Pittsburgh Flexicore Co., Inc.

Quality System Manual

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Pittsburgh Flexicore Co., Inc.

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Introduction

Pittsburgh Flexicore Co., Inc. has made a firm commitment to quality. It is our policy to produce products and services that competitively meet our customer's quality requirements and conform to the guidelines of the Precast/Prestressed Concrete Institute (PCI). The policies and procedures contained in this Manual are intended to insure the structural integrity of our products.

Pittsburgh Flexicore uses qualified suppliers and recognizes our suppliers as a valuable and integral part of our business. We also consider training of our employees, suppliers, and sub-contractors a critical component of our quality process.

The management of Pittsburgh Flexicore recognizes and supports the policies and procedures of this Manual and is committed to communicating these policies and procedures to our employees.

This Plant Quality System Manual is the responsibility of the General Manager.

The Quality System Manual is primarily based on the following codes or standards:

1. PCI Manual MNL-116-99 Manual for Quality Control for Plants and Production of Structural Precast Concrete Products
2. Building Officials & Code Administrators (BOCA), 1996 Edition
3. International Building Code (IBC), 2000 Edition

The unit of measure in this Manual is expressed in English (US) unless otherwise noted.

We at Pittsburgh Flexicore are dedicated to providing quality products and to the continuous improvement of our products and services.

Definitions

Accelerated Curing – See curing.

Admixture – A material other than water, aggregates, and cement used as an ingredient in concrete, mortar, or grout to

impart special characteristics.

Aggregate – Granular material, such as sand, gravel, and crushed stone used with a cementing medium to form a hydraulic-cement concrete or mortar.

Aggregate, structural lightweight – Aggregate with a dry, loose weight of 70lbs/ft3 (1121kg/m3) or less.

Air entraining admixture – A chemical added to the concrete for the purpose of providing minute bubbles of air (generally smaller than 1mm) in the concrete during mixing to improve the durability of concrete exposed to cyclical freezing and thawing in the presence of moisture.

Ambient temperature – The temperature of the air surrounding the forms and molds into which concrete is to be cast, or of the air surrounding an element during curing.

Anchorage – The means by which the prestressing force is permanently transmitted from the prestressing steel to the concrete. In post-tensioned applications, a mechanical device comprising all components required to anchor the prestressing steel and transmit the prestressing force to the concrete.

Architectural precast concrete – A product with a specified standard of uniform appearance, surface details, color, and texture.

Architectural precast concrete Trim Units – Wet cast products with a high standard of finish quality and of relatively small size that can be installed with equipment of limited capacity, such as sills, lintels, coping, cornices, quoins, medallions, bollards, benches, planters, and pavers.

Backup mix – The concrete mix cast into the mold after the face mix has been placed and consolidated.

Bleeding – A form of segregation in which some of the water in a mix rises to the surface of freshly placed concrete: also known as water gain.

Blocking – Materials used for keeping concrete elements from touching each other or other materials during storage and transportation.

Bondbreaker – A substance placed on a material to prevent it from bonding to the concrete, or between a face material such as natural stone and the concrete backup.

Bonding agent – A substance used to increase the bond between an existing piece of concrete and a subsequent application of concrete such as a patch.

Bull float – A tool comprising a large, flat, rectangular piece of wood, aluminum, or magnesium usually 8 in (200mm) wide and 42 to 60 in (1.0 to 1.5m) long, and a handle 4 to 16 ft. (1 to 5m) in length used to smooth unformed surfaces of freshly placed concrete.

Bugholes – Small holes on formed concrete surfaces formed by air or water bubbles, sometimes called blowholes.

Camber – (1) The deflection that occurs in prestressed concrete elements due to the net bending resulting from application of a prestressing force. (It does no include dimensional inaccuracies); and (2) A built-in curvature to improve appearance.

Certification – Assurance by a competent third party organization, operating on objective criteria and which is not subject to undue influences from the manufacturer or purchaser or to financial considerations, that elements are consistently produced in conformity with a specification. It not only proclaims compliance of a product with a specification, but also that the manufacturer's quality control arrangements have been approved and that a continuing audit is carried out.

Clearance – Interface space (distance) between two items.

Coarse Aggregate – Aggregate predominantly retained on the US Standard No.4 (4.75mm) sieve; or that portion of an aggregate retained on the No.4 (4.75mm) sieve.

Compaction – The process whereby the volume of concrete is reduced to the minimum practical space by the reduction of voids usually by vibration, tamping or some combination of these.

Connection – Device for the attachment of Precast concrete units to each other or to the building or structure.

Covermeter – See R-meter

Crazing – A network of visible, fine hairline cracks in random directions breaking the exposed face of a panel into areas of from 1/4in to 3in (6 to 75mm) across.

Creep – The time dependent deformation (shortening) of prestressing steel or concrete under sustained loading.

Curing – The maintenance of humidity and temperature of freshly placed concrete during some definite period following placing, casting, or finishing to assure satisfactory hydration of the cementitious materials and proper hardening of the concrete; where the curing temperature remains in the normal environmental range (generally between 50 and 90 deg F (10 to 32 deg C) use the term normal curing; where the curing temperature is increased to a higher range (generally between 90 and 150 deg F (32 and 66 deg C) use the term accelerated curing.

Detensioning of strand or wire – The transfer of strand or wire tension from the bed anchorage to the concrete.

Draft – The slope of concrete surface in relation to the direction in which the precast concrete element is withdrawn from the mold; it is provided to facilitate stripping with a minimum of mold breakdown.

Dunnage – See Blocking

Elastic Shortening – The shortening of a member which occurs immediately after the application of the prestressing force.

Elongation – Increase in length of the prestressing steel (strand) under the applied prestressing force.

Exposed aggregate concrete – Concrete manufactured so that the aggregate on the face is left protruding.

Face mix – The concrete at the exposed face of a concrete unit used for specific appearance purposes.

Fine aggregate – Aggregate passing the 3/8" (9.5mm) sieve and almost entirely passing the No.4 (4.75mm) sieve and predominantly retained on the No. 200 (75µm) sieve; or that portion of an aggregate passing the No. 4 (4.75mm) sieve and predominantly retained on the No.200 (75µm) sieve.

Form – See Mold.

Formed surface – A concrete surface that has been cast against formwork.

Form release agent – A substance applied to the mold for the purpose of preventing bond between the mold and the concrete cast in it.

Friction loss – In post-tensioned applications, the stress (force) loss in a prestressing tendon resulting from friction created between the strand and sheathing due to curvature in the tendon profile during stressing.

Gap-graded concrete – A mix with one or a range of normal aggregate sizes eliminated, and/or with a heavier concentration of certain aggregate sizes over and above standard gradation limits. It is used to obtain a specific exposed aggregate finish.

Grout – A mixture of cementitious materials and water, with or without sand or admixtures.

Hardware – Items used in connecting precast concrete units or attaching or accommodating adjacent materials or equipment. Hardware is normally divided into three categories:

Contractor's Hardware – Items to be place on or in the structure in order to receive the precast concrete units; e.g. anchor bolts, angles, or plates with suitable anchors.

Plant Hardware – Items to be embedded in the concrete units themselves, either for connections and precast concrete erector's work, or for other trades, such as mechanical, plumbing, glazing, miscellaneous iron, masonry, or roofing trades.

Erection Hardware – All loose hardware necessary for the installation of the precast concrete units.

Homogenous Mix – A uniform concrete mix used throughout a precast concrete element.

Initial prestress – The stress (force) in the tendon immediately after transferring the prestressing force to the concrete.

Jacking Force – The maximum temporary force exerted by the jack while introducing the prestressing force into the concrete through the prestressing strand.

Jig – A template or device to align parts of an assembly, usually for pre-assembling reinforcing steel and hardware cages, with a minimum of measurement to attain consistent accuracy from one cage to the next.

Laitance – Residue of weak and nondurable material consisting of cement, aggregate fines, or impurities brought to the surface of plastic concrete by bleed water.

Lifting frame (or beam) – A rigging device designed to provide two or more lifting points of a precast concrete element with predictable load distribution and pre-arranged direction of pulling force during lifting.

Mark number – The individual identifying mark assigned o each precast concrete unit predetermining its position in the building.

Master mold – A mold which allows a maximum number of casts per project; units cast in such molds need not be identical, provided the changes in the units can be simply accomplished as pre-engineered mold modifications.

Matrix – The portion of the concrete mix containing only the cement and fine aggregates (sand).

Miter – An edge that has been beveled to an angle other than 90 degrees.

Mold – The container or surface against which fresh concrete is cast to give it a desired shape; sometimes used interchangeably with form. (The term is used in this manual for custom-made forms for specific jobs while forms are used for standard forms or forms of standard cross-section.)

