Quality Control and Quality Assurance Manual

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QC/QA Manual for STONE STRONG Systems precast modular block retaining wall system.

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INTRODUCTION

This Quality Control and Quality Assurance Manual addresses Quality Control (QC) performed by the licensed STONE STRONG Dealers and the role of Quality Assurance (QA) performed by STONE STRONG. This Manual presents the roles and responsibilities, how Quality Control and Quality Assurance functions are related, provides general information pertinent to Quality Control and Quality Assurance, and discusses Quality Control and Quality Assurance associated with manufacturing, design and installation of STONE STRONG systems precast modular block (PMB) retaining walls.

Building structurally sound walls requires a high level of care and expertise. STONE STRONG is dedicated to the quality and performance of our wall system manufacturing components and the precast modular blocks. Quality Control and Quality Assurance functions are vital to the success of our products.

IMPLEMENTATION TIMELINE

STONE STRONG has adopted the additions and revisions to the Quality Control/Quality Assurance Manual as revised on September 15, 2009 and identified as Version 2.1. Furthermore, STONE STRONG has adopted a Quality Control/Quality Assurance Review Process as presented within version 2.1 of the QC/QA Manual effective September 15, 2009.

REFERENCED DOCUMENTS

The following STONE STRONG manuals are referenced within the Quality Control Quality Assurance Manual. These documents can be provided by STONE STRONG Licensed Dealers. Additionally, these documents will be available on the STONE STRONG Website.

- Stone Strong Production Manual
- Stone Strong Engineering Manual
- Stone Strong Field Construction Manual

RESPONSIBILITIES OF PARTIES

STONE STRONG

The STONE STRONG Quality Control/Quality Assurance program has been established to provide the Dealer (precaster licensee) with the proper tools and education to ensure the consistency and the quality of the Retaining Wall System.

STONE STRONG in its role as the patent holder and designer of the system is responsible to educate the Dealer (precaster licensee) to ensure that the system is produced within the tolerances permitted by STONE STRONG, project specific drawings and the STONE STRONG Production Manual. STONE STRONG shall use document control, plant start-up visits and periodic plant inspections to assure that the Dealers' Quality Control programs are being followed. STONE STRONG will:

- Evaluate each potential Dealer (precaster licensee) in terms of their plant, plans, facilities, existing plant quality control, plant certifications and fiscal strength. Review the potential Dealer's prior experience and reputation in the industry.
- Define the Dealer (precaster licensee's) responsibilities and obligations in terms of the license Agreement.
- Issue an Agreement which conveys particular performance functions to the licensee and grant access to the precaster licensee's plant and quality control information.
- Review with the precaster licensee:
    - The standard drawings and specifications to assure understanding of the drawing nomenclature and the various system components.
    - The Production Manual to assure understanding of the required testing and inspection procedures, casting techniques and quality control.
    - The qualified material sources from which to order the specified system components.
- Review monthly production reports. Periodically review concrete break reports and testing certifications.
- A STONE STRONG representative or a trained Dealer licensee representative is on site at the start of each project to assure compliance with project specifications and the

Installation Manual and trains the Contactor and his crew in the proper techniques of construction.

- Visit each new Dealer licensee for a start-up visit to assist the precaster licensee in setting up the manufacturing operation and makes periodic follow up visits to each licensed plant. The STONE STRONG representative's role is to assure that the precast modular block is manufactured in accordance with specifications and to verify that the established procedures are being adhered to.
- For established Dealers, STONE STRONG or their designee may conduct plant visits and oversight. The frequency of the reoccurring visits/oversight will be determined by STONE STRONG based on the Dealer's performance, annual documentation reviews, periodic QC data submittals and history of complaints and nonconformances

STONE STRONG LICENSED DEALERS

STONE STRONG Licensed Dealers will produce precast modular blocks following the most current version of the STONE STRONG Systems Production Manual at the time of manufacturing. The Dealer is responsible for the manufacturing of the STONE STRONG systems precast modular blocks and to ensure that units meet the dimensional tolerances and materials specifications as required by STONE STRONG, LLC. The dimensional tolerances are defined within the QC/QA Manual. The materials specifications are found in a standalone STONE STRONG document, the *Manufacturing Specifications for Precast Modular Block retaining Wall System.*

Updates to manuals will be distributed either by mail or by email. Updates sent via email will be sent in PDF format. Dealers will be required to sign and return an acknowledgment form noting the receipt of updates to manuals.

