

ADDENDUM NO.: 6

DATE OF ADDENDUM: July 27, 2016

**Chiller Plant Upgrades
CT Mental Health Center
34 Park Street
New Haven, CT
BI – MH – 112A**

Original Bid Due Date / Time:

July 27, 2016

1:00 pm

Previous Addendums: Addendum #5 dated 7/20/2016, Addendum #4 dated 7/8/2016, Addendum #3 dated 6/30/2016, Addendum #2 dated 6/29/2016, Addendum #1 dated 6/27/2016

TO: Prospective Bid Proposers:

This Addendum forms part of the "Contract Documents" and modifies or clarifies the original "Contract Documents" for this Project dated 8/28/2015. Prospective Bid Proposers shall acknowledge receipt of the total number the Addenda issued for this Project on the space provided on Section 00 41 00 Bid Proposal Form. Failure to do may subject Bid Proposers to disqualification.

The following clarifications are applicable to drawings and specifications for the project referenced above.

Item 1

Question: Detail 2 of drawing M-101 indicates the size of the existing steam line as 2". Original contract drawings available on site indicate the existing steam line to be 5". If so, would a new 3" steam line be required?

Answer: The new 3-inch high pressure steam line is a required portion of this project, as shown on the contract documents. This new 3-inch steam line is to follow the routing of the existing high pressure steam and condensate piping through the basement. The existing high pressure steam line is mislabeled as 2" on drawing M-101, but this does not affect the project's scope of work.

Item 2

Question: Detail 1 of drawing M-102 seems to indicate that the Lecture Hall and Mechanical Equipment Room share a common wall. Please verify this to be the case.

Answer: No, the Lecture Hall and the Mechanical Room do not share a common wall. There are other spaces between these two rooms, as well as corridors on both the left and the right of the Lecture Hall. **See attached plan for approximate locations of the Lecture Hall and Mechanical Room. Note:** The separation is illustrated by the red font and boundaries.

Item 3

Question: Are As-Built drawings available for the area of the proposed new steam line? It is impossible to determine any and all interferences i.e. other piping, ductwork, electrical, etc. that may be encountered installing the new steam line.

Answer: No, there are not any current drawings that we consider accurate as-built drawings. The only drawings we have are from the 1960's (the attached drawing is part of that set), and we would expect that the mechanical systems unrelated to this project have been extensively modified since those drawings were produced. The existing conditions must be verified by the contractor prior to submission of bids. The bids must include all costs associated with installation of the new 3-inch steam line, including resolution of all interferences and conflicts. As discussed at the pre-bid walkthrough, additional site visits can be arranged if requested.

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Item 4

Question: Section 230516 of the contract documents references expansion fittings and loops, however none are shown on the contract drawings. Are expansion fittings and loops required, and if so, where and what style?

Answer: Per Specification Sections 230516 (Expansion Fittings and Loops for HVAC Piping) and 232213 (Steam and Condensate Heating Piping), the design of all expansion joints, expansion loops, swing connections, anchors, alignment guides, hangers, and supports is the responsibility of the Contractor and/or his vendor. Expansion Joints must be rated for steam service with a minimum pressure rating of 300 psig at 480 degrees F. While the design of these components is a delegated design and must meet the calculated requirements for thermal expansion, we would expect to see a minimum of two pipe expansion loops. One of these pipe expansion loops would be in the HP steam piping running from near the top of drawing M-102 toward the bottom, and the second pipe expansion loop would be in the HP steam piping running from the right side of Drawing M-102 toward the left side of Drawing M-101. We would also expect to see that each expansion loop contains four expansion joints.

Item 5

Question: Article 3.2.A.1 of Section 236413.13 specifies concrete bases for the chillers and references section 033000 which is not included in the project manual. Are concrete bases required for the chillers, and if so, please provide section 033000.

Answer: Yes, 6-inch thick concrete bases are required for the chillers. **See attached Specification Section 033000.** Full coordination drawings showing proposed chillers, concrete bases, required service areas, and all associated piping and components are required prior to installation of concrete bases.

Item 6

Question: The check list in the Bid Proposal Form, Page 5 of 11, Check List Item 6, General Contractor Bidder's Qualification Statement – 00 45 14 but there is no section 00 45 14 in the specifications; rather, section 00 45 17 Prime Contractor Bidder's Qualification Statement.

Response: Yes, there is an error in the numbering. Refer to Section 00 45 17.

All questions must be in writing (not phone or e-mail) and must be forwarded to the consulting Architect/Engineer (Steve Gendreau, Fax (203) 234 7376) with copies sent to the DCS Project Manager Wayne E. Thorpe, FAX (860) 713 7261.

End of Addendum 6



Mellanee Walton, Associate Fiscal Administrative Officer
Department of Administrative Services
On Behalf of the Division of Construction Services

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures and finishes for the following applications:
 - a. Equipment bases and pads.
 - b. Footings.
 - c. Foundation walls.
 - d. Slabs-on-grade.
 - e. Suspended slabs.
 - f. Building frame members.
 - g. Building walls.
 - h. Cast-in-place concrete columns/piers.
 - i. Cast-in-place concrete retaining wall.
 - j. Cutting and patching of mechanical and electrical penetrations through cast-in-place concrete.
 - k. Cast-in-place site concrete including curbs and sidewalks.
 - l. Cast-in-place, stamped, concrete pavement.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.

- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
 - 2. Indicate amount of fly ash in the mix.

- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement. Comply with ACI Manual of Standard Practice for Detailing Reinforced Concrete Structures.
 - 1. Blockouts for Architectural Joint Systems: Indicate blockouts and coordination with architectural joint systems

- D. Anchor Bolt Location: Indicate compliance with approved shop drawings.

- E. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Aggregates.

- F. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Form materials and form-release agents.
 - 4. Steel reinforcement and accessories.
 - 5. Waterstops.
 - 6. Curing compounds.
 - 7. Floor and slab treatments.
 - 8. Bonding agents.
 - 9. Adhesives.
 - 10. Vapor retarders.
 - 11. Semirigid joint filler.
 - 12. Joint-filler strips.
 - 13. Repair materials.

- G. Floor surface flatness and levelness measurements to determine compliance with specified tolerances and requirements for applied finishes and materials, except as noted for slope to drains.

- H. Field quality-control test and inspection reports.

- I. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
- B. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
 - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
- C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- D. Welding: No welding of reinforcing will be allowed.
- E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specification for Structural Concrete."
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
 - 3. ACI 318, "Building Code Requirements for Reinforced Concrete".
 - 4. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice".
 - 5. ACI 304, "Recommended Practice for Measuring, Mixing Transporting, and Placing Concrete".
 - 6. ACI 305, "Hot Weather Concreting".
 - 7. ACI 306, "Cold Weather Concreting".
 - 8. ACI 315, "Details and Detailing of Concrete Reinforcement".
 - 9. ACI 347, "Recommended Practice for Concrete Formwork".
 - 10. ACI 211, "Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete".
 - 11. ACI 214, "Recommended Practice for Evaluation of Compressive Test Results of Concrete".
 - 12. ACI 302, "Guide for Concrete Floor and Slab Construction".
 - 13. ACI 201, "Guide to Durable Concrete".
- F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- G. Mockups: Cast concrete slab-on-grade (stamped site pavement and finished building slabs) and formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship.

1. Build panel approximately 200 sq. ft. for slabs-on-grade and 100 sq. ft. for formed surfaces in the location indicated or, if not indicated, as directed by Architect.
 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.
1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete subcontractor.
 2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.7 PROJECT CONDITIONS

- A. Protection of Footings Against Freezing: Cover completed work at footing level with sufficient temporary or permanent cover as required to protect footings and adjacent subgrade against possibility of freezing, maintain cover for time period as necessary.
- B. Protect adjacent finish materials against spatter during concrete placement.

1.8 STORAGE OF MATERIALS

- A. Metal Reinforcement: Store on wood mud sills, off ground. Keep clean of dirt. Provide proper drainage of groundwater.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

- A. Cement: shall be American-made Portland Cement, free from water soluble salts or alkalis which will cause efflorescence on exposed surfaces. Portland Cement shall be Type II, ASTM C150. Use only one brand of cement for each type of cement throughout project. Contractor shall be responsible for whatever steps are necessary to insure that no visual variations in color will result in exposed concrete and shall place on order and secure in advance a sufficient quantity of this cement to complete concrete work specified herein.
1. Fly Ash: ASTM C 618 Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Users as a Mineral Admixture in Portland Cement Concrete. ASTM C 311, Standard Methods of Sampling and Testing Fly Ash and Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete.
 2. Ground Granulated Blast-Furnace Slag: ASTM C 989, Ground Granulated Blast-Furnace Slag for Use in Concrete Mortars. Grade 100 or 120. Standard Practice ACI 226.R1, Ground Granulated Blast-Furnace Slag as a Cementitious Constituent in Concrete.
- B. Normal weight Fine Aggregate: shall be washed, inert, natural sand conforming to ASTM C33 and following additional requirements:

Sieve	Retained Percent	
#4	0 - 5	
#16	25 - 40	
#50	70 - 87	
#100	93 - 97	
Fineness Modulus		2.80 (Plus/Minus 0.20)
Organic		Plate 2 maximum
Silt		2.0 percent maximum
Mortar Strength		100 percent minimum compression ratio
Soundness		5 percent maximum loss, magnesium sulfate, five cycles

- C. Normal weight Coarse Aggregate: shall be well graded crushed stone or washed gravel conforming to ASTM C33 and the following additional requirements:

Designated Size								
(inches)	3	2	1-1/2	1	3/4	1/2	3/8	
F.M.(+/-0.20)	7.95	7.45	7.20	6.95	6.70	6.10	4.50	
Organic	Plate 1 maximum							
Silt	1.0 percent maximum							
Soundness	5 percent maximum loss, magnesium sulfate, five cycles							

Maximum designated sizes for normalweight coarse aggregate to be used in concrete sections shall be as noted below, except that sizes shall also be chosen in conjunction with required clearances.

1. One and one-half inches for sections over ten inches in thickness.
 2. One inch for sections more than eight and up to ten inches in thickness.
 3. Three-quarter inch for sections more than three and up to eight inches in thickness.
- D. Concrete Fill for Steel Stair and Landing Pans: Shall be composed of 1:2:2 mix with three-eighths inch maximum size normalweight aggregate and shall be placed with a 0 inches to 1 inch slump.
- E. Water: Shall be from approved source, potable, clean and free from oils, acids, alkali, organic matter and other deleterious material.
- F. Admixtures:
1. Water-reducing agent: ASTM C 494, Type A, and containing not more than 0.1 percent chloride ions by weight of cement.
 - a. "WRDA" - W.R. Grace & Co.
 - b. "PDA25" - Protex Industries, Inc.
 - c. "Pozzolith 344H" - Master Builder's Co.
 - d. Note: Water-reducing agent shall be by same manufacturer as air-entraining agent.
 2. Air-entraining agent: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
 - a. "DAREX AEA" - W.R. Grace & Co.
 - b. "PROTEX AEA" - Protex Industries
 - c. "MB-VR" or "MB-AE" - Master Builder's Co.
 3. Superplasticizer: High-range water-reducer conforming to ASTM C494, Type F or Type G.
 4. Water-Reducing; Non-Chloride Accelerator Admixture: ASTM C 494, Type C or E, and containing not more than 0.1 percent chloride ions by weight of cement.

