

**Submittal for Temporary Shoring
Rochester, Vermont**

2014



- GSI® provides the most responsive and experienced geohazard mitigation services in North America and specializes in design/build/warranty landslide repair, rockfall mitigation, excavation shoring, and GRS-IBS abutment construction.
- Branch offices in Arizona, British Columbia, California, Colorado, Florida, Kentucky, North Carolina, Ohio, Ontario, Oregon, Tennessee, Utah, and Virginia.
- The content of this document is confidential –do not disclose to third parties without prior authorization. If you are not the intended recipient of this document, please contact the sender and destroy all copies of the original message.

Submittal for Temporary Shoring Rochester, Vermont

February 23, 2014

Subject: Temporary Shoring for the Route 73 Bridge Project in
Rochester, Vermont

Dear Review Committee:

GeoStabilization International (GSI) is pleased to present the following Submittal for the installation of temporary shoring for the Route 73 Bridge Replacement Project in Rochester, Vermont.

This submittal shall consist of information regarding the design and construction of a temporary shoring system. The information presented herein will substantiate our capabilities and unique company structure that contains an experienced group of geotechnical engineers and crews that focus solely on slope stabilization and retention with the use of ground anchors. The anchors will be encapsulated in grout and anchored to a shotcrete facing at the face of the slope, thus achieving the required Factor of Safety.

Information in this submittal is based on the following documents:

- VT Route 73, Bridge 19: Proposed Improvement Bridge Project Drawings (dated December 2011)
- GSI's proposal for Slope Stabilization, Route 73 Temporary Shoring for Bridge Project in Rochester, Vermont

Our opinions and statements regarding this project shall remain confidential and shall not be shared with other parties without the express written consent of GSI. All concepts and procedures outlined in this submittal shall be considered the intellectual property of GSI.

If you have questions regarding this submittal, or if we may be of further service, please contact us at your convenience.

Sincerely,

GeoStabilization International



Tim Ruckman
CEO



Colby Barrett
President



TABLE OF CONTENTS

COMPANY MERGER STATEMENT ii

LETTER OF INTENT iii

QUALIFICATIONS, EXPERIENCE & CAPABILITIES.....1

 STATEMENT OF QUALIFICATIONS 2

 PERSONNEL RESUME SUMMARIES 3

METHODS & APPROACH.....11

 PROJECT SCHEDULE AND CONSTRUCTION SEQUENCE 12

 PROJECT TEAM MEMBERS 12

 SHOTCRETE NOZZLEMAN CERTIFICATIONS 12

MATERIALS.....13

 GROUND ANCHOR 14

 GROUT 14

 FACING..... 15

 SHOTCRETE 15

ADDITIONAL INFORMATION17

 SAFETY 18

 EQUAL EMPLOYMENT AND AFFIRMATIVE ACTION POLICY..... 18

APPENDICES20



QUALIFICATIONS, EXPERIENCE & CAPABILITIES



STATEMENT OF QUALIFICATIONS

GeoStabilization International (GSI®) offers specialty design and contracting throughout the United States and beyond. Our slope and landslide repair portfolio is extensive in the geotechnical construction industry and contains over 800 slope and slide corrections since 2005. Of these projects, at least approximately 75% were design-build with many being completed under emergency declarations. Our expertise, proprietary tools and technologies (including exclusive patents and trademarked tools and technologies), worldwide reach, and design/build/service allow us to stabilize slopes and to repair virtually any stability problem in any kind of geologic setting.

GSI® is uniquely qualified for the slope stabilization project due to our in-house staff of geotechnical engineers that focus solely on slope and landslide stabilization projects with the use of Geosynthetically Reinforced Soils (GRS), soil nails / ground anchors, tiebacks, and micro-piles. The engineering staff works integrally with field personnel, often times with a continuous onsite presence, to ensure that the conditions encountered during construction are those assumed during design. When deviations exist, remedial measures are quickly developed to ensure that the project schedule is maintained without sacrifice to the design intent.

GSI® engineers utilize the most cutting edge limit equilibrium and finite element analysis programs to evaluate slope stability. The models are powerful tools, but only when coupled with proper input data and the experience and intuition to understand the results. At any given time our team is involved in several research projects sponsored by the company or by public entities. That translates into the newest methods and technologies going from concept to verification to implementation with no delays and with significant cost and time savings to our clients.

Equipment inventory includes Soil Nail Launchers™, SuperNailers™ (modified excavator-based rock drills), crane basket drills, compressors, grout plants, shotcrete pumps, welders and a variety of support trucks, trailers and other related equipment. Most of the equipment has been custom built or modified specifically for slope or landslide mitigation. GSI's expertise includes shoring (using soil nails, rock bolts and micropiles), retaining walls, bridges, foundations, avalanche/mudflow deflection barriers, rockfall mitigation and rock slope stabilization, landslide repair, and ground anchoring systems for communication and wind turbine towers, and transmission lines.

Our founders, Albert Ruckman, P.E. and Robert Barrett, P.G. have more than 80 combined years of geotechnical stabilization experience. GSI's expert crews have recently completed projects in Alabama, California, Colorado, Indiana, Iowa, Kentucky, Maryland, Minnesota, Montana, New York, North Carolina, Ohio, Oregon, Pennsylvania, Tennessee, Virginia, and West Virginia. Individual slope stabilization projects have ranged in cost from \$20,000 to \$3,350,000.00.



PERSONNEL RESUME SUMMARIES

TIM RUCKMAN, CEO, Tim has over 15 years of construction management and soil stabilization experience, serving as project manager and field superintendent on projects as large as \$30 million. As the previous president of Rock Creations, Inc., Tim is also an expert in dry stacked stone and block faced GCS® walls. Tim's expertise in the industry gives GSI a competitive edge as he continues to be the mastermind behind GSI's innovations in tools, equipment and techniques. He holds multiple patents in the field of soil nailing and has constructed multiple pieces of specialty equipment for difficult access installations across the United States, Canada, Australia, and New Zealand. These concepts and techniques are utilized in repairing landslides throughout the most rigorous terrain. Tim combines experience with superior skills in planning, scheduling, and teaching to ensure job quality every time.

COLBY BARRETT, PRESIDENT, Colby has worked on stabilization projects for over 10 years, managing projects throughout the continental United States, Puerto Rico, and Jamaica. He holds multiple patents in the field of soil nailing and has given numerous invited presentations in Canada, New Zealand, Mexico, and Taiwan. Colby handles marketing, site visits, proposals and project management assignments throughout the United States and Canada. Colby is involved in countless groups including ADSC-IAFD, ASCE, ASCE: Geotechnical Engineering, and Deep Foundations Institute, which have allowed GSI to remain a proven leader and trendsetter in the industry. After studying Chemistry and Chemical Engineering at the University of California at Berkeley and Oxford University on an NROTC scholarship, Colby served as a Captain in the United States Marine Corps, leading both infantry and Scout/Sniper platoons throughout the Pacific Rim and the Middle East. Colby has current TS/SCI clearance, a Juris Doctor from Yale Law School and is wrapping up the requirements for his Professional Engineer License.

NATHAN BEARD, P.E., M.B.A., M. ASCE, EASTERN REGION DIRECTOR. Nathan is in direct charge of implementing the design, management and construction of multiple specialty earth retention systems utilizing the sciences of Soil Nailing, Tiebacks, Micropiles, Grout Injecting as well as Geosynthetically Confined Soil structures in some of our nation's most difficult terrain. Nathan is a registered professional engineer in multiple states including California, Nevada, Colorado and many of the states in the south and Midwest. Nathan has authored multiple papers on stabilization technology and regularly presents workshops across the United States and Canada. A former Captain in the United States Air Force, Nathan attended the United States Air Force Academy, graduating with a B.S. in Civil Engineering.

CAMERON LOBATO, PE, M. ASCE, WESTERN REGIONAL DIRECTOR. Cameron Lobato was formerly the President of Soil Nail Launcher Inc. Partner Company, GeoStabilization, Inc. and Chief Engineer since it's founding in 2007. With the Soil Nail Launcher Inc. merger he will join GeoStabilization International as its Western Regional Director. Cameron is responsible for all facets of geotechnical design including project management, design, design review, and logistics. He has particular expertise in



Submittal for Temporary Shoring Rochester, Vermont

construction means and methods associated with earth retention and landslide mitigation adjacent to active public highways. His geotechnical construction career began in 1996 with an established Colorado design/build firm; where he gained over eleven years of managing and designing experience in temporary and permanent soil nail landslide stabilization, micropile walls, rockfall mitigation, tieback stabilization, and Geosynthetically Confined Soil (GCS) retaining walls. Cameron has designed and supervised the construction of over 300 earth retention systems and rockfall mitigation projects. A native of Western Colorado, Cameron received his BS in Civil Engineering from Colorado School of Mines in Golden, CO.