Licensed Dealers also may assist the engineer, owner, contractor and inspectors in scheduling of materials, construction procedures, contract documents, plans and specifications. The STONE STRONG Dealer shall not be responsible for means or methods of design, construction or for safety of workers or of the general public.

STONE STRONG Dealers can be available to assist and train contractors and inspectors as requested and as necessary. Dealers may also refer interested parties to the STONE STRONG Quality Assurance Officer for additional information, technical support and resource materials.

To support our Dealers, the STONE STRONG website provides numerous resources on our components, design considerations and installation guidelines.

STONE STRONG Dealers shall have product liability insurance and will provide insurance certificates to STONE STRONG. The required limits of insurance coverage shall be 2 Million each occurrence and 2 Million aggregate per the License Agreement.

SUPPLIERS OF MATERIALS TO DEALERS

Materials Suppliers will be responsible for the materials delivered and utilized to manufacture STONE STRONG precast modular blocks. Materials Suppliers materials may include: Ready Mixed Concrete, wire or reinforcing steel, aggregates, Portland cement or other materials utilized in the manufacturing of the precast modular blocks. Material suppliers will provide STONE STRONG Dealers with materials test data and or statements of conformance to specifications. Test data and or statements of conformance will be submitted to the STONE STRONG Dealers at the intervals presented in later sections of this Manual.

Materials Suppliers will provide STONE STRONG Dealers with certificates of insurance. The coverages shall include Workers Compensation and Product Liability. The required limits of coverage shall be 1 Million each occurrence and 1 Million in aggregate coverage.

ENGINEER OR OWNER'S REPRESENTATIVE

The Engineer or Owner's representative is responsible for the preparation and enforcement of the wall construction contract documents, plans and specifications. STONE STRONG recommends that the Engineer or Owner employ services of a geotechnical/materials engineering firm to provide Quality Control testing during embankment construction and backfilling operations. It is further recommended to employ an Engineer or inspection firm to document the installation procedures and the conformance of the installed system to the plans and specifications. The Engineer and Owner shall not be responsible for means or methods of manufacturing, construction or for safety of workers or of the general public.

INSTALLATION CONTRACTOR

Installation Contractors shall follow shop drawings or construction procedures and recommendations cited in the most current version of the STONE STRONG Systems *Field Construction Manual* at the time of installation. The Installation Contractor is responsible for checking materials upon delivery to assure that proper materials have been received. Contactors will protect materials from damage. Damaged materials shall not be incorporated into the wall or the reinforced soil embankments, and should be disposed of properly off site. Furnishing and installing STONE STRONG precast modular blocks to the lines and grades shown on the plans and as specified is the responsibility of the Installation Contractor. The Installation Contractor is responsible for proper embankment, construction, placement in fill materials, backfilling and localized drainage control. The contractor is solely responsible for site safety.

QUALITY CONTROL AND QUALITY ASSURANCE OVERVIEW

QUALITY CONTROL ROLE - DEALERS

Quality Control will refer to the quality related activities associated with the manufacturing of the precast modular blocks. Quality Control is used to monitor and document that the precast modular blocks are manufactured to meet the specified quality requirements. Quality Control functions will focus on monitoring, auditing and improving the manufacturing process. STONE STRONG Dealers will implement their own internal Quality Control systems and provide documentation of Quality Control activities to STONE STRONG that are acceptable to the standards presented within this Manual.

STONE STRONG Dealers may utilize documents presented within this Manual, may develop their own systems and documentation or may follow accepted QC programs developed by organizations such as the National Precast Concrete Association (NPCA), the Precast/Prestressed Concrete Institute (PCI), the Pre-Cast Concrete Association of America **(**PCA) or similar national or regional organizations.

QUALITY ASSURANCE ROLE – STONE STRONG

The role of Quality Assurance is intended to review and document the quality of and help improve and support the Dealers' QC systems, manufacturing processes and the product.

