond: 6 ft Unbonded: 13.5 ft	Diameter: 5.1 in (130 mm) (nominal)	Test Nail: C1	**SCHNABEL ENGINEERING, LLC**	
				Verification Soil Nail Load Test	
Design Test Load (P) : 35 kip	Comments: Nail did not pull ot.			Hollow Core Bar Soil Nail Research	
				Montrose, CO	
Maximum Test Load: 300% P = 135 kip				11/6/2008	07150064



Type of Test: Verification	Bond: 6 ft Unbonded: 13.5 ft	Diameter: 5.1 in (130 mm) (nominal)	Test Nail: C1	**SCHNABEL ENGINEERING, LLC** Verification Soil Nail Load Test
Design Test Load (P) : 35 kip	Comments: Nail did not pull ot.			Hollow Core Bar Soil Nail Research Montrose, CO
Maximum Test Load: 300% P = 135 kip				11/6/2008 — 07150064

Soil Nail Verification Load Test Data

Schnabel Engineering

Project: Hollow Core Bar Soil Nail Research
Location: Montrose, CO
Client: ADSC

Performed: Mountain Highwall Concrete (Norm Parsons)
Observed: Schnabel Engineering (Andy Baxter)
Data by: Schnabel Engineering (Andy Baxter)

Soil Nail: C1
Date: 11/6/2008

Design Test Load (P): 45 kips **# Dials:** 2 **Jack Calibration:** Pressure = 50.26746244 X reading (kip) + 16.6010236 (psi)

Sequence of Loading	Estimated Load [kip]	Dial Load [psi]	Applied Pressure [psi]	Applied Load [kip]	Time [min]	Time of Test	Dial 1 Deformation [in.]	Dial 2 Deformation [in.]	Dial 3 Deformation [in.]	Dial 4 Deformation [in.]	Average Deformation [in.]	Comments:
AL	2.3	129.7	130.0	2.3	1	8:24 AM	0.000	0.000			0.000	
25%	11.3	582.1	590.0	11.4	1	8:25 AM	0.012	0.012			0.012	
	11.3	582.1	590.0	11.4	2	8:26 AM	0.012	0.012			0.012	
	11.3	582.1	590.0	11.4	3	8:27 AM	0.010	0.011			0.011	
	11.3	582.1	590.0	11.4	4	8:28 AM	0.010	0.011			0.011	
	11.3	582.1	590.0	11.4	5	8:29 AM	0.015	0.015			0.015	
	11.3	582.1	590.0	11.4	6	8:30 AM	0.014	0.015			0.015	
	11.3	582.1	590.0	11.4	10	8:34 AM	0.014	0.015			0.015	
50%	22.5	1147.6	1150.0	22.5	1	8:35 AM	0.037	0.045			0.041	
	22.5	1147.6	1150.0	22.5	2	8:36 AM	0.037	0.045			0.041	
	22.5	1147.6	1150.0	22.5	3	8:37 AM	0.037	0.045			0.041	
	22.5	1147.6	1150.0	22.5	4	8:38 AM	0.037	0.044			0.041	
	22.5	1147.6	1150.0	22.5	5	8:39 AM	0.037	0.044			0.041	
	22.5	1147.6	1150.0	22.5	6	8:40 AM	0.038	0.045			0.042	
	22.5	1147.6	1150.0	22.5	10	8:44 AM	0.038	0.044			0.041	
75%	33.8	1713.1	1720.0	33.9	1	8:45 AM	0.048	0.057			0.053	
	33.8	1713.1	1720.0	33.9	2	8:46 AM	0.048	0.057			0.053	
	33.8	1713.1	1720.0	33.9	3	8:47 AM	0.048	0.057			0.053	
	33.8	1713.1	1720.0	33.9	4	8:48 AM	0.051	0.061			0.056	
	33.8	1713.1	1720.0	33.9	5	8:49 AM	0.051	0.061			0.056	
	33.8	1713.1	1720.0	33.9	6	8:50 AM	0.051	0.061			0.056	
	33.8	1713.1	1720.0	33.9	10	8:54 AM	0.053	0.062			0.058	
100%	45.0	2278.6	2280.0	45.0	1	8:55 AM	0.072	0.090			0.081	
	45.0	2278.6	2280.0	45.0	2	8:56 AM	0.072	0.090			0.081	
	45.0	2278.6	2280.0	45.0	3	8:57 AM	0.072	0.090			0.081	
	45.0	2278.6	2280.0	45.0	4	8:58 AM	0.071	0.088			0.080	
	45.0	2278.6	2280.0	45.0	5	8:59 AM	0.071	0.088			0.080	
	45.0	2278.6	2280.0	45.0	6	9:00 AM	0.072	0.090			0.081	
	45.0	2278.6	2280.0	45.0	10	9:04 AM	0.072	0.090			0.081	
125%	56.3	2844.1	2850.0	56.4	1	9:05 AM	0.085	0.107			0.096	
	56.3	2844.1	2850.0	56.4	2	9:06 AM	0.085	0.107			0.096	
	56.3	2844.1	2850.0	56.4	3	9:07 AM	0.080	0.104			0.092	
	56.3	2844.1	2850.0	56.4	4	9:08 AM	0.082	0.106			0.094	
	56.3	2844.1	2850.0	56.4	5	9:09 AM	0.080	0.105			0.093	
	56.3	2844.1	2850.0	56.4	6	9:10 AM	0.080	0.105			0.093	
	56.3	2844.1	2850.0	56.4	10	9:14 AM	0.085	0.109			0.097	
150%	67.5	3409.7	3410.0	67.5	1	9:15 AM	0.120	0.156			0.138	
	67.5	3409.7	3410.0	67.5	2	9:16 AM	0.120	0.158			0.139	
	67.5	3409.7	3410.0	67.5	3	9:17 AM	0.119	0.156			0.138	
	67.5	3409.7	3410.0	67.5	4	9:18 AM	0.122	0.161			0.142	
	67.5	3409.7	3410.0	67.5	5	9:19 AM	0.123	0.162			0.143	
	67.5	3409.7	3410.0	67.5	6	9:20 AM	0.121	0.161			0.141	
	67.5	3409.7	3410.0	67.5	10	9:24 AM	0.123	0.163			0.143	

Soil Nail Verification Load Test Data

Schnabel Engineering

Project: Hollow Core Bar Soil Nail Research
Location: Montrose, CO
Client: ADSC

Performed: Mountain Highwall Concrete (Norm Parsons)
Observed: Schnabel Engineering (Andy Baxter)
Data by: Schnabel Engineering (Andy Baxter)

Soil Nail: C1
Date: 11/6/2008

Design Test Load (P): 45 kips **# Dials:** 2 **Jack Calibration:** Pressure = 50.26746244 X reading (kip) + 16.6010236 (psi)

Sequence of Loading	Estimated Load [kip]	Dial Load [psi]	Applied Pressure [psi]	Applied Load [kip]	Time [min]	Time of Test	Dial 1 Deformation [in.]	Dial 2 Deformation [in.]	Dial 3 Deformation [in.]	Dial 4 Deformation [in.]	Average Deformation [in.]	Comments:
	67.5	3409.7	3410.0	67.5	20							
	67.5	3409.7	3410.0	67.5	30							
	67.5	3409.7	3410.0	67.5	40							
	67.5	3409.7	3410.0	67.5	50							
	67.5	3409.7	3410.0	67.5	60							
125%	56.3	2844.1	2850.0	56.4	1	9:25 AM	0.105	0.156			0.131	
100%	45.0	2278.6	2280.0	45.0	1	9:25 AM	0.093	0.132			0.113	
75%	33.8	1713.1	1720.0	33.9	1	9:26 AM	0.067	0.104			0.086	
50%	22.5	1147.6	1150.0	22.5	1	9:26 AM	0.046	0.081			0.064	
25%	11.3	582.1	590.0	11.4	1	9:26 AM	0.030	0.060			0.045	
AL	2.3	129.7	130.0	2.3	1	9:27 AM	0.008	0.026			0.017	
25%	11.3	582.1	590.0	11.4	1	9:27 AM	0.014	0.049			0.032	
50%	22.5	1147.6	1150.0	22.5	1	9:28 AM	0.028	0.069			0.049	
75%	33.8	1713.1	1720.0	33.9	1	9:28 AM	0.054	0.102			0.078	
100%	45.0	2278.6	2280.0	45.0	1	9:29 AM	0.074	0.125			0.100	
125%	56.3	2844.1	2850.0	56.4	1	9:29 AM	0.098	0.152			0.125	
150%	67.5	3409.7	3410.0	67.5	1	9:29 AM	0.121	0.180			0.151	
175%	78.8	3975.2	3980.0	78.8	1	9:31 AM	0.138	0.199			0.169	
	78.8	3975.2	3980.0	78.8	2	9:32 AM	0.139	0.201			0.170	
	78.8	3975.2	3980.0	78.8	3	9:33 AM	0.138	0.201			0.170	
	78.8	3975.2	3980.0	78.8	4	9:34 AM	0.137	0.200			0.169	
	78.8	3975.2	3980.0	78.8	5	9:35 AM	0.135	0.199			0.167	
	78.8	3975.2	3980.0	78.8	6	9:36 AM	0.139	0.202			0.171	
	78.8	3975.2	3980.0	78.8	10	9:40 AM	0.140	0.204			0.172	
200%	90.0	4540.7	4550.0	90.2	1	9:43 AM	0.185	0.257			0.221	
	90.0	4540.7	4550.0	90.2	2	9:44 AM	0.187	0.259			0.223	
	90.0	4540.7	4550.0	90.2	3	9:45 AM	0.188	0.260			0.224	
	90.0	4540.7	4550.0	90.2	4	9:46 AM	0.184	0.257			0.221	
	90.0	4540.7	4550.0	90.2	5	9:47 AM	0.190	0.262			0.226	
	90.0	4540.7	4550.0	90.2	6	9:48 AM	0.188	0.260			0.224	
	90.0	4540.7	4550.0	90.2	10	9:52 AM	0.192	0.265			0.229	
175%	78.8	3975.2	3980.0	78.8	1	9:53 AM	0.174	0.246			0.210	
150%	67.5	3409.7	3410.0	67.5	1	9:53 AM	0.151	0.223			0.187	
125%	56.3	2844.1	2850.0	56.4	1	9:54 AM	0.138	0.210			0.174	
100%	45.0	2278.6	2280.0	45.0	1	9:54 AM	0.116	0.188			0.152	
75%	33.8	1713.1	1720.0	33.9	1	9:55 AM	0.102	0.173			0.138	
50%	22.5	1147.6	1150.0	22.5	1	9:55 AM	0.068	0.132			0.100	
25%	11.3	582.1	590.0	11.4	1	9:56 AM	0.038	0.089			0.064	
AL	2.3	129.7	130.0	2.3	1	9:56 AM	0.016	0.043			0.030	
25%	11.3	582.1	590.0	11.4	1	9:56 AM	0.024	0.065			0.045	
50%	22.5	1147.6	1150.0	22.5	1	9:57 AM	0.043	0.099			0.071	
75%	33.8	1713.1	1720.0	33.9	1	9:57 AM	0.063	0.125			0.094	
100%	45.0	2278.6	2280.0	45.0	1	9:58 AM	0.090	0.156			0.123	

Soil Nail Verification Load Test Data

Schnabel Engineering

Project: Hollow Core Bar Soil Nail Research
Location: Montrose, CO
Client: ADSC

Performed: Mountain Highwall Concrete (Norm Parsons)
Observed: Schnabel Engineering (Andy Baxter)
Data by: Schnabel Engineering (Andy Baxter)

Soil Nail: C1
Date: 11/6/2008

Design Test Load (P): 45 kips **# Dials:** 2 **Jack Calibration:** Pressure = 50.26746244 X reading (kip) + 16.6010236 (psi)

Sequence of Loading	Estimated Load [kip]	Dial Load [psi]	Applied Pressure [psi]	Applied Load [kip]	Time [min]	Time of Test	Dial 1 Deformation [in.]	Dial 2 Deformation [in.]	Dial 3 Deformation [in.]	Dial 4 Deformation [in.]	Average Deformation [in.]	Comments:
125%	56.3	2844.1	2850.0	56.4	1	9:58 AM	0.119	0.186			0.153	
150%	67.5	3409.7	3410.0	67.5	1	9:58 AM	0.144	0.214			0.179	
175%	78.8	3975.2	3980.0	78.8	1	9:59 AM	0.168	0.238			0.203	
200%	90.0	4540.7	4550.0	90.2	1	9:59 AM	0.193	0.266			0.230	
225%	101.3	5106.2	5110.0	101.3	1	10:00 AM	0.218	0.294			0.256	
	101.3	5106.2	5110.0	101.3	2	10:01 AM	0.214	0.292			0.253	
	101.3	5106.2	5110.0	101.3	3	10:02 AM	0.212	0.290			0.251	
	101.3	5106.2	5110.0	101.3	4	10:03 AM	0.212	0.290			0.251	
	101.3	5106.2	5110.0	101.3	5	10:04 AM	0.218	0.295			0.257	
	101.3	5106.2	5110.0	101.3	6	10:05 AM	0.218	0.295			0.257	
	101.3	5106.2	5110.0	101.3	10	10:09 AM	0.219	0.295			0.257	
250%	112.5	5671.7	5680.0	112.7	1	10:10 AM	0.252	0.330			0.291	
	112.5	5671.7	5680.0	112.7	2	10:11 AM	0.254	0.332			0.293	
	112.5	5671.7	5680.0	112.7	3	10:12 AM	0.254	0.332			0.293	
	112.5	5671.7	5680.0	112.7	4	10:13 AM	0.253	0.332			0.293	
	112.5	5671.7	5680.0	112.7	5	10:14 AM	0.259	0.338			0.299	
	112.5	5671.7	5680.0	112.7	6	10:15 AM	0.263	0.341			0.302	
	112.5	5671.7	5680.0	112.7	10	10:19 AM	0.266	0.345			0.306	
275%	123.8	6237.2	6240.0	123.8	1	10:21 AM	0.318	0.401			0.360	
	123.8	6237.2	6240.0	123.8	2	10:22 AM	0.320	0.404			0.362	
	123.8	6237.2	6240.0	123.8	3	10:23 AM	0.320	0.404			0.362	
	123.8	6237.2	6240.0	123.8	4	10:24 AM	0.320	0.404			0.362	
	123.8	6237.2	6240.0	123.8	5	10:25 AM	0.315	0.400			0.358	
	123.8	6237.2	6240.0	123.8	6	10:26 AM	0.315	0.399			0.357	
	123.8	6237.2	6240.0	123.8	10	10:30 AM	0.316	0.401			0.359	
300%	135.0	6802.7	6810.0	135.1	1	10:31 AM	0.395	0.490			0.443	
	135.0	6802.7	6810.0	135.1	2	10:32 AM	0.401	0.495			0.448	
	135.0	6802.7	6810.0	135.1	3	10:33 AM	0.403	0.496			0.450	
	135.0	6802.7	6810.0	135.1	4	10:34 AM	0.404	0.498			0.451	
	135.0	6802.7	6810.0	135.1	5	10:35 AM	0.408	0.502			0.455	
	135.0	6802.7	6810.0	135.1	6	10:36 AM	0.408	0.500			0.454	
	135.0	6802.7	6810.0	135.1	10	10:40 AM						
275%	123.8	6237.2	6240.0	123.8	1	10:37 AM	0.398	0.494			0.446	
250%	112.5	5671.7	5680.0	112.7	1	10:38 AM	0.387	0.483			0.435	
225%	101.3	5106.2	5110.0	101.3	1	10:39 AM	0.366	0.461			0.414	
200%	90.0	4540.7	4550.0	90.2	0	10:39 AM	0.337	0.431			0.384	
175%	78.8	3975.2	3980.0	78.8	0	10:39 AM	0.309	0.404			0.357	
150%	67.5	3409.7	3410.0	67.5	1	10:40 AM	0.293	0.388			0.341	
125%	56.3	2844.1	2850.0	56.4	0	10:40 AM	0.273	0.369			0.321	
100%	45.0	2278.6	2280.0	45.0	0	10:40 AM	0.238	0.332			0.285	
75%	33.8	1713.1	1720.0	33.9	0	10:40 AM	0.206	0.300			0.253	
50%	22.5	1147.6	1150.0	22.5	1	10:41 AM	0.155	0.241			0.198	
25%	11.3	582.1	590.0	11.4	0	10:41 AM	0.120	0.194			0.157	

Soil Nail Verification Load Test Data

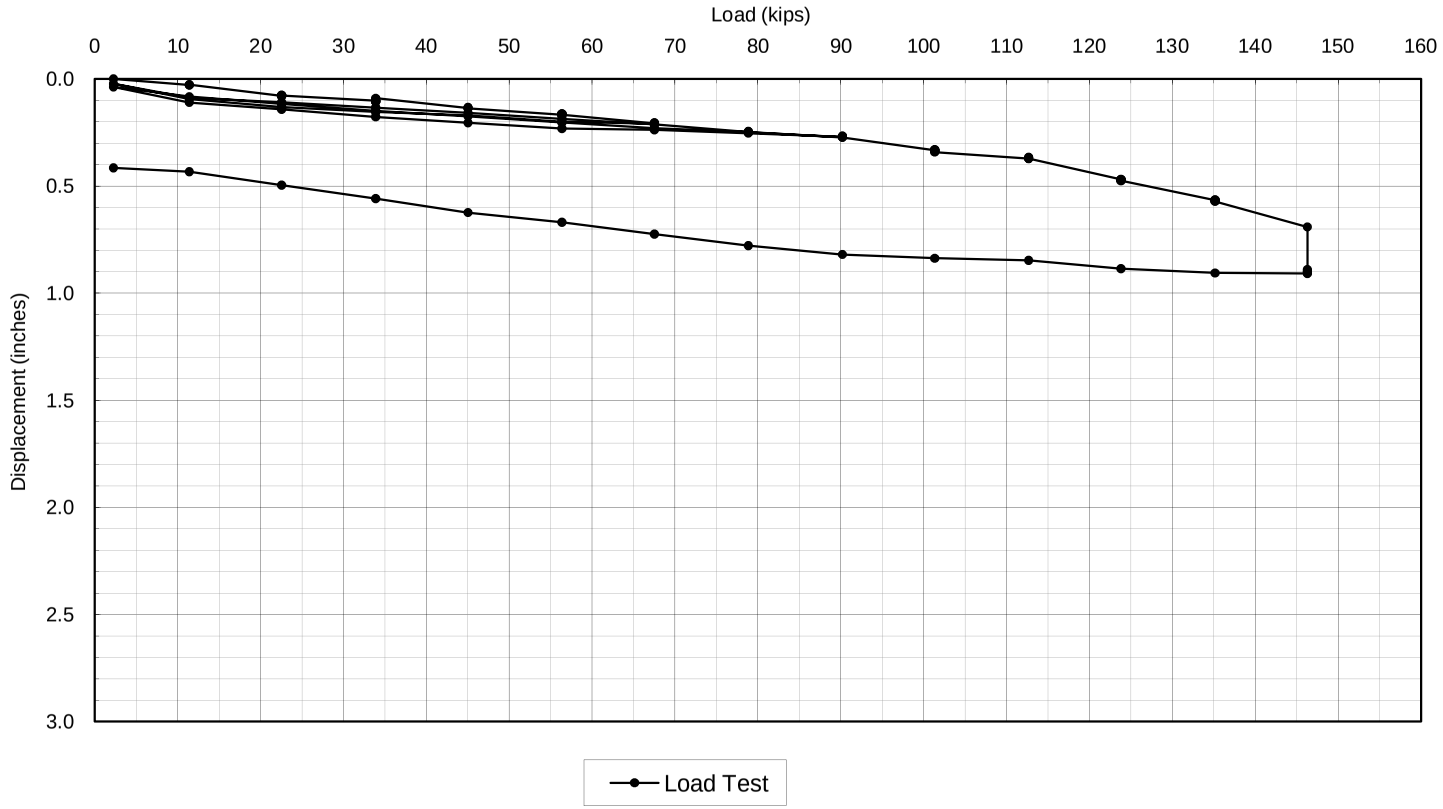
Schnabel Engineering

Project:	Hollow Core Bar Soil Nail Research	**Performed:**	Mountain Highwall Concrete (Norm Parsons)	**Soil Nail:**	C1
Location:	Montrose, CO	**Observed:**	Schnabel Engineering (Andy Baxter)		
Client:	ADSC	**Data by:**	Schnabel Engineering (Andy Baxter)	**Date:**	11/6/2008