MATT BIRCHMIER, PE., CHIEF ENGINEER GSI Matthew Birchmier has been an engineer for GSI's performing design, project management, and quality control functions for the past 3 years. He began his geotechnical career and honed his geotechnical expertise through work with Terracon Consultants in Boise, ID and Phoenix, AZ. A native Iowan, Matthew graduated from Iowa State University with both Bachelors and Master of Science Degrees in Civil Engineering with a geotechnical engineering emphasis. He first became interested in landslides with his master's research and thesis, which focused on correlating the loss in residual strength with the weathering effects on micro and macro level of material from the Pierre Shale formation. Matt has worked on projects throughout the United States with an eye for detail and design that is unparalleled.

MARTIN WOODARD, Ph.D., P.G., P.E., NORTHEAST REGIONAL ENGINEER. Marty is a professional engineer and professional engineering geologist whose experience includes investigation, design, and implementation of remediation techniques for unstable soil and rock slopes. He has significant experience in rock slope stability, rock slope rating systems, subsurface geology and geotechnical interpretation, landslide investigations, foundation analysis, and geologic reconnaissance. His expertise is in rock mass characterization, rock slope engineering and rock mechanics. Marty has a B.A in Geology from the State University of New York at Potsdam College, M.S. in Environmental and Engineering Geosciences from Radford University (Virginia), and a Ph.D. in Engineering Geology from Kent State University in Ohio. He has authored the Rockfall Hazard Rating Matrix and Rock Slope Design Manual for the Ohio Department of Transportation. He has worked throughout the United States and South and Central America.

JUSTIN D. PETERSEN, EIT, MID-ATLANTIC REGIONAL ENGINEER. A native of Wyoming, Justin attended the University of Wyoming and graduated in 2011 with a B.S. in Civil Engineering. While attending the University of Wyoming, he worked as an engineering intern for a Wyoming engineering firm where he learned AutoCAD drafting skills and valuable construction experience. After receiving his degree, Justin moved to Grand Junction, Colorado and joined the GeoStabilization International team in June 2011. Since joining the GSI team, Justin has designed and managed projects in VA, SD, CA, CO, MT, MN, NC, KY, WV, AL, GA, NY, PA and WY.

VASCO DUKE, P.E., SOUTHEAST REGIONAL ENGINEER. Born in Panama City, Panama, Vasco graduated with a Civil Engineering Degree from the Technological



Submittal for Temporary Shoring Rochester, Vermont

University of Panama. As part of graduation requirements in Panama, Vasco had the option to participate in an exchange program with The University of Arizona in Tucson, AZ where he ended up completing the Master of Science in Civil Engineering program with an emphasis in geotechnical engineering. He began his career in 2003 with Terracon Consultants in Las Vegas, NV and then transferred to the Phoenix, AZ where he gained experience in field exploration, geotechnical instrumentation and data collection, retaining wall design, slope stability and seepage modeling and general design of foundation structures. In late 2007, he joined URS Corporation where he continued his growth, and worked in larger projects such as the Panama Canal Expansion project. He gained much more experience in the modeling of the stability of slopes monitoring the stability of gypsum stacks, a by-product of fertilizer production in the phosphate industry. He also worked in the construction inspection of drilled shaft foundations and driven pile installation. Having worked in so many projects involving slope stability monitoring and modeling and knowing how critical earth slopes are in society, he became fascinated in using his knowledge and skills and its application to the repair and stabilization of landslides and retaining structures.

ADAM LEWIS, EIT, PROJECT ENGINEER TECH. Adam Lewis joined GeoStabilization International in the summer of 2012 as an intern after impressing industry leaders with his presentation on “Experimental Modeling of Sandy Slope with Simulated Rainfall and 1g Earthquake Shaking” at GeoCongress in 2012. He previously placed top 10 nationwide for accurately analyzing the axial capacity of a 160-foot pile in Geo-Prediction 2011. After receiving his masters in Civil Engineering with an emphasis in Geotechnical Engineering from California State University, Fullerton in December of 2012 Adam beat out heavy competition and joined the GSI team permanently as a Project Engineer. In his short time with the company Adam has worked on Soil Nail, Micropile, and GCS Wall projects for MNDOT, City of Duluth, CODOT, ALDOT, WVDOT, and Kennedy Township, PA.

DANIEL WAYNE KOEHMSTEDT, EIT, SENIOR PROJECT MANAGER. Dan completed his Civil Engineering degree at the South Dakota School of Mines in 1998. Dan then started his construction career as a field engineer for Affholder, Inc., then Project Engineer for Kiewit Western, Inc. from 1998 until 2001. His scope of work included management of resources for Rock Bolting and blasting as well as tunneling. From 2001 until the end of 2004 Dan was a key Project Manager for Ames Construction. This included heavy highway construction projects ranging from \$ 1.5 mil to \$10 mil and consisted of various earth retention techniques such as retaining walls and soil nails projects as well as rock bolting. After that Dan was a key Senior Project Manager at Yenter Companies, Inc. specializing in design/build specialty bolting and soil nailing and other earth retention projects as well as scaling and meshing of slopes. In January of 2013 Dan came to GSI and immediately became a key resource manager and Senior Project manager in GSI’s Western US projects as well as advising and managing on an as-needed basis in the Eastern US as well. Dan’s creativity, work ethic and overall knowledge of earth retention are vital to his management success.



Submittal for Temporary Shoring Rochester, Vermont

KIM RUCKMAN-WRIGHT, COO. Since joining the GSI team in 2006 Kim has never shied away from challenges. Formerly of Qwest Communications, Kim founded the company's Business and Government Collections Division. Kim has been with GSI since its infancy where she filled a need for management that has allowed GSI to become the company it is today. She has sat on the Board of Directors since 2006 and acted as SNLI's CFO, overseeing daily operations, contracts, administrative management, and financials until this year when she became GSI's acting COO. With her new title Kim will continue to manage operations for the company as it grows at an international level.

J. TODD HAMILTON, CONSTRUCTION MANAGER. Before joining the GSI team in 2011, Todd gained valuable experience through real estate, construction consulting, and project management. While in real estate, he handled transactions from opening to close, inspected properties/projects under construction for financial companies, and brokered single-family homes and vacant land. As a construction consultant, Todd oversaw all construction material deliveries and scheduling, identified properties to provide easements from engineering plans, drafted necessary documentation, obtained necessary permits, and prepared takeoffs and submittals. Throughout his career in project management, Todd performed estimating, scheduling, supervision and inspections for commercial and residential projects ranging in cost from \$300,000 to \$6,000,000. Todd was also the project engineer for the \$23 million dollar Northstar SE Corner Expansion project in Anchorage, Alaska. Todd uses his experience and expertise to handle everything from scheduling crews to insuring the quality and efficiency of materials used on every job.

SIKOT MAHAXAY, GENERAL SUPERINTENDENT. Sikot Mahaxay was born in Champasack, Laos, and then moved to Iowa to live with a sponsor family at an early age. From the time he entered high school, Sikot worked as a full-time heavy equipment operator. Sikot has over twenty years of experience as an equipment operator, and over ten years of experience in soil nailing, GCS® wall construction, and is a world-class rock mason using mortar less construction techniques. Sikot is also an expert driller and has repaired landslides across the United States. He manages daily operations for crews throughout the East Coast and ensures that each GSI project is run smoothly and effectively.

MARTY FLAHERTY, REGIONAL PROJECT MANAGER. Marty has 17 years of experience as a construction project manager or project superintendent. He is responsible for managing, coordinating, evaluating and directing GSI crews and subcontractors to ensure that projects are built according to plans, specifications, schedules and cost limits. Marty is a well-rounded leader with experience managing public, private, federal, state, and airport projects with various construction disciplines ranging from heavy civil roadway projects, department of transportation, commercial building, Army Corps of Engineers and tenant improvements. More importantly, Marty has extensive experience running heavy civil roadway landslide stabilization projects in California under a National Joint Powers Alliance Contract and with ALDOT. Marty's ability to prioritize project tasks, manage schedules, and resolve issues quickly have made him a key member of the



Submittal for Temporary Shoring Rochester, Vermont

GSI team. Originally from Boston, Massachusetts but currently living in El Dorado Hills, California, Marty holds a B.A. From Merrimack College.

CHRIS JOHNSON; GENERAL SUPERINTENDENT. Chris joined GSI after working with Allied Contractors Inc., GSI's former subcontractor, for over eight-years. With 23-years of experience as a superintendent Chris has been integral in the success of many of GSI's large-scale projects. In New Market, Virginia Chris and his crew injected 2,850 injection soil nails on Route 820. Chris was a part of both phases of GSI's Cross Gate Village Project in Nashville, Tennessee where 16,000 square-feet of soil nails and 10,000 square-feet of micropiles were installed. An avid outdoorsmen Chris enjoys hunting and fishing when home in Lafollette, TN.

