



SCOTT SYSTEM

Section 03 11 00

CONCRETE FORMING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. CONTRACTOR shall supply all labor, tools, equipment, and materials to set forms for the proper placement of concrete for HPU structures. It is CONTRACTOR's responsibility to design and build adequate forms and to leave them in place until the forms can safely be removed. CONTRACTOR is responsible for damage and injury caused by removing forms carelessly or before the concrete has gained sufficient strength. Means and methods of repair shall be reviewed by ENGINEER ARCHITECT prior to performing work
- B. Fabrication, attachment, and maintenance of 3D Formwork for Cast-in-Place (CIP) concrete.
- C. Form ties for cast-in-place concrete with 3D milled and coated foam formwork.
- D. Release agent for use with 3D milled and coated foam formwork.
- E. Form Stripping

1.02 Products installed but not furnished under this section - Section 03 30 00 – Cast-in-Place Concrete.

1.03 RELATED SECTIONS

- A. Section 01 31 19 Project Meetings
- B. Section 01 33 01 Submittals
- C. Section 01 45 16 Field Quality Control Procedures
- D. Section 01 35 02 Material and Equipment
- E. Section 03 21 00 Concrete Reinforcement
- F. Section 03 31 00 Cast-in-Place Concrete

1.04 REFERENCES -The following is a list of standards which may be referenced in this section:

- A. ACI 301 CH 13 – Specifications for Structural Concrete.
- B. ACI 318 – Building Code Requirements for Reinforced Concrete.

- C. ACI 347 1978 CH 5.2 - Recommended Practice for Concrete Formwork.
- D. ACI 117 "Standard Tolerances for Concrete Construction and Materials"
- E. ACI 303R-91 "Guide to Cast-in-Place Architectural Concrete"
- F. ACI 309 1972 [78] CH.7; "Recommended Practice for Consolidation of Concrete"
- G. PS-1 - Construction and Industrial Plywood.

1.05 DESIGN REQUIREMENTS

- A. Design, engineer and construct custom design molds to conform to shape, line and dimensions indicated for specific locations as indicated in drawings.
- B. Contractor shall be responsible for design of formwork and backup of panels containing form to meet structural stability and sufficiency.

1.06 SUBMITTALS

- A. Submit under provisions of Section 01 33 01.
- B. Shop Drawings: Indicate 3D shape of concrete and formwork, layout, jointing and termination reveal, and chamfer strip details, if any.
- C. Product Data: Provide manufacture's installation instructions and product data related to all materials to be incorporated into formwork.
- D. Samples: 2'-0" w x 2'-0" h x 1'-0" d sample of foam and finish
- E. Compliance certification by release agent manufacturer for local conformance with controlling of VOC's. 3
- F. Architect/Engineers review for conformance to plans for aesthetic criteria.

1.07 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 117, 301, 303R, 309 CH. 7, 347, 301, and 318.
 - 1. Maintain one copy of each document on site.
- B. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
 - 1. Mock-up panel ____ feet by ____ feet (indicate dimensions) designated by Architect to prove concrete form, finish and placement of concrete.
 - 2. Do not proceed with remaining work until workmanship, color, and detail are approved by Architect.
 - 3. Modify mock-up area as required to produce acceptable work.

1.08 QUALIFICATIONS

- A. The Contractor shall as a part of his work employ a firm specializing in the digital fabrication process of custom 3D designed and fabricated coated foam formwork to produce the architectural quality cast-in-place concrete elements.
- B. Acceptable firms shall have a minimum of 3 years of specialized experience in the digital fabrication process of custom 3D CNC milled and coated foam formwork.
- C. As a submittal within the bid process the bidder shall provide the name of the firm, along with a summary of the firm's experience including photographs and description of at least 3 production projects of similar size successfully completed in the last 3 years.

1.09 REGULATORY REQUIREMENTS

- A. Conform to applicable local, city and state code for design, fabrication, erection and removal of formwork.