Pattern or positive – A replica of all or part of the precast element sometimes used for forming the molds in concrete or plastic.

Plastic cracking – Short cracks often varying in width along their length that occur in the surface of fresh concrete soon after it is placed and while it is still plastic.

Post – tensioning – A method of prestressing concrete whereby the tendon is kept from bonding to the plastic (wet) concrete, then elongated and anchored directly against the hardened concrete, imparting stresses through end bearing.

Precast engineer – The person or firm who designs precast concrete members for specified loads and who may also direct the preparation of the shop drawings.

Pretensioning – A method of prestressing concrete whereby the tendons are elongated, anchored while the concrete in the member is cast, and released when the concrete is strong enough to receive the forces from the tendon through bond.

Production drawings – A set of instructions in the form of diagrams and text which contain all the information necessary for the manufacturer to produce the unit.

Quality – The appearance, strength, and durability which is appropriate for the specific product, its particular application and its expected performance requirements. The totality of features and characteristics of a product that bear on its ability to satisfy stated or implied needs.

Quality Assurance (QA) – All those planned or systematic actions necessary to ensure that the final product or service will satisfy given requirements for quality and perform intended function.

Quality Control (QC) – Those actions related to the physical characteristics of the materials, processes, and services, which provide a means to measure and control the characteristics to predetermined quantitative criteria.

Quirk miter – A corner formed by two chamfered members to eliminate sharp corners and ease alignment.

R-meter – An electronic device used to locate and size reinforcement in hardened concrete.

Retarder – An admixture which delays the setting of cement paste and therefore of concrete.

Retarder, surface – A material used to produce exposed aggregate concrete by retarding or delaying the hardening of the cement paste on a concrete surface within a time period and to a depth to facilitate removal of this paste after the concrete element is otherwise cured.

Retempering – The addition of water or admixture and remixing of concrete which has started to stiffen in order to make it more workable.

Return – A projection that is angles away from the main face or plane of view.

Reveal – (1) Groove in a panel face generally used to create a desired architectural effect; and (2) The depth of exposure of the coarse aggregate in the matrix after production of an exposed aggregate finish.

Rustification – A groove in a panel face for architectural appearance; also reveal.

Sandwich wall panel – A prefabricated panel that is a layered composite formed by attaching two wythes or skins of concrete separated by an insulating core.

Scabbing – A finish defect in which parts of the form face including release agent adhere to the concrete, some probably causes are an excessively rough form face, inadequate application of release agent, or delayed stripping.

Scouring – Irregular eroded areas or channels with exposed stone or sand particles; some probable causes of this finish defect are excessively wet concrete mix, insufficient fines, water in form when placing, poor vibration practices, and low temperature when placing.

Sealer – A clear chemical compound applied to the surface of precast concrete units for the purpose of improving weathering qualities or reducing water absorption.

Segregation – The tendency for the coarse particles to separate from the finer particles in handling; in concrete, the coarse aggregate and drier material remaining behind and the mortar and wetter material flowing ahead; this also occurs in a vertical direction when wet concrete is overvibrated or dropped vertically into the forms, the mortar and wetter material rising to the top; in aggregate, the coarse particles roll to the outside edges of the stockpile.

Self-stressing form – A form provided with suitable end bulkheads and sufficient cross-sectional strength to resist the total prestressing force.

Set-up – The process of preparing molds or forms for casting, including installation of materials (reinforcement and hardware) prior to the actual placing of concrete.

Sheathing – A material covering forming an enclosure around the prestressing steel to avoid temporary or permanent bond between the prestressing steel and the surrounding concrete.

Shrinkage – The volume change in precast concrete units caused by drying normally occurring during the hardening process of concrete.

Shop drawings – (1) Collective term used for erection drawings, production drawings, and hardware details; and (2) Diagrams of precast concrete members and their connecting hardware, developed from information in the contract documents. They show information needed for both field assembly (erection) and manufacture (production) of the precast concrete units.

Specially Finished Structural Precast Concrete – A product fabricated using forms and technique common to the production of structural elements as defined in MNL-116 and having specified surface finishes that require uniformity and detailing more demanding than the requirements of MNL-116. These surface finish requirements should be clearly specified, and verified with appropriate samples and mockups.

Spreader beam – A frame of steel channels or beams attached to the back of a panel, prior to striping, for the purpose of evenly distributing loads to inserts and for lifting the panel about its center of gravity.

Strand – A group of wires laid helically over a central-core wire. A seven-wire strand would thus consist of six outer wires laid over a single wire core.

Strand anchor – A device for holding a strand under tension, sometimes called a strand chuck or vice.

Stripping – The process of removing a precast concrete element from the form in which it was cast.

Strongback/Stiffback – A steel or wooden member which is attached to a panel for the purpose of adding stiffness during handling, shipping, and/or erection.

Structural lightweight concrete – Structural concrete made with lightweight aggregate with an air-dry unit weight of the concrete in the range of 90 to 155 lb/ft3 (1440 to 1850 kg/m3) and a 28-day compressive strength of more than 2500 psi (17.24 MPa).

Superplasticizer – A high range water reducing (HRWR) admixture producing concrete of significantly higher slump without addition of water.

Surface retarder – A material used to retard or prevent the hardening of the cement paste at a concrete surface to facilitate removal of this paste after curing.

Tendon – A high strength steel element consisting of one or more wires, strands or bars, or a bundle of such elements, used to impart prestressing forces to the concrete. In post-tensioned applications, a complete assembly consisting of anchorages, prestressing steel (strand), corrosion inhibiting coating and sheathing. It imparts the prestressing force to the concrete.

Tolerance – Specified permissible variation from stated requirements such as dimensions, location, alignment, strength, and air entrainment.

Product tolerances – Those variations in dimensions relating to individual precast concrete members.
Erection tolerances – Those variations in dimensions required for acceptable matching of precast members after they are erected.
Interfacing tolerances – Those variations in dimensions associated with other materials in contact with or in close proximity to precast concrete.

Transfer strength – The minimum concrete strength specified for the individual concrete elements before the prestressing force may be transferred to them, sometimes called detensioning strength or release strength.

Unbonded tendon – A tendon in which the prestressing steel (strand) is prevented from bonding to the concrete. When unbonded tendons are used, prestressing force is permanently transferred to the concrete by the anchorage only.

Veneered construction – The attachment of other materials, such as natural stone or clay products to a concrete panel.

Wedges – Pieces of tapered metal with teeth that bite into the prestressing steel (strand) during transfer of the prestressing force. The teeth are beveled to assure gradual development of the tendon force over the length of the wedge.

Wedge set – The relative movement of the wedges into the anchorage cavity during the transfer of the prestressing force to the anchorage.

Workability – The ease with which a given set of materials can be mixed into concrete and subsequently handled, transported, placed, and finished with a minimum loss of homogeneity

I. Management Responsibility

A.1 Quality Policy Statement

Pittsburgh Flexicore establishes as its quality goal to work for continuous quality improvement in its products and service to its customers. This Manual sets forth the management guidelines for our Quality System of plant operations. All personnel shall be aware of and committed to the policies in this Manual. Our plant shall use the PCI Plant Certification Program as our external audit system and the Quality Control Manual MNL-116-99 as the basis for our Quality system.

_____
Robert M. Patterson
Vice President

_____
(Date)

I. Management Responsibility

A.2 Quality System Awareness

It is the responsibility of the General Manager to insure that all employees are aware of, and comply with, the provisions of our Quality System Manual. Communication of our plant Quality System begins with each employee's initial training as discussed in Section XV. Training. Subsequent employee awareness consists of:

1. *Discussion and review of our Quality System at our Quality meeting, every two (2) weeks, which includes our General Manager, Plant Manager and Quality Control Manager.*
2. *Distribution of Sections of the Quality System Manual to those individuals affected by that portion of the Manual.*
3. *Encouraging the review of and strategically placing Sections of the Manual for the convenience of our employees.*
4. *Including the maximum number of employees in the review process of PCI Audits and Internal Quality Reviews.*
5. *Including different employees as rotating members of the Quality Committee.*
6. *Distribution of revisions to the Manual.*
7. *Annual safety and quality training for all employees. This meeting provides the opportunity to insure that all employees are familiar with the provisions and content of this Quality System Manual. The meeting is conducted by the Plant Manager, and each person attending signs a sheet indicating that they understand and agree to abide by the quality policies. This record of the attendance is maintained by the Plant Manager.*

The Quality System Manual is one method utilized by Pittsburgh Flexicore to create customer awareness of our shared standard of quality. The Manual or portions thereof are frequently provided to customers as a demonstration of this plant's commitment to quality.