STONE STRONG will act as the Quality Assurance reviewer. Quality Assurance will focus on reviews of the Dealers' plant certifications, personnel certifications, form and liner inspections, Quality Control records, materials test data, manufacturing documentation, addressing technical complaints and installation monitoring. The role of Quality Assurance by STONE STRONG will also include product research and development, product improvements and design modifications. Quality Assurance will include emphasis on reviewing each Dealer's Quality Control activities and related documentation through a periodic Dealers' Quality Control submittal and Quality Assurance review process.

QUALITY CONTROL REVIEW SCHEDULE

IMPLEMENTATION

As this Manual presents a series of Quality Control mechanisms that each existing licensed STONE STRONG Dealer is required to conform to; an implementation schedule follows. Existing Dealers will be given 60 days from the date of this Manual to develop and implement a Quality Control system and its associated documentation that complies with the scope of this Manual. Existing Dealers must submit their initial Quality Control Submittal package to STONE STRONG within 120 days of the date of this Manual. These timeframes will serve as the programs identified within this Manual are implemented and until each existing Dealer's schedule is defined within the following Quality Control Submittals Schedule section of the Manual.

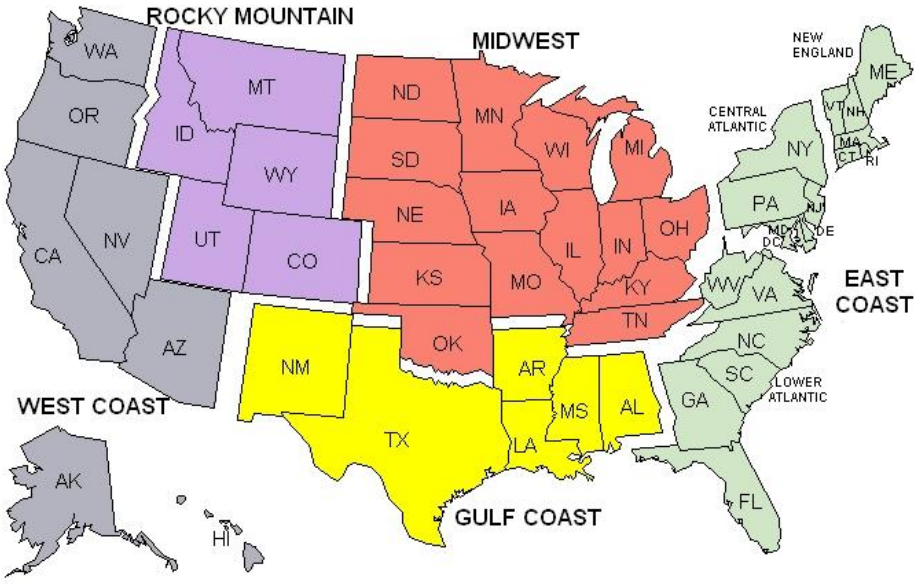
In the case of future Dealers, their Quality Control program(s) will be reviewed concurrently with the initial start visit and approval of being a Licensee. After the initial review and acceptance of the Dealers programs, the Dealer will submit Quality Control documentation to STONE STRONG for review per the following Quality Control Submittals Schedule section of the Manual

QUALITY CONTROL SUBMITTALS

STONE STRONG Dealers will be required to submit Quality Control documentation to STONE STRONG for review. A summary of each Dealer's Quality Control documentation will be sent to STONE STRONG per the following schedule.

Quality Control Documentation Schedule

Regions	Dealer Quality Control Submittal Deadline	STONE STRONG Quality Assurance Response Deadline	Dealer Corrective Actions Due By
East Coast	February 15	March 15	March 30
Midwest	April 15	May 15	May 30
Gulf Coast	June 15	July 15	July 30
Rocky Mountain	August 15	September 15	September 30
West Coast	October 15	November 15	November 30
Outside of U.S.	December 15	January 15	January 30



QUALITY CONTROL SUBMITTAL REVIEWER

STONE STRONG Dealers will be required to submit Quality Control documentation to a designated STONE STRONG reviewer. Submittals should be directed to STONE STRONG to the attention of the Quality Assurance Officer. STONE STRONG may assign different submittal reviewers, at their discretion, for the above identified regions or for specific Dealers at a later time.