ZECHARIAH MORIARTY, GENERAL SUPERINTENDENT. Zechariah Moriarty served in the Army for six years prior to joining the GeoStabilization International team where he graduated top of his class in PLDC, was 2nd in Supply School and made the Commandants List. Zech began superintendent duties when an injury to a former Superintendent required him to step up into a leadership role after only 4 months with the company. Using the leadership skills he learned in the service he impressed GSI leading to his temporary promotion becoming permanent. Zech has installed over 50,000 launched nails and 75,000 of each SuperNails® and Self-Drilling Nails.

RONALD J. "SPIKE" PRIESTLY III, FIELD OPERATIONS MANAGER AND SUPERINTENDENT. Spike is a Site Superintendent and Field Operations Manager with over 10 years of superintendent experience installing soil nails, ground anchors, rock reinforcing dowels, rock bolts and supervising complex stabilization projects across the United States. The majority of these projects were specifically for stabilization of active landslides and slope failures and range in value from \$40,000 to over \$1,800,000. In 2009 alone Spike installed Soil Nails in 5 states on projects including landslide repair, temporary shoring, permanent shoring, tieback installation, failed RECO wall repair, and MSE wall remedial stabilization. During his career, Spike has completed approximately 500,000 square feet of shotcrete installation, drilled over 13,000 earth-reinforcing elements (soil nails, rock bolts, rock anchors, ground anchors, tie backs), and installed over 10,000 square feet of geosynthetically confined soil wall.

DUSTIN LEONHARDT, SUPERINTENDENT. Mr. Leonhardt has been involved in heavy civil construction for 15 years. He has completed formal education at the Wyoming Technical Institute where he became a skilled diesel and heavy equipment mechanic. Dustin has been with GSI for over 5 years and has been a site superintendent since 2008. He successfully completed a number of temporary shoring and permanent stabilization projects utilizing soil nailing and shotcreting techniques as well as an array of projects using methods involving micropiles, rock scaling. Projects Mr. Leonhardt was site superintendent on over the past 5 years include the Hyalite Canyon Slide repair for the Gallatin National Forest (303 permanent soil nails, 75 permanent micropiles, approximately 3,000 SF of facing) and the Nez Perce Road stabilization (268 permanent soil nail, 1,000 SF of facing).



Submittal for Temporary Shoring Rochester, Vermont

ROUSE “CORY” SLAPE, SUPERINTENDENT. Cory joined the GeoStabilization International team in October of 2010 after 10 years in the construction field working for Slape Construction. While at Slape he performed excavation, concrete flatwork and stem-walls, framing and finish work, and commercial construction including roads, factories, and equestrian buildings advancing to the position of foreman while running up to three projects simultaneously. After his move over to GSI, he rapidly advanced through each rank within to Superintendent in March of 2011. Throughout his GSI career Cory has overcome many field related issues, such as limited site access and harsh weather environments. His progression and drive are not surprising to Cory’s crew or peers as he led his crew to GSI’s top production for 2011 and continues to strive in performance. Cory completed over 30 jobs in his first year as Superintendent and has installed well over 3,000 SuperNails and Self-Drilling Nails.

PHAIVANE “A” ROMYEN, SUPERINTENDANT. Phaivane has been in the construction industry for over 12 years, and specializes in slope stabilization using various types of soil nails, GCS® walls, and SuperNails®. He has been a superintendent with GSI since 2006. Phaivane has installed over 3,000 SuperNails® and Self-Drilling Nails on over 30 projects (with over 20,000 square feet of slope treated). Most recently, Phaivane supervised and drilled four landslide repair projects in West Virginia, totaling 1,750 square feet of reinforced shotcrete and 164 Supernails® and Self-Drilling Nails. Immediately before that, Phaivane was in Virginia installing 3,250 square feet of shotcrete over 325 SuperNails®, and in Kentucky building a SGCS™ (Shored Geosynthetically Confined Soil) Wall founded on Self-Drilling Nails and shored with Self-Drilling soil nails (220 nails and micropiles and 2,200 square feet of shotcrete). During his time with GSI, Phaivane has maintained a 100% safety track record.

BRETT GUSTAFSON, SUPERINTENDENT. Brett Gustafson joined the GeoStabilization International team in July of 2009. While at Montana State University Brett graduated with a 3.73 GPA and participated in the universities Rodeo Team. Brett has a wide range of skill from rodeo to shotcrete and precise nailing techniques have allowed him to work his way up through the ranks to superintendent. While working on the Kentucky Highway-93 Emergency Slide Repair Brett showed calm under pressure, repairing the damage in under a month ensuring civilian commutes were uninterrupted.

ZACHARY GARBER, SUPERINTENDENT. Zachary Garber began working with GeoStabilization International in 2010 where his work ethic and attention to detail resulted in a swift promotion to superintendent by 2011. Since becoming a superintendent with GSI he and his crew have completed over 40 projects across the United States. Zachary oversaw the J. Cook State Park Project in Minnesota where he and his crew launched soil nails, installed GCS walls and high tension mesh. A native of Colorado, Zachary is an avid outdoorsman and enjoys hunting and fishing when he is not working for GSI.

ALBERT RUCKMAN, P.E., M.ASCE, FOUNDER, A registered Professional Engineer in several states, Al holds a B.S. in Civil Engineering from the University of Colorado and holds four patents in the area of rock and soil slope stabilization methods and innovations



Submittal for Temporary Shoring Rochester, Vermont

in soil nailing. Mr. Ruckman worked at the Colorado Department of Highways from 1963 to 1982 in the area of materials engineering and geotechnical engineering. During this time he was involved in highway designs including slope stability, highway stability and structural inspections and material designs. Research performed during this time included soil collapse potential, swelling of bedded shales and clays, and soil reinforcement. Included in this research was the design and construction supervision of the Glenwood Canyon fabric walls with instrumentation for determining strain and deformation of the full height test walls. In 1982 he began work for Corn Construction Company as the Materials and Quality Control Engineer. In this position he was responsible for locating and obtaining materials for highway construction projects in 5 Western states. Location of the materials sources requires an understanding of the geology of the area and the performance characteristics of various types of geologic materials. Modification of the materials to meet performance criteria was also a large part of the job. In 1986 he was employed by Sergent, Hauskins & Beckwith Consulting Engineers in Phoenix, Arizona. In this assignment he was in charge of the materials laboratory. In this position he was responsible for the instrumentation of structural foundation elements including the installation and operation of load cells, inclinometers, strain gauges, piezometers, and supervision, training and operation of the 1000 ton load test frame. Projects included design of fabric reinforced soil walls. In 1994 Mr. Ruckman returned to Denver, Colorado to consult independently for soil nail shoring and reinforced soil design and construction in Colorado. He designed and supervised construction of geosynthetically confined soil walls as great as 93 feet in height. He designed and supervised construction of ground anchored and soil nail walls up to 110 feet in height. After consulting for Yenter Companies for several years, he joined Yenter as Chief Engineer and later became President of the company. At that time, Yenter was the dominant blasting and slope stabilization contractor in the Rocky Mountain region. Al has design responsibility for hundreds of reinforced soil structures throughout the U. S. and internationally, valued at well over a 300 million dollars, and over 100 soil nail walls and landslide stabilization repairs using soil nails totaling over 100,000 square feet. He is one of the top geotechnical and structural researchers, innovators, designers and constructors in the world. Al has designed and supervised the installation of over 5,000 each launched soil nails, SuperNails®, and Self-Drilling Nails.

ROBERT BARRETT, P.G., FOUNDER, Bob Barrett holds a B.S. in Geology from Marshall University. Bob worked for the West Virginia DOT and the Colorado DOT for over 30 years as a landslide specialist and as the chief geologist for design and construction of Interstate 70 across the Colorado Rockies. Bob was Manager of Geotechnical Research for the Colorado DOT and for the Colorado Transportation Institute, was a co-inventor of the Colorado Rockfall Simulation Program (CRSP), and received the 1991 Colorado Governor's award for creativity and innovation in government service. He chaired the Transportation Research Board Committee on Geosynthetics, the NCHRP Panel on Sealing Geotechnical Boreholes, and NCHRP Panel 12-59, dealing with design of GRS bridge abutments. He is a leading researcher in the Geotechnical area and holds patents for rockfall mitigation devices and Geosynthetically Confined Soil (GCS®) retaining wall innovations. He and Al have patents on Earthquake Wings for bridges and Scour Micropiles for Open Bottom Boxes and other applications. Bob is currently a



Submittal for Temporary Shoring Rochester, Vermont

member of the NCHRP Project Panel to develop seismic guidelines for GRS bridge abutments. He was the former Manager of Bridge Design and Construction for Yenter Companies and now sits on the Board of Directors of GSI. Bob and Al Ruckman were the recipients of the 1998 IFAI international design award for the design and construction of a 55-ft high GCS® retaining wall in Grand County, Colorado, and continue to enjoy solving difficult problems. Together, they have presented technology transfer programs on five continents on the subjects of GCS®, landslide mitigation, and rockfall control. They have constructed GCS® walls and abutments across the globe. Mr. Barrett is currently using his expertise working on a new venture for GSI, US GeoBridge, which aims to use GCS technology to rebuild failing bridges at a fraction of the cost.