B. 1. Responsibility and Authority

a. Organization Chart

The organization of management of Pittsburgh Flexicore Co., Inc. is illustrated in the chart on the following page.

b. Personnel Responsibility

Responsibility outlines for each of our key management personnel primarily responsible for quality assurance / quality control are illustrated on the following pages.

I. Management Responsibility

B.1. Responsibility and Authority

b. Personnel Responsibility

General Manager

The General Manager reports directly to the President. The General Manager is also the Quality System Facilitator or Manual Controller and is responsible for the distribution of the Quality System Manual as directed by the Quality Committee. As the Facilitator, he is also responsible for maintaining all administrative documentation for the Quality System. The General Manager completely understands all aspects of plant quality control and assist in the planning, coordinating and monitoring of quality assurance/quality control activities within the plant. Specific responsibilities include:

I. Quality Assurance/Quality Control (QA/QC)

A. Through co-ordination with the Plant Manager and Quality Control Manager, establish, implement and maintain quality policies and procedures consistent with PCI standards and Pittsburgh Flexicore's Quality System. Specifically:
   1. Set up standards for receiving, testing, and acceptance.
   2. Set up standards for production testing.
   3. Set up standards for pre and post placement and extrusion inspections.

B. Participate with the Plant Manager and Quality Control Manager in defining the short and long term direction of the plant with respect to overall product quality and continuous improvement.

II. Personnel

A. Staff and supervise the required QA/QC management personnel for:
   Plant Manager Quality Control Manager
   Production and Shipping Manager

B. Maintain required PCI and/or ACI certifications for all quality related personnel.

C. Facilitate personnel training as illustrated in Section XV – Training.

D. Insure that all management responsibilities (included on following pages) are performed accurately and completely.

III. Mix Proportion Maintenance

A. In conjunction with the Plant Manager and Quality Control Manager, evaluate and maintain mix proportions based on selected component materials.

IV. Product Set-Up

A. Calculate stressing force and elongation for each strand.

b. Personnel Responsibility:

Plant Manager

The Plant Manager is responsible for all daily production activities including the production and delivery of concrete for hollow core products. He reports directly to the General Manager. Specific responsibilities include:

I. Quality Assurance/Quality Control (QA/QC)

A. Through co-ordination with the General Manager and Quality Control Manager, establish, implement and maintain quality policies and procedures consistent with PCI standards and Pittsburgh Flexicore's Quality System. Specifically:
   1. Set up standards for receiving, testing, and acceptance.
   2. Set up standards for production testing.
   3. Set up standards for pre and post placement and extrusion inspections.

B. Participate with the General Manager and Quality Control Manager in defining the short and long term direction of the plant with respect to overall product quality and continuous improvement.

II. Personnel

A. Staff and supervise the required production personnel.

B. Facilitate employee training in accordance with Section XV. Training.

III. Equipment

A. Procure, manage and maintain all production equipment.

B. Maintain Operation and Maintenance (O & M) manuals for all production equipment. Monitor and review each *Fork Lift Maintenance Checklist* for every 200 hours of service. Monitor daily equipment checks of oil and other fluid levels, brakes, etc.

C. Co-ordinate and monitor periodic equipment calibrations. Maintain required concrete test equipment and all calibration recordkeeping.

IV. General Requirements

A. Employ general knowledge and troubleshooting capabilities regarding hardened concrete.

B. Compensate for free moisture in aggregates and the effectof admixtures as required in the concrete batching.

C. Determine proper curing cycle for each bed.

I. Management Responsibility

B.1. Responsibility and Authority

b. Personnel Responsibility

Quality Control Manager

The Quality Control Manager reports directly to the General Manager. The Quality Control Manager is able to read and understand shop drawings illustrating dimensions of members. Our Quality Control Manager is familiar with allowable tolerances for Hollow Core product and reports any excesses to the Plant Engineer and/or Plant Manager for decisions on acceptance or rejection. The Quality Control Manager and Plant manager are responsible for the quality of the concrete from the batching operation, through delivery, placement, curing, and finished product. Specific responsibilities include:

I. Quality Assurance/Quality Control (QA/QC)

A. Through co-ordination with the General Manager and Plant Manager, establish, implement and maintain quality policies and procedures consistent with PCI standards and Pittsburgh Flexicore's Quality System. Specifically:
B. Set up standards for receiving, testing, and acceptance.
C. Set up standards for production testing.
D. Set up standards for pre and post placement and extrusion inspections.

E. Participate with the General Manager and Plant Manager in defining the short and long term direction of the plant with respect to overall product quality and continuous improvement.

II. Ready Mixed Concrete Testing

A. Perform concrete tests and procedures in accordance with applicable ASTM standards:
   1. Sampling
   2. Mix Consistency
   3. Unit Weight
   4. Temperature
   5. Make Cylinders

B. Perform proper handling and procedures for test cylinders
   1. Stripping
   2. Identification
   3. Log-In
   4. Curing
   5. Test Report
   6. Establish and record break dates
   7. Cap and break cylinders

III. Product Set Up

A. Check forms for cleanliness

B. Insure that prestressing strand are not contaminated with release

agent.

C. Monitor strand stressing and prepare stressing reports for each bed. Monitor stressing operations as required to insure that established procedures are being followed.

IV. **Production Testing**

A. Monitor placement of fresh concrete and confirm that all plates are properly located.

B. Complete an Extruder QC Report for each bed.

C. Monitor compressive strength test results of release, 7 day and 28 day cylinders (if required).

D. Confirm all sieve analysis are complete for each aggregate being used.

V. Post Pour

A. Inspect the finished product for dimensional accuracy and appearance. Mark all product in accordance with Section IX – Inspection and Testing Status.

B. Clearly mark each member with (1) piece mark (2) casting date and (3) bed location in accordance with Section V – Product Identification and Traceability.

C. Verify that any remedial work is clearly identified and reported to the appropriate individual.

VI. Recordkeeping

A. Maintain all records in chronological production order which ties daily production to the project records.

B. Maintain all concrete test results.

VII. **General Responsibilities**

A. Employ general knowledge and troubleshooting capabilities regarding hardened concrete.

B. Maintain laboratory facility and equipment (in accordance with Section VIII).

C. Maintain appropriate test data from suppliers of raw materials (Section VII).

D. Determine, implement, monitor, and evaluate results of all plant and laboratory testing.

I. Management Responsibility

B.2.a. Verification Resources and Personnel

Outline of Inspection and Verification Testing

	Responsibility	Qualifications and Training
A. Receiving Inspection and Testing		
1. Review Raw Material Data a. Cement mill test and ASTM C 917 reports b. Aggregate gradations and required test data c. Admixture certifications d. Reinforcing steel mill test reports	General Manager, Plant Manager and/or Quality Control Manager	Certified as PCI T/I Level II Five years experience

B. In-Process Inspection and Testing		
1. Qualified individuals include	Quality Control Manager Plant Manager	(see qualifications and training above)
C. Planning and Documentation of Inspection for Quality System	General Manager Plant Manager Quality Control Manager	

D. Handling of changes to shop drawings during production		
1. Initiated by:	Engineer	
2. Checked by:	Engineer General Manager Production Manager	
2. Distributed by: to:	Engineer/General Manager See D.4.	
4. Delivered to and Reviewed by:	General Manager Plant Manager Quality Control Manager Production Manager	
E. Identification of Inspection status of product		
1. Inspection System established by:	General Manager and Quality Control Manager	
F. Handling of Non-conforming Product		
1. System of review for non-conforming product may include:	Quality Control Manager General Manager Plant Manager Plant Engineer	
G. Final Inspection	Quality Control Manager Plant Manager	
H. Inspection and Test Records		
1. Initiated by:	Quality Control Manager Plant Manager	
2. Reviewed and filed by:	Quality Control Manager Plant Manager	
I. Welding Procedures and Review		
1. Welding performed by:	Certified Welders from approved suppliers	Qualified by AWS standards for weld type being performed

I. Management Responsibility

B.2.b Self Inspection

Self-Inspection operations and procedures at this plant are as follows:

Each employee is trained in their individual responsibilities for

I. Management Responsibility

C. Management Review

This Pittsburgh Flexicore plant has a Quality Committee to establish and maintain the Quality System. The role and composition of the Committee are as defined in Section II, Quality System Definition. The Committee meets four times per year based on the PCI and Internal Quality Review schedule. The anticipated meeting dates would be as follows:

1st Quarter

- Review Quality System Manual and update as required.
- Assign personnel and schedule the performance of the two Internal Quality Reviews for the year.
- Review and modify as required the Internal Quality Review report form.
- Review recommendations and departmental responses to the First PCI Audit. The Quality Control and Plant Managers are required to respond within 30 days of receiving PCI or Internal reports.
- Review the ongoing implementation of the Plant Quality System and discuss continuous quality improvements.
- Review approved vendor list.