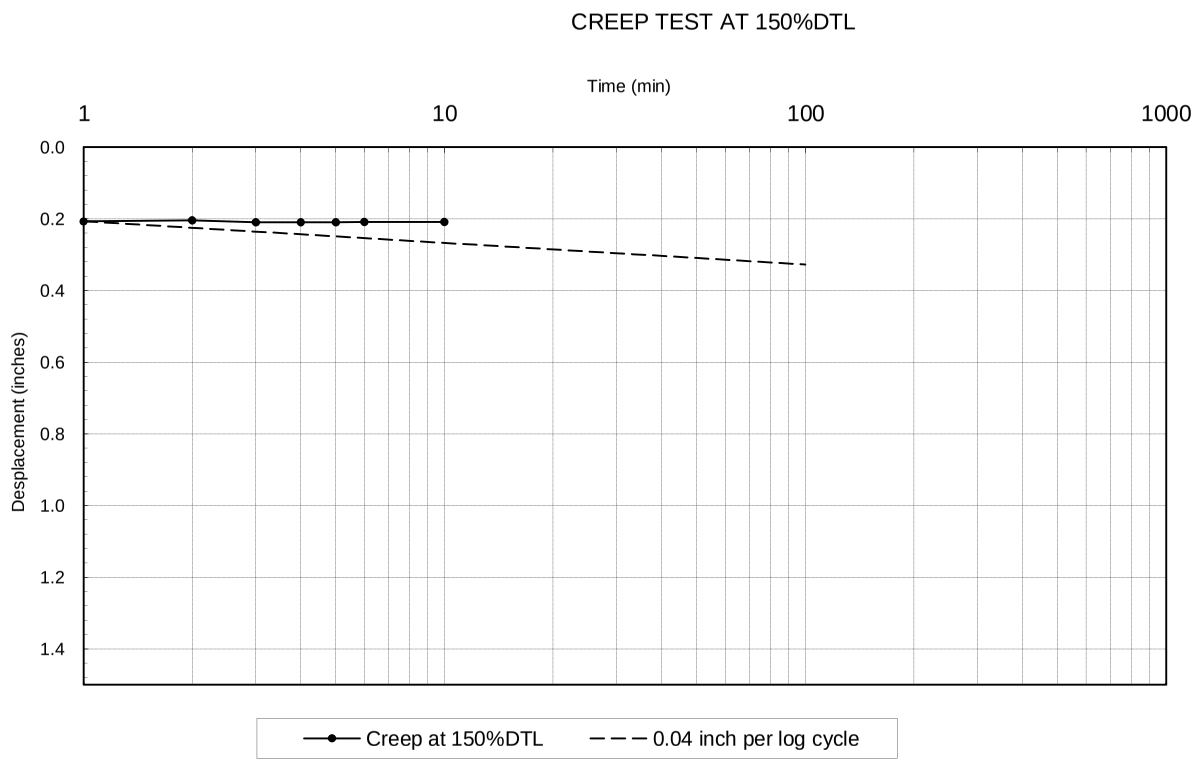
Design Test Load (P): 45 kips **# Dials:** 2 **Jack Calibration:** Pressure = 50.26746244 X reading (kip) + 16.6010236 (psi)

Sequence of Loading	Estimated Load [kip]	Dial Load [psi]	Applied Pressure [psi]	Applied Load [kip]	Time [min]	Time of Test	Dial 1 Deformation [in.]	Dial 2 Deformation [in.]	Dial 3 Deformation [in.]	Dial 4 Deformation [in.]	Average Deformation [in.]	Comments:
AL	2.3	129.7	130.0	2.3	1	10:42 AM	0.070	0.115			0.093	

VERIFICATION SOIL NAIL LOAD TEST
Hollow Core Bar Research - Montrose, Colorado



Type of Test: Verification	Bond: 6 ft Unbonded: 13.2 ft	Diameter: 5.1 in (130 mm) (nominal)	Test Nail: C2	**SCHNABEL ENGINEERING, LLC** Verification Soil Nail Load Test
Design Test Load (P) : 35 kip	Comments:Nail pulled out at approximately 146.3 kip.			Hollow Core Bar Soil Nail Research Montrose, CO
Maximum Test Load: 325% P = 146.3 kip				11/5/2008 — 07150064



Type of Test: Verification	Bond: 6 ft Unbonded: 13.2 ft	Diameter: 5.1 in (130 mm) (nominal)	Test Nail: C2	**SCHNABEL ENGINEERING, LLC** Verification Soil Nail Load Test
Design Test Load (P) : 35 kip	Comments:Nail pulled out at approximately 146.3 kip.			Hollow Core Bar Soil Nail Research Montrose, CO
Maximum Test Load: 325% P = 146.3 kip				11/5/2008 | 07150064

Soil Nail Verification Load Test Data

Schnabel Engineering

Project: Hollow Core Bar Soil Nail Research
Location: Montrose, CO
Client: ADSC

Performed: Mountain Highwall Concrete (Norm Parsons)
Observed: Schnabel Engineering (Andy Baxter)
Data by: Schnabel Engineering (Andy Baxter)

Soil Nail: C2
Date: 11/5/2008

Design Test Load (P): 45 kips **# Dials:** 2 **Jack Calibration:** Pressure = 50.26746244 X reading (kip) + 16.6010236 (psi)

Sequence of Loading	Estimated Load [kip]	Dial Load [psi]	Applied Pressure [psi]	Applied Load [kip]	Time [min]	Time of Test	Dial 1 Deformation [in.]	Dial 2 Deformation [in.]	Dial 3 Deformation [in.]	Dial 4 Deformation [in.]	Average Deformation [in.]	Comments:
AL	2.3	129.7	130.0	2.3	1	11:28 AM	0.000	0.000			0.000	
25%	11.3	582.1	590.0	11.4	1	11:29 AM	0.014	0.044			0.029	
	11.3	582.1	590.0	11.4	2	11:30 AM	0.013	0.043			0.028	
	11.3	582.1	590.0	11.4	3	11:31 AM	0.012	0.042			0.027	
	11.3	582.1	590.0	11.4	4	11:32 AM	0.012	0.042			0.027	
	11.3	582.1	590.0	11.4	5	11:33 AM	0.012	0.042			0.027	
	11.3	582.1	590.0	11.4	6	11:34 AM	0.012	0.042			0.027	
	11.3	582.1	590.0	11.4	10	11:38 AM	0.012	0.042			0.027	
50%	22.5	1147.6	1150.0	22.5	1	11:39 AM	0.056	0.102			0.079	
	22.5	1147.6	1150.0	22.5	2	11:40 AM	0.056	0.102			0.079	
	22.5	1147.6	1150.0	22.5	3	11:41 AM	0.055	0.100			0.078	
	22.5	1147.6	1150.0	22.5	4	11:42 AM	0.054	0.098			0.076	
	22.5	1147.6	1150.0	22.5	5	11:43 AM	0.057	0.102			0.080	
	22.5	1147.6	1150.0	22.5	6	11:44 AM	0.055	0.101			0.078	
	22.5	1147.6	1150.0	22.5	10	11:48 AM	0.055	0.101			0.078	
75%	33.8	1713.1	1720.0	33.9	1	11:49 AM	0.078	0.125			0.102	
	33.8	1713.1	1720.0	33.9	2	11:50 AM	0.078	0.125			0.102	
	33.8	1713.1	1720.0	33.9	3	11:51 AM	0.083	0.126			0.105	
	33.8	1713.1	1720.0	33.9	4	11:52 AM	0.080	0.125			0.103	
	33.8	1713.1	1720.0	33.9	5	11:53 AM	0.084	0.129			0.107	
	33.8	1713.1	1720.0	33.9	6	11:54 AM	0.083	0.128			0.106	
	33.8	1713.1	1720.0	33.9	10	11:58 AM	0.053	0.128			0.091	
100%	45.0	2278.6	2280.0	45.0	1	12:00 PM	0.115	0.157			0.136	
	45.0	2278.6	2280.0	45.0	2	12:01 PM	0.114	0.156			0.135	
	45.0	2278.6	2280.0	45.0	3	12:02 PM	0.112	0.154			0.133	
	45.0	2278.6	2280.0	45.0	4	12:03 PM	0.117	0.158			0.138	
	45.0	2278.6	2280.0	45.0	5	12:04 PM	0.117	0.158			0.138	
	45.0	2278.6	2280.0	45.0	6	12:05 PM	0.117	0.158			0.138	
	45.0	2278.6	2280.0	45.0	10	12:09 PM	0.117	0.158			0.138	
125%	56.3	2844.1	2850.0	56.4	1	12:10 PM	0.150	0.184			0.167	
	56.3	2844.1	2850.0	56.4	2	12:11 PM	0.145	0.180			0.163	
	56.3	2844.1	2850.0	56.4	3	12:12 PM	0.151	0.185			0.168	
	56.3	2844.1	2850.0	56.4	4	12:13 PM	0.148	0.184			0.166	
	56.3	2844.1	2850.0	56.4	5	12:14 PM	0.146	0.182			0.164	
	56.3	2844.1	2850.0	56.4	6	12:15 PM	0.146	0.182			0.164	
	56.3	2844.1	2850.0	56.4	10	12:19 PM	0.149	0.185			0.167	

Soil Nail Verification Load Test Data

Schnabel Engineering

Project: Hollow Core Bar Soil Nail Research
Location: Montrose, CO
Client: ADSC

Performed: Mountain Highwall Concrete (Norm Parsons)
Observed: Schnabel Engineering (Andy Baxter)
Data by: Schnabel Engineering (Andy Baxter)

Soil Nail: C2
Date: 11/5/2008

Design Test Load (P): 45 kips **# Dials:** 2 **Jack Calibration:** Pressure = 50.26746244 X reading (kip) + 16.6010236 (psi)

Sequence of Loading	Estimated Load [kip]	Dial Load [psi]	Applied Pressure [psi]	Applied Load [kip]	Time [min]	Time of Test	Dial 1 Deformation [in.]	Dial 2 Deformation [in.]	Dial 3 Deformation [in.]	Dial 4 Deformation [in.]	Average Deformation [in.]	Comments:
150%	67.5	3409.7	3410.0	67.5	1	12:22 PM	0.185	0.230			0.208	
	67.5	3409.7	3410.0	67.5	2	12:23 PM	0.183	0.226			0.205	
	67.5	3409.7	3410.0	67.5	3	12:24 PM	0.187	0.232			0.210	
	67.5	3409.7	3410.0	67.5	4	12:25 PM	0.187	0.232			0.210	
	67.5	3409.7	3410.0	67.5	5	12:26 PM	0.187	0.232			0.210	
	67.5	3409.7	3410.0	67.5	6	12:27 PM	0.187	0.231			0.209	
	67.5	3409.7	3410.0	67.5	10	12:31 PM	0.187	0.231			0.209	
125%	56.3	2844.1	2850.0	56.4	1	12:32 PM	0.178	0.224			0.201	
100%	45.0	2278.6	2280.0	45.0	1	12:32 PM	0.147	0.193			0.170	
75%	33.8	1713.1	1720.0	33.9	1	12:33 PM	0.131	0.178			0.155	
50%	22.5	1147.6	1150.0	22.5	1	12:33 PM	0.108	0.156			0.132	
25%	11.3	582.1	590.0	11.4	1	12:34 PM	0.072	0.118			0.095	
AL	2.3	129.7	130.0	2.3	1	12:34 PM	0.020	0.025			0.023	
25%	11.3	582.1	590.0	11.4	1	12:34 PM	0.072	0.104			0.088	
50%	22.5	1147.6	1150.0	22.5	1	12:35 PM	0.094	0.125			0.110	
75%	33.8	1713.1	1720.0	33.9	1	12:35 PM	0.118	0.150			0.134	
100%	45.0	2278.6	2280.0	45.0	1	12:35 PM	0.141	0.175			0.158	
125%	56.3	2844.1	2850.0	56.4	1	12:35 PM	0.164	0.209			0.187	
150%	67.5	3409.7	3410.0	67.5	1	12:36 PM	0.190	0.234			0.212	
175%	78.8	3975.2	3980.0	78.8	1	12:37 PM	0.226	0.270			0.248	
	78.8	3975.2	3980.0	78.8	2	12:38 PM	0.223	0.267			0.245	
	78.8	3975.2	3980.0	78.8	3	12:39 PM	0.229	0.272			0.251	
	78.8	3975.2	3980.0	78.8	4	12:40 PM	0.225	0.270			0.248	
	78.8	3975.2	3980.0	78.8	5	12:41 PM	0.225	0.270			0.248	
	78.8	3975.2	3980.0	78.8	6	12:42 PM	0.225	0.270			0.248	
	78.8	3975.2	3980.0	78.8	10	12:46 PM	0.228	0.272			0.250	
200%	90.0	4540.7	4550.0	90.2	1	12:47 PM	0.250	0.293			0.272	
	90.0	4540.7	4550.0	90.2	2	12:48 PM	0.245	0.290			0.268	
	90.0	4540.7	4550.0	90.2	3	12:49 PM	0.249	0.292			0.271	
	90.0	4540.7	4550.0	90.2	4	12:50 PM	0.245	0.290			0.268	
	90.0	4540.7	4550.0	90.2	5	12:51 PM	0.245	0.290			0.268	
	90.0	4540.7	4550.0	90.2	6	12:52 PM	0.245	0.290			0.268	
	90.0	4540.7	4550.0	90.2	10	12:56 PM	0.250	0.292			0.271	
175%	78.8	3975.2	3980.0	78.8	1	12:58 PM	0.232	0.275			0.254	
150%	67.5	3409.7	3410.0	67.5	1	12:59 PM	0.215	0.260			0.238	
125%	56.3	2844.1	2850.0	56.4	1	12:59 PM	0.208	0.255			0.232	
100%	45.0	2278.6	2280.0	45.0	1	12:59 PM	0.181	0.229			0.205	
75%	33.8	1713.1	1720.0	33.9	1	1:00 PM	0.154	0.201			0.178	

Soil Nail Verification Load Test Data

Schnabel Engineering

Project: Hollow Core Bar Soil Nail Research
Location: Montrose, CO
Client: ADSC

Performed: Mountain Highwall Concrete (Norm Parsons)
Observed: Schnabel Engineering (Andy Baxter)
Data by: Schnabel Engineering (Andy Baxter)

Soil Nail: C2
Date: 11/5/2008

Design Test Load (P): 45 kips **# Dials:** 2 **Jack Calibration:** Pressure = 50.26746244 X reading (kip) + 16.6010236 (psi)

Sequence of Loading	Estimated Load [kip]	Dial Load [psi]	Applied Pressure [psi]	Applied Load [kip]	Time [min]	Time of Test	Dial 1 Deformation [in.]	Dial 2 Deformation [in.]	Dial 3 Deformation [in.]	Dial 4 Deformation [in.]	Average Deformation [in.]	Comments:
50%	22.5	1147.6	1150.0	22.5	1	1:00 PM	0.119	0.165			0.142	
25%	11.3	582.1	590.0	11.4	1	1:00 PM	0.087	0.133			0.110	
AL	2.3	129.7	130.0	2.3	1	1:01 PM	0.034	0.041			0.038	
25%	11.3	582.1	590.0	11.4	1	1:01 PM	0.062	0.104			0.083	
50%	22.5	1147.6	1150.0	22.5	1	1:01 PM	0.095	0.138			0.117	
75%	33.8	1713.1	1720.0	33.9	1	1:01 PM	0.127	0.171			0.149	
100%	45.0	2278.6	2280.0	45.0	1	1:02 PM	0.153	0.196			0.175	
125%	56.3	2844.1	2850.0	56.4	1	1:02 PM	0.181	0.225			0.203	
150%	67.5	3409.7	3410.0	67.5	1	1:02 PM	0.208	0.252			0.230	
175%	78.8	3975.2	3980.0	78.8	1	1:02 PM	0.226	0.270			0.248	
200%	90.0	4540.7	4550.0	90.2	1	1:03 PM	0.250	0.296			0.273	
225%	101.3	5106.2	5110.0	101.3	1	1:04 PM	0.310	0.356			0.333	
	101.3	5106.2	5110.0	101.3	2	1:05 PM	0.312	0.359			0.336	
	101.3	5106.2	5110.0	101.3	3	1:06 PM	0.310	0.357			0.334	
	101.3	5106.2	5110.0	101.3	4	1:07 PM	0.305	0.354			0.330	
	101.3	5106.2	5110.0	101.3	5	1:08 PM	0.313	0.359			0.336	
	101.3	5106.2	5110.0	101.3	6	1:09 PM	0.310	0.358			0.334	
	101.3	5106.2	5110.0	101.3	10	1:13 PM	0.318	0.365			0.342	
250%	112.5	5671.7	5680.0	112.7	1	1:14 PM	0.347	0.396			0.372	
	112.5	5671.7	5680.0	112.7	2	1:15 PM	0.347	0.396			0.372	
	112.5	5671.7	5680.0	112.7	3	1:16 PM	0.342	0.390			0.366	
	112.5	5671.7	5680.0	112.7	4	1:17 PM	0.346	0.395			0.371	
	112.5	5671.7	5680.0	112.7	5	1:18 PM	0.346	0.395			0.371	
	112.5	5671.7	5680.0	112.7	6	1:19 PM	0.344	0.392			0.368	
	112.5	5671.7	5680.0	112.7	10	1:23 PM	0.347	0.397			0.372	
275%	123.8	6237.2	6240.0	123.8	1	1:24 PM	0.440	0.498			0.469	
	123.8	6237.2	6240.0	123.8	2	1:25 PM	0.442	0.498			0.470	
	123.8	6237.2	6240.0	123.8	3	1:26 PM	0.442	0.498			0.470	
	123.8	6237.2	6240.0	123.8	4	1:27 PM	0.445	0.501			0.473	
	123.8	6237.2	6240.0	123.8	5	1:28 PM	0.443	0.500			0.472	
	123.8	6237.2	6240.0	123.8	6	1:29 PM	0.441	0.500			0.471	
	123.8	6237.2	6240.0	123.8	10	1:33 PM	0.447	0.504			0.476	
300%	135.0	6802.7	6810.0	135.1	1	1:34 PM	0.533	0.598			0.566	
	135.0	6802.7	6810.0	135.1	2	1:35 PM	0.535	0.602			0.569	
	135.0	6802.7	6810.0	135.1	3	1:36 PM	0.536	0.602			0.569	
	135.0	6802.7	6810.0	135.1	4	1:37 PM	0.530	0.600			0.565	
	135.0	6802.7	6810.0	135.1	5	1:38 PM	0.530	0.600			0.565	
	135.0	6802.7	6810.0	135.1	6	1:39 PM	0.538	0.605			0.572	
	135.0	6802.7	6810.0	135.1	6	1:43 PM	0.538	0.605			0.572	