1.10 FIELD SAMPLES and MOCK-UPS

- A. Provide under provisions of Section 01 45 16.
- B. Coordinate with requirements stated in Section 01 33 23.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, Store, Protect and Handle products to site under provisions of Section 01 35 02.
- B. Provide mock-up as described elsewhere in this section.
- C. Store off ground in ventilated and protected manner to prevent deterioration from moisture.
- D. Protect forms from petroleum-based products, oil, dirt, and UV exposure.
- E. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.12 COORDINATION

- A. Coordinate Work under provisions of Section 01 31 19.
- B. Coordinate this Section with other Sections of Work, which require attachment of components to/through formwork.
- C. If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement, request concurrence from Construction Manager with corrective action proposed.
- D. In the event there are conflicting statements between the various references ACI 303R shall govern on issues related to quality control in casting of architectural finished concrete surfaces.

PART 2 PRODUCTS

2.01 3D MILLED AND COATED CONCRETE FORMS

A. 3D Milled and Coated Concrete Forming materials:

1. Polyurethane coating materials, which accurately transfers a detailed replication of smooth textures.
2. Expanded Polystyrene that can be milled to accurately transfer a detailed replication of the architectural Cast-in-Place concrete form and details.

2.02 MANUFACTURERS

A. Acceptable Manufacturer:

Scott System

109 General Fellows Road

Greenwich, New York 12834

Phone: 518-383-0500 Fax: 518-992-5140

Website: www.scottsystem.com

- #### B. Substitutions: Substitutions may be considered that meet the qualifications within the specification.

2.02 FORMLINER ACCESSORIES

- #### A. Form Release Agent: 3D Milled, and Coated Foam Formwork shall be treated with release agents, which are non-staining, compatible with the EPS foam and polyurethane products and approved for use by the manufacturer.

Part 3 EXECUTION

3.01 3D MILLED, AND COATED FOAM FORMWORK DIGITAL FABRICATION

A. Custom Design Formwork Construction

1. The Contractor as a part of the scope of work shall have project-specific custom design formwork fabricated to produce the cast-in-place architectural concrete.
2. Custom Design Formwork shall be constructed from materials approved by manufacturer. Formwork will be produced by staff at manufacturer's facility or other approved location. Parties shall meet when necessary to review progress and adjust design as needed.
3. The cost of the custom design formwork shall be included in the Bid Price.
4. The Contractor will be supplied 3D models and drawing which delineates the shapes and patterns of the architectural concrete. The manufacturer shall review and prepare scaled shop drawings reflective of the shapes and patterns of the original design drawings to be reviewed and approved.

5. The shop drawings shall conform to the original drawings in all respects except in locations where in the opinion of the manufacturer the design cannot be successfully accomplished without modification. The manufacturer via the shop drawing process shall identify these areas of concern.
6. The Contractor shall conduct a working session with all involved parties where collaboratively the modifications will be approved.
7. The custom design formwork shall be constructed of polyurethane materials which are true to the original approved shop drawings within 1/4" in the vertical and horizontal axis.
8. The custom design formwork shall accurately replicate the architectural shapes indicated on the drawings, resulting in continuous uninterrupted patterns to the shape and dimensions as indicated on the approved shop drawings.

B. Digital Fabrication of Formwork

1. Manufacturer will utilize CAD/CAM software to digitally fabricate the custom architectural concrete shapes.
2. Fabrication of the custom formwork to be completed on CNC milling machines and coated to the finish required by the Project Team and accepted ___ x ___ samples.

C. FINISH

1. The final finish shall be that finish, which is transferred from the 3D milled, and coated formwork.
2. Minor rubbing of the surface with a stone to remove small burrs or non-form liner projections shall be allowed if the surface textures transferred from the coating to the concrete are not damaged.
3. Bug holes shall be kept to the absolute minimum but in no case will bug holes larger than a 3/8" in diameter be allowed. If the event that larger than acceptable bug holes occur, they may be patched and hand surfaced to match the finish to the satisfaction of the owner or the designer.
4. The Contractor shall use identical materials to fill bug holes. Patching materials and techniques shall be tested in inconspicuous areas for approval before repairs in highly visible areas are made.
5. Bug holes and voids, which are unacceptable due to concerns regarding the structural integrity of the wall, are not covered by this section.

D. MOCKUP

1. Using the 1/2 scale prototype of the 3D milled, and coated formwork, the Contractor shall construct a 1/2 scale mockup of the wall section.