Products: Provide one of the following:

- a. "Accelguard 80", Euclid Chemical Co.
 - b. "Pozzotec 20", Master Builders
 - c. "Daraset Accelerator", W. R. Grace
5. Water-Reducing, Retarding Admixture: ASTM C 494, Type D., and containing not more than 0.1 percent chloride ions by weight of cement.

Products: Provide one of the following:

- a. "Pozzolith 100XR", Master Builders
- b. "Eucon Retarder 75", Euclid Chemical Co.
- c. "Daratard", W. R. Grace

6. Concrete Waterproofing admixture: Concrete moisture proofing admixture for interior slab-on-grade construction. (Note: sheet vapor retarder must be compatible with concrete waterproofing admixture and conform to ASTM E 1745-09 Class A vapor barrier maintaining a permeance of 0.01 US perms (grains/ft² *hr*inHg) or less. Sheet vapor barrier shall include manufacturer's recommended adhesive or pressure-sensitive tape.) The Manufacturer shall issue a 10 year warranty, that the product will stop moisture emission from the concrete, and such warranty shall include labor and material for repair, removal and replacement of a moisture remediation system and replacement of flooring materials like or if not available exceeding the quality of the original products.

Products: Provide one of the following:

- a. Barrier-1 Admixture, Barrier-1, Inc.
 - b. Concure Systems Admixture, Concure Systems.
 - c. Moxie 1800 Super-Admix, Moxie International
7. Prohibited Admixtures: Calcium chloride thycyanates of admixtures containing more than 011 percent chloride ions are not permitted.

2.2 CONCRETE MIXTURES

- A. The Contractor shall recommend, on the basis of trial mixes and strength curves specified below, design mixes for each type and strength of concrete. The Testing Agency will verify that the proposed mix designs conform to all specification requirements.
- B. Sufficient materials for concrete mix design shall be furnished by Contractor not less than five weeks before use. Duplicate small samples plainly and neatly labeled with source, where proposed to be used, date, and name of collector shall be provided and presented to Testing Agency for permanent reference.
- C. Mixes shall be designed in accordance with "Method 1" of ACI 301, and the requirements of this Section. All concrete is normalweight unless specifically designated otherwise; air-dry weight not to exceed 150 lbs. per cubic foot.
- D. Limiting values shown below apply for specific strengths of concrete with coarse aggregates less than one and one-half inches unless noted otherwise in TABLE A below.

TABLE A

Use compressive strengths of concrete as shown on the drawings and classes of concrete generally as tabulated below.

1. Class I: All interior concrete not specifically mentioned.
2. Class II: Interior slabs on grade.
3. Class III: All exterior concrete, including but not limited to, walls and foundations.
4. Class IV: Concrete fill on metal deck.
5. Class V: Concrete subject to deicers.
6. Class VI: Concrete framing members.
7. Class VII: Concrete site work, including curbs and sidewalks.
8. Class VIII: Concrete pavement.
9. Class IX: Concrete columns and Piers.

Class Requirements	Strength @ 28 Days	Maximum Water/Cement	Slump	Special
I	3000 PSI	0.54	4"	Note (1)
II	4000 PSI	0.45	3"	Note (3) Note (4) Note (6)
III	4000 PSI	0.54	4"	Note (1) Note (2)
IV	3500 PSI	0.45	3"	Note (1) Note (3) Note (4) Note (6)
V	4000 PSI	0.40	3"	Note (1) Note (2) Note (3)
VI	4000 PSI	0.45	3"	Note (1) Note (3) Note (4)
VII	4500 PSI	0.45	4"	Note (1) Note (2)
VIII	4500 PSI	0.45	4"	Note (1) Note (2) Note (5)
IX	4000 PSI	0.45	4"	Note (1) Note (2) Note (3)

Table A (Continued)

Slump values are those which will be measured at the point of discharge and prior to the addition of super-plasticizer.

Note (1) Use water reducing admixture

Note (2) Use air-entraining admixture

Note (3) High range water reducing admixture (super-plasticizer) may be used to increase slump to a maximum value of 8".

Note (4) Limit air content to 3%.

Note (5) Pigmented concrete with stamped finish, Color to be selected by Landscape Architect.

Note (6) Concrete Waterproofing Admixture.

- E. In all slabs and walls exposed to weather, all concrete shall contain the approved air-entraining admixture as per manufacturer's written instructions, to provide entrained air, by volume, in the cured concrete within 4.5 to 6.5 percent.
- F. Water-Reducing Admixture - The approved water-reducing admixture shall be used in all concrete, in accordance with manufacturer's written instructions.
- G. Concrete slabs, including slabs on grade, shall have a maximum water cement ratio of 0.45.
- H. The approved superplasticizer shall be used in all concrete slabs, including slabs on grade.
- I. Water content and cement content of concrete to be used in work shall be based on curve showing relation between water content, cement content, and 7 and 28 day compressive strengths of concrete made using proposed materials. Curves shall be determined by four or more points, each representing an average of at least three test specimens at each age, and shall have range of values sufficient to yield desired data, including all compressive strengths required by Contract Documents, without extrapolation. Design mix of concrete to be used in work, as determined from curve, shall correspond to following test strengths (TABLE B) obtained in laboratory trial mixtures, but in no case shall resulting mix conflict with limiting values as specified in TABLE A.