Soil Nail Verification Load Test Data

Schnabel Engineering

Project: Hollow Core Bar Soil Nail Research
Location: Montrose, CO
Client: ADSC

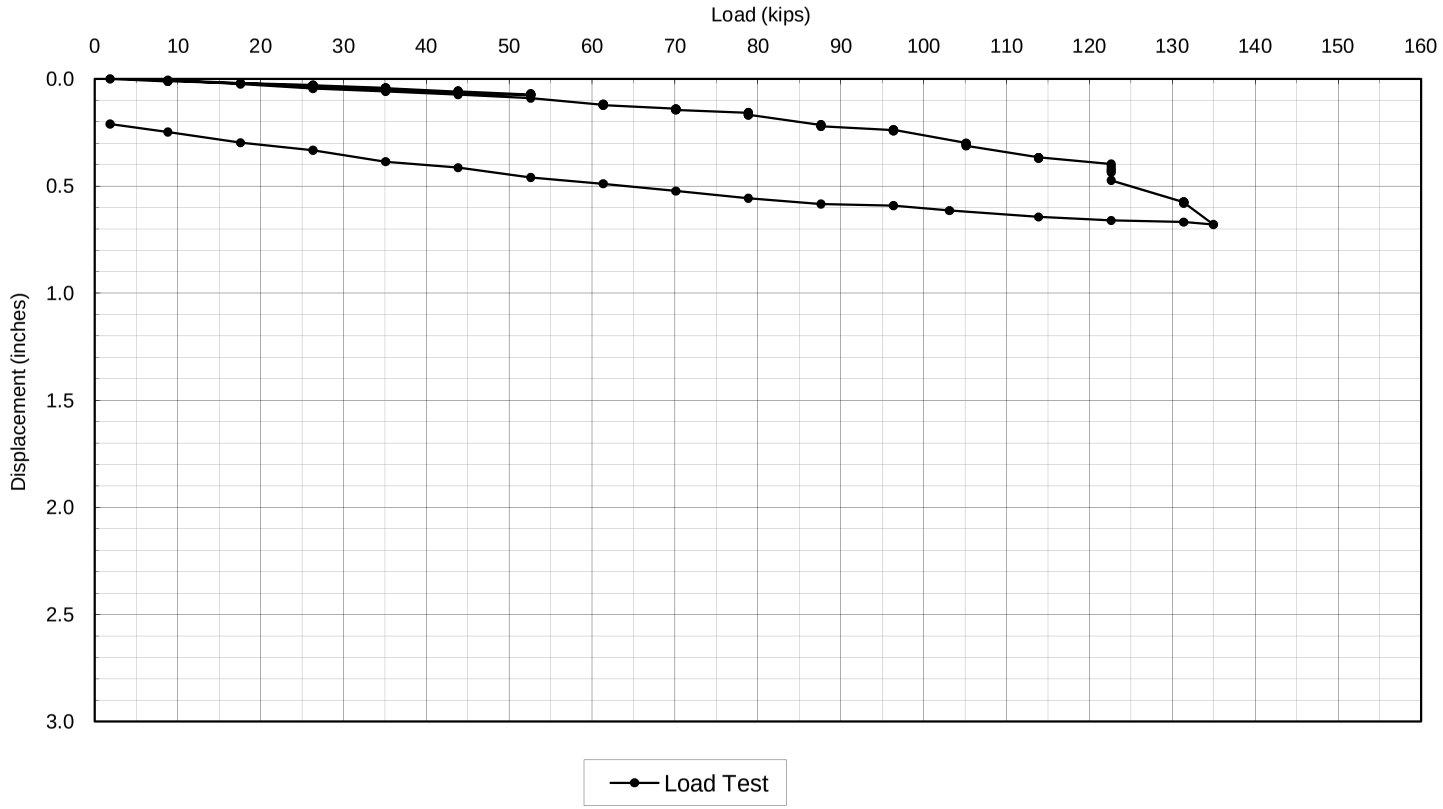
Performed: Mountain Highwall Concrete (Norm Parsons)
Observed: Schnabel Engineering (Andy Baxter)
Data by: Schnabel Engineering (Andy Baxter)

Soil Nail: C2
Date: 11/5/2008

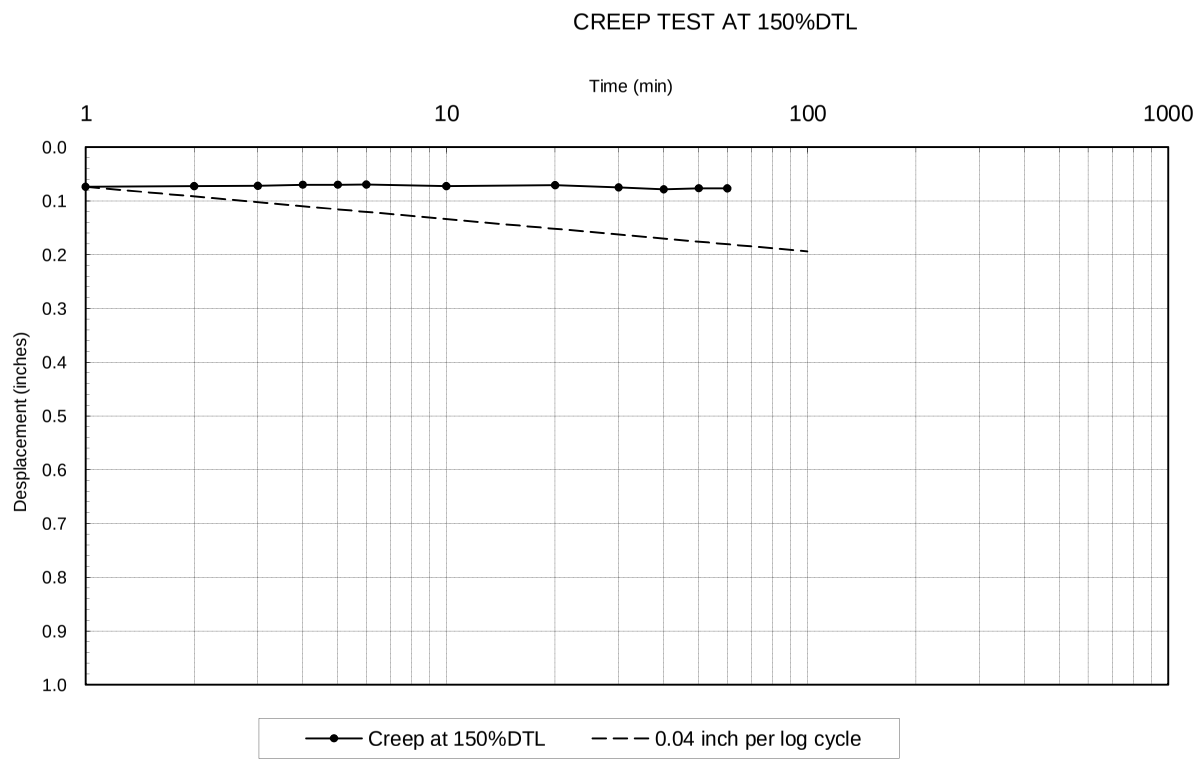
Design Test Load (P): 45 kips
 # Dials: 2
Jack Calibration: Pressure = 50.26746244 X reading (kip) + 16.6010236 (psi)

Sequence of Loading	Estimated Load [kip]	Dial Load [psi]	Applied Pressure [psi]	Applied Load [kip]	Time [min]	Time of Test	Dial 1 Deformation [in.]	Dial 2 Deformation [in.]	Dial 3 Deformation [in.]	Dial 4 Deformation [in.]	Average Deformation [in.]	Comments:
325%	146.3	7368.2	7370.0	146.3	1	11:45 PM	0.652	0.730			0.691	
	146.3	7368.2	7370.0	146.3	2	11:46 PM	0.845	0.935			0.890	
	146.3	7368.2	7370.0	146.3	3	11:47 PM	0.850	0.937			0.894	
	146.3	7368.2	7370.0	146.3	4	11:48 PM	0.856	0.947			0.902	
	146.3	7368.2	7370.0	146.3	5	11:49 PM	0.860	0.950			0.905	
	146.3	7368.2	7370.0	146.3	6	11:50 PM	0.852	0.952			0.902	
	146.3	7368.2	7370.0	146.3	6	11:54 PM	0.858	0.960			0.909	
300%	135.0	6802.7	6810.0	135.1	1	1:54 PM	0.861	0.951			0.906	
275%	123.8	6237.2	6240.0	123.8	1	1:55 PM	0.839	0.933			0.886	
250%	112.5	5671.7	5680.0	112.7	1	1:56 PM	0.802	0.892			0.847	
225%	101.3	5106.2	5110.0	101.3	1	1:56 PM	0.791	0.883			0.837	
200%	90.0	4540.7	4550.0	90.2	1	1:57 PM	0.774	0.865			0.820	
175%	78.8	3975.2	3980.0	78.8	1	1:57 PM	0.732	0.824			0.778	
150%	67.5	3409.7	3410.0	67.5	1	1:57 PM	0.679	0.770			0.725	
125%	56.3	2844.1	2850.0	56.4	1	1:58 PM	0.625	0.714			0.670	
100%	45.0	2278.6	2280.0	45.0	1	1:58 PM	0.580	0.668			0.624	
75%	33.8	1713.1	1720.0	33.9	1	1:58 PM	0.516	0.602			0.559	
50%	22.5	1147.6	1150.0	22.5	1	1:59 PM	0.454	0.538			0.496	
25%	11.3	582.1	590.0	11.4	1	1:59 PM	0.393	0.473			0.433	
AL	2.3	129.7	130.0	2.3	1	1:59 PM	0.336	0.495			0.416	

VERIFICATION SOIL NAIL LOAD TEST
Hollow Core Bar Research - Montrose, Colorado



Type of Test: Verification	Bond: 6 ft Unbonded: 13.5 ft	Diameter: 5.1 in (130 mm) (nominal)	Test Nail: C3	**SCHNABEL ENGINEERING, LLC** Verification Soil Nail Load Test
Design Test Load (P) : 35 kip	Comments: Nail did not pull out.			Hollow Core Bar Soil Nail Research Montrose, CO
Maximum Test Load: 386% P = 134.9 kip				11/4/2008 — 07150064



Type of Test: Verification	Bond: 6 ft Unbonded: 13.5 ft	Diameter: 5.1 in (130 mm) (nominal)	Test Nail: C3	**SCHNABEL ENGINEERING, LLC** Verification Soil Nail Load Test
Design Test Load (P) : 35 kip	Comments: Nail did not pull out.			Hollow Core Bar Soil Nail Research Montrose, CO
Maximum Test Load: 386% P = 134.9 kip				11/4/2008 — 07150064

Soil Nail Verification Load Test Data

Schnabel Engineering

Project: Hollow Core Bar Soil Nail Research
Location: Montrose, CO
Client: ADSC

Performed: Mountain Highwall Concrete (Norm Parsons)
Observed: Schnabel Engineering (Andy Baxter)
Data by: Schnabel Engineering (Andy Baxter)

Soil Nail: C3
Date: 11/4/2008

Design Test Load (P): 35 kips **# Dials:** 2 **Jack Calibration:** Pressure = 50.26746244 X reading (kip) + 16.6010236 (psi)

Sequence of Loading	Estimated Load [kip]	Dial Load [psi]	Applied Pressure [psi]	Applied Load [kip]	Time [min]	Time of Test	Dial 1 Deformation [in.]	Dial 2 Deformation [in.]	Dial 3 Deformation [in.]	Dial 4 Deformation [in.]	Average Deformation [in.]	Comments:
AL	1.8	104.6	110.0	1.9	1	2:55 PM	0.000	0.000			0.000	
25%	8.8	456.4	460.0	8.8	1	2:56 PM	0.013	0.010			0.012	
	8.8	456.4	460.0	8.8	2	2:57 PM	0.011	0.010			0.011	
	8.8	456.4	460.0	8.8	3	2:58 PM	0.011	0.010			0.011	
	8.8	456.4	460.0	8.8	4	2:59 PM	0.012	0.010			0.011	
	8.8	456.4	460.0	8.8	5	3:00 PM	0.012	0.010			0.011	
	8.8	456.4	460.0	8.8	6	3:01 PM	0.012	0.010			0.011	
	8.8	456.4	460.0	8.8	10	3:05 PM	0.012	0.010			0.011	
50%	17.5	896.3	900.0	17.6	1	3:05 PM	0.030	0.013			0.022	
	17.5	896.3	900.0	17.6	2	3:06 PM	0.030	0.013			0.022	
	17.5	896.3	900.0	17.6	3	3:07 PM	0.029	0.012			0.021	
	17.5	896.3	900.0	17.6	4	3:08 PM	0.028	0.012			0.020	
	17.5	896.3	900.0	17.6	5	3:09 PM	0.028	0.012			0.020	
	17.5	896.3	900.0	17.6	6	3:10 PM	0.028	0.012			0.020	
	17.5	896.3	900.0	17.6	10	3:14 PM	0.028	0.012			0.020	
75%	26.3	1336.1	1340.0	26.3	1	3:14 PM	0.044	0.014			0.029	
	26.3	1336.1	1340.0	26.3	2	3:15 PM	0.045	0.013			0.029	
	26.3	1336.1	1340.0	26.3	3	3:16 PM	0.047	0.015			0.031	
	26.3	1336.1	1340.0	26.3	4	3:17 PM	0.046	0.014			0.030	
	26.3	1336.1	1340.0	26.3	5	3:18 PM	0.045	0.013			0.029	
	26.3	1336.1	1340.0	26.3	6	3:19 PM	0.045	0.013			0.029	
	26.3	1336.1	1340.0	26.3	10	3:23 PM	0.048	0.013			0.031	
100%	35.0	1776.0	1780.0	35.1	1	3:23 PM	0.062	0.022			0.042	
	35.0	1776.0	1780.0	35.1	2	3:24 PM	0.063	0.023			0.043	
	35.0	1776.0	1780.0	35.1	3	3:25 PM	0.063	0.023			0.043	
	35.0	1776.0	1780.0	35.1	4	3:26 PM	0.064	0.023			0.044	
	35.0	1776.0	1780.0	35.1	5	3:27 PM	0.063	0.022			0.043	
	35.0	1776.0	1780.0	35.1	6	3:28 PM	0.063	0.022			0.043	
	35.0	1776.0	1780.0	35.1	10	3:32 PM	0.064	0.023			0.044	
125%	43.8	2215.8	2220.0	43.8	1	3:32 PM	0.084	0.036			0.060	
	43.8	2215.8	2220.0	43.8	2	3:33 PM	0.085	0.037			0.061	
	43.8	2215.8	2220.0	43.8	3	3:34 PM	0.082	0.035			0.059	
	43.8	2215.8	2220.0	43.8	4	3:35 PM	0.081	0.033			0.057	
	43.8	2215.8	2220.0	43.8	5	3:36 PM	0.080	0.032			0.056	
	43.8	2215.8	2220.0	43.8	6	3:37 PM	0.080	0.032			0.056	
	43.8	2215.8	2220.0	43.8	10	3:41 PM	0.082	0.035			0.059	

Soil Nail Verification Load Test Data

Schnabel Engineering

Project: Hollow Core Bar Soil Nail Research
Location: Montrose, CO
Client: ADSC

Performed: Mountain Highwall Concrete (Norm Parsons)
Observed: Schnabel Engineering (Andy Baxter)
Data by: Schnabel Engineering (Andy Baxter)

Soil Nail: C3
Date: 11/4/2008

Design Test Load (P): 35 kips **# Dials:** 2 **Jack Calibration:** Pressure = 50.26746244 X reading (kip) + 16.6010236 (psi)

Sequence of Loading	Estimated Load [kip]	Dial Load [psi]	Applied Pressure [psi]	Applied Load [kip]	Time [min]	Time of Test	Dial 1 Deformation [in.]	Dial 2 Deformation [in.]	Dial 3 Deformation [in.]	Dial 4 Deformation [in.]	Average Deformation [in.]	Comments:
150%	52.5	2655.6	2660.0	52.6	1	3:41 PM	0.099	0.049			0.074	
	52.5	2655.6	2660.0	52.6	2	3:42 PM	0.098	0.047			0.073	
	52.5	2655.6	2660.0	52.6	3	3:43 PM	0.098	0.046			0.072	
	52.5	2655.6	2660.0	52.6	4	3:44 PM	0.095	0.045			0.070	
	52.5	2655.6	2660.0	52.6	5	3:45 PM	0.095	0.045			0.070	
	52.5	2655.6	2660.0	52.6	6	3:46 PM	0.094	0.045			0.070	
	52.5	2655.6	2660.0	52.6	10	3:50 PM	0.098	0.047			0.073	
	52.5	2655.6	2660.0	52.6	20	4:00 PM	0.097	0.045			0.071	
	52.5	2655.6	2660.0	52.6	30	4:10 PM	0.100	0.050			0.075	
	52.5	2655.6	2660.0	52.6	40	4:20 PM	0.104	0.053			0.079	
	52.5	2655.6	2660.0	52.6	50	4:30 PM	0.102	0.051			0.077	
	52.5	2655.6	2660.0	52.6	60	4:40 PM	0.102	0.052			0.077	
125%	43.8	2215.8	2220.0	43.8	1	4:40 PM	0.093	0.042			0.068	
100%	35.0	1776.0	1780.0	35.1	1	4:40 PM	0.077	0.027			0.052	
75%	26.3	1336.1	1340.0	26.3	1	4:41 PM	0.060	0.010			0.035	
50%	17.5	896.3	900.0	17.6	1	4:41 PM	0.044	-0.005			0.020	
25%	8.8	456.4	460.0	8.8	1	4:41 PM	0.026	-0.015			0.006	
AL	1.8	104.6	110.0	1.9	1	4:42 PM	0.008	-0.015			-0.004	
25%	8.8	456.4	460.0	8.8	1	4:42 PM	0.024	-0.013			0.006	
50%	17.5	896.3	900.0	17.6	1	4:43 PM	0.052	-0.003			0.025	
75%	26.3	1336.1	1340.0	26.3	1	4:43 PM	0.075	0.015			0.045	
100%	35.0	1776.0	1780.0	35.1	1	4:44 PM	0.089	0.028			0.059	
125%	43.8	2215.8	2220.0	43.8	1	4:44 PM	0.106	0.042			0.074	
150%	52.5	2655.6	2660.0	52.6	1	4:45 PM	0.122	0.057			0.090	
175%	61.3	3095.5	3100.0	61.3	1	4:45 PM	0.154	0.087			0.121	
	61.3	3095.5	3100.0	61.3	2	4:46 PM	0.155	0.088			0.122	
	61.3	3095.5	3100.0	61.3	3	4:47 PM	0.152	0.085			0.119	
	61.3	3095.5	3100.0	61.3	4	4:48 PM	0.157	0.090			0.124	
	61.3	3095.5	3100.0	61.3	5	4:49 PM	0.153	0.085			0.119	
	61.3	3095.5	3100.0	61.3	6	4:50 PM	0.153	0.085			0.119	
	61.3	3095.5	3100.0	61.3	10	4:54 PM	0.157	0.088			0.123	
200%	70.0	3535.3	3540.0	70.1	1	4:55 PM	0.175	0.104			0.140	
	70.0	3535.3	3540.0	70.1	2	4:56 PM	0.178	0.110			0.144	
	70.0	3535.3	3540.0	70.1	3	4:57 PM	0.176	0.107			0.142	
	70.0	3535.3	3540.0	70.1	4	4:58 PM	0.178	0.110			0.144	
	70.0	3535.3	3540.0	70.1	5	4:59 PM	0.175	0.106			0.141	
	70.0	3535.3	3540.0	70.1	6	5:00 PM	0.179	0.110			0.145	
	70.0	3535.3	3540.0	70.1	10	5:04 PM	0.179	0.110			0.145	