QUALITY ASSURANCE REVIEW FORMATS

Within this QC/QA Manual, two types of Quality Assurance review formats will be presented. These reviews are not intended to be an economic or time burden to the Dealers, but the intention is to assure the quality of the deliverable product, to improve the product and to protect the product image, brand and name.

All STONE STRONG Dealers will be required to submit documentation on an annual basis for review by STONE STRONG. The minimum requirements and organizational format for the review submittal are described in later sections of this Manual.

STONE STRONG reserves the right to conduct detailed on site or correspondence audits on a discretionary basis.

QUALITY CONTROL REVIEW SUBMITTALS

QC SUBITTAL PACKAGE FOR QA REVIEW

STONE STRONG Dealers will be required to submit their Quality Control documentation for Quality Assurance Review. Dealers may utilize forms or formats developed in-house, developed by other organizations or agencies, or utilize the generic forms provided by STONE STRONG. It is not the intent herein to specify specific forms and formats, but to provide a general overview of STONE STRONG's expectations of the Dealer's Quality Control review submittal package.

If a Dealer is a member firm of and is operating a Certified Plant through organizations such as the NPCA or other nationally or regionally recognized programs, the Dealer is required to submit copies of their inspections or assessments to STONE STRONG as part of the review submittal information.

The Quality Assurance review submittal includes the items identified in the following Quality Assurance Review Submittal Package Contents. The review submittal package sections followed by ** indicate that these sections may be omitted from the review submittal package if the STONE STRONG Dealer is a member of the NPCA or an organization considered equivalent by STONE STONG and the Dealer's NPCA Plant Certification or equivalent is in active status.

To determine if an organization will be considered equivalent to the NPCA, contact the STONE STRONG Quality Assurance Officer. It is preferred that the organizational format for the Quality Control review submittal package follows a format similar to the following.

INSPECTION FREQUENCIES

The Quality Control inspection intervals for molds, liners, lifting loops, completed precast units and related items shall be no greater than those indicated in the following table. Inspection intervals may be extended provided the equipment has not been in use and documented accordingly. If the Dealer deems necessary due to perceived wear and tear or other concerns, it is recommend that intervals be decreased to ensure that the equipment consistently meets the dimensional requirements set forth by STONE STRONG or the item is removed from service when appropriate.

Items	Inspect for	Frequency
Mold (form)	Dimensions & Condition	Monthly
Mold (form) – Short Doors	Straightness	Quarterly
Mold (form) – Long Doors	Straightness	Monthly
Liner	Dimensions & Condition	Monthly
Lifting Loops	Dimensions & Condition	Min. 10 units for each shipment
Precast Modular Blocks	Dimensions	weekly
Random Single Block Check	Dimensions	weekly

QUALITY ASSURANCE REVIEW SUBMITTAL PACKAGE CONTENTS shall include:

SECTION 1 - PLANT & PERSONNEL CERTIFICATIONS (**)

- Summary of any plant certifications and support documentation held by dealer with expiration dates, if applicable
- Records of QC personnel training and certifications
- Certificates of calibration or verification of testing and reference equipment

SECTION 2 – FORMS, LINERS AND RELATED

- Form, Block Insert and Liner inventories
- Form Inspection Records - actual dimensions, compliance with tolerances and condition

- Form tracking system – not required at this time – consider RFID or barcode technologies – Serial Numbers
- Form removal from service records
- Form and Liner maintenance records, policies and programs
- Form and Liner Storage policies and procedures for system components
- Records of non-conformances

SECTION 3 – MATERIALS (**)

- Results of Air Content, Slump, Unit Weight, and Compressive Strength testing
- Welded Wire or Block Mesh – Manufacturer's Production QC
- Records of non-conformances

SECTION 4 – MANUFACTURING / PRODUCTION DOCUMENTATION (**)

- Policies for Curing and Handling
- Post Pour Inspection Forms
- Records of Non-conformances – Precast modular blocks Damaged, Destroyed or Repaired

SECTION 5 – LOADING / TRANSPORT /UNLOADING (**)

- Dealers Loading Procedures
- Precast modular blocks Damaged or Destroyed

SECTION 6 - INSTALLATION MONITORING

- Provide a brief written summary of at least two projects completed within the most recent 12 months. If two projects or less have been constructed, this section may be omitted from the QA Submittal Package.