2nd Quarter

- Review recommendations and departmental responses to the First Internal Quality Review.
- Review the ongoing implementation of the Plant Quality System and discuss continuous quality improvements.

3rd Quarter

- Review recommendations and departmental responses to the Second PCI Audit.
- Review the ongoing implementation of the Plant Quality System and discuss continuous quality improvements.

4th Quarter

- Review recommendations and departmental responses to the Second Internal Quality Review.
- Appoint Committee members to serve on the Quality Committee for the next year.
- Review the ongoing implementation of the Plant Quality System and discuss continuous quality improvements.

II. Quality System Definition

Pittsburgh Flexicore Co., Inc. maintains a comprehensive Quality System which

has been approved by the Board of Directors and is monitored by the Quality Committee. The Company has adopted PCI Manual MNL 116-99 as the basis for its Quality System. The Plant maintains this site specific Quality System Manual which is reviewed no less frequently than annually by the plant Quality Committee. Documentation of the Quality System in this Manual is the responsibility of the Quality System Facilitator and is submitted for adoption by the Quality Committee.

This plant Quality Committee consists of the following members:

- Vice President and General Manager
- Plant Manager
- Quality Control Manager
- Rotating Member – rotating members are assigned to two-year terms.

The plant Quality Committee meets quarterly as defined in Section I.C. The agenda for and the minutes of the meeting are the responsibility of the General Manager. The agenda shall be distributed at least two days prior to the scheduled meeting.

Forms used in the Quality System are the responsibility of the Quality Control Manager or General Manager as adopted by the Quality Committee. Those forms currently adopted as part of this Manual are as follows (a copy of each form is illustrated on the following pages):

1. Production Schedule
2. Daily Tensioning Report
3. Strand Pack Log
4. 4” x 8” PCI Cylinder Breaks
5. Slab Cross Section and Initial Camber
6. Extruder Quality Control Report
7. Daily Quality Control Report
8. Batch Plant Water Meter Calibration
9. Daily Sand Log
10. Daily Stone Log
11. Concrete Mix and Strand Form

The Quality Committee meets and reviews the Quality System status in accordance with Section I.C. Management Review.

III. Document Control

The plant Quality Committee is responsible for distribution of the Quality System Manual. Revisions to the Manual are approved only by the Quality Committee. Suggested revisions may be submitted by any employee at this plant (as outlined by the Quality System Committee in this section). Revisions to the Manual shall be submitted in writing or verbally communicated to the General Manager (Quality System Facilitator) or Quality Control Manager at least three days prior to a scheduled meeting of the Quality Committee.

Distribution of the Quality System Manual is the responsibility of the Quality System Facilitator as directed by the Quality Committee. Two master lists of the Quality System Manual are maintained. One list contains the listing of all persons with a Manual. This list has the initials of the personal originally receiving the manual and the date reviewed. All subsequent revisions of pages or sections are made with a revision summary, which is initialed by the receiving person at the time that the Manual revision is delivered. The controller maintains these initialed revision summaries as the control record of each Manual's status. Major revisions to this Manual are submitted to PCI for review. Routine updates are left at the Plant for pick-up (2 copies), by the Ross Bryan Engineer performing the next audit. One copy is for Ross Bryan's master file and the other copy is sent to PCI to update their file. The plant will also have available for the Auditor to pick-up, three (3) signed copies of the revised signature page with the revision date indicated. The auditor initials the Revision Page in the QSM Administrative Manual indicating Ross Bryan Associates and PCI receipt of the documents. Tacit acceptance is concluded for routine updates and the Plant is only notified if the review is found to be unacceptable.

The second list kept by the controller is a listing of the Quality System Manual by page with the date of the latest revision of the page. This provides a listing of the most current copy of the Quality System Manual.

The Quality System Manual adopted by the Quality Committee facilitates revisions by page as needed. The Manual is numbered by section so that a whole section can be changed without affecting the numbers of adjacent sections.

The Plant Engineer prepares shop drawings and/or engineering drawings to produce product. These drawings are an important part of this plant's Quality System. The General Manager is responsible for maintaining a compilation of these drawings in their most current state.

The General Manager maintains a master list of drawings for each project.

The drawings are distributed to any, or all of the following:

- General Manager / Production and Shipping Manager
- Quality Control Manager
- Plant Manager
- Field Operations Manager
- Lead Man
- Sawing

IV. Purchasing

Purchasing at Pittsburgh Flexicore may incorporate any unique project

specification requirements as well as plant standards. Purchase Orders are written contracts with a technical standard outlined for the material or product to be produced. Purchased materials and products are only obtained from reliable sources that have proven themselves on previous projects or demonstrated the ability to meet or exceed our standards. An approved vendor list of qualified suppliers is maintained by our Vice President and General Manager and is reviewed annually by the Quality Committee.

Standard Purchase Order

Purchase orders for component materials contain specific standards and guidelines as to manufacture, delivery, acceptance, rejection, and replacement. Each component material Purchase Order includes by reference a "conditions of procurement" (samples of which are illustrated on the following pages). Vendors of job specific or unusual product require a copy of the project specifications, pertaining to their product, well in advance of the required delivery date.

The approved vendor list with annual review is monitored by the Quality Committee and updated for use in issuing Purchase Orders.

Purchase Orders are Required for all Component Materials and include:

- *Specific standard for acceptance of component materials.*
- *Provisions for supplier to provide mill certificates, tests data, or general certifications as confirmation that material shipped meets the specific standard for the product and/or project.*
- *Acknowledgement that acceptance of material at our plant is based on acceptance inspection, testing, or conformance to standard for material as well as acceptable performance by the material.*
- *Testing of aggregates performed by or for the supplier that assures product is non-reactive.*
- *Resolution of rejected material.*
- *Confirmation of vendor of their Quality Control Program.*

"Condition of Procurement"
Attachment to Purchase Order
Pittsburgh Flexicore Co., Inc.

In compliance with our established Quality System and PCI Plant Certification

requirements the following criteria are conditions of procurement for the material (s) or product(s) purchased.

Coarse Aggregates for Hollow Core Concrete

1. Provide aggregates as specified meeting the requirements of ASTM C 33, or C 330 except for grading and soundness if otherwise agreed upon.

2. Provide a monthly summary of your gradation and fineness modulus representing a minimum of 1 sieve analysis for every 800 tons purchased.

3. Provide specific gravity, absorption, and petrographic analysis test results every 5 years or when a new lift or horizon in a quarry is utilized or there appears to be a change in quality of the aggregate.

4. Provide tests results of the evaluation of the aggregate for potential alkali-silica or alkali-carbonate reactions.

5. Provide test results for aggregates containing particles with an iron sulfide content that shows a stain index less than 20 when tested in accordance with ASTM C 641.

6. Provide an original notarized letter of certification annually (during the month of January) for each product purchased.

7. Non-conforming product will be evaluated for use, returned, or disposed of. All cost associated with non-conforming product are the responsibility of the supplier.

8. Provide a copy of the Material Safety Data Sheet (MSDS) for the product and copies of any subsequent revisions.

"Condition of Procurement"
Attachment to Purchase Order
Pittsburgh Flexicore Co., Inc.

In compliance with our established Quality System and PCI Plant Certification requirements the following criteria are conditions of procurement for the material (s) or product(s) purchased.

Fine Aggregates for Hollow Core Concrete

1. Provide aggregates as specified meeting the requirements of ASTM C 33, or C 330 except for grading and soundness if otherwise agreed upon.

2. Provide a monthly summary of your gradation and fineness modulus representing a minimum of 1 sieve analysis for every 400 tons purchased.

3. Provide tests results for deleterious substances and organic impurities annually.

4. Provide an original notarized letter of certification annually (during the month of January) for each product purchased.

5. Non-conforming product will be evaluated for use, returned, or disposed of. All cost associated with non-conforming product are the responsibility of the supplier.

6. Provide a copy of the Material Safety Data Sheet (MSDS) for the product and copies of any subsequent revisions.

7. Provide tests results of Materials finer than No.200 sieve for new sources or any time variations are experienced.

"Condition of Procurement"
Attachment to Purchase Order
Pittsburgh Flexicore Co., Inc.

In compliance with our established Quality System and PCI Plant Certification requirements the following criteria are conditions of procurement for the material (s) or product(s) purchased.

Cement

1. Provide cement as specified by Type meeting the requirements of ASTM C 150

2. Provide mill certificates with each shipment of cement.

3. Provide a monthly ASTM C-917 report by the 15th of the month following the 28-day cube breaks. This report may be for the Type I cement in lieu of Type III if it is from the same source.

4. Provide an original notarized letter of certification annually (during the month of January) for each product purchased.

5. Non-conforming product will be evaluated for use, returned, or disposed of. All cost associated with non-conforming product are the responsibility of the supplier.