Soil Nail Verification Load Test Data

Schnabel Engineering

Project: Hollow Core Bar Soil Nail Research
Location: Montrose, CO
Client: ADSC

Performed: Mountain Highwall Concrete (Norm Parsons)
Observed: Schnabel Engineering (Andy Baxter)
Data by: Schnabel Engineering (Andy Baxter)

Soil Nail: C3
Date: 11/4/2008

Design Test Load (P): 35 kips **# Dials:** 2 **Jack Calibration:** Pressure = 50.26746244 X reading (kip) + 16.6010236 (psi)

Sequence of Loading	Estimated Load [kip]	Dial Load [psi]	Applied Pressure [psi]	Applied Load [kip]	Time [min]	Time of Test	Dial 1 Deformation [in.]	Dial 2 Deformation [in.]	Dial 3 Deformation [in.]	Dial 4 Deformation [in.]	Average Deformation [in.]	Comments:
225%	78.8	3975.2	3980.0	78.8	1	5:04 PM	0.192	0.124			0.158	
	78.8	3975.2	3980.0	78.8	2	5:05 PM	0.192	0.122			0.157	
	78.8	3975.2	3980.0	78.8	3	5:06 PM	0.200	0.130			0.165	
	78.8	3975.2	3980.0	78.8	4	5:07 PM	0.202	0.132			0.167	
	78.8	3975.2	3980.0	78.8	5	5:08 PM	0.205	0.134			0.170	
	78.8	3975.2	3980.0	78.8	6	5:09 PM	0.202	0.131			0.167	
	78.8	3975.2	3980.0	78.8	10	5:13 PM	0.204	0.132			0.168	
250%	87.5	4415.0	4420.0	87.6	1	5:13 PM	0.254	0.175			0.215	
	87.5	4415.0	4420.0	87.6	2	5:14 PM	0.256	0.178			0.217	
	87.5	4415.0	4420.0	87.6	3	5:15 PM	0.253	0.174			0.214	
	87.5	4415.0	4420.0	87.6	4	5:16 PM	0.260	0.182			0.221	
	87.5	4415.0	4420.0	87.6	5	5:17 PM	0.256	0.178			0.217	
	87.5	4415.0	4420.0	87.6	6	5:18 PM	0.255	0.178			0.217	
	87.5	4415.0	4420.0	87.6	10	5:22 PM	0.260	0.182			0.221	
275%	96.3	4854.8	4860.0	96.4	1	5:22 PM	0.278	0.200			0.239	
	96.3	4854.8	4860.0	96.4	2	5:23 PM	0.282	0.202			0.242	
	96.3	4854.8	4860.0	96.4	3	5:24 PM	0.278	0.198			0.238	
	96.3	4854.8	4860.0	96.4	4	5:25 PM	0.282	0.202			0.242	
	96.3	4854.8	4860.0	96.4	5	5:26 PM	0.282	0.202			0.242	
	96.3	4854.8	4860.0	96.4	6	5:27 PM	0.282	0.201			0.242	
	96.3	4854.8	4860.0	96.4	10	5:31 PM	0.278	0.198			0.238	
300%	105.0	5294.7	5300.0	105.1	1	5:31 PM	0.342	0.257			0.300	
	105.0	5294.7	5300.0	105.1	2	5:32 PM	0.342	0.257			0.300	
	105.0	5294.7	5300.0	105.1	3	5:33 PM	0.345	0.259			0.302	
	105.0	5294.7	5300.0	105.1	4	5:34 PM	0.345	0.259			0.302	
	105.0	5294.7	5300.0	105.1	5	5:35 PM	0.350	0.262			0.306	
	105.0	5294.7	5300.0	105.1	6	5:36 PM	0.350	0.262			0.306	
	105.0	5294.7	5300.0	105.1	10	5:40 PM	0.356	0.270			0.313	
325%	113.8	5734.5	5740.0	113.9	1	5:40 PM	0.411	0.322			0.367	
	113.8	5734.5	5740.0	113.9	2	5:41 PM	0.412	0.324			0.368	
	113.8	5734.5	5740.0	113.9	3	5:42 PM	0.416	0.326			0.371	
	113.8	5734.5	5740.0	113.9	4	5:43 PM	0.416	0.326			0.371	
	113.8	5734.5	5740.0	113.9	5	5:44 PM	0.414	0.325			0.370	
	113.8	5734.5	5740.0	113.9	6	5:45 PM	0.414	0.325			0.370	
	113.8	5734.5	5740.0	113.9	10	5:49 PM	0.412	0.321			0.367	
350%	122.5	6174.4	6180.0	122.6	1	5:49 PM	0.442	0.352			0.397	
	122.5	6174.4	6180.0	122.6	2	5:50 PM	0.452	0.360			0.406	
	122.5	6174.4	6180.0	122.6	3	5:51 PM	0.456	0.377			0.417	
	122.5	6174.4	6180.0	122.6	4	5:52 PM	0.471	0.380			0.426	
	122.5	6174.4	6180.0	122.6	5	5:53 PM	0.477	0.385			0.431	
	122.5	6174.4	6180.0	122.6	6	5:54 PM	0.482	0.392			0.437	
	122.5	6174.4	6180.0	122.6	10	5:59 PM	0.520	0.428			0.474	

Soil Nail Verification Load Test Data

Schnabel Engineering

Project: Hollow Core Bar Soil Nail Research
Location: Montrose, CO
Client: ADSC

Performed: Mountain Highwall Concrete (Norm Parsons)
Observed: Schnabel Engineering (Andy Baxter)
Data by: Schnabel Engineering (Andy Baxter)

Soil Nail: C3
Date: 11/4/2008

Design Test Load (P): 35 kips
 # Dials: 2
Jack Calibration: Pressure = 50.26746244 X reading (kip) + 16.6010236 (psi)

Sequence of Loading	Estimated Load [kip]	Dial Load [psi]	Applied Pressure [psi]	Applied Load [kip]	Time [min]	Time of Test	Dial 1 Deformation [in.]	Dial 2 Deformation [in.]	Dial 3 Deformation [in.]	Dial 4 Deformation [in.]	Average Deformation [in.]	Comments:
375%	131.3	6614.2	6620.0	131.4	1	5:59 PM	0.622	0.527			0.575	
	131.3	6614.2	6620.0	131.4	2	6:00 PM	0.627	0.532			0.580	
	131.3	6614.2	6620.0	131.4	3	6:01 PM	0.627	0.532			0.580	
	131.3	6614.2	6620.0	131.4	4	6:02 PM	0.624	0.528			0.576	
	131.3	6614.2	6620.0	131.4	5	6:03 PM	0.621	0.525			0.573	
	131.3	6614.2	6620.0	131.4	6	6:04 PM	0.628	0.532			0.580	
	131.3	6614.2	6620.0	131.4	10	6:08 PM	0.624	0.528			0.576	
386%	134.9	6800.0	6800.0	134.9	1	6:11 PM	0.730	0.629			0.680	
375%	131.3	6614.2	6620.0	131.4	1	6:12 PM	0.718	0.619			0.669	
350%	122.5	6174.4	6180.0	122.6	1	6:13 PM	0.710	0.612			0.661	
325%	113.8	5734.5	5740.0	113.9	1	6:13 PM	0.694	0.595			0.645	
295%	103.1	5200.0	5200.0	103.1	1	6:15 PM	0.664	0.565			0.615	
275%	96.3	4854.8	4860.0	96.4	1	6:15 PM	0.653	0.530			0.592	
250%	87.5	4415.0	4420.0	87.6	1	6:16 PM	0.634	0.535			0.585	
225%	78.8	3975.2	3980.0	78.8	1	6:16 PM	0.607	0.508			0.558	
200%	70.0	3535.3	3540.0	70.1	1	6:17 PM	0.573	0.474			0.524	
175%	61.3	3095.5	3100.0	61.3	1	6:17 PM	0.539	0.440			0.490	
150%	52.5	2655.6	2660.0	52.6	1	6:17 PM	0.510	0.411			0.461	
125%	43.8	2215.8	2220.0	43.8	1	6:17 PM	0.464	0.365			0.415	
100%	35.0	1776.0	1780.0	35.1	1	6:18 PM	0.436	0.337			0.387	
75%	26.3	1336.1	1340.0	26.3	1	6:18 PM	0.382	0.284			0.333	
50%	17.5	896.3	900.0	17.6	1	6:18 PM	0.346	0.250			0.298	
25%	8.8	456.4	460.0	8.8	1	6:19 PM	0.293	0.203			0.248	
AL	1.8	104.6	110.0	1.9	1	6:19 PM	0.248	0.174			0.211	

APPENDIX C

Soil Nail Installation Logs

Sketch	Depth [feet]	Casing	Bars	Grout	Time Start	Time End	Description and Observations of Drilling	Stage	Time Start	Time End	Pressure	Gs	Observations of Grouting
	0				8:50		Baretta T43????		2:15			1.82	
										2:30			sound grout, about 9 ft down casing
	5					9:05	very difficult drilling, cobbles						
					9:17		and gravel with sand, hole caving when casing pulled back						
					9:40								final sound after casing removed, 9' from face of ground
	10					9:47	begin adding water to air add casing						
	15				9:51		consistent gravel w/ sand layer						
							B.O.H. 18.5 ft						
	20					10:05							Casing installed to nail tip and was removed after grouting.
280							Bar was greased from 2' to 12'.						

Sketch: top and bottom of temporary casing, location of temporary casing sections and location of centralizers

Sketch: top and bottom of bar, location of bar sections and location of centralizers.

Schnabel Engineering

SOIL NAIL: A2

Soil Boring:			
Soil Nail Geometry:	Perpendicular to face		
Soil Nail elev.	-36" BGS		ft
Total casing length	20		ft
Total hole depth	18.5		ft
Total grout length	9.5		ft
	Design	As-built	
Total bar length	20	20	ft
Bonded length	6	6	ft
Unbonded length	10	10	ft
Tail length	4	1.67	ft
Bit type	Superjaw		
Bit diameter	7.75		in
Hole inclination	10		degrees
Centralizers	2 in bond zone		
Reinforcing steel:			
Date of installation	10/10/2008		
Supplier	Williams Form		
Casing description			
Diameter	7 " .43 wa	Type	N80
Nail description			
	Design	As-built	
No. Bars	1	1	
Diameter	1.75	1.75	in
Primary grouting			
Date of grouting	10/10/2008		
Cement typ. & supp	I/II Quickcrete		
Dosage / Admixture	5 gal :1- 94 lb bag		
Grouting method	gravity		
Batch ID	GS	Cubes	
13	1.82		
Final			
Volume	Theor.	As-built	
Drilling Grout			gal
Final Grout		21	gal

Project:	HBSN testing research program	Manager:	Allen Cadden	Date Drilled:	10-Oct
Location:	Montrose, CO	Engineer:	Javier Rodriguez	Date Grouted:	10-Oct
Client:	FHWA/ADSC	Superint.:	Terry		
Job No.:	07150064	Weather:	partly Cloudy, wind 65°	Capacity:	

Page: 1 of 1

Mike/Jason
Installer Representative
(Name and Date)

Allen Cadden 10/10/08
Schnabel's Representative
(Name and Date)

Sketch	Depth [feet]	Casing	Bars	Grout	Time Start	Time End	Description and Observations of Drilling	Stage	Time Start	Time End	Pressure	Gs	Observations of Grouting
	0				1:52:00		Baretta T46		4:05			1.84	
						1:54							sound grout, about 10 ft down casing
						1:56							
	5					2:00	very difficult drilling, cobbles						bar came up 2 ft when casing pulled
						2:01	and gravel with sand, hole						
						2:02	caving when casing pulled back						
						2:03							
						2:04							
	10												pulled 10 ft casing, grout at 10 ft
					2:13								
						2:25							bar 2 ft from face, grout 10 ft from face
						2:42							
						3:12	got through boulder						
	15					3:13	add water to air						hole cave about 4 ft from end of bar
					3:26		finish						
	20						B.O.H. 18 ft.						Casing installed to nail tip and was removed after grouting.
							casing 27" sitckout						
							bar 5" below casing						
							Bar was greased from 2' to 12'.						

Sketch: top and bottom of temporary casing, location of temporary casing sections and location of centralizers.

Sketch: top and bottom of bar, location of bar sections and location of centralizers.

281

Schnabel

Schnabel Engineering

SOIL NAIL: A3

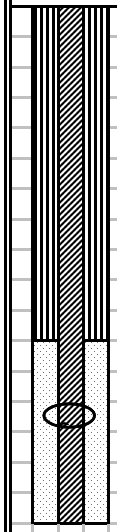
Soil Boring:			
Soil Nail Geometry:	Perpendicular to face		
Soil Nail elev.	-40" BGS		ft
Total casing length	20		ft
Total hole depth	18		ft
Total grout length	10		ft
	Design	As-built	
Total bar length	20	20	ft
Bonded length	6	6	ft
Unbonded length	10	10	ft
Tail length	2' outside face		ft
Bit type	Superjaw		
Bit diameter	7.75		in
Hole inclination	15		degrees
Centralizers	2 in bond zone		
Reinforcing steel:			
Date of installation	10/9/2008		
Supplier	Williams Form		
Casing description			
Diameter	7 " .43 wall	Type	N80
Nail description			
	Design	As-built	
No. Bars	1	1	
Diameter	1.75	1.75	in
Primary grouting			
Date of grouting	10/9/2008		
Cement typ. & supp	I/II Quickcrete		
Dosage / Admixture	5 gal :1- 94 lb bag		
Grouting method	gravity		
Batch ID	GS	Cubes	
12	1.84	yes	
Final			
Volume	Theor.	As-built	
Drilling Grout			gal
Final Grout		20	gal

Project:	HBSN testing research program	Manager:	Allen Cadden	Date Drilled:	9-Oct
Location:	Montrose, CO	Engineer:	Javier Rodriguez	Date Grouted:	9-Oct
Client:	FHWA/ADSC	Superint.:	Terry		
Job No.:	07150064	Weather:	Sunny 70	Capacity:	

Page: 1 of 1

Mike/Jason
Installer Representative
(Name and Date)

Allen Cadden 10/9/08
Schnabel's Representative
(Name and Date)

Sketch	Depth [feet]	Casing	Bars	Grout	Time Start	Time End	Description and Observations of Drilling	Stage	Time Start	Time End	Pressure	Gs	Observations of Grouting
	0	Sketch: top and bottom of temporary casing, location of temporary casing sections and location of centralizers.	Sketch: top and bottom of bar, location of bar sections and location of centralizers.				TEI 550 or Terex TXC 225 LC-1 Excavator						
							Casing installed prior to arrival						
	5												
	10				12:50	12:52	fix alignment begin drilling				40	1.87	8.08 gpm
						12:52:30							
						12:53:15					40	1.87	8.1 gpm
						12:53:45	add rod						
					12:55:20	12:55:45							
	15					12:56:15							batch 9
						12:56:45					120	1.83	8.07 gpm
													Hole flushed to 9 ft depth.
	20												

282

Schnabel Engineering

SOIL NAIL: B1

Soil Boring:			
Soil Nail Geometry:	Perpendicular to face		
Soil Nail elev.	-24" BGS		ft
Total casing length	10		ft
Total hole depth	16		ft
Total grout length	7		ft
	Design	As-built	
Total bar length	18	18	ft
Bonded length	6	6	ft
Unbonded length	10	10	ft
Tail length	14" abov	32" to soil	ft
Bit type	carbide cross cut		
Bit diameter	5		in
Hole inclination	14		degrees
Centralizers	1 in bond zone		
Reinforcing steel:			
Date of installation	10/9/2008		
Supplier	Contech Systems		
Casing description			
Diameter	7 "	Type	N80
Nail description			
	Design	As-built	
No. Bars	1	1	
Diameter	52/26	52/26	in
Primary grouting			
Date of grouting	10/9/2008		
Cement typ. & supp	I/II Quickcrete		
Dosage / Admixture	5 gal :1- 94 lb bag		
Grouting method	gravity		
Batch ID	GS	Cubes	
8	1.87		
9	1.83		
Final			
Volume	Theor.	As-built	
Drilling Grout		37	gal
Final Grout			gal

Project:	HBSN testing research program	Manager:	Allen Cadden	Date Drilled:	9-Oct
Location:	Montrose, CO	Engineer:	Javier Rodriguez	Date Grouted:	9-Oct
Client:	FHWA/ADSC	Superint.:	Terry		
Job No.:	07150064	Weather:	Sunny 70°	Capacity:	

Page: 1 of 1

Mike/Jason
Installer Representative
(Name and Date)

Allen Cadden 10/9/08
Schnabel's Representative
(Name and Date)

Sketch	Depth [feet]	Casing	Bars	Grout	Time Start	Time End	Description and Observations of Drilling	Stage	Time Start	Time End	Pressure	Gs	Observations of Grouting
	0						TEI 550 or Terex TXC 225 LC-1 Excavator						
							Casing installed prior to arrival						
	5												
	10				1:09:30	1:09:55	sandy gravel				120	1.83	8.04 gpm
					1:10:30	1:10:45							
						1:11:10							
						1:11:30							
					1:12:45	1:13:10	add rod						
	15					1:13:30					120	1.83	batch 10
							B.O.H. 16 ft						
													Hole flushed to 9 ft depth.
	20												

Sketch: top and bottom of temporary casing, location of temporary casing sections and location of centralizers.

Sketch: top and bottom of bar, location of bar sections and location of centralizers.