TABLE B
Minimum Strength of Lab Trial Mixes (psi)

Design Strength	Trial Mix Strength	
	7-days	28-days
3000	2700	3750
3500	3150	4375
4000	3800	5000
5000	4750	5750
6000	5700	6800

J. Any deviation from approved mix design, which Contractor deems desirable under certain project conditions, will not be allowed without written approval of the Engineer. Cost of any additional testing by Testing Agency associated therewith shall be paid for by Contractor.

K. Evaluation and Acceptance of Concrete

1. The evaluation and acceptance of concrete shall be governed by "Building Code Requirements for Reinforced Concrete" (ACI 318).
2. In general, the strength level of the concrete will be considered satisfactory if the averages of all sets of three consecutively tested concrete specimens equal or exceed the required strength and no individual strength test result falls below the required strength by more than 500 PSI.
3. If the above requirements are not met, and if the likelihood of low strength concrete is confirmed, additional tests shall be performed at the Contractor's expense as outlined in Chapter 4 of the ACI 318 Code or other action appropriate to the circumstances and as determined by the Architect/Engineer shall be taken to assure the load-carrying capacity of the structure under design loads.

2.3 FORM MATERIALS

- A. Construct formwork to shapes, lines, and dimensions required, plumb and straight, secured and braced sufficiently rigid to prevent deformation under load, and sufficiently tight to prevent leakage, all in conformance with ACI Standard 347, "Recommended Practice for Concrete Formwork".
- B. Formwork for exposed concrete shall be medium-density plastic overlaid plywood, 5/8" minimum thickness; for concealed concrete shall be "Plyform" plywood, 5/8" minimum thickness.
- C. Formwork for pan joists shall be re-usable, fiberglass forms.
- D. Chamfer Strips: Half-inch, 45 degree poplar wood strips, nailed six inches on center, and installed in inside corners of all forms for all exterior corners and edges of permanently exposed concrete, unless otherwise directed by the Engineer.

- E. Form Ties and Spreaders: Richmond Tyscrus by Richmond Screw Anchor Co.; Superior-ties by Superior Concrete Accessories, Inc.; or Sure-Grip Ties by Dayton Sure-Grip and Shore Co. Wire ties shall not be used. Ties for foundation walls shall be snap-ties or type specified above with removal cones and shall incorporate water seal washer. Ties shall be arranged in a symmetrical manner.
- F. Form Release Agent: Non-staining and non-emulsifiable type, or equal approved by the Engineer. Form release agent shall be biodegradable and shall not impart any stain to concrete nor interfere with adherence of any material to be applied to concrete surfaces.

2.4 REINFORCEMENT AND ACCESSORIES

- A. Reinforcing Steel Bars: shall be newly rolled billet steel conforming to ASTM A615 Grade 60. Bars shall be bent cold.
- B. Welded Wire Fabric: shall conform to ASTM A185.
- C. All structural steel reinforcement and embedded items shall be hot-dip galvanized after fabrication in accordance with ASTM A123.

All hot-dip galvanized steel shall be inspected for compliance with ASTM A123 and shall be marked with a stamp that indicates the number of ounces of zinc per square foot of steel. After galvanizing, the bars shall be dipped in a 0.2 percent chromic acid solution. A notarized Certificate of Compliance with all of the above shall be required from the galvanizer.

- D. Reinforcement Accessories: shall conform to Product Standard PS7-766, National Bureau of Standards, Department of Commerce, Class C, as produced by Superior Concrete Accessories, Inc.; Dayton Sure-Grip Co.; or R.K.L. Building Specialties Co., Inc. Reinforcement accessories shall include spacers, chairs, ties, slab bolsters, clips, chair bars, and other devices for properly assembling, placing, spacing, supporting, and fastening reinforcement.
- E. Tie wire shall be annealed wire of sufficient strength for intended purpose, but not less than No. 18 gage. Metal supports shall be of such type as not to penetrate surface of formwork and show through surface of concrete. Accessories touching interior formed surfaces exposed to view shall have not less than 1/8 inch of plastic between metal and concrete surface. Plastic tips shall extend not less than 1/2 inch up on metal legs. Individual and continuous slab bolsters and chairs shall be of type to suit various conditions encountered and must be capable of supporting 300 pound load without damage or permanent distortion.

2.5 MISCELLANEOUS MATERIALS

- A. Grout: shall be ready-to-use metallic aggregate product requiring only addition of water at job site such as "Embeco Pre-mixed Grout" by Master Builder's; "Vibro-Foil Ready-Mixed" by W.R. Grace & Co.; or "Ferrolith G" by Sonneborn Building Products, Inc. Grout shall be easily workable and shall have no drying shrinkage at any age. Compressive strength of grout (2" x 2" cubes) shall not be less than 5000 psi at 7 days, and 7500 psi at 28 days.

- B. Membrane Curing Compound: shall conform to ASTM C309, Type 1. Product used shall be shown to be compatible with the later application of coatings. Curing compound shall not be used on any floor slab scheduled to receive an adhered floor finish.
- C. Chemical Hardener: All exposed concrete floor slabs shall be hardened with three applications of fluosilicate chemical hardener followed by two applications of clear acrylic concrete sealer by Sonneborn Division, ChemRex Inc. "Lapidolith"; or equal product by W.R. Meadows Co. or Concrete Service Material Company.