SECTION 7 – PRODUCTION RELATED TECHNICAL COMPLAINTS

- Provide a brief written summary of technical complaints related to the manufacturing process. Refer to section of Handling Technical Complaints.

SECTION 8 – INSURANCE COVERAGE

- Provide a copy of Certificate of Insurance

QUALITY CONTROL DOCUMENTATION – DISCRETIONARY AUDIT

STONE STRONG reserves the right to conduct Quality Control and production quantity audits at their sole discretion. Discretionary Quality Control and production quantity audits may be performed by STONE STRONG or their designee.

QUALITY CONTROL PERSONNEL

QUALITY CONTROL PERSONNEL CERTIFICATIONS

Quality Control technicians will be certified to perform concrete sampling and testing. Certifications for Quality Control personnel and materials testing technicians shall be acquired through nationally, regionally or locally recognized programs. Organizations providing certification programs include the American Concrete Institute (ACI), the National Institute for Certification in Engineering Technologies (NICET) and Departments of Transportation. To determine if a certification organization or program other than those identified will be considered as acceptable, contact the STONE STRONG Quality Assurance Officer.

The American Concrete Institute (ACI) offers several applicable certification programs for testing technicians working with concrete materials and precast products. Some of the certification programs offered by the American Concrete Institute (ACI) are shown below, as examples of certifications available. STONE STRONG recommends that concrete sampling and testing technicians obtain ACI Concrete Field Testing Technician – Grade I status or an equivalent at a minimum.

ACI Aggregate Technician Certification Program

Aggregate Testing Technician - Level 1

ACI Craftsman Certification Program

Concrete Flatwork Finisher/Technician

ACI Field Technician Certification Program

Concrete Field Testing Technician - Grade I

ACI Inspector Certification Program

Concrete Construction Special Inspector

ACI Laboratory Technician Certification Program

Concrete Laboratory Testing Technician - Level 1

Concrete Strength Testing Technician

TRAINING PROGRAM FOR DEALER QC TECHNICIANS

In addition to being certified to perform materials testing, testing technicians employed by Dealers shall be trained in regards to the Dealer's specific forms and procedures prior to performing tests not previously performed. The following training procedures shall be followed for each test. The Dealer is responsible for technician training per their procedures.

- The trainee shall obtain a copy of the most current applicable test method procedures and test data report forms.
- The trainee shall study the test procedures and test report forms to become familiar with the equipment, terminology, test procedures, calculations and test reports.
- A certified technician shall demonstrate the test procedures for the trainee.
- The trainee shall repeatedly perform the test procedures under the direction of the certified technician until the desired degree of proficiency is achieved.
- A certified technician or supervisor shall observe the trainee demonstrating the procedure(s) and document that the trainee has successfully demonstrated the ability to perform the test procedure(s), if it is performed properly, by making an entry in the trainee's training records.

TEST METHODS

QUALITY CONTROL TEST METHODS

The following table presents the testing methods that will be utilized for testing concrete, aggregates, Portland cement, wire reinforcement or other raw materials. It is preferred to utilize the ASTM test methods, but either the ASTM or AASHTO methodologies are acceptable for Quality Control testing. Always reference the most current version of the test methods being utilized.

ASTM	AASHTO	Materials	Description
C31	T23	Concrete	Making/Curing Concrete Test Specimens in Field
C39	T22	Concrete	Compressive Strength of Cylindrical Concrete Specimens
C42	T24	Concrete	Obtaining and Testing Drilled Cores or Sawed Beams
C138		Concrete	Unit Weight, Yield and Air Content (Gravimetric) of Concrete
C143	T119	Concrete	Slump of Concrete
C172	T141	Concrete	Sampling Freshly Mixed Concrete
C173		Concrete	Air Content by Volume Method
C192		Concrete	Making/Curing Concrete Test Specimens in Laboratory
C231	T152	Concrete	Air Content by Pressure Method
C617		Concrete	Capping of Cylindrical Concrete Specimens
C1064		Concrete	Temperature of Concrete
C1231		Concrete	Use of Unbonded Caps - Compressive Strength
C29	T19	Aggregates	Unit Weight and Voids of Aggregate
C40	T21	Aggregates	Organic Impurities in Sands for Concrete
C117	T11	Aggregates	Amount of Material Finer than 0.075-mm Sieve
C127	T85	Aggregates	Specific Gravity and Absorption of Coarse Aggregate
C128	T84	Aggregates	Specific Gravity and Absorption of Fine Aggregate
C136	T27	Aggregates	Sieve Analysis of Fine & Coarse Aggregate
C566	T255	Aggregates	Total Moisture Content of Aggregate by Drying
C702	T248	Aggregates	Reducing Field Samples of Aggregate to Testing Size
C150	M85	Cement	Portland Cement
A82	M32	Reinforcement	Steel Wire, Plain, for Concrete Reinforcement
A184	M54	Reinforcement	Deformed Steel Bar Mats for Reinforcement
A185	M55	Reinforcement	Steel welded wire fabric
A123	M111	Reinforcement	Zinc (hot-dip galvanized) coatings on steel
A496	M225	Reinforcement	Steel Wire, Deformed, for Concrete Reinforcement
A615	M31	Reinforcement	Deformed & Plain Billet Steel Bars for Reinforcement
D3963	M284	Reinforcement	Epoxy Coated Reinforcing Steel