6. Provide a copy of the Material Safety Data Sheet (MSDS) for the product and copies of any subsequent revisions.

"Condition of Procurement"
Attachment to Purchase Order
Pittsburgh Flexicore Co., Inc.

In compliance with our established Quality System and PCI Plant Certification requirements the following criteria are conditions of procurement for the material (s) or product(s) purchased.

Concrete Admixtures

1. Provide air entraining admixture conforming to the requirements of ASTM C260 and other admixtures conforming to the requirements of ASTM C494, Types A,B,D,F, and G or ASTM C1017.

2. Provide an original notarized letter of certification annually (during the month of January) for each product purchased.

3. Non-conforming product will be evaluated for use, returned, or disposed of. All cost associated with non-conforming product are the responsibility of the supplier.

4. Provide a copy of the Material Safety Data Sheet (MSDS) for the product and copies of any subsequent revisions.

5. Perform quarterly admixture dispenser audits of all equipment and provide initial certification for each piece of dispensing equipment.

"Condition of Procurement"
Attachment to Purchase Order
Pittsburgh Flexicore Co., Inc.

In compliance with our established Quality System and PCI Plant Certification requirements the following criteria are conditions of procurement for the material (s) or product(s) purchased.

Prestressing Strand

1. Provide mill certificates and/or coating reports with each shipment of prestressing strand.

2. Provide an original notarized letter of certification annually (during the month of January) for each roll of strand purchased.

3. Non-conforming product will be evaluated for use, returned, or disposed of. All cost associated with non-conforming product are the responsibility of the supplier.

4. Provide a copy of the Material Safety Data Sheet (MSDS) for the product and copies of any subsequent revisions.

"Condition of Procurement"
Attachment to Purchase Order
Pittsburgh Flexicore Co., Inc.

In compliance with our established Quality System and PCI Plant Certification requirements the following criteria are conditions of procurement for the material (s) or product(s) purchased.

Hardware and Inserts

1. Provide an original notarized letter of certification annually (during the month of January) for each product purchased.

2. Non-conforming product will be evaluated for use, returned, or disposed of. All cost associated with non-conforming product are the responsibility of the supplier.

3. Provide a copy of the Material Safety Data Sheet (MSDS) for the product and copies of any subsequent revisions.

V. Product Identification and Traceability

Each piece produced by Pittsburgh Flexicore is uniquely marked to confirm production and to tie the product to the specific acceptance testing and to the component materials or assemblies used in its manufacture. Each piece is identified with the date produced; piece number (from shop drawing); mark number identifying the location (or sequence) in the bed; and color coded to identify the bed where the piece was cast. The color codes for bed identification are as follows:

1 Bed # 1 – Red Dot
2 Bed # 2 – Plain Red Mark Number
3 Bed # 3 – Green Mark Number
4 Bed # 4 – Black Mark Number

The identification for the piece is located on the side, except for filler pieces (to be cut), where the identification goes on the top of the part to be saved.

The identification of each piece ties the piece to the production schedule, purchasing and in-plant Quality Control records.

All component materials delivered to this plant require the inclusion of a delivery ticket with the load. The delivery ticket illustrates the product received, the date the product was received, and the quantity of product received. The component material delivery ticket must make reference to the purchase order number for the product. The specific component materials used on a given bed on a given day may be identified based on the receiving records and the production schedule of product using the same component materials (consumption). The production of product within the identifiable time constraints defines the usage of the product. All concrete related component materials are inventoried on a monthly basis to verify the accuracy and accountability of receiving and production records. Mill Test Reports are also required for delivery of cement and strand and the testing of component materials is in accordance with Section VII. Inspection and Testing.

Strand rolls are pre-tagged with tickets indicating the coil number which correlates with the strand Mill Certificate. When a new roll of strand is required, the roll is placed in a pre-numbered rack and the ticket is removed. The rack number is written on the ticket and the ticket is turned into the Plant Manager. The Plant Manager records the date and what strand pack (coil number) is on what rack.

As the strand is pulled, the stressing crew records the rack number for each

stand used on each bed. For instance, Bed # 2 contains pieces requiring 4 strands and the racks used are 14 – 15 – 1 – 3. This information is always recorded from left to right when standing at the concrete batch plant looking out at the beds. Bed 3 may require 5 strands and use racks numbered 7 – 12 – 11 – 5 – 12. The strands used for each bed are recorded by the Quality Control Manager on the Tensioning Report form.

The traceability process and recordkeeping were developed by production and accounting personnel to provide a workable system that is understood by everyone. The process documentation has been reviewed by the plant Quality Committee and is verified as part of our Internal Quality Review. Receiving inspection is a critical part of providing traceability and proper documentation is as much of the process as the material itself.

VI. Process Control

The purpose of process control is to ensure that the Pittsburgh Flexicore Plant has a system in place to control the manufacturing of our product throughout the production process. The process controls for this plant specifically include:

A. Production Planning

Production Planning is an ongoing process at the plant. Each product and/or project is evaluated based on the bed length and space available for production; space available for product; handling equipment capabilities; and scheduling and delivery requirements. A plan illustrating the production areas (beds) at this facility is included in the site plan at the end of Section XII. This plan is part of our production planning.

B. Production Environment

The production area of this plant is outside and consist of four (4), four foot wide, production beds. To insure adequate release strengths, bed temperatures are properly controlled during the curing operations. The curing procedure is as follows:

1. All beds are covered with insulated tarps as soon as possible after extruding without disturbing the surface of the member.
2. After placing, the initial set (ASTM C403) must be achieved before the application of electric heat. If necessary, the concrete temperature may be increased during the preset period at a rate not to exceed 10ºF per hour. The total permissible temperature gain during the preset period does not exceed 40ºF higher than the placement temperature or 104ºF, whichever is less.
3. Electric heat is applied at a controlled rate, following the preset period, not to exceed 36ºF per hour (measured in the concrete). The maximum curing temperature shall not exceed 180ºF. Three (3) of the four (4) production beds are controlled by a Sure Cure system for accelerated curing. The Quality Control Manager and/or Plant Manager checks the bed temperatures daily.
4. This plant maintains sufficient curing capabilities to operate without interruption during the winter months.

During extreme conditions, the plant utilizes hot and cold weather concrete practices in the production and placement of concrete. The procedure for hot weather (as defined by ACI 305) concreting include:

1. Coarse aggregate stockpiles are watered for cooling.

2. Delays in the ordering and delivery of concrete are minimized. All concrete is placed within 1 hour of the time the concrete was batched.
3. Re-tempered concrete is not used in our product. During the placement of the concrete, if the concrete becomes stiff and requires the addition of excessive water for workability, it is disposed of.

The procedures for cold weather concreting (as defined by ACI 306) include:

1. The beds are kept warm by using a minimal amount of heat.
2. Heated mixing water is ordered. The concrete temperature is maintained at not less than 45 degrees and not more than 75 degrees.
3. The beds are covered as quickly as possible after finishing to retain maximum heat.

C. Production Equipment/Setup and Calibration

1. The Pittsburgh Flexicore batch plant scales are calibrated semi-annually and records are maintained in the Plant Manager's office in accordance with Section VIII. of this Manual. The concrete is mixed in a counter current mixer with six (6) agitating paddles. The batch computer is located in the Plant Manager's office. The batch plant has the capability of handling all of the appropriate materials required for the projects and hollow core products produced at this plant.

2. All beds are properly cleaned each day prior to concrete placement. The Quality Control Manager and/or Plant Manager is responsible for ensuring that the bed has been thoroughly cleaned before allowing the placement of concrete. The following procedures apply to the cleaning and preparation of beds:

   a. Any large deposits of concrete on the beds remaining after stripping are removed. The use of hammers for this purpose is avoided; scrapers or other acceptable tools are used.
   b. Beds are swept by machine or by hand to completely remove all loose debris and dirt.

   c. Any visible residue is removed from all parts of the bed, including siderails and other critical areas. Residue is not allowed to accumulate on the bed and create a buildup that is difficult to remove. Any acceptable means of removing residue that does not damage the form is permitted. Nylon pads, steel wool, and other means of hand labor are used whenever necessary.
   d. Excess concrete is removed by the pouring crew during placement

operations. Siderails are cleaned at finishing time. Any additional concrete remaining is removed prior to setting up the bed by the production crew. A light visible coat of release agent is applied to the bed after cleaning.

e. To insure proper distribution of release agent a squeegee or felt pad is used to spread a light coat over all parts of the bed.
f. Any large concentration of release agent remaining on the bottom of the forms is removed.

3. Fork Lifts are capable of handling all project loads and are maintained in accordance with Section XII. of this manual.