283

Schnabel

Schnabel Engineering

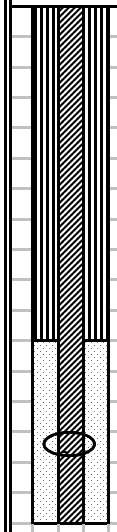
SOIL NAIL: B2

Soil Boring:			
Soil Nail Geometry:	Perpendicular to face		
Soil Nail elev.	-24" BGS		ft
Total casing length	10		ft
Total hole depth	16		ft
Total grout length	6		ft
	Design	As-built	
Total bar length	18	18	ft
Bonded length	6	6	ft
Unbonded length	10	10	ft
Tail length	12" abov	30" to soil	ft
Bit type	carbide cross cut		
Bit diameter	5		in
Hole inclination	14		degrees
Centralizers	1 in bond zone		
Reinforcing steel:			
Date of installation	10/9/2008		
Supplier	Contech Systems		
Casing description			
Diameter	7 "	Type	N80
Nail description			
	Design	As-built	
No. Bars	1	1	
Diameter	52/26	52/26	in
Primary grouting			
Date of grouting	10/9/2008		
Cement typ. & supp	I/II Quickcrete		
Dosage / Admixture	5 gal :1- 94 lb bag		
Grouting method	gravity		
Batch ID	GS	Cubes	
9	1.83		
10	1.83		
Final			
Volume	Theor.	As-built	
Drilling Grout		37	gal
Final Grout			gal

Project:	HBSN testing research program	Manager:	Allen Cadden	Date Drilled:	9-Oct
Location:	Montrose, CO	Engineer:	Javier Rodriguez	Date Grouted:	9-Oct
Client:	FHWA/ADSC	Superint.:	Terry		
Job No.:	07150064	Weather:	Sunny 70°	Capacity:	
				Page:	1 of 1

Mike/Jason
Installer Representative
(Name and Date)

Allen Cadden 10/9/08
Schnabel's Representative
(Name and Date)

Sketch	Depth [feet]	Casing	Bars	Grout	Time Start	Time End	Description and Observations of Drilling	Stage	Time Start	Time End	Pressure	Gs	Observations of Grouting
	0						TEI 550 or Terex TXC 225 LC-1 Excavator						
							Casing installed prior to arrival						
	5												
	10				1:23:30		sandy gravel						
							wandering to one side in casing				90	1.83	Batch 10 8.03 gpm
						1:24:25							
						1:24:50							
						1:25:10	add rod						
	15				1:27:40	1:28:30					90	1.83	8.03 gpm
						1:29:55	rock at tip				150	1.87	Batch 11
							B.O.H. 16 ft						
													Hole flushed to 9 ft depth.
	20												

Sketch: top and bottom of temporary casing, location of temporary casing sections and location of centralizers

Sketch: top and bottom of bar, location of bar sections and location of centralizers.

284

Schnabel Engineering

SOIL NAIL: B3

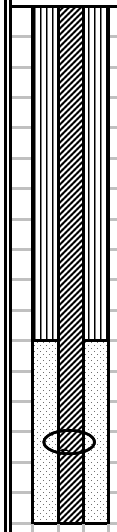
Soil Boring:			
Soil Nail Geometry:	Perpendicular to face		
Soil Nail elev.	-30" BGS		ft
Total casing length	10		ft
Total hole depth	16		ft
Total grout length	6		ft
	Design	As-built	
Total bar length	18	18	ft
Bonded length	6	6	ft
Unbonded length	10	10	ft
Tail length	13" abov	34" to soil	ft
Bit type	carbide cross cut		
Bit diameter	5		in
Hole inclination	11		degrees
Centralizers	1 in bond zone		
Reinforcing steel:			
Date of installation	10/9/2008		
Supplier	Contech Systems		
Casing description			
Diameter	7 "	Type	N80
Nail description			
	Design	As-built	
No. Bars	1	1	
Diameter	52/26	52/26	in
Primary grouting			
Date of grouting	10/9/2008		
Cement typ. & supp	I/II Quickcrete		
Dosage / Admixture	5 gal :1- 94 lb bag		
Grouting method	gravity		
Batch ID	GS	Cubes	
10	1.83		
11	1.87		
Final			
Volume	Theor.	As-built	
Drilling Grout		41	gal
Final Grout			gal

Project:	HBSN testing research program	Manager:	Allen Cadden	Date Drilled:	9-Oct
Location:	Montrose, CO	Engineer:	Javier Rodriguez	Date Grouted:	9-Oct
Client:	FHWA/ADSC	Superint.:	Terry		
Job No.:	07150064	Weather:	Sunny 70°	Capacity:	

Page: 1 of 1

Mike/Jason
Installer Representative
(Name and Date)

Allen Cadden 10/9/08
Schnabel's Representative
(Name and Date)

Sketch	Depth [feet]	Casing	Bars	Grout	Time Start	Time End	Description and Observations of Drilling	Stage	Time Start	Time End	Pressure	Gs	Observations of Grouting
	0	Sketch: top and bottom of temporary casing, location of temporary casing sections and location of centralizers.	Sketch: top and bottom of bar, location of bar sections and location of centralizers.		11:09:00		Include a description of drilling equipment						
							Sandy Gravel						
							face crumbling, stop add bar				30 psi		8.1 gal per minute
							PVC installed from 0 to 10.3 ft					1.74	
	5					11:11:00							0 pressure at swivel, bad gage
					11:14:45		restart, 1 ft - 30 sec						
							1 ft - 45 sec						
					11:22:40	11:23:20	1 ft - 40 sec						
	10				11:23:40		1 ft - 40 sec						
							pvc pushing over coupler at top,					1.82	
					11:33:45	11:34:55	2 ft - 1 min 10 sec						
	15						add centralizer over pvc to hold						
					11:36:00		in place				110		
							finish, 16 ft bar in ground						
											130		
							B.O.H. 16 ft						
285												1.87	8.1 gal per minute
											120		8.1 gpm

Schnabel
Schnabel Engineering

SOIL NAIL: C1

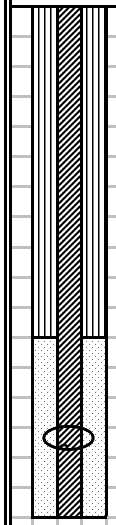
Soil Boring:			
Soil Nail Geometry:	Perpendicular to face		
Soil Nail elev.	-40" BGS		ft
Total casing length	0		ft
Total hole depth	16		ft
Total grout length	16		ft
	Design	As-built	
Total bar length	18	18	ft
Bonded length	6	6	ft
Unbonded length	10	10	ft
Tail length	2	2	ft
Bit type	carbide cross cut		
Bit diameter	5		in
Hole inclination	12		degrees
Centralizers	1 in bond zone		
Reinforcing steel:			
Date of installation	10/9/2008		
Supplier	Contech Systems		
Casing description			
Diameter	NA	Type	
Nail description			
	Design	As-built	
No. Bars	1	1	
Diameter	52/26	52/26	in
Primary grouting			
Date of grouting	10/9/2008		
Cement typ. & supp	I/II Quickcrete		
Dosage / Admixture	5 gal :1- 94 lb bag		
Grouting method	gravity		
Batch ID	GS	Cubes	
1	1.74		
2	1.82		
3	1.87	NO	
Final			
Volume	Theor.	As-built	
Drilling Grout		93	gal
Final Grout			gal

Project:	HBSN testing research program	Manager:	Allen Cadden	Date Drilled:	9-Oct
Location:	Montrose, CO	Engineer:	Javier Rodriguez	Date Grouted:	9-Oct
Client:	FHWA/ADSC	Superint.:	Terry		
Job No.:	07150064	Weather:	Sunny 70°	Capacity:	

Page: 1 of 1

Mike/Jason
Installer Representative
(Name and Date)

Allen Cadden 10/9/08
Schnabel's Representative
(Name and Date)

Sketch	Depth [feet]	Casing	Bars	Grout	Time Start	Time End	Description and Observations of Drilling	Stage	Time Start	Time End	Pressure	Gs	Observations of Grouting
	0				11:43:00		Include a description of drilling equipment					1.87	
							PVC installed from 0 to 9.75 ft Sandy Gravel						
	5					11:45:40	kicking on cobble						
					11:50:30		add bar centralizer on top						
							1:20 per foot, boulder					1.89	
	10					11:55:00	boulder, hole staying open.						
					11:58:00							1.82	
							1:35 per foot				110		
	15					12:00:00						1.85	8.05 gpm
					12:06:30		last 2 ft, 2:30				100		
						12:09:00	B.O.H. 16 ft						
													gage on swivel was not functioning

Sketch: top and bottom of temporary casing, location of temporary casing sections and location of centralizers.

Sketch: top and bottom of bar, location of bar sections and location of centralizers.

286

Schnabel

Schnabel Engineering

SOIL NAIL: C2

Soil Boring:			
Soil Nail Geometry:	Perpendicular to face		
Soil Nail elev.	-36" BGS		ft
Total casing length	0		ft
Total hole depth	16		ft
Total grout length	16		ft
	Design	As-built	
Total bar length	18	18	ft
Bonded length	6	6	ft
Unbonded length	10	10	ft
Tail length	2	2	ft
Bit type	carbide cross cut		
Bit diameter	5		in
Hole inclination	15		degrees
Centralizers	1 in bond zone		
Reinforcing steel:			
Date of installation	10/9/2008		
Supplier	Contech Systems		
Casing description			
Diameter	NA	Type	
Nail description			
	Design	As-built	
No. Bars	1	1	
Diameter	52/26	52/26	in
Primary grouting			
Date of grouting	10/9/2008		
Cement typ. & supp	I/II Quickcrete		
Dosage / Admixture	5 gal :1- 94 lb bag		
Grouting method	gravity		
Batch ID	GS	Cubes	
3	1.87		
4	1.89	cubes 6	
5	1.82		
6	1.85		
Volume	Theor.	As-built	
Drilling Grout		113	gal
Final Grout			gal

Project:	HBSN testing research program	Manager:	Allen Cadden	Date Drilled:	9-Oct
Location:	Montrose, CO	Engineer:	Javier Rodriguez	Date Grouted:	9-Oct
Client:	FHWA/ADSC	Superint.:	Terry		
Job No.:	7150064	Weather:	Sunny 70°	Capacity:	

Page: 1 of 1

Mike/Jason
Installer Representative
(Name and Date)

Allen Cadden 10/9/08
Schnabel's Representative
(Name and Date)

Sketch	Depth [feet]	Casing	Bars	Grout	Time Start	Time End	Description and Observations of Drilling	Stage	Time Start	Time End	Pressure	Gs	Observations of Grouting
	0				12:15:15		Include a description of drilling equipment						
											100	1.85	8.06 gpm
							PVC installed from 0 to 10.08 ft						
							Sandy Gravel						
	5					12:16:30							
					12:17:15	12:17:50							
						12:18:15							
						12:18:40							
						12:19:00					100	1.85	batch 7
	10					12:19:45							
						12:20:00							
						12:20:30							8.02 gpm
						12:21:15							
	15					12:22:00							
					12:24:30	12:25:30	add rod, getting top centralizer				100		8.07 gpm
						12:26:00	past foot clamp was tight						batch 8 just started
							B.O.H. 16 ft.						
													gage on swivel was not functionir

Sketch: top and bottom of temporary casing, location of temporary casing sections and location of centralizers.

Sketch: top and bottom of bar, location of bar sections and location of centralizers.

287

Schnabel

Schnabel Engineering

SOIL NAIL:	C3		
Soil Boring:			
Soil Nail Geometry:	Perpendicular to face		
Soil Nail elev.	-36" BGS		ft
Total casing length	0		ft
Total hole depth	16		ft
Total grout length	16		ft
	Design	As-built	
Total bar length	18	18	ft
Bonded length	6	6	ft
Unbonded length	10	10	ft
Tail length	2	2	ft
Bit type	carbide cross cut		
Bit diameter	5		in
Hole inclination	10		degrees
Centralizers	1 in bond zone		
Reinforcing steel:			
Date of installation	10/9/2008		
Supplier	Contech Systems		
Casing description			
Diameter	NA	Type	
Nail description			
	Design	As-built	
No. Bars	1	1	
Diameter	52/26	52/26	in
Primary grouting			
Date of grouting	10/9/2008		
Cement typ. & supp	I/II Quickcrete		
Dosage / Admixture	5 gal :1- 94 lb bag		
Grouting method	gravity		
Batch ID	GS	Cubes	
6	1.85		
7	1.85		
8	1.87		
Volume	Theor.	As-built	
Drilling Grout		82	gal
Final Grout			gal

Project:	HBSN testing research program	Manager:	Allen Cadden	Date Drilled:	9-Oct
Location:	Montrose, CO	Engineer:	Javier Rodriguez	Date Grouted:	9-Oct
Client:	FHWA/ADSC	Superint.:	Terry		
Job No.:	7150064	Weather:	Sunny 70°	Capacity:	

Page: 1 of 1

Mike/Jason
Installer Representative
(Name and Date)

Allen Cadden 10/9/08
Schnabel's Representative
(Name and Date)

APPENDIX D

Grout Compressive Strength

BUCKHORNGEOTECH FIELD / LAB DATA -- COMPRESSIVE STRENGTH TESTS

STANDARD MASONRY GROUT CUBES

Civil, Structural & Geotechnical Engineers
222 So. Park Ave. Montrose, Colorado 81401
970-249-6828 Fax No. 970-249-0946

Project #: 2008-364-GEO Date Due: 10-09-08

Event/Invoice #: _____ Lab #: _____

Project: ADSC-FHWA Hollow Bar Soil Nail Test Program

Authorized By: Shane Puckett Date 10-09-08

Sample Location: Batch #4 (2nd Nail)

Sampled By: L. Sanchez Date 10-09-08

AREA/TYPE PLACEMENT: ☐ CURB/GUTTER ☐ FLOOR SLAB ☐ FOOTING ☐ WALL ☐ OTHER

Supplier/Plant #: Site Mixed

Submitted By: _____ Date _____

Truck/Ticket #: N/A Mix Identification: _____ Maximum Size Aggregate: N/A inches

Batch Size: N/A cubic yards; Required Strength: _____ psi at _____ days; Water Added Before Sampling: N/A gallons

Time In Mixer: N/A hours N/A minutes Ambient Air Temperature: 72°F degrees F Time Sampled: 11:30 AM

FRESHLY MIXED CONCRETE SAMPLED IN ACCORDANCE WITH: ☒ ASTM C172 ☐ AASHTO T141 ☐ _____

FRESHLY MIXED CONCRETE TESTED IN ACCORDANCE WITH DESIGNATED SPECIFICATIONS:

UNIT WEIGHT: ☒ ASTM C138 ☐ AASHTO T121 N/T LBF / CU. FT.

TEMPERATURE: ☒ ASTM C1064 ☐ _____ N/T degrees F.

AIR CONTENT: ☐ ASTM C173 ☐ AASHTO T196 ☒ ASTM C231 ☐ ASTM C153 ☐ _____ N/T %

SLUMP: ☒ ASTM C143 ☐ AASHTO T119 ☐ _____ N/T INCHES

CYLINDRICAL CONCRETE SPECIMENS MOLDED & CURED IN ACCORDANCE WITH: ☒ ASTM C31 ☐ AASHTO T23 ☐ _____

OF SPECIMENS MOLDED: 6 DIAMETER/LENGTH: 2 IN. x 2 IN. CROSS-SECTIONAL AREA: 4 SQ. IN.

CYLINDRICAL CONCRETE SPECIMENS CURED AND TESTED IN THE LAB IN ACCORDANCE WITH:

☒ ASTM C31 & C39 ☐ AASHTO T23 ☐ _____

SPECIMEN MARKING IF ANY	DATE TESTED	TIME TESTED	AGE IN DAYS	COMPRESSIVE STRENGTH MAXIMUM LOAD LBF	PSI	CONFORMANCE INDICATED?	TYPE FRACTURE (SEE SKETCHES BELOW)	DEFECTS IN SPECIMENS / CAPS IF ANY	TESTED BY
2487	10/16		7	28430	7230		Type 3		CC
2488	10/16		7	27970	6990		Type 2		CC
2489	10/06		28	28460	7120		Type 1		CC
2490	11/06		28						
2491	11/06		28						
2492	11/06		28						

COMMENTS: Specific Gravity = 1.89
Avg. 7-day @ 7110 psi

COMMENT CODES

A. Indication of possible damage to specimen _____ noted.

B. Access was not available for timely removal / transport of specimens.

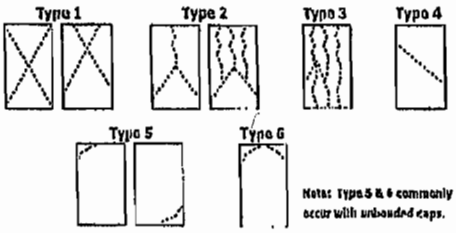
C. Hardened specimens and related data were provided by: _____

D. Special Instructions: _____

E. Test results for this sample indicate material does not meet requirements for: _____

F. _____

SKETCHES OF TYPES OF FRACTURES:



Note: Type 5 & 6 commonly occur with unbonded caps.

grout New CST.xlsCST

BUCKHORN GEOTECH

Civil, Structural & Geotechnical Engineers
222 South Park Ave. • Montrose, CO 81401
Ph.: (970) 249-6828 • FAX: (970) 249-0945

FIELD / LAB DATA -- COMPRESSIVE STRENGTH TESTS

STANDARD MASONRY GROUT CUBES

Project #: CB-364-GFO Date Due: _____

Event/Invoice #: _____ Lab #: _____

Project: ADSC/FHWA HBSN Authorized By: S. Duckworth Date: _____

Sample Location: _____ Sampled By: T. Davis Date: 9 OCT 08.

AREA/TYPE PLACEMENT: ☐ CURB/GUTTER ☐ FLOOR SLAB ☐ FOOTING ☐ WALL ☑ OTHER SOIL NAIL GROUT

Supplier/Plant #: SITE MIXED Submitted By: BW Date: 10 OCT 08.

Truck/Ticket #: — Mix Identification: — Maximum Size Aggregate: — inches

Batch Size: — cubic yards; Required Strength: _____ psi at _____ days; Water Added Before Sampling: — gallons

Time in Mixer: — hours — minutes Ambient Air Temperature: _____ degrees F Time Sampled: _____

SEE ALLEN CASSIDY.

FRESHLY MIXED CONCRETE SAMPLED IN ACCORDANCE WITH: ☒ ASTM C172 ☐ AASHTO T141 ☐ _____

FRESHLY MIXED CONCRETE TESTED IN ACCORDANCE WITH DESIGNATED SPECIFICATIONS:

UNIT WEIGHT: ☒ ASTM C138 ☐ AASHTO T121 N/T LBF / CU. FT.

TEMPERATURE: ☒ ASTM C1064 ☐ _____ N/T degrees F.

AIR CONTENT: ☐ ASTM C173 ☐ AASHTO T196 ☒ ASTM C231 ☐ ASTM C153 ☐ _____ N/T %

SLUMP: ☒ ASTM C143 ☐ AASHTO T119 ☐ _____ N/T INCHES

CYLINDRICAL CONCRETE SPECIMENS MOLDED & CURED IN ACCORDANCE WITH: ☒ ASTM C31 ☐ AASHTO T23 ☐ _____

OF SPECIMENS MOLDED: 6 DIAMETER/LENGTH: 2 IN. x 2 IN. CROSS-SECTIONAL AREA: 4 SQ. IN.