QUALITY SYSTEMS RECORDS RETENTION

The minimum recommended retention periods for various Dealers' Quality Control documentation retention timeframes are shown in the following table.

Test Equipment Calibrations/Verifications	5 years minimum
Form, Block Insert & Liner Inventories & Condition Assessments	5 years minimum
Inspections by Outside Organizations or Agencies	5 years minimum
Post Pour Inspections	5 years minimum
QC Personnel Training & Certifications	5 years minimum
QC Testing Records	5 years minimum

PROCEDURES FOR HANDLING TECHNICAL COMPLAINTS

A technical complaint is a real or perceived issue that could result in adverse performance of an individual precast modular block or a completed installed system. A technical complaint is defined as an issue occurring between the start of the manufacturing process and lasting through the life of the installed system.

Upon receipt of a manufacturing technical complaint at the Dealer level, the following actions shall be taken as Quality Control by the Dealers:

- The Dealer's Quality System Manager shall be notified orally or by written statement.
- The Complaint is brought to the attention of the Supervisor of the department or section in question by the Quality Control System Manager.
- A designated representative at the Dealer will contact the complainant to verify aspects of the complaint and establish a resolution date, if necessary.
- Review reports, records and pertinent data. Review calculations for accuracy.
- A designated representative shall formulate an appropriate reply and issue it to the complainant, in either verbal or written form, preferably both.
- The Dealer will notify the STONE STRONG Quality Control Officer of the complaint, the key factors associated with the complaint, any pertinent QC documentation and the resolution.
- STONE STRONG can assist in the resolution process, if requested by the Dealer.

QUALITY CONTROL OF MANUFACTURING

STONE STRONG Systems is dedicated to overall quality and performance, to assure that the wall system will perform to the requirements of the project.

STONE STRONG Manufacturers Shall:

- Be a licensed dealer.
- Have knowledge and experience in the processes necessary to manufacture precast modular blocks.
- Have a thorough understanding of the STONE STRONG system.
- Have the proper equipment and adequate labor to manufacture the STONE STRONG system.
- Directly employ or subcontract personnel certified to perform materials testing services.

Proper manufacturing techniques should include the following:

- Conformance with the most current version of the STONE STRONG Production Manual as available at the time of production.
- Sample and test concrete in compliance with the most current version of either AASHTO's Standard Specifications for Transportation and Methods of Sampling and Testing or the most current applicable versions of ASTM testing methodologies.
- Block should be clearly marked with the date of manufacture and as required by project specifications.
- Record and keep on file for future reference each days production to include mix design, date of manufacture.
- Check tolerances of the forms and blocks per the previous identified inspection intervals and record for compliance with specifications. Tolerances should be recorded and kept on file for future reference.