4. Stressing jacks are calibrated semi-annually in accordance with Section VIII. of this manual. The beds are designed to handle all tensioning forces required. Procedures for the proper use and care of strand chucks are strictly enforced to insure both quality and safety requirements are met. It is the responsibility of the Plant Manager to insure that all chucks are in proper condition. Individuals responsible for the cleaning and assembly of chucks are made aware of the following procedures:

   a. All chucks must be disassembled daily and lubricated and checked for jaw wear and cracks.

   After approximately 30 days:

   b. Chucks and wedges are cleaned with appropriate cleaner. “O” rings are never placed in the cleaner.
   c. The barrels and jaws are inspected to insure that no cracks are present. The “O” ring and set spring are inspected for damage or loss of elasticity. Jaw teeth are required to be in perfect condition.
   d. Chuck bodies are inspected for dents and knicks. Damaged or deformed chuck bodies are discarded.

   e. Assemble jaws, chuck and cap and the chuck is ready for use. The unit is not complete until both the cap and spring are in place.

   f. The designee of the Plant Manager is responsible for the care and cleaning of chucks and is required to notify the Plant Manager if chucks are being abused or improperly handled.
   g. Chucks are placed securely against the template, and strand is pulled in a straight line to prevent tilting.
   h. A chuck release tool may be required to remove the chuck.
   i. An acceptable chuck release agent is applied.

5. Welding and the fabrication of all embed items for this plant are accomplished by outside suppliers.

D. Process Control

The review and testing of product and/or project members is an ongoing process. The process includes receiving (acceptance) inspection and testing, in-process inspection and testing, and final inspection as defined in Sections VII and X of this Manual. All production equipment at this plant is serviced and maintained in accordance with the manufacturers' recommendations.

The specific Quality Process Controls are categorized as follows:

1. Inspection of bed
2. Inspection of placement operations
3. Inspection of finished pieces after stripping and re-inspection of defective pieces prior to shipment.
4. Material inspection and certification review.
5. Maintenance of required records in all areas.

Inspections performed by the Quality Control Inspectors generally consist of the following:

Operation	Frequency	Action
Bed Setup	Daily Each Bed	Inspect entire operation prior to placement of concrete in beds. Review includes cleanliness and maintenance of beds. All non-conforming conditions are corrected before placement of concrete.
Placement and Extruding Operations	Daily	Inspector observes the placement and extruding operation to determine compliance with standard operating procedures as defined in this Manual and PCI MNL 116. Any deficiencies are discussed with the production/bed supervisor and noted on the inspection summary report.
Tensioning Operations	Each Strand	The Quality Control Manager reviews the stressing operation for each bed. Verification of accurate stressing forces with

Operation	Frequency	Action
Re-inspection of Finished Pieces	Daily or as necessary	The Quality Control Manager completes a final review of originally non-conforming product prior to shipment. A check of deficiencies previously noted and condition of surface finish is made to determine if corrective action has been taken. Non conformities are reported to the Plant Manager.
Preparation of Cylinders	Daily	Strength test cylinders are prepared in accordance with ASTM test procedures. The Quality Control Manager insures that the testing, recording, and reporting of cylinder strengths are completed for each time period required.
Concrete at Placement	Daily	The Quality Control Manager periodically checks the consistency of concrete delivered to the beds. All concrete delivered is in accordance with this Manual, PCI MNL 116 and/or project specifications.
Cast-in-Items	Daily	The Quality Control Manager inspects all cast-in-items to insure compliance with the appropriate shop drawings.
Certification of Steel Material	As Required	The Quality Control Manager reviews material for manufacturer's certification of quality. If necessary, tests are performed to verify quality standards.

As part of the Quality Control Process, the Quality Control Manager has authority in the following areas:

1. Bed Setup – The Quality Control Manager is required to stop the delivery of concrete to beds that are not properly set up. The Quality Control Manager will observe and inspect all phases of the set up operation including observing proper procedures for cleaning and maintenance of beds. During the inspection, any deficiencies are reported to the set-up crew and/or Plant Manager for corrective action. Concrete delivery will not commence until all deficiencies have been corrected.

2. Concrete Placement – The Quality Control Manager and/or Plant Manager is required to reject all concrete that does not meet specification requirements. During the extruding process, the Quality Control Manager shall reject the use of any concrete that does not meet the necessary consistency requirements.

The Quality Control Manager shall also monitor the addition of water to

3. Quality tests are performed in accordance with Section VII. of this manual and as defined in PCI MNL-116 - 99. The specific test procedures comply with ASTM, AASHTO, project specifications, etc. and PCI plant certification requirements.

4. Quality is the responsibility of each employee at this Plant. Workmanship standards for production are defined for each employee in accordance with Section XV. of this manual. In addition to the introductory training regarding quality, all production personnel receive on-the-job quality training.

VII. Inspection and Testing

Inspection and Testing begins at receiving of materials and vendor fabrications. It continues through production, and is completed at final inspection. The Quality System Committee monitors the plant quality control procedures as a part of their Quality System Manual review. Inspections are performed by the Quality Control Manager who is not otherwise responsible for production in the area being tested. The Quality Control Manager and Plant Manager are responsible for the inspection and testing of component materials and product. The Quality Control Manager reports to the General Manager and performs inspection tasks as defined in Section I.B.1.b of this manual. The plant inspections and testing consist of the following:

A. Receiving Inspection and Testing

The purpose of receiving inspection and testing is to verify that component materials supplied to our plant meet project specifications, plant standards, and all purchase order requirements. Receiving inspection and testing includes:

1. Initial setup Review Procedures. At the start of each project, the project design documents (drawings and specifications) are reviewed to determine project criteria. Project standards are established based on project criteria or plant standards (if more stringent). Purchase orders are written (if required) with these standards in accordance with Section IV of this manual.

2. Review component material mill certificates, certificates of compliance, test data, and any additional information provided by the vendor. This information is reviewed on a continuing basis for compliance with purchase orders.

3. Non-conforming material is rejected and treated in accordance with Purchase Order requirements and Section X of this manual. Material that does not conform is segregated and/or appropriately marked to insure that it does not reach the production area.

4. Component Materials are tested by the Quality Control Manager in accordance with ASTM, AASHTO, etc. standards and PCI plant certification requirements.

5. Documentation of receiving inspection is completed and maintained by the Quality Control Manager. Inspection and tests indicating non-conformance are immediately brought to the attention of the Plant Manager and/or General Manager and maintained for evaluation of the vendor on the approved vendor list.

B. In-Process Inspection and Testing

The purpose of in-process inspection and testing is to establish inspection and testing procedures to control the manufacturing of hollow core products to project specifications and plant standards. In-process inspection and testing includes:

1. The plant production schedule is available to the Quality Control Manager for planning of inspection and testing.

2. The Quality Control Manager and/or Plant Manager inspect the beds. The inspection standards and tolerances comply with PCI MNL 116, plant standards and/or project standards, whichever are more stringent.

3. Up-to-date shop and/or engineering drawings are available for each product.

5. All record forms of project testing and inspection are maintained by the Quality Control Manager.

6. The concrete mixes from the batch plant are regularly tested for use at this Pittsburgh Flexicore Plant. All concrete used complies with the strength requirements as specified on the drawings. Three (3) concrete

test cylinders are made, from a single batch, for each bed used. The 4" x 8' PCI Cylinder Break form is completed, indicating the batch number and subsequent batch ticket report.

7. Cylinder molds are labeled by bed and as the molds are stripped, the cylinder number and date are recorded on the cylinder. Prior to breaking cylinders, each cylinder is weighed for consistency of density (8.65 to 8.75). As the concrete cylinders are broken, the hours to record for the break can be determined by referring back to the previous days batch ticket for the batch time.

8. Generally, 3000 PSI is required for detensioning and 5000 PSI is required to ship and install. If the initial cylinder break exceeds 5000 PSI a second cylinder will be broken and the two will be averaged together.

9. If the release strength is greater than 3000 PSI, the insulated tarp will be rolled up on the ends and the bed will be simultaneously detensioned. The tarp will then be completely removed from the bed. The strand chucks will be checked and graphite will be put on them.

10. The saw is then set on the bed, the numbering process begins and a date stamp is placed on each piece. Strand slippage is checked beginning with the bed the saw is set on. Ahead of the saw, the bed is checked to:
    1 Verify the length of the piece
    2 Identify the finish acceptability
    3 Confirm notch detail from shop drawing (if required)
    4 Determine any special requirements (cut at an angle, sawing or filler piece, etc.)
    5 Install any embed (add on) items

    Completion of the Production Schedule form begins and the remainder of the bed is cut to length. The Quality Control Manager checks the length of each piece cut. If the length exceeds +/- ½ inch a "Hold" is placed on the piece.