CYLINDRICAL CONCRETE SPECIMENS CURED AND TESTED IN THE LAB IN ACCORDANCE WITH:

☒ ASTM C31 & C39 ☐ AASHTO T23 ☐ _____

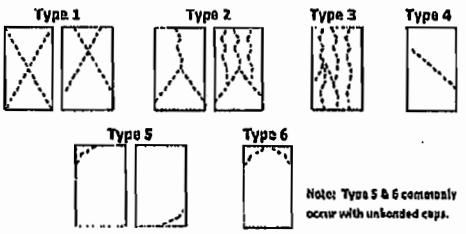
SPECIMEN MARKING IF ANY	DATE TESTED	TIME TESTED	AGE IN DAYS	COMPRESSIVE STRENGTH MAXIMUM LOAD LBF	PSI	CONFORMANCE INDICATED?	TYPE FRACTURE (SEE SKETCHES BELOW)	DEFECTS IN SPECIMENS / CAPS IF ANY	TESTED BY
2493	10/16		7	21380	5900		Type 6	3.125 - Seeback	CC
2494	10/16		7	20380	5430		Type 6	3.75 - Seeback	CC
2495	10/16		7	20680	5490		Type 2	3.75 See back	CC
2496	11/06		28						
2497	11/06		28						
2498	11/06		28						

COMMENTS: Avg. 7-day (@ 5610 psi

COMMENT CODES

A. Indication of possible damage to specimen _____ noted.
B. Access was not available for timely removal / transport of specimens.
C. Hardened specimens and related data were provided by: _____
D. Special Instructions: _____
E. Test results for this sample indicate material does not meet requirements for: _____
F. _____

SKETCHES OF TYPES OF FRACTURES:



Note: Type 5 & 6 commonly occur with unbonded caps.

grout CUBE New CST (CD).xlsCST

APPENDIX E

Jack Calibrations

FORM ENGINEERING CORP.

CONVERSION CHART

Jack Gauge PSI to Bolt Tension (in lbs.)

for 100 Ton Test Jack Model #RH 1006 6"

20.03 sq. in. Ram Area (20.03 sq. in. X PSI)

Gauge PSI	Corresponding Tension in Lbs.	Gauge PSI	Corresponding Tension in Lbs.
200	4006	3800	76114
300	6009	4000	80120
400	8012	4200	84126
500	10015	4400	88132
600	12018	4600	92138
700	14021	4800	96144
800	16024	5000	100150
900	18027	5200	104156
1000	20030	5400	108162
1100	22033	5600	112168
1200	24036	5800	116174
1300	26039	6000	120180
1400	28042	6200	124186
1500	30045	6400	128192
1600	32048	6600	132198
1700	34051	6800	136204
1800	36054	7000	140210
1900	38057	7200	144216
2000	40060	7400	148222
2100	42063	7600	152228
2200	44066	7800	156234
2300	46069	8000	160240
2400	48072	8200	164246
2500	50075	8400	168252
2600	52078	8600	172258
2800	56084	8800	176264
3000	60090	9000	180270
3200	64096	9200	184276
3400	68102	9400	188282
3600	72108	9600	192288
		9800	196294

P.O. BOX 7088 • GRAND RAPIDS, MICHIGAN 49510 • (616) 452-3107 • TELEX No. 226410 • FAX (616) 452-4089

WILLIAMS FORM ENGINEERING CORP.
8165 GRAPHIC DR.NE. www.williamsform.com
BELMONT, MI 49306
Ph: 616-8660815 - Fx: 616-866-1890

Testing Laboratory
Calibration Test No.: 1613

HYDRAULIC JACK UNIT CALIBRATION REPORT

Customer: TEI ROCK DRILLS Salesman: Tom Bird Customer Order No. 167574

Jack Model No.: RH1006 Service Gauge Model No: WIKA Pump Model No.: PE554

Jack Serial No.: RH1006-23 Service Gauge Serial No.: 106712 Pump Serial No.: PE554-35

Capacity: 100 ton Capacity Range : 0-10,000 psi Power - AIR ☐ Elec. ☑

Ram Area: 20.03 sq.in. Hand ☐

Calibration Date: 10/8/2008 (calibration invalid after 6 months)

Calibration Location: Williams Form Engineering Corp, Test Lab - 5501 Rusche Rd, Comstock Park, MI 49321

Test Frame Load Cell No. 1 : Model no: HBM-C6 Serial No.: 52141

Calibration Date : 8/01/2008, Next calibration: 8/01/2009, by Calibration Services Inc.

Test Frame Load Cell No. 2 : Model no: HBM-C6 Serial No.: 52128

Calibration Date : 8/01/2008, Next calibration: 8/01/2009, by Calibration Services Inc.

Hydraulic Transducer : Model no: HBM-P3M Serial No.: 5210090

Calibration Date : 8/01/2008, Next calibration: 8/01/2009, by Calibration Services Inc..

TEST DATA TEMP 65 DEG HUMIDITY: 90% BAROMETER 29.74"

Master Gauge P3M (psi)	Service gauge (psi)	Run 1 cell 1 and 2 average (lbs)	Run 2 cell 1 and 2 average (lbs)	Run 3 cell 1 and 2 average (lbs)	Test Average (lbs)
0	0	0	0	0	0
952	1000	18,451	18,370	18,735	18,519
1986	2000	38,845	39,088	38,279	38,737
2996	3000	58,632	58,955	58,106	58,564
3975	4000	77,731	77,933	77,892	77,852
4997	5000	97,517	98,488	98,246	98,084
6011	6000	118,518	118,396	117,790	118,235
7025	7000	137,940	138,911	138,224	138,358
8020	8000	158,658	158,374	157,565	158,199

Calibrated by: _____

Verified by: _____ Engineering Dept. - Lab Manager

This Jack Calibration is issued as a statement of the fact that on this date the above equipment(s) had accuracy as indicated in the date section of this calibration. It should not be construed or regarded as a Guarantee or Warranty of any kind, which the equipment will continue to retain the same percentage of accuracy or efficiency as determined on the date when the calibration was performed by Williams. Operation, damage, or loss sustained by all parties arising or resulting from deterioration, obsolescence, malfunction, or substandard performance of said equipment(s) shall be and remain the sole responsibility of the equipment(s) user, renter, and/or owner. This document shall not be reproduced except in full, without written approval of Williams Form Engineering Co.

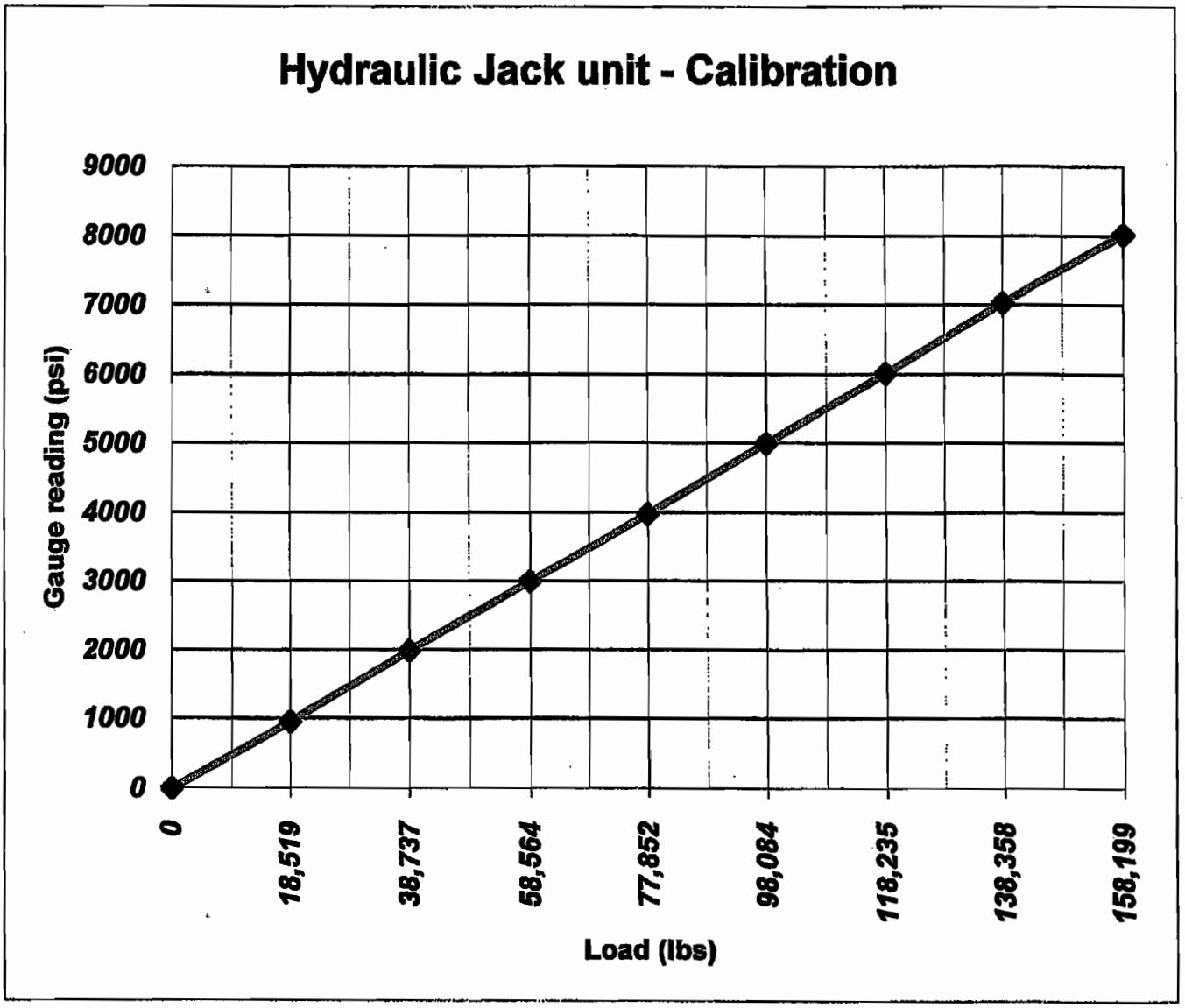
RHT 8/10/05

WILLIAMS FORM ENGINEERING CORP.
8165 GRAPHIC DR. NE
BELMONT, MI 49306
www.williamsform.com
Ph: 616-365-9220 - Fx: 616-365-2668

Testing Laboratory
Calibration Test No.: 1613

Customer:	TEI ROCK DRILLS	Salesman:	Tom Bird	Customer Order No:	167574
Jack Model No.:	RH1006	Service Gauge Model No:	WIKA	Pump Model No.:	PE554
Jack Serial No.:	RH1006-23	Service Gauge Serial No.:	106712	Pump Serial No.:	PE554-35
Capacity:	100 ton	Capacity Range :	0-10,000 psi	Power - AIR ☐	Elec. ☑
Ram Area:	20.03 sq.in.			Hand ☐	

Calibration Date: 10/8/2008 (calibration invalid after 6 months)



Page 2

10/8/2008

WILLIAMS FORM ENGINEERING CORP.
8165 GRAPHIC DR.NE. www.williamsform.com
BELMONT, MI 49306
Ph: 616-8660815 - Fx: 616-866-1890

Testing Laboratory
Calibration Test No.: 1613

HYDRAULIC JACK UNIT CALIBRATION REPORT

Customer: TEI ROCK DRILLS Salesman: Tom Bird Customer Order No. 167574

Jack Model No.: RH1006 Service Gauge Model No: WIKA Pump Model No.: PE554

Jack Serial No.: RH1006-23 Service Gauge Serial No.: 106712 Pump Serial No.: PE554-35

Capacity: 100 ton Capacity Range : 0-10,000 psi Power - AIR ☐ Elec. ☑

Ram Area: 20.03 sq.in. Hand ☐

Calibration Date: 10/8/2008 (calibration invalid after 6 months)

Calibration Location: Williams Form Engineering Corp, Test Lab - 5501 Rusche Rd, Comstock Park, MI 49321

Test Frame Load Cell No. 1 : Model no: HBM-C6 Serial No.: 52141

Calibration Date : 8/01/2008, Next calibration: 8/01/2009, by Calibration Services Inc.

Test Frame Load Cell No. 2 : Model no: HBM-C6 Serial No.: 52128

Calibration Date : 8/01/2008, Next calibration: 8/01/2009, by Calibration Services Inc.

Hydraulic Transducer : Model no: HBM-P3M Serial No.: 5210090

Calibration Date : 8/01/2008, Next calibration: 8/01/2009, by Calibration Services Inc..

TEST DATA TEMP 65 DEG HUMIDITY: 90% BAROMETER 29.74"

Master Gauge P3M (psi)	Service gauge (psi)	Run 1 cell 1 and 2 average (lbs)	Run 2 cell 1 and 2 average (lbs)	Run 3 cell 1 and 2 average (lbs)	Test Average (lbs)
0	0	0	0	0	0
952	1000	18,451	18,370	18,735	18,519
1986	2000	38,845	39,088	38,279	38,737
2996	3000	58,632	58,955	58,106	58,564
3975	4000	77,731	77,933	77,892	77,852
4997	5000	97,517	98,488	98,246	98,084
6011	6000	118,518	118,396	117,790	118,235
7025	7000	137,940	138,911	138,224	138,358
8020	8000	158,658	158,374	157,565	158,199

Calibrated by:

Verified by: Engineering Dept. - Lab Manager

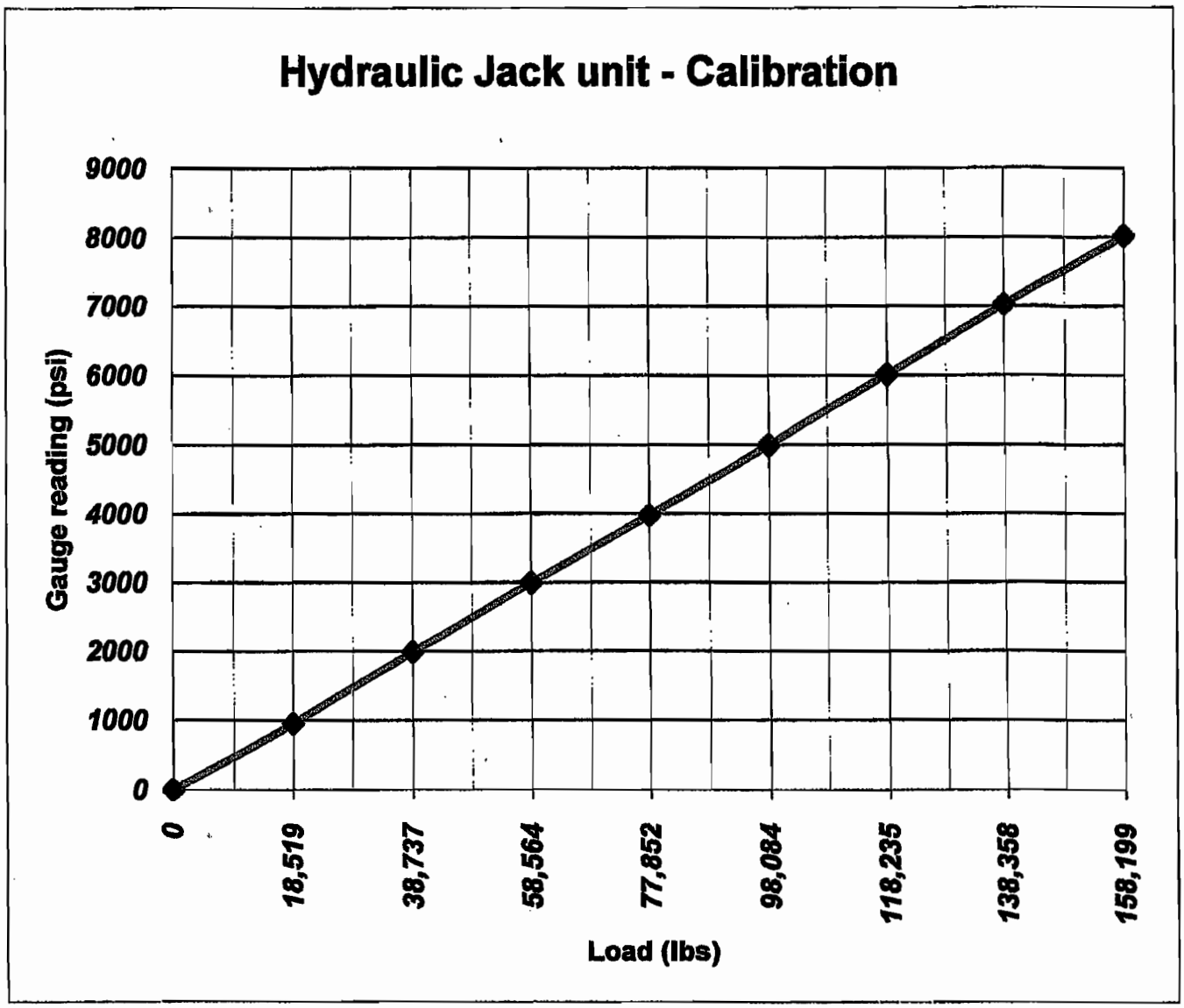
This Jack Calibration is issued as a statement of the fact that on this date the above equipment(s) had accuracy as indicated in the date section of this calibration. It should not be construed or regarded as a Guarantee or Warranty of any kind, which the equipment will continue to retain the same percentage of accuracy or efficiency as determined on the date when the calibration was performed by Williams. Operation, damage, or loss sustained by all parties arising or resulting from deterioration, obsolescence, malfunction, or substandard performance of said equipment(s) shall be and remain the sole responsibility of the equipment(s) user, renter, and/or owner. This document shall not be reproduced except in full, without written approval of Williams Form Engineering Co. RHT 8/10/05

WILLIAMS FORM ENGINEERING CORP.
8165 GRAPHIC DR. NE
BELMONT, MI 49306
www.williamsform.com
Ph: 616-365-9220 - Fx: 616-365-2668

Testing Laboratory
Calibration Test No.: 1613

Customer:	TEI ROCK DRILLS	Salesman:	Tom Bird	Customer Order No:	167574
Jack Model No.:	RH1006	Service Gauge Model No:	WIKA	Pump Model No.:	PE554
Jack Serial No.:	RH1006-23	Service Gauge Serial No.:	106712	Pump Serial No.:	PE554-35
Capacity:	100 ton	Capacity Range :	0-10,000 psi	Power - AIR ☐	Elec. ☑
Ram Area:	20.03 sq.in.			Hand ☐	

Calibration Date: 10/8/2008 (calibration invalid after 6 months)



Page 2

10/8/2008

WILLIAMS FORM ENGINEERING CORP.	8165 GRAPHIC DR.NE. www.williamsform.com BELMONT, MI 49306 Ph: 616-8660815 - Fx: 616-866-1890	Testing Laboratory Calibration Test No.: 1614

GAUGE CALIBRATION REPORT

Customer: TEI ROCK DRILL Salesman: Tom Bird Customer Order No. 167574

Service Gauge Serial No.: 10-708 Service Gauge WIKA Capacity Range : 0-10,000 psi

Calibration Date: 10/8/2008 (calibration invalid after 6 months)

Calibration Location: Williams Form Engineering Corp, Test Lab - 5501 Rusche Rd, Comstock Park, MI 49321