METHODS & APPROACH



PROJECT SCHEDULE AND CONSTRUCTION SEQUENCE

GeoStabilization International (GSI®) intends to begin work upon Vtrans approval and notice-to-proceed.

Overall Construction:

1. Set up traffic control and erosion control measures by Shultz Construction.
2. Shultz Construction will conduct clearing, excavation, and hauling of overburden soils and existing structure. Excavation will be conducted in a series of five (5) foot vertical lifts. After lift excavation, associated soil nails, drain strips, and reinforced shotcrete facing will be installed. Subsequent vertical lifts will be conducted in a similar manner.
3. GSI will provide and install the soil nails per the construction documents. GSI intends on using a Komatsu PC150 or Caterpillar 320 Hydraulic Excavator with a hydraulic percussion drill.
4. Steel reinforcement and shotcrete facing (up to 25-ft tall) will be applied to the wall face.

PROJECT TEAM MEMBERS

- **Project Engineer:** Al Ruckman, P.E.
- **Project Engineer Alternate:** Nate Beard, P.E.
- **Project Engineer Tech/Geologist:** Martin Woodard, PhD, P.G., P.E.
- **Project Manager:** Marty Flarhety
- **Project Manager Alternate:** Martin Woodard, PhD, P.G., P.E.
- **General Superintendent:** Sikot Mahaxay
- **Superintendent:** Corey “Rouse” Slape

SHOTCRETE NOZZLEMAN CERTIFICATIONS

ACI Certification Certified Personnel

Search Results

Last name: Slape
Location: OR

Item 1 of 1 matching your search criteria are show below. Click **Search Again** to initiate a new search.

Slape Rouse C
ACI SHOTCRETE NOZZLEMAN WET MIX PROCESS, VERTICAL POSITION ONLY
Expires: January 30, 2017
Portland, OR 97206-2817



MATERIALS



GROUND ANCHOR

Self-Drilling SuperNail®

- Nominal Diameter: 38 mm (Hollow Bar Soil Nail or equivalent)
- Minimum Yield Strength: 90.7 kips
- Embedment Length: Up to 19 feet
- Grouting Pressure: As required for grout return at surface.
- Drilling Fluid: Soil Nails will be drilled with grout. No other drilling fluids will be used.
- Corrosion Protection: Not necessary for temporary conditions.
- Centralizers: Not applicable for this system

All material certificates will be submitted upon delivery.

GROUT

- a. Type of Portland Cement: Type I/II
- b. Proportions of mix by weight and water/cement ratio: 0.6

Water/Cement Ratio= 0.6

(Batch Weight Per Cubic Yard)

<u>Material</u>	<u>Weight</u>	<u>Volume</u>	
Cement	1837 lbs	9.3 Cubic Feet	19.5 bags (94#)
Water	1102 lbs	17.7 Cubic Feet	132 gallons
Total		1 Cubic Yard	

(Per 94# Bag of Cement)

<u>Material</u>	<u>Weight</u>	<u>Volume</u>	
Cement	94 lbs	0.48 Cubic Feet	1 bag (94#)
Water	56.4 lbs	0.9 Cubic Feet	6.8 gallons
Total Volume		1.38 Cubic Feet	

- c. Admixtures: None.
- d. Grouting pressure: Minimal pressure to ensure visual return during drilling operations. The drilling and grouting methods proposed for this installation does not require grout pressure readings.

If mixing grout on site, GSI will mix 6.8 gallons of water with each 94 lbs bag of Type II neat cement.

Compressive strength test results will verify the proposed mix design achieves a minimum compressive strength of 1500 psi at 3 days, and a minimum compressive strength of 3,000 psi at 28 days. Compressive strength shall be tested in accordance with the requirements



Submittal for Temporary Shoring Rochester, Vermont

given in AASHTO T 106, “Compressive Strength of Hydraulic Cement Mortar (Using 50 mm or 2 inch Specimens)”.

Grout equipment will produce a uniformly mixed grout free of lumps and shall be capable of continuously agitating the mix. A positive displacement grout pump will be used. The equipment will be sized to enable the entire nail to be grouted in one continuous operation, barring any large unforeseen voids in the soil matrix

All material certificates will be submitted upon delivery.

FACING

Bearing Plates, Nuts, Washers, and Mesh for Anchorage of Soil Nails:

- Welded Wire Mesh Steel Reinforcement for Shotcrete Wall Face
 - Size: 4.0x4.0xW4xW4
 - Shall conform to the requirements given in AASHTO M 55.
- Bearing Plates: 3/8”x8”x8” AASHTO M183 / ASTM A36
- Steel Nuts: Shall conform to the requirements given in AASHTO M 291.

Geocomposite Sheet Drain:

Geocomposite Sheet Drain shall be manufactured with a drainage core and a drainage geotextile encapsulating the core such as Mirafi G100N, Ameridrain 500 or equal. The drainage core will be manufactured from long chain synthetic polymers composed of at least 85% by weight polypropylenes, polyester, polyamine, polyvinyl chloride, polyolefin, or polystyrene and shall have a minimum compressive strength of 40 psi when tested in accordance with ASTM D 1621 Procedure A. The geotextile shall have a minimum flow rate of 0.08 gallons per second per foot of width when tested in accordance with the requirements given in ASTM D 4716. The test conditions shall be an applied load of 10 psi at a gradient of 1.0 after a 100-hour seating period.

All material certificates will be submitted upon delivery.

SHOTCRETE

Shotcrete shall be a pumpable mixture with a minimum 28-day compressive strength of 4,000 psi and a minimum 3-day compressive strength of 2,000 psi. Use Type I or II cement. Shotcrete shall comply with the requirements of ACI 506.2, “Specifications for Materials, Proportioning and Application of Shotcrete”. Except as otherwise specified. The wet-mix process consists of thoroughly mixing all ingredients, introducing the mixture into the delivery equipment and delivering it by positive displacement.



Submittal for Temporary Shoring Rochester, Vermont

<u>Material</u>	<u>Weight per Cubic Yard</u>
3/8" Rock	650 lbs
Sand	1800 lbs
Cement	750 lbs
Water	300 lbs
Fly Ash	150 lbs
Air Entrainment	6% (1.6 cubic feet)

0.40 to 0.50 water/cement ratio

Weather is a key factor in the placement of shotcrete because it affects how quickly the material matures and gains strength. In hot weather, concrete stiffens quickly, especially when the concrete temperature exceeds 90-deg F. This reduces the length of time it remains workable and can cause difficulties in placing and finishing it. Cold temperatures have the opposite effect. Chemical reactions are slower at lower temperatures, so the objective during winter concrete construction is to maintain a rate of cement hydration sufficient to avoid freezing of the fresh concrete.

The placement of shotcrete should be stopped if the wind is detrimental to the placement of the shotcrete, when the air temperatures are below 40-deg F or above 90-deg F, raining or lighting.

Warm water or heated aggregates may be used in batching and the shotcrete will be covered with shotcrete blankets if the weather is expected to be at 29-deg F or below and stay there for more than two hours. If the temperatures are below 50-deg the shotcrete will be covered with plastic for 24 hours.

Shotcrete thickness will be 4 inches nominal. Additional shotcrete may be added to provide adequate bearing plate coverage of 3 inches. The shotcrete finish will be a rough "undisturbed" gun finish.



ADDITIONAL INFORMATION



SAFETY

GeoStabilization International (GSI) is dedicated to safety. GSI's program focuses on the health, safety and well-being of every employee. GSI incorporates weekly safety meetings and "toolbox talks" at the start of each week. "Jobsite Emergency Instructions" have been trained and regularly reviewed and are available to each crew in the event of an emergency. Additionally GSI has annual safety meetings that integrate over 100 hours of safety related classes and material that is mandatory for all employees. Among the classes and material reviewed every team member is recertified in CPR, first aid and blood borne pathogens training. At GSI we find that management involvement and commitment to the safety program is the key to its success. Management is directly involved in any safety issue and addresses concerns immediately. Management is also directly involved in the training of superintendents and crews on any new and recurring safety issues. GSI employs a safety manager that is available 24/7.

GSI has had three (3) mishap/accident within the last 100,000+ man-hours:

- An employee tore his ACL while working on a slope for a project. Date: 5/17/08 in the state of Kentucky while working on project KY 714. Following the accident the employee was taken to a local doctor and then sent home to the employee's family doctor. After evaluation the employee had surgery and was brought back to work under modified duty until recovery to full duty.
- An employee cut open the palm of his hand while grabbing a guardrail. Date: 12/17/12 in the state of Alabama while working on SR 35 project.
- An employee was struck in the face with a pressurized shotcrete hose during cleanup. Date: 02/28/13 in the state of West Virginia on a project near Rt. 21.