- D. Bonding Compound: Acrylic or Styrene Butadiene:

Products: Provide one of the following:

- a. "J-40 Bonding Agent", Dayton Superior Corp.
- b. "Everbond", L & M Construction Chemicals
- c. "SBR Latex", Euclid Chemical Company
- d. "Daraweld C", W. R. Grace Company

- E. Epoxy Adhesive: ASTM C 881, two component material suitable for use on dry or damp surfaces. Provide material "Type", "Grade", and "Class" to suite project requirements.

Products: Provide one of the following:

- a. "Thiopoxy", W. R. Grace Co.
- b. "Sikadur Hi-Mod", Sika Chemical Co.
- c. "Euco Epoxy 452 or 620", Euclid Chemical Co.

- F. Structural Repair Compound: The Euclid Chemical Company's "Euco Epoxy #460 or #463, Sika Corporation's "Colma-Dur LV", or L & M Construction Chemical's "Epopatch".

- G. Absorption Cover: Burlap cloth made from jute or kenaf, weighting approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.

- H. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.

- 1. Waterproof paper
- 2. Polyethylene film
- 3. Polyethylene-coated burlap

- I. Premoulded Joint Filler: Homex 300 expansion joint filler, ¼" thick by full depth of slab for building slabs, ½" thick by full depth of slab for site work slabs and pavement, as manufactured by Homasote Company. Equivalent non-bituminous material may be used if approved by the Architect/Engineer.

- J. Urethane Joint Filler: Self leveling two part elastomeric joint filler.

Products: Provide one of the following:

- 1. "Sikaflex-2c NS/SL", Sika Corporation
- 2. "3200 Hand-Mix", The Burke Company

3. "Mark-262", Poly-Carb, Inc.
- K. Compressible Backup Material: Closed cell polyethylene foam rod equivalent to Ethafoam sealant backer rod, manufactured by Dow Chemical Company.
- L. Dovetail Slots: Shall be 22 gage material.
Products: Provide one of the following:
 1. "D/A 100", Dur-O-Wal
 2. "AA 100", AA Wire Product Company
 3. "No. 100 Standard", Heckmann
- M. PVC Waterstop: Provide polyvinyl Chloride waterstops conforming to Corps of Engineers CRD-C 572 flat, dumbbell type or centerbulb type waterstops at construction joints and other joints as indicated. Size to suite the joint.

Manufacturer: Subject to compliance with requirements, provide products of one of the following:
 1. Anti-Hydro Waterproofing Co.
 2. The Burke Co.
 3. Harbour Town Products
 4. W. R. Meadows
- N. Below Grade Wall Waterproofing: As specified in Division 07.
- O. Wall Joint Waterproofing: Volclay Hydrobar tube waterproofing manufactured by American Colloid Company.
- P. Joint Seal: Trowel grade form of volclay bentonite with a consistency similar to grease manufactured by American Colloid Company.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine all work prepared by others to receive work of this Section and report any defects affecting installation to the Contractor for correction. Commencement of work will be construed as complete acceptance of preparatory work by others.

3.2 HANDLING, STORAGE, AND PROTECTION OF MATERIALS

- A. Handle and store materials separately in such manner as to prevent intrusion of foreign matter, segregation, or deterioration. Do not use foreign materials or those containing ice. Remove improper and rejected materials immediately from point of use. Cover materials,

including steel reinforcement and accessories, during construction period. Stockpile concrete constituents properly to assure uniformity throughout project.

3.3 EQUIPMENT BASES AND PADS

- A. For all equipment bases and pads, provide 6 inch thick reinforced concrete pad. Pad to extend 12 inches beyond limit of equipment in plan dimensions. Reinforcement to be 6x6 – W1.4xW1.4 welded wire mesh. Provide broom finish on top surface of pad.

3.4 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Construct forms tight enough to prevent loss of concrete mortar.
- D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- E. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- F. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- G. Chamfer exterior corners and edges of permanently exposed concrete.
- H. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- I. Set and maintain formwork to insure complete concrete work within tolerance limits listed in ACI 347 latest edition, "Recommended Practice for Concrete Formwork", and with following additional requirements:
 - 1. Maximum variations from plumb:

- a. In surfaces of columns and walls:

In any 10 feet of length	1/4 inch
Maximum for entire length	1/2 inch

2. Maximum variations from established position in plan shown on the drawings:

Column	1/2 inch
Walls	3/4 inch

3. Variations in cross-sectional dimensions of columns and beams and in thickness of slabs and walls.

Minus	1/8 inch
Plus	1/4 inch

- J. For a minimum of one hour prior to concrete placement, wet forms continuously with water to swell forms in order to prevent leakage of concrete matrix and to minimize absorption of concrete matrix water by form materials. This requirement may be waived for those specific cases where the Engineer deems it unnecessary or impractical. Care must be exercised to prevent a build-up of water at base of forms.
- K. Before form materials can be re-used, surfaces that will be in contact with freshly cast concrete shall be thoroughly cleaned, damaged areas repaired and projecting nails withdrawn. Re-use of form material shall be subject to approval by the Engineer. Follow form liner manufacturer recommendation on reuse of form liner.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.5 PLACING OF REINFORCEMENT

- A. Reinforcement shall be placed in accordance with requirements of CRSI 93, "Recommended Practice for Placing Reinforcing Bars" and CRSI 93, "Recommended Practice for Placing Bar Supports" and with further requirements below.
- B. Reinforcement shall be accurately placed in accordance with Contract Documents and shall be firmly secured in position by wire ties, chairs, spacers, and hangers, each of type approved by the Engineer.
- C. Bending, welding or cutting reinforcement in field in any manner other than as shown on Drawings, is prohibited, unless specific approval for each case is given by the Engineer.
- D. Reinforcement shall be continuous through construction joints unless otherwise indicated on Drawings.