Hydraulic Transducer Model no: HBM-P3M Serial No. 5210090

Calibration Date : 8/01/2008, Next calibration: 8/01/2009, by Calibration Services Inc., per ASTM E4

TEST DATA TEMP 65 DEG HUMIDITY: 90% BAROMETER 29.74"

Service load increment (psi)	Master Gauge P3M (psi) Load 1	Master Gauge P3M (psi) Load 1	Master Gauge P3M (psi) Load 1	Average P3M gauge reading (psi)
0	0	0	0	0
1000	1006	1,003	1,011	1,007
2000	2010	2,032	2,028	2,023
3000	3042	3,024	3,017	3,028
4000	4067	4,038	4,068	4,057
5000	5059	5,038	5,042	5,046
6000	6017	6,046	6,048	6,037
7000	7063	7,039	7,063	7,055
8000	8055	8,086	8,088	8,076
9000	9019	9,076	9,066	9,054
10000	0	0	0	0

Calibrated by:

Verified by: Engineering Dept. - Lab Manager

This Calibration is issued as a statement of the fact that on this date the above equipment(s) had accuracy as indicated in the date section of this calibration. It should not be construed or regarded as a Guarantee or Warranty of any kind, which the equipment will continue to retain the same percentage of accuracy or efficiency as determined on the date when the calibration was performed by Williams. Operation, damage, or loss sustained by all parties arising or resulting from deterioration, obsolescence, malfunction, or substandard performance of said equipment(s) shall be and remain the sole responsibility of the equipment(s) user, renter, and/or owner. This document shall not be reproduced except in full, without written approval of Williams Form Engineering Co. RHT 1/27/08

WILLIAMS FORM ENGINEERING CORP.
8165 GRAPHIC DR.NE. www.williamsform.com
BELMONT, MI 49306
Ph: 616-8660815 - Fx: 616-866-1890

Testing Laboratory
Calibration Test No.: 1614

GAUGE CALIBRATION REPORT

Customer: TEI ROCK DRILL Salesman: Tom Bird Customer Order No. 167574

Service Gauge Serial No.: 10-708 Service Gauge WIKA Capacity Range : 0-10,000 psi

Calibration Date: 10/8/2008 (calibration invalid after 6 months)

Calibration Location: Williams Form Engineering Corp, Test Lab - 5501 Rusche Rd, Comstock Park, MI 49321

Hydraulic Transducer Model no: HBM-P3M Serial No. 5210090

Calibration Date : 8/01/2008, Next calibration: 8/01/2009, by Calibration Services Inc., per ASTM E4

TEST DATA TEMP 65 DEG HUMIDITY: 90% BAROMETER 29.74"

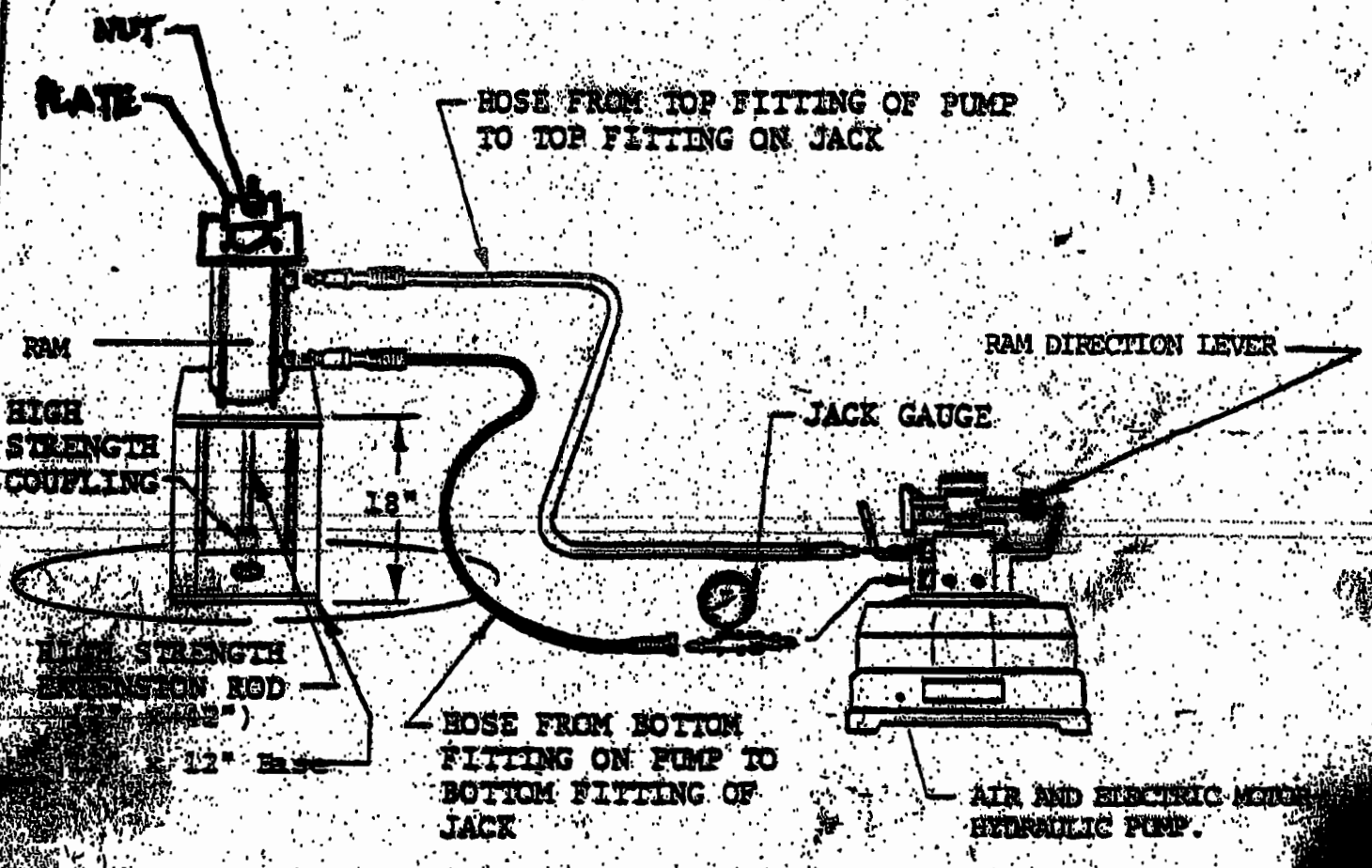
Service load increment (psi)	Master Gauge P3M (psi) Load 1	Master Gauge P3M (psi) Load 1	Master Gauge P3M (psi) Load 1	Average P3M gauge reading (psi)
0	0	0	0	0
1000	1006	1,003	1,011	1,007
2000	2010	2,032	2,028	2,023
3000	3042	3,024	3,017	3,028
4000	4067	4,038	4,068	4,057
5000	5059	5,038	5,042	5,046
6000	6017	6,046	6,048	6,037
7000	7063	7,039	7,063	7,055
8000	8055	8,086	8,088	8,076
9000	9019	9,076	9,066	9,054
10000	0	0	0	0

Calibrated by:

Verified by: Engineering Dept. - Lab Manager

This Calibration is issued as a statement of the fact that on this date the above equipment(s) had accuracy as indicated in the date section of this calibration. It should not be construed or regarded as a Guarantee or Warranty of any kind, which the equipment will continue to retain the same percentage of accuracy or efficiency as determined on the date when the calibration was performed by Williams. Operation, damage, or loss sustained by all parties arising or resulting from deterioration, obsolescence, malfunction, or substandard performance of said equipment(s) shall be and remain the sole responsibility of the equipment(s) user, renter, and/or owner. This document shall not be reproduced except in full, without written approval of Williams Form Engineering Co.
RHT 1/27/08

WILLIAMS FORM TEST JACK
(STANDARD SIZES SHOWN ONLY)



TO OBTAIN TENSION IN POUNDS, MULTIPLY P.S.I. BY RAM AREA SHOWN NEAR TOP OF RAM.

WILLIAMS FORM ENGINEERING CORP.

P.O. BOX 7343 • GRAND RAPIDS, MICH. 49510

(616) 452-3107 • TX. 22-4416

DRAWN BY MT

SCALE ——

DATE 5-2-89

REV. NO.

869-2

THIS DRAWING IS THE PROPERTY OF THE WILLIAMS FORM ENGINEERING CORP. AND IS SUBMITTED TO THE CONTRACTOR SOLELY AS A SUGGESTED DESIGN FOR APPROVAL BY HIS JOB DESIGN AGENCY. IT IS SUBJECT TO RECALL AND MUST NOT BE REPRODUCED OR ITS CONTENTS DIVULGED WITHOUT WRITTEN PERMISSION. ALL WILLIAMS PRODUCTS ARE PATENTED OR HAVE PATENTS APPLIED FOR.

APPENDIX F

Geotechnical Information

OCT 20 2008

BUCKHORN GEOTECH

Civil, Structural & Geotechnical Engineers

222 South Park Ave. • Montrose, CO 81401
Ph.: (970) 249-6828 • FAX: (970) 249-0945

8 October 2008

Schnabel Engineering, LLC
510 East Gay Str.
West Chester, PA 19380

Attn: Allen W. Cadden, P.E.

RE: ADSC/FHWA HOLLOW BAR SOIL NAIL TEST PROGRAMME
SURFICIAL GEOLOGY OF "HOGBACK" COUNTY GRAVEL PIT
SUNSET MESA, MONTROSE COUNTY, COLORADO

Dear Mr. Cadden:

At you request, Buckhorn Geotech is providing surficial geologic information that we have available for the "Hogback" County Gravel Pit on Sunset Mesa, near Montrose, Colorado. We understand the information is being used as the basis for a soil nail test program with the Association of Drilled Shaft Contractors (ADSC) and the Federal Highways Administration (FHWA). The study is aimed at determining the comparative performance of hollow bar soil nails to the traditionally-specified solid-bar soil nails in varying subsurface conditions across the United States.

The Hogback Gravel Pit is located east-centrally on the crest of Sunset Mesa, a geologic feature immediately west of the City of Montrose, as shown on the attached Vicinity Map (Figure 1). The mesa is a remnant valley feature formed by the meandering and down-cutting action of the Uncompahgre River, which now flows immediately adjacent to the eastern flank of the mesa. The mesa slopes toward the north-northwest at approximately 1 percent, which is the general gradient of the Uncompahgre River Valley. The flanks on the side of the mesa slope uniformly at 30 to 45 percent. Mining of the gravel from the eastern flank of the mesa has created an artificial bench at the level of the underlying bedrock formation, which is about 20 feet below the mesa top. The mesa is generally unimproved rangeland that does not appear to have been irrigated or cultivated. The mesa is also home to several gravel pits, several residences, a City recreational complex, City and water district water tanks, and a cemetery. Aerial photographs from the late 1940s shows three airstrips we understand were used for training World War II pilots. The airstrips have been erased from the landscape through expansion of the cemetery, establishment of the recreational complex, and excavation of gravel pits.

Access to the Hogback Gravel Pit is granted from Hogback Road, to the west.

REGIONAL GEOLOGY

Sunset Mesa is located within the Uncompahgre River Valley, a northwesterly trending depression lying between the Uncompahgre Plateau uplift to the west and the Gunnison uplift, consisting of Pre-Cambrian Black Canyon schist, to the east. The Cretaceous Dakota Sandstone Formation is a prominent formation exposed along the west and east margins of the valley. The Dakota Sandstone is a resistant sandstone unit that forms a cap layer on the Uncompahgre Plateau and the western flank of the Black Canyon (*Geologic Map of the Montrose 30′ x 60′ Quadrangle*, USGS Map I-1939: Steven and Hail, 1989).

The Mancos Shale (locally known as the "Adobes") overlies the Dakota Sandstone and is the bedrock unit underlying the Uncompahgre Valley. The Mancos Shale forms a bedrock wedge that is thickest in the eastern portion of the valley, where it outcrops as adobe badlands, and thins to the west at the edge of the Uncompahgre Plateau. Under the subject property, the Mancos Shale is approximately 550 feet thick and is composed of variably silty, calcareous clay shale with minor inclusions of sandstone, siltstone and limestone. The valley floor is a broad outwash plain formed by meltwater from glaciers. As glaciers in the headwaters of rivers melted, mud, sand, and gravel contained within the mass of ice was swept downstream and redeposited, eventually filling in the valleys to a depth typically between 30 and 50 feet. Erosion of the adjacent adobe hills transported fine-grained silts and clays into the valley that were deposited over the glacial alluvium. Subsequent erosion by the river and its tributaries have incised the valley to the present landscape. This incision has not been a uniform process but has been punctuated by climatic cycles that accelerated the rate of erosion during extended periods of high energy flow which were often followed by periods of quiescence.

SUNSET MESA SURFICIAL GEOLOGY

Sunset Mesa lies on the west side of the Uncompahgre River Valley on the remnant of an ancient erosional terrace. The top of Sunset Mesa is a terrace of glacial till that was part of a broad outwash plain formed by melting glaciers. Melting glaciers and the resulting river flow eroded much of the glacial till and underlying shale. At some point during this time, the river flowed through the valley on the west side of Sunset Mesa, then shifted its course to its present location on the east side of the mesa. This process has left Sunset Mesa as a relatively flat plain about 150 feet higher than today's streambed. Smaller and less-defined secondary terraces were also formed on the shoulder of the mesa. The largest of these is still apparent on the east side of the mesa where it forms an irregular shelf about 30 feet above the river.

According to the *Delta-Montrose Area Soil Survey* (Soil Conservation Service: Cline et al., 1967), the soils at the property are classified as Rough Broken Land (*Ru*, 10 to 60 percent slopes), Mesa clay loam (*MlA*, 0 to 2 percent slopes), and Mesa gravelly clay loam (*MoC*, 5 to 10 percent slopes). Rough broken land denotes mesa escarpments where shale is partially exposed and partially covered in a gravelly colluvium. Mesa series soils are deep, well-drained and moderately fine-textured grassland soils that form on mesa terraces and can be gravelly and calcareous. The Mesa gravelly clay loam is described as having good stability and bearing value, good internal drainage, and low shrink-swell potential. These descriptions are consistent with our observations at the site.

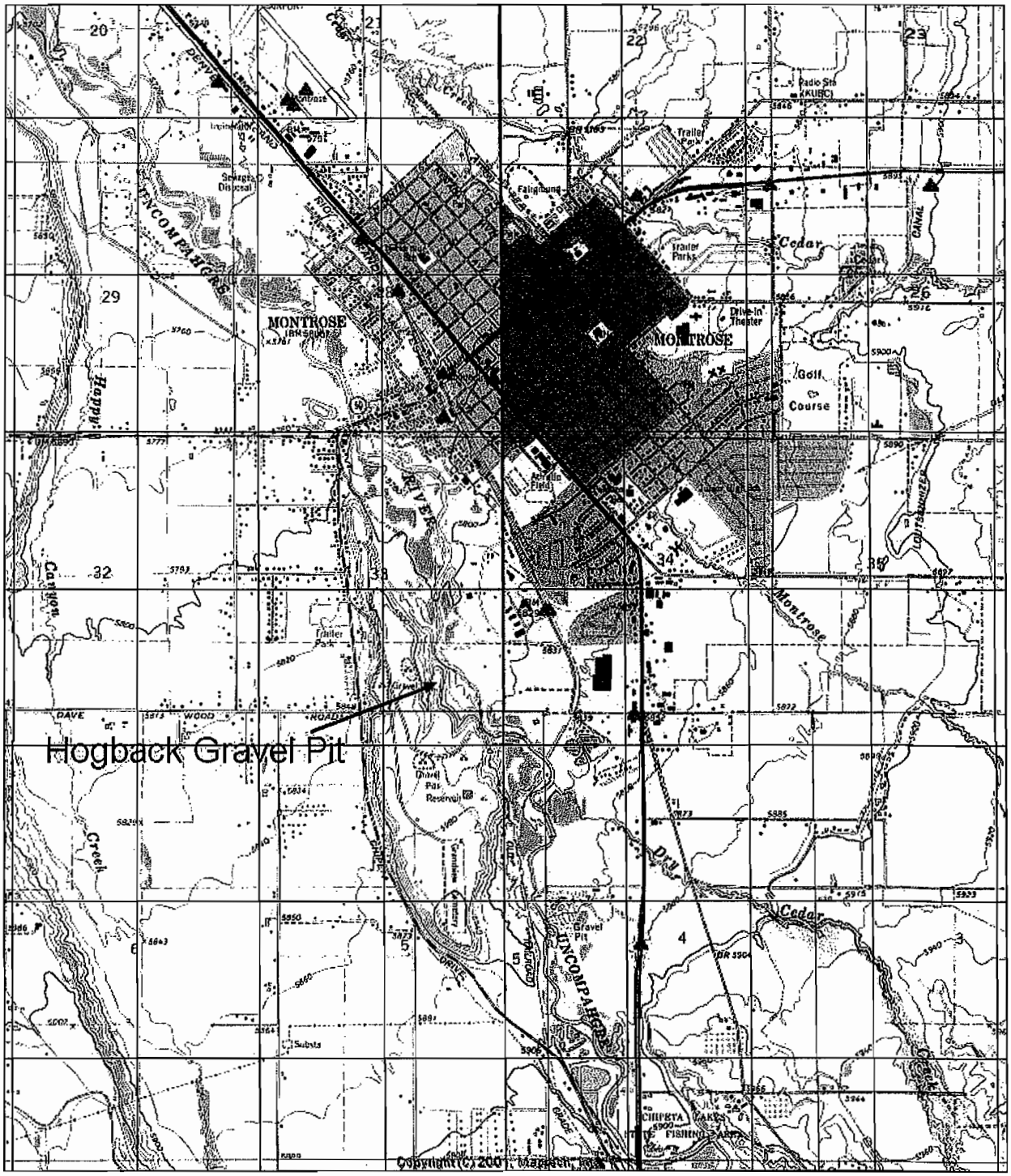


Figure 1. Vicinity Map. The USGS quadrangle shows the relationship of Sunset Mesa and the Hogback County Gravel Pit to the City of Montrose and the Uncompahgre River.