2. All materials and techniques to be used on the actual construction shall be employed to produce the wall mockup. This is to include the construction of the forms, form release agent, form ties, chamfer strips, concrete mix design, aggregate size, water ratio, slump, bracing and shoring, placement rate, form pressures, joint sealing, vibrating and stripping practices.
3. Upon review of the ½ scale sized cast mock-up, the Contractor will be given direction regarding the acceptance of or rejection of the 3D milled, and coated foam formwork for use on the project.
4. Rejected mock-ups shall be removed from the site. The Contractor shall cast additional mockup panels as required until the quality desired for the project can be achieved.
5. Upon approval of the ½ scale size mockup, the Contractor may engage the fabricator in the completion of the remainder of the work. The remainder of the work shall be equal or better in quality to the approved prototype materials.
6. The accepted mockup shall be the standard by which the subsequent architectural concrete shall be reviewed and accepted. The approved mock-up shall remain in place until such time as the Contractor needs to serve as the standard for overall quality.

3.02 FORMWORK MAINTENANCE

1. 3D milled, and coated foam shall be assembled per the manufacturer's instruction and under the supervision of manufacturer's representative.
2. Formwork shall be cleaned and prepared per manufacturer's instructions. Formwork shall be thoroughly and securely attached to the formwork using screws through Contractor's formwork and into the plywood perimeter surrounding the 3D milled and coated formwork. Specifically supplied by or approved in writing by the form liner manufacturer such that the formwork is held held true to the form and design of the as indicated in the approved shop drawings to within 3/8" in the horizontal and vertical plain of the pattern.
3. Care and maintenance of the formwork is required to ensure that the formwork remains in good condition throughout the duration of the project. The Contractor shall use all means at his disposal to protect the formwork from damage due to construction activity, including erection, pouring, curing, stripping, movement, and storage on the site. The formwork shall be cleaned and maintained per the manufacturer's instructions.
4. Contractor shall seal joints between formwork and adjacent formwork and accessories to prevent concrete paste from bleeding.
5. Drill or pierce formwork to install form ties.
6. Provide openings, offsets keyways, recesses, chamfers, blocking, and screeds as required to achieve architectural concrete textured finish.
7. In the event the formwork is damaged, the Contractor shall consult with the manufacturer.

8. Damaged and improperly maintained or repaired formwork will be rejected. The Contractor shall replace all the damaged formwork at no additional cost to the Agency.

3.03 APPLICATION - FORM RELEASE AGENT

1. Apply form release agent on formwork in accordance with manufacturer's recommendations.
2. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
3. Keep surfaces coated prior to placement of concrete.

3.05 Formwork Cleaning

1. Clean and remove foreign matter within forms prior to erection.
2. Clean surfaces and formed cavities of debris after removal from concrete and before reinstallation on subsequent uses.
3. Formwork should be cleaned with approved release agent when the liner begins to resist stripping.
4. Flush with water or use compressed air to remove foreign matter and re-release formwork after cleaning.

3.07 TEXTURED FORM LINER TOLERANCES

1. Construct textured form liners to within 3/8" in both horizontal and vertical plans to the dimensions indicated on the plans.
2. Location of cast impressions from textured form liners in finished wall shall not vary more than 0.1 Foot from the vertical grades indicated on walls elevations.

3.08 FIELD QUALITY CONTROL

1. Attach formwork as specified above. Inspect erected formwork, shoring, and bracing to ensure that Work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.
2. Formwork may be used on this contract repeatedly, provided the following criteria are met:
 - (a) Formwork has been properly stripped, cleaned, maintained, and stored between uses.
 - (b) Formwork continues to produce acceptable quality when compared to the approved mockup.
 - (c) The formwork has not been patched other than by means and methods as recommended by the manufacturer and repairs approved by the GC.

3.09 FORM REMOVAL

1. Forms shall be removed in accordance with the manufacturer's recommendations and procedures, after a minimum of 12 hours and stripped preferably within 24 hours of concrete placement. However, do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads specified

2. Separate the form from the concrete slightly. Hold in this position for several minutes to allow the induced stress in the form to diminish. Continue to separate the formwork from the concrete in stages until final separation.
3. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finished concrete surfaces scheduled for exposure to view.
4. Store removed forms in a manner that the liner surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

END OF SECTION 03 11 16.13