- E. Reinforcement shall be spliced only in accordance with requirements of Contract Documents or as otherwise specifically approved by the Engineer. Splices of reinforcement at points of maximum stress shall generally be avoided. Welded wire fabric shall lap six inches or one space plus two inches whichever is larger, and shall be wired together.
- F. At time concrete is placed, reinforcement shall be free of excessive rust, scale, or other coatings that will destroy or reduce bond requirements. Reinforcement expected to be exposed to weather for a considerable length of time shall be painted with a heavy coat of cement grout. Protect stored materials so as not to end or distort bars in any way. Bars that become damaged will be rejected.
- G. Before concrete is cast, check all reinforcement after it is placed to insure that reinforcement conforms to Contract Documents and approved Shop Drawings. Such checking shall be done only by qualified experienced personnel. In addition, the Engineer shall be notified at least 36 hours prior to concrete placement and given opportunity to inspect completed reinforcement and formwork before concrete placement. Prior approval of Shop Drawings shall in no way limit the Engineer's right to demand modifications or additions to reinforcement or accessories.

3.6 JOINTS

- A. Construction and control joints indicated on Drawings are mandatory and shall not be omitted.
- B. Joints not indicated or specified shall be placed to least impair strength of structure and shall be subject to approval of the Engineer.
- C. Provide keyways at least 1-1/2" deep in construction joints in walls, slabs, and between walls and footings; accepted bulkheads designed for this purpose may be used for slabs.
- D. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints, except as otherwise indicated.
- E. Waterstops: Install waterstops in construction joints where indicated on the drawings in accordance with the manufacturer's recommendations. Each piece of premoulded waterstop shall be the maximum practicable length to limit the number of joints. Joint at intersections and at ends shall be made in accordance with the manufacturer's recommendations and shall develop effective watertightness equal to that of the continuous waterstop.
- F. Isolation Joints in Slabs-on-Ground: Construct isolation joints in slabs-on-ground at points of contact between slabs-on-ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated, using 1/2" thick premoulded joint filler through full thickness of slab.
- G. Contraction (Control) Joints on Slabs-on-Ground: Construct contraction joints in slabs-on-ground to form panels of patterns as shown. Use saw cuts 1/8" x 1/4 slab depth, unless otherwise indicated.
 - 1. Contraction Joints in unexposed floor slabs shall be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.

- H. If joint patterns not shown, provide joints not exceeding 20 feet in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third-bays), with equal or close to equal spacings in each direction.
- I. At exposed interior construction and contraction joints in floor slabs shall be filled with the specified urethane joint filler. Joint preparation and mixing and placing of the joint filler shall be in strict accordance with the directions of the manufacturer. Joints shall not be filled sooner than 28 days after slab placement. Carefully clean joints prior to filling with joint filler.

3.7 INSTALLATION OF EMBEDDED ITEMS

- A. Conform to requirements of ACI 318, paragraph 6.3, "Conduits and Pipes Embedded in Concrete", and as specified below.
- B. Install steel sleeves, embedded wall plates and similar items, furnished by other trades, at locations shown on the drawings.
- C. Anchor bolts for column baseplates shall be installed with templates provided. Vertical alignment and plan locations shall be maintained within one-sixteenth inches of the locations shown on the drawings.
 - 1. Inspection shall be performed by a surveyor licensed in the state the project is located. Certify compliance with shop drawings.
- D. No pipes or conduit of any kind is permitted to be installed in slabs in metal deck.

3.8 MIXING, CONSISTENCY, AND DELIVERY OF CONCRETE

- A. Concrete shall be ready-mixed, produced by plant acceptable to the Engineer. Hand or site mixing shall not be done. Constituents, including admixtures except certain corrosion inhibitors and superplasticizers, shall be batched at central batch plant. Admixtures shall be premixed in solution form and dispensed as recommended by manufacturer.
- B. Central plant and rolling stock equipment and methods shall conform with Truck Mixer and Agitator Standard of Truck Mixer Manufacturer's Bureau of National Ready-Mixed Concrete Association, and Contract Documents. Consistency of concrete at time of deposit shall be as follows:

Portion of Structure	Slump	
	Recommended	Max. Range
Walls columns	4"	3" - 5"
Slabs, beams	3"	2" - 4"

- C. Ready mixed concrete shall be transported to site in watertight agitator or mixer trucks loaded not in excess of rated capacities. Discharge at site shall be within one and one-half hours after

cement was first introduced into mix. Discard cement not discharged within one and one-half hours and dispose of legally. Concrete with a temperature greater than 85 degrees F. shall not be placed. Central mixed concrete shall be plant mixed a minimum of five minutes. Agitation shall begin immediately after premixed concrete is placed in truck and shall continue without interruption until discharged. Transit mixed concrete shall be mixed at mixing speed for at least ten minutes immediately after charging truck followed by agitation without interruption until discharged. Concrete shall be furnished by a single plant unless accepted by the Engineer in writing.

- D. Retempering of concrete which has partially hardened, that is, mixing with or without additional cement, aggregates, or water, will not be permitted.