The contact for this occurrence is Kim Ruckman, COO at GeoStabilization International (970) 210-6170 or kim@soilnaillauncher.com.

EQUAL EMPLOYMENT AND AFFIRMATIVE ACTION POLICY

GeoStabilization International shall provide Equal Employment Opportunity to all employees and applicants for employment in accordance with all applicable Equal Employment/Affirmative Action laws, directives and regulations of Federal, State, and Local governing bodies or agencies thereof.

GeoStabilization International will not discriminate against or harass any employee or applicant for employment on the basis of race, color, creed, religion, national origin, sex, sexual orientation, disability, age, marital status, or status with regard to public assistance.

GeoStabilization International will take affirmative action to ensure that all practices are free of such discrimination. Such employment practices include, but are not limited to, the following: hiring, upgrading, demotion, transfer, recruitment or recruitment advertising,



Submittal for Temporary Shoring Rochester, Vermont

selection, layoff, disciplinary action, termination, rates of pay or other forms of compensation, and selection for training.

GeoStabilization International will commit the necessary time and resources, both financial and human, to achieve the goals of Equal Employment Opportunity and Affirmative Action.

GeoStabilization International will evaluate the performance of its management and supervisory personnel on the basis of their involvement in achieving these Affirmative Action objectives as well as other established criteria. Any employee of this organization, or subcontractor to this employer, who does not comply with the Equal Opportunity policies and procedures, as set forth in this statement will be subject to disciplinary action.

GeoStabilization International has appointed the Kim Ruckman the Chief Operating Officer to manage the Equal Employment Opportunity Program. The COO's responsibilities will include monitoring all Equal Employment Opportunity activities and reporting the effectiveness of the Affirmative Action Program, as required by Federal, State and Local agencies. Both the President and the C.E.O. of GeoStabilization International will receive and review reports on the progress of the program.

If any employee or applicant believes he or she has been discriminated against, please contact Kim Ruckman at 970-210-6170 or 2841 North Avenue Grand Junction, CO 81501.



APPENDICES



Soil Nail Wall Properties

25 Max. Wall Height (ft)
0.3'H x 1'V Slope Angle

Soil Properties

Fill (overburden)
Bedrock

Clayey Sand w/Gravel

γ (pcf) c (psf) ϕ (deg.)
120 1 34
150 4000 35

Nail Properties

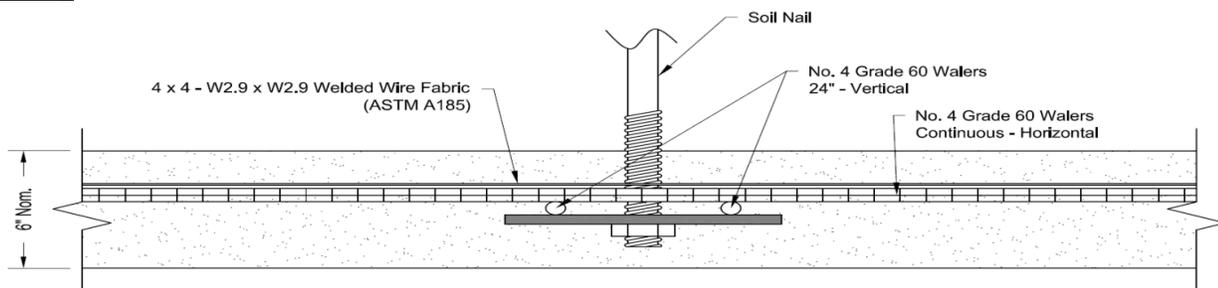
4" Φ Drillhole
38mm
6'H x 5'V Nail Spacing
Min. Yeild (kip) = 90.7 kips
Allowable (kip) = 90.7 / 1.8 = 50.4

Facing Properties

S_H (ft) = 6
 S_V (ft) = 5
 H (ft) = 25
 T_{max_s} (lbs) = 8000

$$T_o = T_{max_s} (0.6 + 0.057 (S_{max} - 3))$$

$$T_o \text{ (kips)} = 6.17$$

Facing**Punching Shear**

f'_c (psi) = 3000
 D'_c (in) = 8
 h_c (in) = 2

$$V_F = 0.58 (v(f'_c)) (\pi) (D'_c) (h_c)$$

$$V_F \text{ (kips)} = 11.09$$

$$FoS = \frac{R_{FP}}{T_o} = \frac{11.09}{6.17} = 1.8 > 1.5 \text{ for Permanent Walls}$$

Flexure

$$A_{vw} = A_{hw} = 0.4$$

$$A_{vm} = 0.087$$

$$A_{hm} = 0.087$$

$$a_{vn} = \frac{0.4}{5} + 0.087 = 0.167 \frac{in^2}{ft}$$

$$a_{hn} = a_{hm} = \frac{0.4}{6} + 0.087 = 0.154 \frac{in^2}{ft}$$

$$R_{FF} = 3.8 (C_F) (a_{vn} + a_{vm}) ((S_H * h)/S_V) * f_y$$

$$R_{FF} \text{ (kips)} = 52.5$$

$$FoS = \frac{R_{FF}}{T_o} = \frac{52.53}{6.17} = 8.5 > 1.5 \text{ for Permanent Walls}$$

$$\rho_n = \frac{a_{vn}}{0.5 * h} = 0.70\%$$

$$\rho_m = \frac{a_{vm}}{0.5 * h} = 0.36\%$$

$$\rho_{min} = 0.24 ((\sqrt{f'c})/f_y) = 0.14\%$$

$$\rho_{max} = 0.05 (f'c/f_y)(90/(90+f_y)) = 0.8\%$$

$$\rho_n = 0.70\% < \rho_{max} = 0.8\% \quad \mathbf{OK}$$

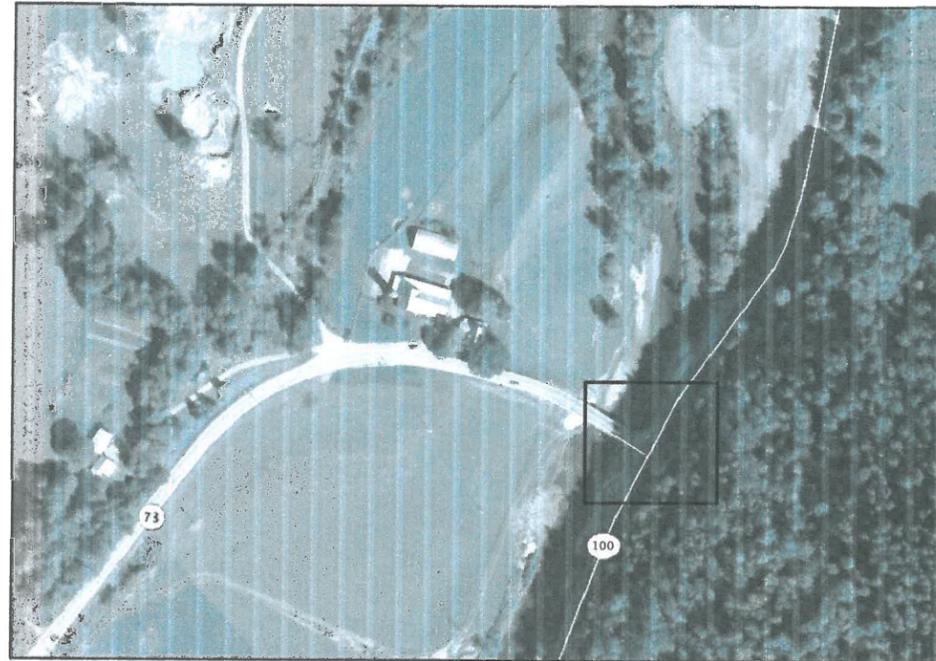
$$\rho_m = 0.36\% \geq \rho_{min} = 0.14\% \quad \mathbf{OK}$$

$$(\rho_n / \rho_m) = \frac{0.70}{0.36} = 1.92 < 2.5 \quad \mathbf{OK}$$

Temporary Shoring Details

Route 73 Bridge Project

Rochester, Vermont



Project Coordinates: 43° 51' 47.87"N 72°48' 36.58"W

Sheet Index

1. Cover Sheet
2. General Notes
3. Plan View
4. Elevation View
5. Typical Cross-Section and Elevation Detail
6. Self-Drilling SuperNail® Detail



Albert C. Ruckman
3/20/14

This drawing is furnished solely for the use of or in connection with this project and the proprietary information shown hereon is not to be transmitted to any other organization without specific authorization by GeoStabilization International. (GSI). The design is only valid if constructed and supervised by GSI or its authorized subcontractor.	Sheet Revision		Cover Sheet		Project No./Code:			GeoStabilization International Corporate Address: PO Box 4709 Grand Junction, CO 81502 P: 970.210.6170 F: 970.245.7737 www.geostabilization.com
	Date:	By:						
			Route 73 Bridge Project	MJW	1			
			Date:	Checked By:				
			February 24, 2014					

Construction Sequence/Work Schedule:

1. Set up traffic control and erosion control measures by Schultz Construction.
2. Schultz Construction will conduct clearing, excavation, and hauling of overburden soils and existing structure. Excavation will be conducted in a series of six (6) foot vertical lifts. After lift excavation, associated soil nails, drain strips, and reinforced shotcrete facing will be installed. Subsequent vertical lifts will be conducted in a similar manner.
3. GSI will provide and install the soil nails per the construction documents. GSI intends on using a Komatsu PC150 or Caterpillar 320 Hydraulic Excavator with a hydraulic percussion drill.
4. Steel reinforcement and shotcrete facing (up to 25-ft tall) will be applied to the wall face.