11. The entire bed is then stripped, one piece at a time. Three (3) pieces from the bed are checked for camber, and slippage and the Slab Cross Section & Initial Camber form is completed.

12. Once the bed has been stripped, a buggy is placed on the bed for cleaning, pulling strand, and applying a form release agent. These task

may be performed manually.

13. Repeat the process for each bed.

C. Final Inspection

The purpose of final inspection is to provide final review of each piece for project conformance. Final inspections include:

1. Up-to-date shop and/or engineering drawings are available for each product.

2. An inspection of the piece, including a dimensional review, notch detail and special requirements, was performed after the piece was cut and removed from the bed. The results of the inspection are recorded on the Hollow Core Checklist included in Section II of this Manual. The product is marked, if required, after inspection in accordance with Section IX.

3. The inspection standards and tolerances comply with PCI MNL 116, plant standards, and/or project standards whichever is most stringent.

4. Non-conforming product is identified through the inspection process and corrected in accordance with Section XI.

VIII. Inspection, Measuring, and Test Equipment

The equipment used by Quality Control personnel to monitor process and product is maintained in a calibrated status. The calibration list illustrated in the Equipment Calibration Records identifies all equipment by model and serial number and indicates the date of calibration.

Equipment calibration records are maintained for the following equipment at the frequency indicated:

Equipment	Calibration Frequency	Calibration Range
Concrete Batch Plant		
Aggregate Scales	Semi-Annually	500 lb. - 6,000 lb.
Cement Scales	Semi-Annually	50 lb. - 1,000 lb.
Water Meter	Every 3 months	up to 10 gal.
Hercules Single Strand Prestress Jack	Semi-Annually	(initial) up to 4,000 lb. (final) 3,500 lb. - 35,000 lb.
Simms Single Strand Prestress Jack	Semi-Annually	(initial) up to 4,000 lb. (final) 3,500 lb. - 35,000 lb.
Forney 250 ksi Hydraulic Testing (compression) Machine	Annually	25,000 lbs. to 250,000 lbs.
Digital Platform Scales	Annually	
Triple Beam Balance Scales	Annually	

Calibrations are performed at any time the equipment indicates erratic results, and in any case at intervals not greater than the calibration frequency illustrated above.

Calibration records comply with the requirements of PCI Manuals MNL 116.

IX. Inspection and Testing Status

Each hollow core member produced by Pittsburgh Flexicore is uniquely identified with a mark number indicating the production sequence, the production date, the piece number, and a color code which identifies the bed the piece was cast in. Product extruded in Bed 1 has a red dot; Bed 2 has a red mark number; Bed 3 has a green mark number; and Bed 4 has a black mark number. This product identification system ties each piece to the process testing as well as traceability of materials.

In addition to the Mark Number, Piece Number and date on each product there is an established inspection acceptance procedure at the Plant. This procedure is as follows:

> **Not Marked -** Product meets project requirements and plant standards and may be shipped.
>
> **Red "Hold"** – Indicates the piece is unacceptable for shipment and requires cutting or repair.
>
> **"RJS" (Initials of the Quality Control Manager)** – Indicates significant non-conformance requiring cutting or repairing the piece. The piece is set aside and may not be placed in product storage or placed on a trailer for shipment.

Product is marked for inspection rejection (if required) once it is stripped from the form.

X. Control of Non-Conforming Product

A. Acceptance Inspection and Testing

1. Purchase orders outline the agreed policy for handing non-conforming materials. Non-conforming material is identified, segregated, evaluated for use, and modified or disposed of at our Vendor's expense in accordance with our "conditions of procurement". All cost associated with Vendor supplied non-conforming product are the responsibility of the Vendor.

2. The Quality Control Manager and/or Plant Manager at Pittsburgh Flexicore inspects component materials to verify compliance with ASTM, PCI, and purchase order standards. The records for receiving inspections are maintained by the Plant Quality Control Manager. The forms used for recording receiving inspections have been approved by the Plant Quality System Committee.

3. Aggregate Vendors are required to provide summaries of their gradations and the Quality Control Manager at this plant performs check tests in accordance with PCI standards. If a sample fails to meet acceptance criteria, a check sample is run to confirm non-conformance. When identified as non-conforming, the material is evaluated for use; shipped back to the supplier; or disposed of at the suppliers' expense. This procedure is addressed as a "condition of procurement" in the purchase order with our suppliers.

B. In-Process Inspection and Testing

1. During pre-placement review or in fresh concrete testing, changes may be made or concrete may be discarded to prevent non-conformance. Fresh concrete conformance is in accordance with the requirements of ASTM C-94.

C. Final Inspection

1. 28-day compressive strength requirements must be met before the product is fully acceptable. This strength may be achieved at release strengths or anytime thereafter. When the strength is reached in less time, the product is approved for final acceptance if all other parameters are met.

2. Product finish must match approved samples, if applicable. A non-conforming finish may be reparable but is identified in accordance with Section IX. with "Hold" until the acceptable finish is achieved.

Finish standards must be met before final approval, as project samples are a very important part of final acceptance.

3. Products are always reviewed at shipping in accordance with Section XII. to confirm product acceptability and to verify the products condition at shipment. Although the product was acceptable after finishing, it is checked prior to shipment to catch any handling damage or contaminants from storage that may require repair or cleaning. Visual inspections prior to shipping are performed by the yard forklift driver. Any deficiencies are brought to the attention of a Quality Control Manager and/or Plant Manager.

4. Repair mixes are prepared in accordance with Section XI. Batches of each sample mix are made by the Quality Control Manager and/or Plant Manager for use in patching of spalls or other damage to products.

XI. Corrective Action

Standard spalls, chips, and defects are visually inspected by the Quality Control Manager. Non-conforming hollowcore pieces are:

1. Cut to make another piece for other use
2. Classified as a remake and disposed of

3. Patched using a filler mix

The filler mix (patching material) used to patch defects requires taking a portion of the standard mix from the mixer and placing it in the ¼ cubic yard Bobcat mixer. Approximately 32 oz. of High Range Water Reducer is added to the mixer and the filler mix is mixed to the consistency desired.

Major spalls or honeycomb are reviewed by the General Manager, Quality Control Manager, and/or Plant Manager to determine the cause of the defect and if a repair is feasible.

Cosmetic repairs are performed to the finish requirements of the project.

XII. Handling, Storage, and Loading/Delivery

A. General

Equipment available for handling pieces at this Pittsburgh Flexicore Plant include the following:

Location	Equipment	Description	Quantity

Plant	Taylor Model THD-300S Forklift	15 Ton Capacity	1
Plant	Clark Model C500 Y300 Forklift	15 Ton Capacity	1
Plant	Clark Model C500 YF200 Forklift	10 Ton Capacity	1
Plant	Clark Model CY160	10 Ton Capacity	1
Plant	Cat Model V180B	10 Ton Capacity	1
Plant	Cat Model V180 B	10 Ton Capacity	1

Each hollowcore bed has been laid out to allow for adequate clearance to lift and handle members being removed from the beds. The selection of handling equipment was based on actual and anticipated weights of product to be handled.

The storage plan for our Plant is included at the end of this section. The plan is based on actual and anticipated product requirements and includes a potential storage layout.

The number of hollowcore pieces stacked in storage is based on the bearing capacity of the soil and the type and size of the base dunnage units. Care is taken to avoid excessively high stacking of pieces in the yard. If it is necessary to place members in high stacks, the Plant Engineer must be consulted prior to stacking to determine possible adverse results.

B. Handling

Handling equipment for this plant was selected based on anticipated loads and the capability of handling products without damaging the piece or the equipment. “Lifting rigs” are used to handle large pieces. It is necessary that all material be handled and stored in the proper manner prior to shipping. All personnel involved in the stripping, storage, and shipping operations are properly trained in established procedures.

An operations manual is located in the Plant Manager’s office for each piece of handling equipment and the individual operator performs a daily visual check of oil, hydraulic fluid, water, etc. The Plant Manager maintains a *Forklift Maintenance Checklist* and schedule for all handling equipment.

C. Storage

Methods established on the drawings for shipping, storage, and handling are closely followed. Special emphasis is placed on any

storage requirements necessary to prevent excessive camber.

In storing members, the bottom member is adequately stabilized and supported in a level position. Full width timbers are used on the bottom members, when necessary.

The Yard Forklift Operator is responsible for product storage. Product storage is reviewed for conformance to shop drawings as products are stored. The yard is reviewed monthly by the Plant Manager to determine any damage to the units by equipment or personnel. A record of each yard review is maintained by the Plant Manager on the "Yard Review" form illustrated on page XII – 5.