    - **Form Tolerances**
        - ± 1/8 inch across side doors and end doors
        - ± 1/8 inch at side door stops
        - ± 1/8 inch at squaring pins on side doors
        - ± 1/16 inch at door hinge pins

- **Block Tolerances**
  - ± 1/8 inch in height
  - ± 1/8 inch in length
  - ± 1/8 inch differential from plane across the top and base of unit
  - Minus 1/4 inch to plus 1/2 inch maximum width (face to tail)

- Check liners on a monthly basis to ensure proper fit when the mold door is closed. Liners shall meet the same specifications as above in areas effecting critical dimensions.
- Clean forms prior to pouring product. It is recommended to use steel wool for removal of any residual concrete prior to each pour and power wash entire form monthly.
- Install lift/alignment loops manufactured to the materials specifications in accordance with the STONE STRONG Production Manual.
- Handle and store the block in accordance with the STONE STRONG Production Manual.

STONE STRONG systems or their representative will provide the following:

- Technical assistance to the manufacture at their request
- Production Manual
- Engineering Manual
- Field Construction Manual
- Maintenance Guide

ADDRESSING NON-CONFORMANCES

A nonconformity is any raw materials deficiency, any damage that occurs from normal handling/storage, and/or exceeding the tolerances as described within the Form and or Block tolerances section in the Quality Control of Manufacturing section of this Manual.

When a nonconformity is detected it must be documented in writing. Nonconformance documentation may include photographs, specific observations, measurements, test data, or other data. The Dealer shall document the nonconformity and submit documentation to STONE STRONG for review within 5 days of becoming aware of the nonconformity.

The Dealer will investigate and attempt to define how long the nonconformity has existed and the production output that may be affected. If more than a single unit is expected to have a

related nonconformity, the Dealer will inspect the production run in question. Furthermore, the Dealer will attempt to define the impact of the nonconformity. The impact could include effects of product nonconformity on wall system performance in terms of durability or structural capacity, changes in product manufacture, and product liability concerns.

The Dealer shall consider the factors that allowed the nonconformity to exist or occur. Consider the possible casual factors in regards to what sequence of event(s) lead to the nonconformity, what conditions allowed the nonconformity to occur, what other nonconformities may surround the occurrence of the central nonconformity. Then identify the root causes for causal factors to exist and the reason(s) the nonconformity occurred.

After indentifying the root cause of the nonconformity, recommend and implement solutions to resolve the root causes of the nonconformity. Identify what can be done to prevent the nonconformity from happening again. In addition consideration shall be given to what improvements to the Dealer's Quality Control system can be implemented to prevent a similar nonconformity. Document the plan to monitor the effective implementation of the corrections and or improvements. The Dealer will identify in writing how and when the resolution will be implemented, who will be responsible for it, and what the risks of implementing the solution are.

QUALITY CONTROL OF DESIGN

STONE STRONG Systems is dedicated to overall quality and performance to assure that the wall system will perform to the requirements of the project. The Design Engineer shall be able to demonstrate and document experience with earth retaining systems design. STONE STRONG will be available to provide additional support for assessing the Design Engineer's ability to design earth retaining systems utilizing the STONE STRONG precast modular blocks. Furthermore, STONE STRONG Design software is available to licensed engineers to assist in wall design of gravity retaining walls.

The engineer of record is responsible for conforming to customary engineering standards.

The Design Engineer shall:

- Be a licensed engineer in the state of the project.
- Have knowledge and experience in the process necessary to design precast modular block retaining walls.
- Have a thorough understanding of the STONE STRONG system.
- Have knowledge of local codes as they pertain to the process necessary to design precast modular block retaining walls.
- Be familiar with the requirements of the AASHTO Standard Specifications for Bridge Construction and FHWA-NHI-00-043, or other relevant design standards.
- Be familiar with the STONE STRONG System Engineering Manual.
- Be familiar with the most current version of the STONE STRONG Systems Field Construction Manual.
- The design engineer is solely responsible for the design of the individual walls issued under his/her seal.
- Provide a Certificate of Insurance to the Dealer manufacturing the precast modular blocks (does not apply if engineer is retained by owner or contractor).
- Provide a complete set of calculations showing how the wall meets the design criteria and AASHTO or other relevant safety factors. External design should be evaluated at each critical section of the wall, including different boundary and loading conditions. Internal design should be evaluated at each critical section for each change in size of units (stepped modules) and for each module layer where the wall is subjected to lateral loading at the top of the wall or to seismic load conditions. Global stability may or may not be the responsibility of the wall engineer. Responsibility for global stability shall be noted within the drawings.
- Provide drawing review and design review checklists to the dealer (does not apply if engineer is retained by owner or contractor).