3.9 PLACING CONCRETE

- A. **Preplacement Inspection:** Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work, cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.
- B. Remove water and foreign matter from forms and excavations and, except in freezing weather or as otherwise directed, thoroughly wet wood forms just prior to placing concrete. Place no concrete on frozen soil and provide adequate protection against frost action during freezing weather.
- C. To secure full bond at construction joints, surfaces of concrete already placed, including vertical and inclined surfaces, shall be thoroughly cleaned of foreign materials and laitance, roughened with suitable tools such as chipping hammers or wire brushes, and recleaned by stream of water or compressed air. Well before new concrete is deposited, joints shall be saturated with water. After free or glistening water disappears joints shall be given thorough coating of neat cement slurry mixed to consistency of very heavy paste. Surface shall receive coating of approximately one-eighth inch thick; this shall be scrubbed in by means of stiff bristle brushes. New concrete shall be deposited before neat cement dries or changes color.
- D. Do not place concrete having slump outside of allowable slump range.
- E. Transport concrete from mixer to place of final deposit as rapidly as practical by methods which prevent separation of ingredients and displacement of reinforcement, and which avoid rehandling. Deposit no partially hardened concrete. When concrete is conveyed by chutes, equipment shall be of such size and U-shaped design as to insure continuous flow in chute. Flat (coal) chutes shall not be employed. Chutes shall be of metal or metal lined and different portions shall have approximately same slope. Slope shall not be less than 25 degrees nor more than 45 degrees from horizontal and shall be such as to prevent segregation of ingredients. Discharge end of chute shall be provided with baffle plate or spout to prevent segregation. If discharge end of chute is more than five feet above surface of concrete in forms, spout shall be used, and lower and maintained as near surface of deposit as practicable. When operation is intermittent, chute shall discharge into hopper. Chute shall be thoroughly cleaned before and after each run and debris and any water used shall be discharged outside forms. Concrete shall not be allowed to flow horizontally over distances exceeding five feet.

- F. Concrete shall be placed in such manner as to prevent segregation, and accumulations of hardened concrete on forms or reinforcement above mass of concrete being placed. To achieve this end, suitable hoppers, spouts with restricted outlets and tremies shall be used as required.
- G. During and immediately after depositing, concrete shall be thoroughly compacted by means of internal type mechanical vibrators or other tools, or by spading to produce required quality of finish. Vibration shall be done by experienced operators under close supervision and shall be carried on only enough to produce homogeneity and optimum consolidation without permitting segregation of constituents or "pumping" of air. Vibrators used for normalweight concrete shall operate at speed at not less than 7,000 vpm and be of suitable capacity. Do not use vibrators to move concrete. Vibration shall be supplemented by proper wooden spade puddling to remove included bubbles and honeycomb adjacent to visible surfaces. At least one vibrator shall be on hand for every 10 cubic yards of concrete placed per hour, plus one spare. Vibrators shall be operable and on site prior to starting placement.
- H. Vertical lifts shall not exceed 18 inches. Vibrate completely through successive lifts to avoid pour lines. Vibrate first lift thoroughly until top of lift glistens to avoid stone pockets, honeycomb, and segregation.
- I. Concrete shall be deposited continuously, and in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause formation of seams and planes of weakness within section. If section cannot be placed continuously between planned construction joints, as specified, field joint and additional reinforcement shall be introduced so as to preserve structural continuity. The Engineer shall be notified in any such case.
- J. Cold joints, particularly in exposed concrete, including "honeycomb", are unacceptable. If they occur in concrete surfaces exposed to view, the Engineer will require that entire section in which blemish occurs be removed and replaced with new materials at Contractor's expense.
- K. When placing exposed concrete walls or columns, strike corners of forms rapidly and repeatedly from outside along full height while depositing concrete and vibrating.
- L. Chutes, hoppers, spouts, adjacent work, etc. shall be thoroughly cleaned before and after each run and water and debris shall be discharged outside form.

3.10 FINISHING OF UNFORMED CONCRETE SURFACES

- A. Smooth troweled finish: shall be provided where concrete flatwork is to be exposed in the finished work or is to receive resilient flooring materials.
 - 1. After floating, being first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances of F_F 20 – F_L 17. Grind smooth surface defects which would telegraph through applied floor covering system. For concrete slabs on metal deck level surface to a tolerance of F_F 25.

- B. Floated finish: shall be provided where concrete flatwork is to receive waterproofing membranes or setting beds for finished materials.
- C. Rough struck surface shall be provided at top of pedestals.
- D. Steel Broom Finish (with smooth edging): shall be provided at exterior concrete walks, pavements and steps. Sidewalks shall receive a broom finish perpendicular to the run of the sidewalk.
- F. Site curbs shall receive a rubbed and brushed finish.
- E. Contractor, at his own expense, shall level depressed spots and grind high spots in concrete surfaces which are in excess of specified tolerances. Leveling materials proposed for providing proper surface shall be approved by the Engineer.

3.11 REPAIRING OF UNFORMED CONCRETE SURFACES

- A. Tops of slabs and top of walls shall be repaired by using either same material as originally cast or by use of dry-pack material, as approved by the Engineer. Areas affected shall be chipped back square and to depth of one inch minimum. Hole shall then be moistened with water for a minimum of two hours, followed by brush coat of 1/16 inch thick cement paste. Immediately plug hole with concrete, or with dry pack material consisting of 1:1.5 mixture of cement and concrete sand mixed slightly damp to touch. Hammer dry-pack into hole until dense, and excess paste appears on surface. Finish patch flush and to same texture as surrounding concrete. For large repairs employ 1-1-2 mixture of cement, concrete sand and pea gravel at same dry-pack consistency.