D. Loading/Delivery

Product that has been approved by Quality Control is transported by forklift to the designated storage area. The Yard Forklift Operator is responsible for proper yard storage. A final visual check of the product is made by the forklift operator (yard) as each piece is loaded on the trailer. The Operator is checking to insure that the piece has not been damaged in storage and that no loose materials or aggregates are left on the member (which might blow off during transit). The truck driver is responsible for insuring that the load is tied down and that the tie-downs do not impose loads which the product cannot handle without damage.

Storage Plan
Pittsburgh Flexicore Co., Inc.

This Pittsburgh Flexicore Plant produces custom hollowcore products. The concrete is extruded onto the bed and each piece is cut to the length desired.

Pieces are stored on the yard by project. The attached plat of the property indicates the yard storage area available at this plant. The actual storage locations vary according to the projects underway at any given time.

Access lanes are required to remain clear (unobstructed) to provide easy access to each hollowcore project and piece. The layout of storage areas and access

lanes is based on consideration of the forklift turning radius in order to minimize damage to our product.

Products are stored in rows, blocked by dunnage, and stacked. Each piece is stored within the respective project location and the Forklift Operator is responsible for knowing the location of each project..

Yard Review
Pittsburgh Flexicore Co., Inc.

For the Month of _____, _____ (year)

On this date: _____, _____, I reviewed the yard storage at our Hollowcore Plant and found the following units to be damaged:

Piece No.	Job No.	Location	Damage (Description)

Other comments or observations:

Reviewer: _____

XIII. Quality Records

It is the policy of Pittsburgh Flexicore to prepare complete and accurate quality records. These records meet the requirements of the PCI Plant Certifications Program as detailed in the MNL 116-99, Quality Control Manual.

The records prepared on pre-printed forms are outlined in Section II of this Quality System Manual. Records are assembled and stored in the Quality Control Manager's office for use by the inspector (PCI and/or internal). The maintenance of these records is the responsibility of the plant Quality Control Manager.

To provide retrievable records, the records are stored in chronological order.

Example sheets illustrating various types of records maintained are illustrated on the following pages.

Time of record retention is in accordance with PCI Manuals MNL 116-99.

XIV. Internal Quality Review

The Internal Quality Review is one method employed by Pittsburgh Flexicore to insure that the Quality System is being followed. As outlined in Section I.C of this Manual, the Internal Reviews are a standard part of this plant's Quality System.

The Quality Committee, at its initial meeting each year, schedules and determines who will perform the two Internal Reviews for this plant during the year. It is anticipated that the Internal Review will be conducted by any of the following individuals (or combination thereof):

General Manager
Plant Manager
Quality Control Manager

The Internal Quality Review is to determine whether the Quality System is working properly and completely. The Internal Review addresses each function of the plant and is performed using the Internal Review report form (illustrated on the following pages). This initial form is included for illustration purpose only. It is anticipated that this form will frequently change based on areas of emphasis, results of PCI Audits, revised procedures, etc. This form is evaluated, modified if required, and approved annually at the initial meeting of the Quality Committee.

The Internal Quality Reviews are evaluated and acted upon as defined in Section I.C of this Manual.

Internal Quality Review
Pittsburgh Flexicore Co., Inc.

Date of Audit: _____ **Plant:** _____

Auditor: _____

I. Management Responsibility

A. Are methods outlines for Quality System Awareness being implemented?

B. Is the organization chart for this plant current?

C. Are the personnel responsibilities documented accurate and all inclusive?

D. Are personnel qualifications and training indicated and current?

E. Are self inspection procedures used?

F. Review Quality Committee meeting minutes. Was each activity identified for Management Review accomplished?

II. Quality System Definition

A. Is Board approval of the Quality System on record?

B. Review Quality Committee meeting agendas and minutes. Were designated members in attendance? Are records current?

C. Are the forms illustrated in the manual used and current?

III. Document Control

A. Are the Quality System Manual “master list” (2 each) maintained?

B. Are manual revisions accomplished as indicated in the manual?

C. Is the drawing distribution process as indicated in the manual?

IV. Purchasing

A. Are “Conditions and Procurement” included with all applicable Purchase Orders?

B. Is the approved vendor list maintained?

V. Product Identification and Traceability

A. Verify process by tracing the product. Is the process as documented accurate?

B. Confirm that a monthly inventory is accomplished.

VI. Process Control

A. Is production planning accomplished as indicated in the manual?

B. Are the procedures identified for production equipment/setup and calibration accurate?

C. Are the Quality Process Controls as indicated?

VII. Inspection and Testing

A. Are raw material mill certificates, certificates of compliance, and test data available for each material used?

B. Is the Production Schedule form current and used as indicated in the Manual?

C. Randomly review product in storage and record observations.

Piece Number	Storage Location	Date Extruded	Remarks

VII. Inspection, Measuring, and Test Equipment

A. Review Equipment Calibration Records. Is all necessary equipment calibrated?

B. Are equipment calibrations current?

IX. Inspection and Test Status

A. Is each product uniquely identified with mark number and date cast?

B. Is the acceptance/rejection identification system employed as outlined in the manual?

C. Is the proper procedure followed after the Quality Control Manager's initials have been placed on a piece?

X. Control of Non-conforming Product

A. Are specifications included with Purchase Orders?

B. Is the process for non-conforming product accurate as indicated in the manual?

C. Is the plant tracking repetitive non-conformance?

XI. Corrective Action

A. Are non-conforming pieces cut, remade or repaired as indicated in the manual?

B. Observe the repair of a non-conforming piece. Is the corrective action as indicated in the manual?

XII. Handling, Storage, and Loading/Delivery

A. Is the equipment identified in the manual available and current as listed?

B. Are equipment operations manuals available in the Plant Manager's office?

C. Is the storage plan for the plant current and accurate?

D. Is the Plant Manager conducting a monthly review of the storage areas? Are records of each review maintained?

XIII. Quality Records

A. Are records stored and maintained as and where indicated in the manual?

B. Are the example forms in the manual the actual forms being used?

XIV. Internal Quality Reviews

A. Are Internal Quality Reviews conducted as indicated in the manual?

B. Are records maintained of all Internal Quality Reviews?

C. Is the Internal Quality Review report form approved by the Quality Committee annually?

XV. Training

A. Is on-the-job training implemented as indicated in the Manual?

B. Are bi-weekly Managers (quality and safety) meetings conducted at the plant?

XV. Training

Training of personnel is an important part of Pittsburgh Flexicore's Quality System and operational procedure. Training of our employees begins with the interview process and continues throughout their career with Pittsburgh Flexicore. The following outline provides an overview of our training process at this Plant:

A. Interview Process

The interview process gives our managers the opportunity to evaluate applicants and inform the applicants about Pittsburgh Flexicore. Specific items addressed during the interview process include:

1. Pittsburgh Flexicore Safety Policy. A copy of our Policy is reviewed with all new employees during introductory training.
2. Pittsburgh Flexicore's Quality Policy.
3. Company Work Rules including the opportunities and requirements for advancement.
4. Expectations regarding responsibilities, dependability, working conditions, etc.

B. Introductory Training

All new employees receive introductory training once hired by Pittsburgh Flexicore. Introductory training includes:

1. An in depth review of our Safety and Quality policies particularly as each pertains to the position being filled. All employees are issued the required safety equipment.
2. A tour of the facilities at this plant location. This gives each new employee the opportunity to see how his or her work interfaces with the other activities at the plant.
3. A review of major Company policies including benefits, work schedules, standard plant practices, etc.
4. The overall labor force for this plant is provided by the Teamsters, Chauffeurs, Warehousemen, and Helpers Union Local Number 872.

C. On-the-job Training

Upon completion of introductory training, each employee meets with his or her manager to begin their on-the-job training. This training may be conducted by the manager or by a qualified individual designated by the manager. Although on-the-job training is specific for the position being filled, the following items are common to all positions:

1. Safety – Review general safety information (building exits, fire

extinguisher locations, emergency numbers, etc.) and specific hazards to the job.

2. Quality – Review specific sections of this Manual, PCI MNL-116, and other applicable references which relate to the performance of the position being filled.
3. Work procedures – The sequence and performance of each task in the work process is clearly explained and demonstrated. Each employee is informed about how the quality of their work impacts the overall product quality (quality is everyone's responsibility).
4. Job specific responsibilities – Equipment operation, finishing techniques, etc. Equipment operators are thoroughly checked out prior to being authorized to independently operate the equipment.

D. Continuing Education

All employees receive on-going training in various aspects of our business. The types of training received are dependent upon the position held by the employee. Examples of continuing education and training include:

1. Periodic tool box safety and quality meetings for production personnel.
2. Bi-weekly manager meetings as discussed in Section I.A.2.
3. First aid training for designated management personnel.
4. Mandatory annual safety training for all Company personnel.
5. On-going professional training for management, sales, and administrative personnel.