BUCKHORN GEOTECH

Civil, Structural & Geotechnical Engineers

222 South Park Ave. • Montrose, CO 81401
Ph.: (970) 249-6828 • FAX: (970) 249-0945

Sieve Analysis and Atterberg Limits

Project Name	ADSC/FHWA Hollow Bar Soil Nail Study	Date	10/2/2008
Project Location	Hogback Gravel Pit, Sunset Mesa, Montrose, CO	Project #	08-364-GEO
Client	Association of Drilled Shaft Contractors	Sample by	CH
Test Location	TP#1 @1.0-2.0'	Tested by	CC/SJ
Sample #	BS1		

Sieve Analysis

ASTM C136 / C117

Sieve	Opening (mm)	% Passing
3"	76.2	100.0
3/4"	19.0	56.8
3/8"	9.5	42.2
#4	4.750	33.1
#10	2.000	27.0
#40	0.425	12.5
#200	0.075	5.1

Atterberg Limits

ASTM D4318

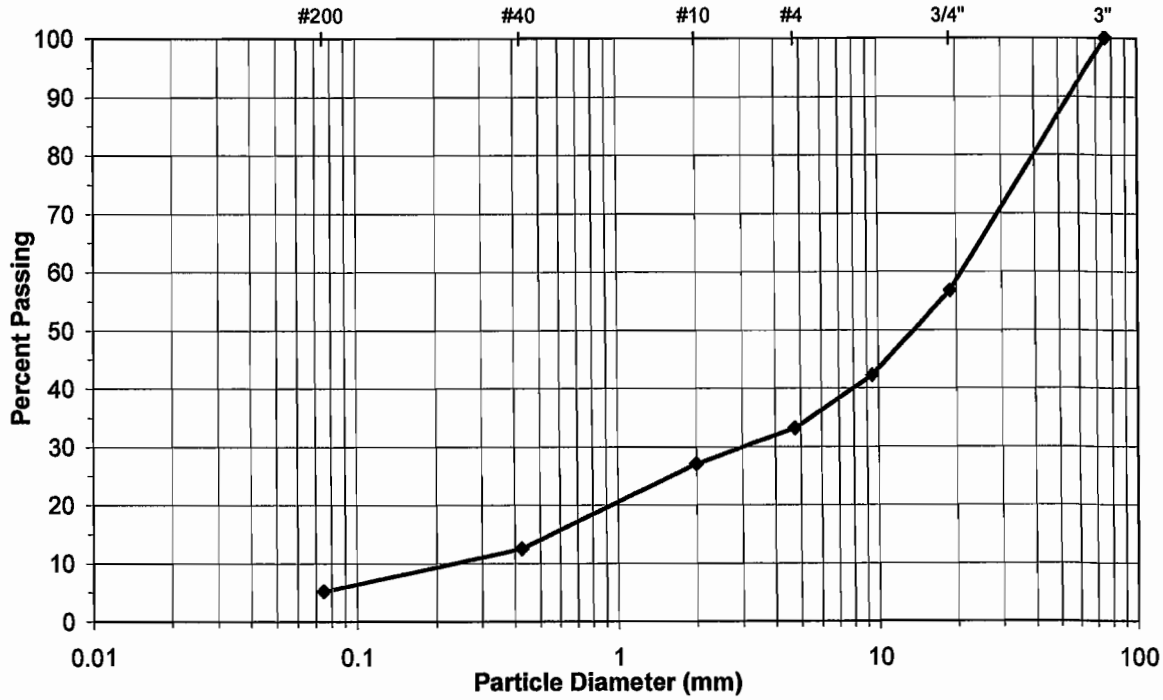
Liquid Limit (LL)	NR
Plastic Limit (PL)	NR
Plasticity Index (PI)	NR

NR= Not Requested

Natural Moisture Content (%) = 6.0%

Soil Description: reddish brown well-graded GRAVEL with silt and sand

USCS Classification: GW-GM



Clay/Silt	Fine	Medium	Coarse	Fine	Coarse
FINES	SAND			GRAVEL	

% Fines = 5.1 % Sand = 28.0 % Gravel = 66.9

AWC

DEC 15 2008

BUCKHORN GEOTECH

Civil, Structural & Geotechnical Engineers

222 South Park Ave. • Montrose, CO 81401
Ph.: (970) 249-6828 • FAX: (970) 249-0945

December 8, 2008

Allen Cadden, P.E.
Schnabel Engineering, LLC
510 East Gay Str.
West Chester, PA 19380

RE: ADSC/FHWA HOLLOW BAR SOIL NAIL STUDY - SIEVE ANALYSIS RESULTS SUNSET MESA, MONTROSE COUNTY, COLORADO

Dear Allen:

Buckhorn Geotech, Inc. (BGI) is pleased to present this letter presenting results of soil testing for the ADSC/FHWA Hollow Bar Soil Nail Study at the Montrose County, Colorado site. Installed soil nails were excavated the week of November 17, 2008 by Mountain Highwall Concrete Contractors, Inc., the installation contractor. BGI visited the site periodically during excavation.

The soils surrounding each soil nail group (Types A, B and C) appeared uniform and consistent in composition, moisture content and density. The soils were logged in the field as damp, dense, sandy GRAVEL, COBBLES, and BOULDERS with trace fines. The typical maximum particle size observed in the field was 12 inches.

Due to the apparent uniform composition of the soil at the site, only one soil sample was taken from each soil nail group type. These samples were labeled as A, B and C for each corresponding group type. The soil samples were taken along the entire bonded zone of the soil nail. Sieve analyses were conducted for each sample. Atterberg limits tests were not conducted as the field description indicated soils to be non-plastic with minimal fines content. The results of the testing are attached to this letter. The three samples classified as poorly-graded gravel with sand (GP) according to the USCS.

I trust this information meets your current needs. We appreciate the opportunity to contribute to this project. Please do not hesitate to contact me if you have any questions regarding the above.

Kind Regards,
BUCKHORN GEOTECH, INC.

Brett R. Byler, P.E.

Encl. Sieve analysis results (samples A, B, C)

BUCKHORN GEOTECH

Civil, Structural & Geotechnical Engineers

222 South Park Ave. • Montrose, CO 81401
Ph.: (970) 249-6828 • FAX: (970) 249-0945

Sieve Analysis and Atterberg Limits

Project Name	FHWA/ADSC Hollow Bar Soil Nail Study	Date	12/2/2008
Project Location	Sunset Mesa Gravel Pit	Project #	08-364-GEO
Client	ADSC	Sample by	BB/DQ
Test Location	soil nail A	Tested by	SJ
Sample #	A		

Sieve Analysis

ASTM C136 / C117

Sieve	Opening (mm)	% Passing
7"	177.8	100%
3"	76.2	93.3
3/4"	19.0	48.9
3/8"	9.5	32.7
#4	4.75	25.3
#10	2.00	21.7
#40	0.425	12.3
#200	0.075	4.8

Atterberg Limits

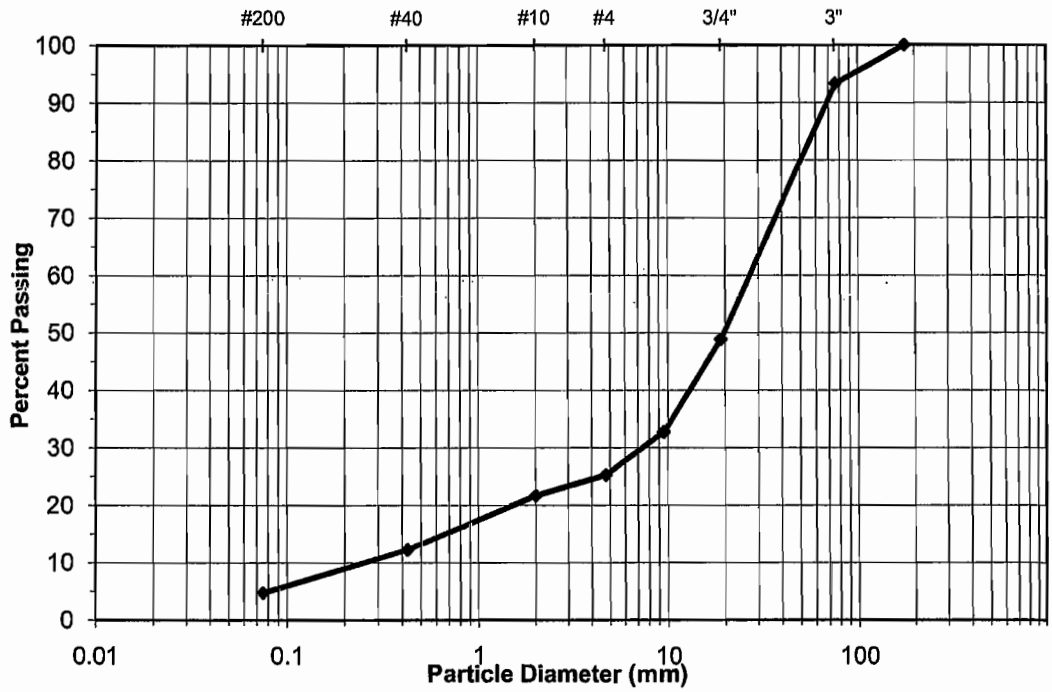
ASTM D4318

Liquid Limit (LL)	NR
Plastic Limit (PL)	NR
Plasticity Index (PI)	NR

NR= Not Requested

Soil Description: light brown poorly-graded GRAVEL with sand

USCS Classification: GP ASTM D2488



Clay/Silt	Fine	Medium	Coarse	Fine	Coarse	
FINES	SAND			GRAVEL		COBBLES

% Fines = 4.8 % Sand = 20.5 % Gravel / Cobbles = 74.7

BUCKHORN GEOTECH

Civil, Structural & Geotechnical Engineers

222 South Park Ave. • Montrose, CO 81401
Ph.: (970) 249-6828 • FAX: (970) 249-0945

Sieve Analysis and Atterberg Limits

Project Name	FHWA/ADSC Hollow Bar Soil Nail Study	Date	12/2/2008
Project Location	Sunset Mesa Gravel Pit	Project #	08-364-GEO
Client	ADSC	Sample by	BB/DQ
Test Location	soil nail B	Tested by	CC
Sample #	B		

Sieve Analysis

ASTM C136 / C117

Sieve	Opening (mm)	% Passing
5"	127	100%
3"	76.2	90.9
3/4"	19.0	45.5
3/8"	9.5	31.6
#4	4.75	23.3
#10	2.00	18.2
#40	0.425	11.1
#200	0.075	3.9

Atterberg Limits

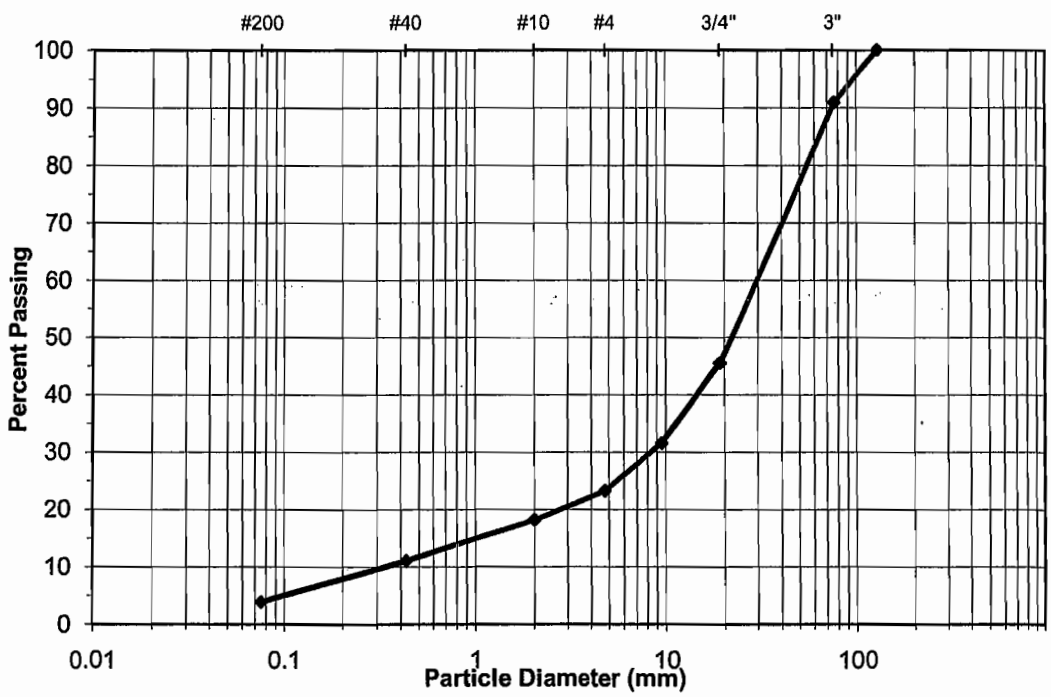
ASTM D4318

Liquid Limit (LL)	NR
Plastic Limit (PL)	NR
Plasticity Index (PI)	NR

NR= Not Requested

Soil Description: light brown poorly-graded GRAVEL with sand

USCS Classification: GP ASTM D2488



Clay/Silt	Fine	Medium	Coarse	Fine	Coarse	
FINES	SAND			GRAVEL		COBBLES

% Fines = 3.9 % Sand = 19.4 % Gravel / Cobbles = 76.7

BUCKHORNGEOTECH

Civil, Structural & Geotechnical Engineers

222 South Park Ave. • Montrose, CO 81401
Ph.: (970) 249-6828 • FAX: (970) 249-0945

Sieve Analysis and Atterberg Limits

Project Name	FHWA/ADSC Hollow Bar Soil Nail Study	Date	12/2/2008
Project Location	Sunset Mesa Gravel Pit	Project #	08-364-GEO
Client	ADSC	Sample by	BB/DQ
Test Location	soil nail C	Tested by	SJ
Sample #	C		

Sieve Analysis

ASTM C136 / C117

Sieve	Opening (mm)	% Passing
7"	177.8	100%
3"	76.2	84.8
3/4"	19.0	40.4
3/8"	9.5	29.3
#4	4.75	22.0
#10	2.00	17.7
#40	0.425	7.9
#200	0.075	3.6

Atterberg Limits

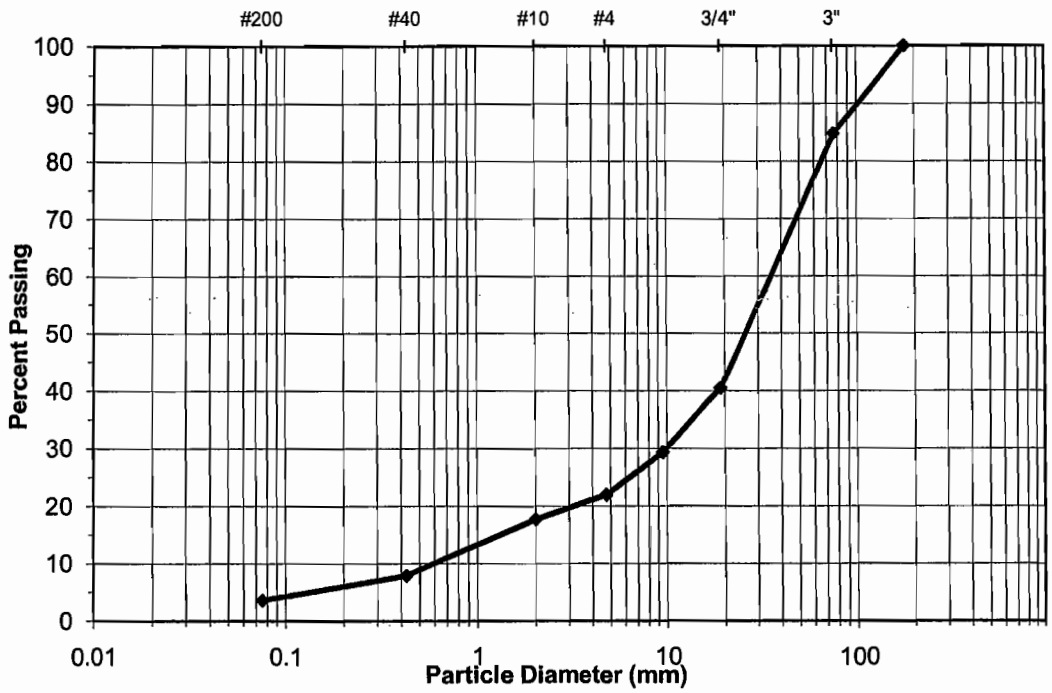
ASTM D4318

Liquid Limit (LL)	NR
Plastic Limit (PL)	NR
Plasticity Index (PI)	NR

NR = Not Requested

Soil Description: light reddish brown poorly-graded GRAVEL with sand

USCS Classification: GP ASTM D2488



Clay/Silt	Fine	Medium	Coarse	Fine	Coarse	
FINES	SAND			GRAVEL		COBBLES

% Fines = 3.6 % Sand = 18.4 % Gravel / Cobbles = 78.0

APPENDIX G

Observation of Exhumed Nails

A2

Sheet 1 of 21

Schnabel Engineering	Hollow Core Bar Research Excavation of Soil Nails – Montrose County, Colorado	Project Number 07150064

A2

Sheet 2 of 21

311

Schnabel
Schnabel Engineering

Hollow Core Bar Research

Excavation of Soil Nails – Montrose County, Colorado

Project Number

07150064

A2

Schnabel Engineering	Hollow Core Bar Research Excavation of Soil Nails – Montrose County, Colorado	Project Number 07150064

A3

Sheet 4 of 21

Schnabel Engineering

Hollow Core Bar Research

Excavation of Soil Nails – Montrose County, Colorado

Project Number

07150064

A3

Sheet 5 of 21

Schnabel
Schnabel Engineering

Hollow Core Bar Research

Excavation of Soil Nails – Montrose County, Colorado

Project Number

07150064

A3

Sheet 6 of 21

Schnabel Engineering

Hollow Core Bar Research

Excavation of Soil Nails – Montrose County, Colorado

Project Number

07150064

B1

Sheet 7 of 21

Schnabel Engineering

Hollow Core Bar Research

Excavation of Soil Nails – Montrose County, Colorado

Project Number

07150064

B1

Sheet 8 of 21

Schnabel Engineering	Hollow Core Bar Research Excavation of Soil Nails – Montrose County, Colorado	Project Number 07150064

B1

Schnabel Engineering

Hollow Core Bar Research

Excavation of Soil Nails – Montrose County, Colorado

Project Number

07150064

B2

Sheet 10 of 21

Schnabel Engineering

Hollow Core Bar Research

Excavation of Soil Nails – Montrose County, Colorado

Project Number

07150064

B2

Schnabel Engineering

Hollow Core Bar Research

Excavation of Soil Nails – Montrose County, Colorado

Project Number

07150064

B3

Schnabel Engineering

Hollow Core Bar Research

Excavation of Soil Nails – Montrose County, Colorado

Project Number

07150064

B3

Sheet 13 of 21

Schnabel Engineering

Hollow Core Bar Research

Excavation of Soil Nails – Montrose County, Colorado

Project Number

07150064

B3

Schnabel Engineering	Hollow Core Bar Research Excavation of Soil Nails – Montrose County, Colorado	Project Number 07150064

C1

Sheet 15 of 21

Schnabel Engineering

Hollow Core Bar Research

Excavation of Soil Nails – Montrose County, Colorado

Project Number

07150064

C1

Schnabel Engineering

Hollow Core Bar Research

Excavation of Soil Nails – Montrose County, Colorado

Project Number

07150064

C2

Sheet 17 of 21

Schnabel Engineering

Hollow Core Bar Research

Excavation of Soil Nails – Montrose County, Colorado

Project Number

07150064

C2

Schnabel Engineering

Hollow Core Bar Research

Excavation of Soil Nails – Montrose County, Colorado

Project Number

07150064

C3

Schnabel Engineering	Hollow Core Bar Research Excavation of Soil Nails – Montrose County, Colorado	Project Number 07150064

C3

Sheet 20 of 21

Schnabel Engineering

Hollow Core Bar Research

Excavation of Soil Nails – Montrose County, Colorado

Project Number

07150064

C3

Schnabel Engineering

Hollow Core Bar Research

Excavation of Soil Nails – Montrose County, Colorado

Project Number

07150064