Design Review

- The wall design shall be reviewed by at least one qualified engineer other than the engineer of record.

- In cases where STONE STRONG or STONE STRONG Dealers have control or employ the Design Engineer, STONE STRONG may elect to perform a Quality Assurance review of the Design.
- In cases when the Design Engineer is employed by others, the Design Engineer may request a design review by approved STONE STRONG Dealers or Engineers recommended by STONE STRONG Systems.
- A design review checklist shall be submitted to the dealer along with the wall drawings and calculations.

STONE STRONG Systems or their representative will provide the following:

- Technical assistance to the design engineer at their request
- Engineering Manual
- Construction Details
- Field Construction Manual
- Maintenance Guide
- Gravity Analysis Software
- Quality Assurance review of design plans as described above

QUALITY CONTROL OF CONSTRUCTION

STONE STRONG Systems is dedicated to overall quality and performance to assure that the wall system will perform to the requirements of the project. The wall system Installation Contractor shall be able to demonstrate and document experience with earth retaining systems installation or demonstrate the ability to install system components with conformance to the most current version of the STONE STRONG Systems Field Construction Manual at the time of installation to the Owner. Licensed STONE STRONG Dealers shall be capable of reviewing an Installation Contractor's ability to install system components. STONE STRONG will be available provide additional support for assessing an Installation Contractor ability to install STONE STRONG precast modular blocks.

Contractor shall:

- Have knowledge and experience in the process necessary to construct precast modular block retaining walls.

- Have knowledge of local codes as they pertain to the installation of precast modular block retaining walls.
- Have a thorough understanding of the project site conditions.
- Review and have an understanding of the project plans and shop drawings.
- Have the proper equipment and adequate labor to assure proper installation of the wall.

Proper installation techniques should include the following:

- Blocks should be inspected prior to installation for quality.
- Excavation of the foundation to line and grade.
- Construction of the wall base to line and grade including compaction and quality control testing.
- Installation of the base course to line and grade. Care should be taken to assure that the base course is level side-to-side and front-to-back. Contractor shall verify base course before processing to next course.
- Installation of each course to assure that it is set to the proper line and grade.
- Grade the site at the end of each day's work so that runoff will be diverted from the wall construction.
- Cleanup site and dispose of excess construction materials at the completion of the installation.
- Site shall be graded as per the plans and verified by the engineer prior to completion of the project.

STONE STRONG Systems or their representative will provide the following:

- Technical assistance to the contractor at their request.
- Field Construction Manual
- Engineering Manual
- Construction Details
- Maintenance Guide

GLOSSARY

AASHTO - American Association of State Highway and Transportation Officials - advocates transportation-related policies and provides technical services in the form of standard specifications for highways and bridges.

ASTM - American Society of Testing and Materials - ASTM International is one of the largest voluntary standards development organizations in the world-a trusted source for technical standards for materials, products, systems, and services.

Contractor - The organization or individual that contracts with another organization or individual (the owner) for the construction of the retaining wall.

Design Engineer – The Engineer of record responsible for the actual design of the retaining wall. The Design Engineer may be the Project Engineer retained by the owner or may be retained by the Stone Strong Dealer or the Contractor to prepare shop drawings to meet the performance requirements established by the owner.

Federal Highway Administration (FHWA) - FHWA-NHI-00-043 Standard Specification.

Manufacturer - See STONE STRONG Dealer.

National Precast Concrete Association (NPCA) - represents manufacturers of plant produced precast concrete products and companies that provide the equipment, supplies and services to make these products.

Owner - The owner of the project for whom a contract has been made for the payment for the work performed under the terms of the contract.

Project Engineer - The owners designated organization or individual with authoritative charge over engineering functions and responsibilities.

Shop Drawings - is a drawing or set of drawings that show details of installations for the contractor

Specifications – STONE STRONG Standard Specifications

STONE STRONG Dealer - Dealer is responsible for the manufacturing of the STONE STRONG systems precast modular block and to ensure that it meets the minimum specifications as required by STONE STRONG. They also may assist the project engineer, owner, and contractor and inspectors in scheduling of materials, construction procedures, contract documents, plans and specifications. The Dealer shall be available to assist and train contractor and inspectors as requested and necessary.