Size and Spacing of Nails:

- GSI will mark the locations of the proposed soil nails with survey marking paint.
- Soil Nails: 38mm B7X Injection Anchor FY=90.7 ksi.
- The Soil Nails will be injected with grout. The grout will be a Type I/II Portland Cement. The water/cement ratio will be 0.40 to 0.60. No additional aggregate or admixtures will be added to the grout.

Facing and Drainage System:

- Drain strips will be provided and installed between the soil nails every 6-feet along the face of the excavation. The drain strips shall be placed with the geotextile side against the ground. Drain strips will be continuous and any splices shall be made with a one-foot minimum overlap such that the flow of water is not impeded. Drain strips shall extend beyond the face of the shotcrete at the downhill face.

Reinforcing Steel Placement:

- Welded wire fabric will be placed along the face of the excavation with a separation of approximately 2 inches between the wire mesh and the soil.
- No. 4 Rebar will be tied to the wire mesh. Vertical bars will extend for approximately 24 inches and the horizontal bars will be continuous (with overlap splices) in the shotcrete.

Bearing Plate Placement:

- 8" x 8" x 3/8" Steel Bearing Plates will be placed over the nails and attached either with a hex nut or by welding to the nail to secure the wire mesh and rebar during shotcrete placement. If the soil nails extend beyond the hex nuts or welded plates, they will be trimmed using a gas powered demolition saw.

Shotcrete Application:

- Shotcrete will be placed from the lower part of the area upwards to prevent accumulation of rebound. The nozzle will be oriented a proper distance from and approximately perpendicular to the working face so that rebound will be minimal and compaction will be maximized.

GSI Employee Certifications:

- ACI Shotcrete Nozzlemen Certification
- 10-hour Occupational Safety and Health Training Course in Construction Safety & Health
- American Red Cross Standard First Aid Training
- American Red Cross Bloodborne Pathogens Training: PDT
- Erosion Control Supervisor Training

House Keeping:

- The site will be organized and clear of any trash or debris. All trash will be placed in a proper container and removed at the end of each work day.

Safety:

- All safety plans for lifting, hearing, dust control, PPE etc. are in place and will be followed accordingly. PPE will include safety vest, steel toed shoes, hard hat, safety glasses, and gloves.

Soil Design Parameters:

Material Name	Unit Weight (pcf)	Cohesion (psf)	Phi	Bond Strength (lb/ft)
Fill (overburden)	120	1	34	1500
Bedrock	150	4000	35	4000

Shotcrete Mix Design:

Shotcrete shall comply with the requirements of ACI 506.2, "Specifications for Materials, Proportioning and Application of Shotcrete", except as otherwise specified. Shotcreting consists of applying one or more layers of concrete conveyed through a hose pneumatically projected at a high velocity against a prepared surface.

The wet-mix process consists of thoroughly mixing all the ingredients, introducing the mixture into the delivery equipment and delivering it, by positive displacement, to the nozzle. Air jet the wet-mix shotcrete from the nozzle at high velocity onto the surface.

Material	Weight per Cubic Yard
3/8" Rock	650 lbs
Natural Sand	1800 lbs
Cement	750 lbs
Water	300 lbs
Fly Ash	150 lbs
Air Entrainment	6% (1.6 cubic feet)

0.40 to 0.50 water/cement ratio

Shotcrete shall be a pumpable mixture with a minimum 28-day compressive strength of 4,000 psi and a minimum 3-day compressive strength of 2,000 psi.

Weather is a key factor in the placement of shotcrete because it affects how quickly the material matures and gains strength. In hot weather, concrete stiffens quickly, especially when the concrete temperature exceeds 90-deg F. This reduces the length of time it remains workable and can cause difficulties in placing and finishing it. Cold temperatures have the opposite effect. Chemical reactions are slower at lower temperatures, so the objective during winter concrete construction is to maintain a rate of cement hydration sufficient to avoid freezing of the fresh concrete. The placement of shotcrete should be stopped if the wind is detrimental to the placement of the shotcrete, when the air temperatures are below 40-deg F or above 90-deg F, raining or lightning.

Warm water or heated aggregates may be used in batching and the shotcrete will be covered with shotcrete blankets if the weather is expected to be at 29-deg F or below and stay there for more than two hours. If the temperatures are below 50-deg the shotcrete will be covered with plastic for 24 hours.

Two methods are allowed for curing. The first method of curing is by keeping the surface of the shotcrete continually moist for at least 7 days by burlap that is kept wet. The second method of curing is by using an impervious membrane (curing compound).

Shotcrete thickness will be 4 inches nominal. The shotcrete finish will be a rough "undisturbed" gun finish.

Grout Mix Design:

Water/Cement Ratio= 0.6

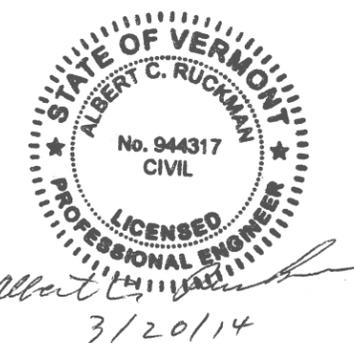
(Batch Weight Per Cubic Yard)

Material	Weight	Volume	
Cement	1837 lbs	9.3 Cubic Feet	19.5 bags (94#)
Water	1102 lbs	17.7 Cubic Feet	132 gallons
Total		1 Cubic Yard	

(Per 94# Bag of Cement)

Material	Weight	Volume	
Cement	94 lbs	0.48 Cubic Feet	1 bag (94#)
Water	56.4 lbs	0.9 Cubic Feet	6.8 gallons
Total Volume		1.38 Cubic Feet	

Compressive strength test results will verify the proposed mix design achieves a minimum compressive strength of 1500 psi at 3 days, and a minimum compressive strength of 3,000 psi at 28 days in accordance with the requirements given in AASHTO T 106, "Compressive Strength of Hydraulic Cement Mortar (Using 50 mm or 2 inch Specimens)".



This drawing is furnished solely for the use of or in connection with this project and the proprietary information shown hereon is not to be transmitted to any other organization without specific authorization by GeoStabilization International. (GSI). The design is only valid if constructed and supervised by GSI or its authorized subcontractor.

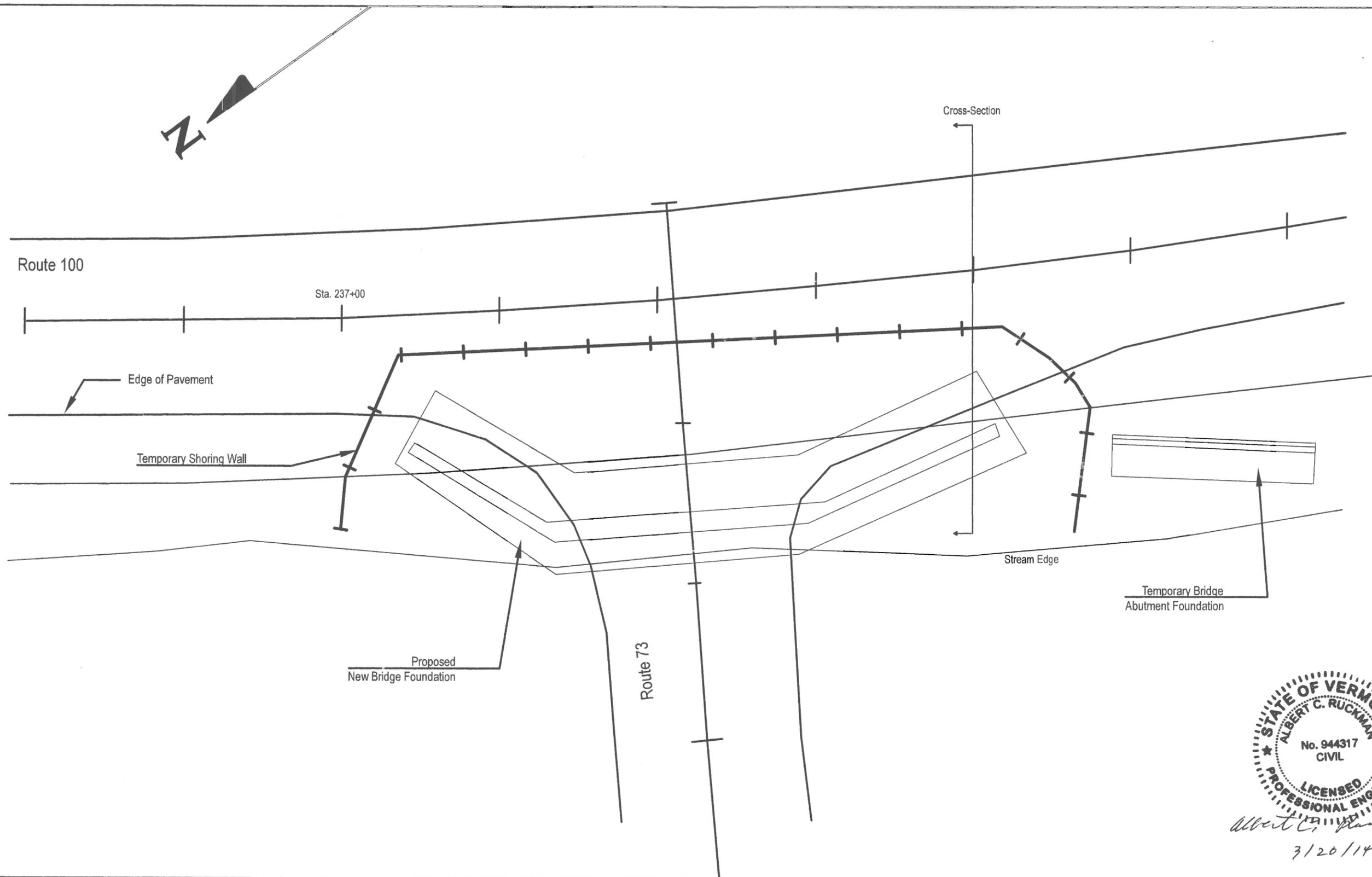
Sheet Revision		
Date:		By:

General Notes	
Project: Route 73 Bridge Project	Drawn By: MJW
Date: February 23, 2014	Checked By:

Project No./Code:
Sheet No.: 2



GeoStabilization International
 Corporate Address: PO Box 4709
 Grand Junction, CO 81502
 P: 970.210.6170
 F: 970.245.7737
 www.geostabilization.com



Albert C. Ruckman
3/20/14

This drawing is furnished solely for the use of or in connection with this project and the proprietary information shown hereon is not to be transmitted to any other organization without specific authorization by GeoStabilization International. (GSI). The design is only valid if constructed and supervised by GSI or its authorized subcontractor.

Sheet Revision	
Date:	By:

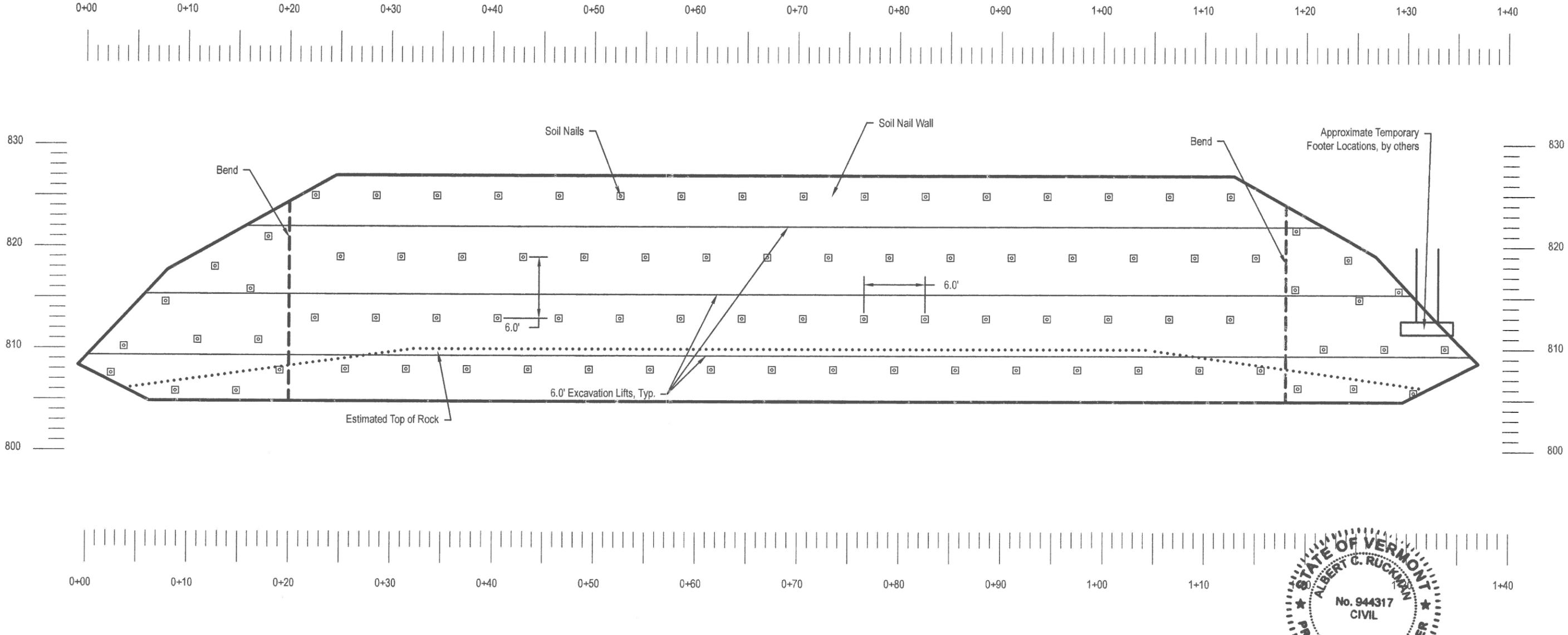
Plan View	
Project: Route 73 Bridge Project	Drawn By: MJW
Date: February 23, 2014	Checked By:

Project No./Code:
Sheet No.: 3



GeoStabilization International
Corporate Address: PO Box 4709
Grand Junction, CO 81502
P: 970.210.6170
F: 970.245.7737
www.geostabilization.com

Shoring Area



Note: Approximately 2,630 sq. ft.



Albert C. Ruckman
3/20/14

This drawing is furnished solely for the use of or in connection with this project and the proprietary information shown hereon is not to be transmitted to any other organization without specific authorization by GeoStabilization International. (GSI). The design is only valid if constructed and supervised by GSI or its authorized subcontractor.

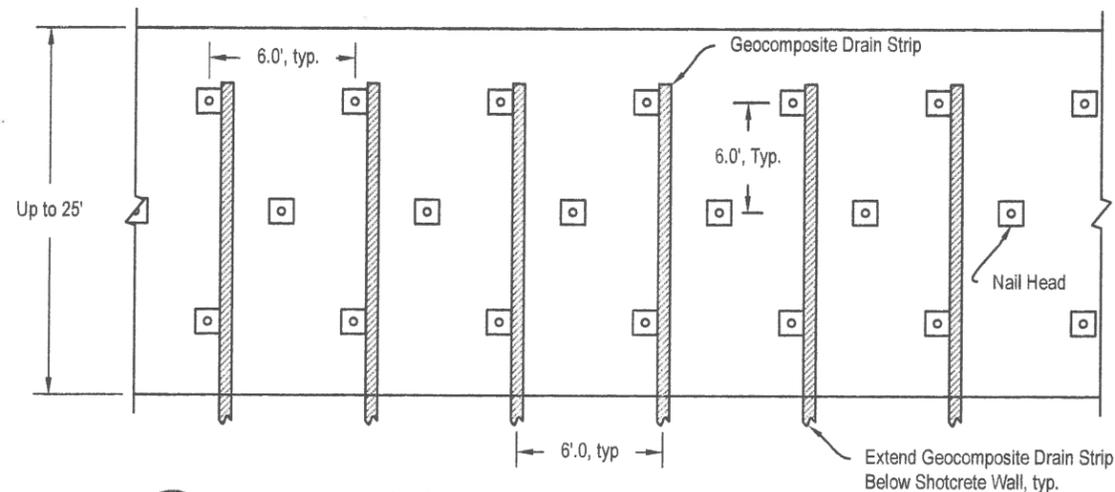
Sheet Revision	
Date:	By:

Elevation View	
Project: Route 73 Bridge Project	Drawn By: MJW
Date: February 23,2014	Checked By:

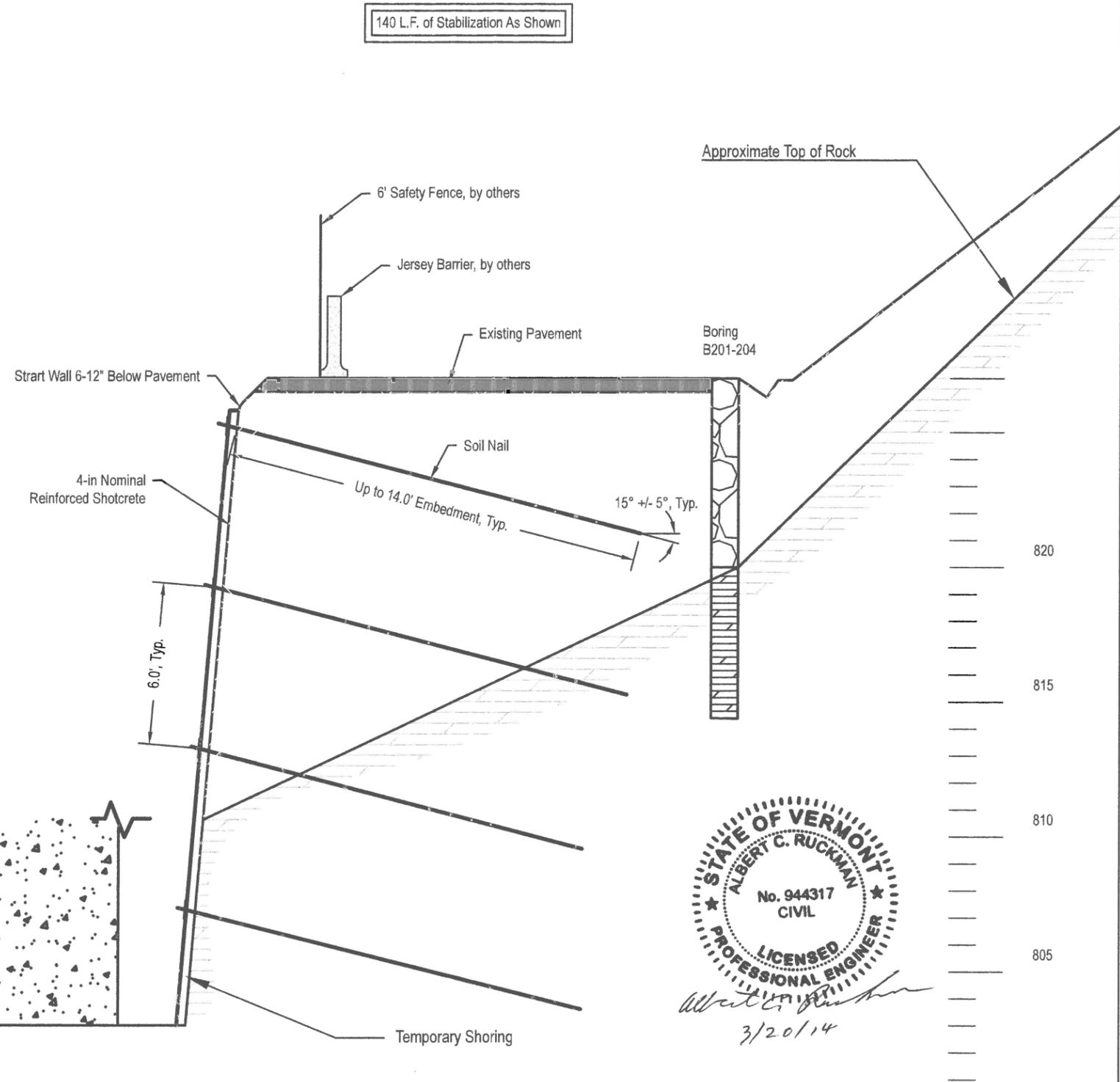
Project No./Code:
Sheet No.: 4



GeoStabilization International
Corporate Address: PO Box 4709
Grand Junction, CO 81502
P: 970.210.6170
F: 970.245.7737
www.geostabilization.com



B Elevation Detail
5 Not to Scale



A Typical Section
5 Not to Scale



Albert C. Ruckman
3/20/14

This drawing is furnished solely for the use of or in connection with this project and the proprietary information shown hereon is not to be transmitted to any other organization without specific authorization by GeoStabilization International. (GSI). The design is only valid if constructed and supervised by GSI or its authorized subcontractor.

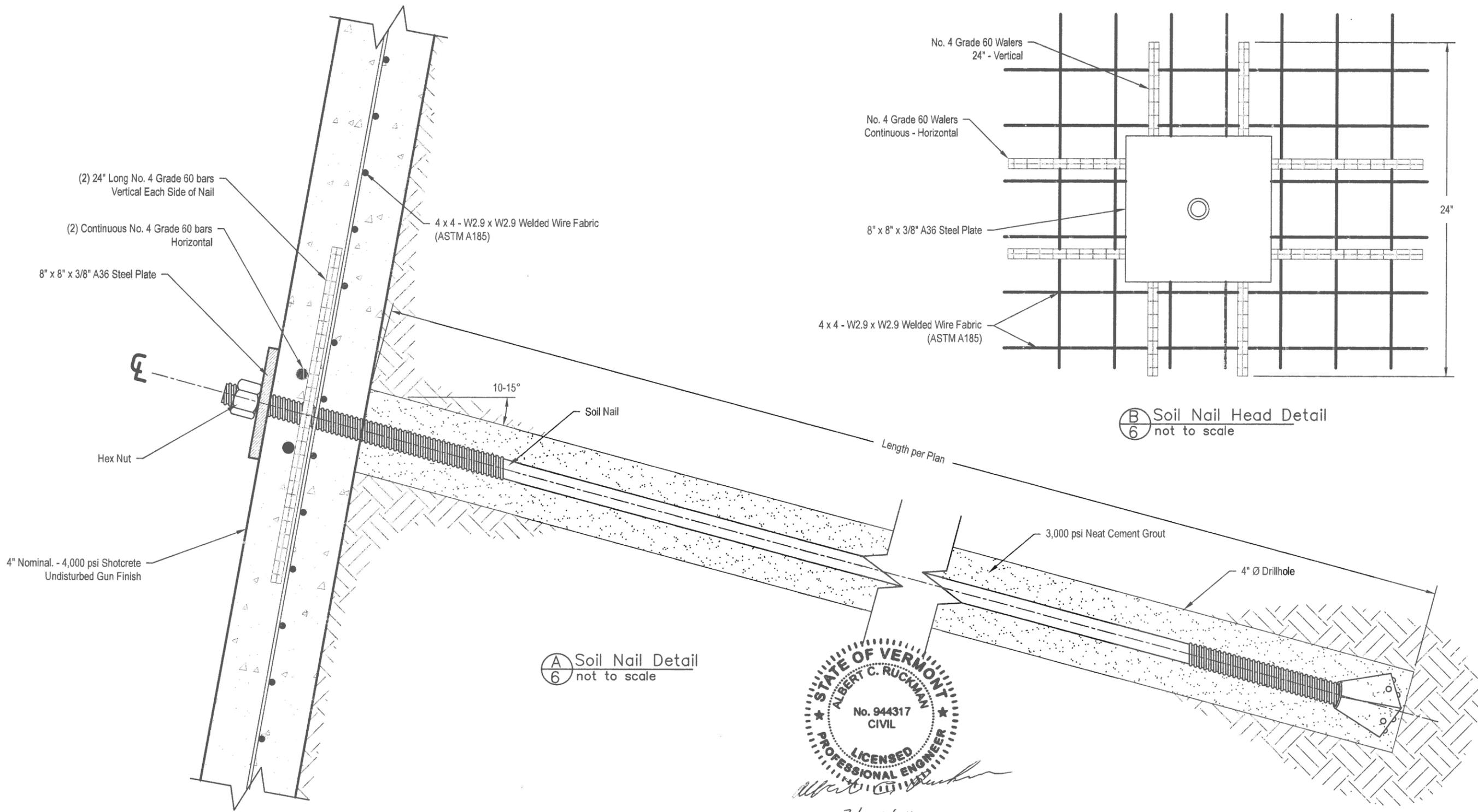
Sheet Revision	
Date:	By:

Typical Cross-Section and Elevation Detail	
Project: Route 73 Bridge Project	Drawn By: MJW
Date: February 24, 2014	Checked By:

Project No./Code:
Sheet No.: 5



GeoStabilization International
Corporate Address: PO Box 4709
Grand Junction, CO 81502
P: 970.210.6170
F: 970.245.7737
www.geostabilization.com



(B) Soil Nail Head Detail
not to scale

(A) Soil Nail Detail
not to scale



This drawing is furnished solely for the use of or in connection with this project and the proprietary information shown hereon is not to be transmitted to any other organization without specific authorization by GeoStabilization International. (GSI). The design is only valid if constructed and supervised by GSI or its authorized subcontractor.

Sheet Revision	
Date:	By:

Self-Drilling SuperNail® Detail	
Project:	Drawn By:
Route 73 Bridge Project	MJW
Date:	Checked By:
February 23, 2014	

Project No./Code:
Sheet No.:
6



GeoStabilization International
 Corporate Address: PO Box 4709
 Grand Junction, CO 81502
 P: 970.210.6170
 F: 970.245.7737
 www.geostabilization.com