3.12 CURING AND PROTECTION

- A. When concrete is placed at or below ambient air temperatures of 40 degrees F. or whenever in opinion of the Engineer, such or lower temperatures are likely to occur within 48 hours after placement of concrete, cold weather concreting procedures, according to ACI 306 and as specified herein, shall be followed. To this end, entire area affected shall be protected by adequate housing or covering, and heating. No salt, chemicals or other foreign materials shall be used in the mix to lower freezing point of concrete.
- B. Protect concrete work against injury from heat, cold, and defacement of any nature during construction operations.
- C. Concrete shall be treated and protected immediately after concreting or cement finishing is completed, to provide continuous moist curing above 50 degrees F. for at least seven days, regardless of ambient air temperatures.
- D. Concrete shall be wet cured for a minimum of 96 hours after placing and finishing.
- E. Curing compounds will not be permitted for slabs, and framed concrete structure.

- F. Keep permanent temperature record showing date and outside temperature for concreting operations. Thermometer readings shall be taken at start of work in morning, at noon, and again late in afternoon. Locations of concrete placed during such periods shall likewise be recorded, in such manner as to show any effect temperatures may have had on construction. Copies of temperature record shall be distributed daily to the Engineer.

3.13 HARDENER

- A. Prepare surfaces and apply surface hardener to all concrete floors not receiving resilient flooring, ceramic tile or membrane waterproofing.
- B. Prepare surface and apply special sealer system to all concrete flatwork and curbs exposed to the elements.

3.14 REMOVAL OF FORMWORK, SHORING AND RESHORING

- A. Contractor shall be responsible for proper removal of formwork, shoring, and reshoring.
- B. Forms shall be removed only after concrete has attained sufficient strength to support its shown weight, construction loads to be placed thereon and lateral loads, without damage to structure or excessive deflection.
- C. Forms and supports shall remain in place for not less than minimum periods of time noted below. These periods represent cumulative number of days or fractions thereof, consecutive unless otherwise approved by the Engineer during which time mean daily air temperature at surfaces of concrete is above 50 degrees F.
 - 1. Vertical surfaces: concrete shall have reached 100 day-degrees* and shall have attained strength of not less than 30 percent of f_c . Where such forms also support formwork for slab or beam soffits, removal times for latter shall govern.
 - 2. Horizontal surfaces: except as noted below, concrete shall have reached 300 day-degrees* of curing and attained strength of not less than 60 percent of f_c .
 - a. Soffits of beams or girders shall remain supported and in place until concrete has attained 600 day-degrees*.
 - b. Forms and supports of floor slabs shall remain in place until concrete has reached 400 day-degrees*.

*Definition of day-degrees: Total number of days times mean daily air temperature at surfaces of concrete. For example, five days at temperature of 60 degrees F. equals 300 day degrees. Days or fractions of days in which temperature is below 50 degrees F. shall not be included in calculation of day-degrees.

- D. Form removal shall be so performed that reshores are placed at same time as stripping operations, and that no area larger than one-fourth of a slab panel is unsupported at any time.

- E. Any test cylinders required to verify the specified minimum strengths for form removal shall be field cured under the same conditions as the concrete they represent. Such cylinders and testing shall be at the Contractor's expense.

3.15 REPAIRING AND FINISHING OF FORMED AND ARCHITECTURAL CONCRETE SURFACES

- A. In accordance with the provisions of ACI 301, Chapter 10, all concrete shall have "smooth form finish".
- B. Intent of this Specification is to require forms, mixtures of concrete, and workmanship so that concrete surfaces will require no patching, except for plugging of tie holes. However, where patching is acceptable to the Engineer, procedure described below shall be followed.
- C. Defective concrete and honeycombed areas shall not be patched unless examined and approval is given by the Engineer. If such approval is received by Contractor, areas involved shall be chipped down square and at least one inch deep to sound concrete by means of cold chisels or pneumatic chipping hammers. If honeycomb exists around reinforcement, chip to provide clear space at least three-quarter inch wide all around steel to afford proper ultimate bond thereto. For areas less than one and one-half inches deep, patch shall be made in same manner as described above for filling unformed concrete surfaces, care being exercised to use crumbly-dry (non-trowelable) mixtures and to avoid sagging. Thicker repairs shall require build-up in successive days, each layer being applied as described. To aid strength and bonding of multiple layer repairs, non-shrink, non-metallic aggregate shall be used as an additive as follows:

Materials	Volumes	Weights
Cement	1.0	1.0
Non-Metallic Aggregate	0.15	0.25
Sand	1.5	1.55

For very heavy (generally, formed) patches, pea gravel may be added to mixture and proportions modified as follows:

Materials	Volumes	Weights
Cement	1.0	1.0
Non-Metallic Aggregate	0.2	0.33
Sand	1.0	1.0
Pea Gravel	1.5	1.55

After hardening, rub lightly as described above for form tie holes.

1. Mortar for patching shall be same mix as above except aggregate shall pass a No. 14 sieve.
 2. For all concrete to receive "smooth" finish, remove formwork fins and clean entire surface of grease, form oil, laitance, dust, and other foreign matter.
 3. "Smooth" finish shall consist of having all fins removed, joint marks smoothed off, blemishes removed, and surfaces left smooth and unmarred.
 4. Begin finishing operations as soon as practicable after removal of forms, continue with curing operations after finishing is completed. After concrete has been well cured, carefully inspect surfaces. Remove any fins, rough spots, streaks, hardened mortar or grout and other foreign material. Patch defects with finishing mortar as specified above, to satisfaction of the Engineer.
- D. Patches which become crazed, cracked, or sound hollow upon tapping shall be removed and replaced with new material at Contractor's expense.

3.16 CLEANING

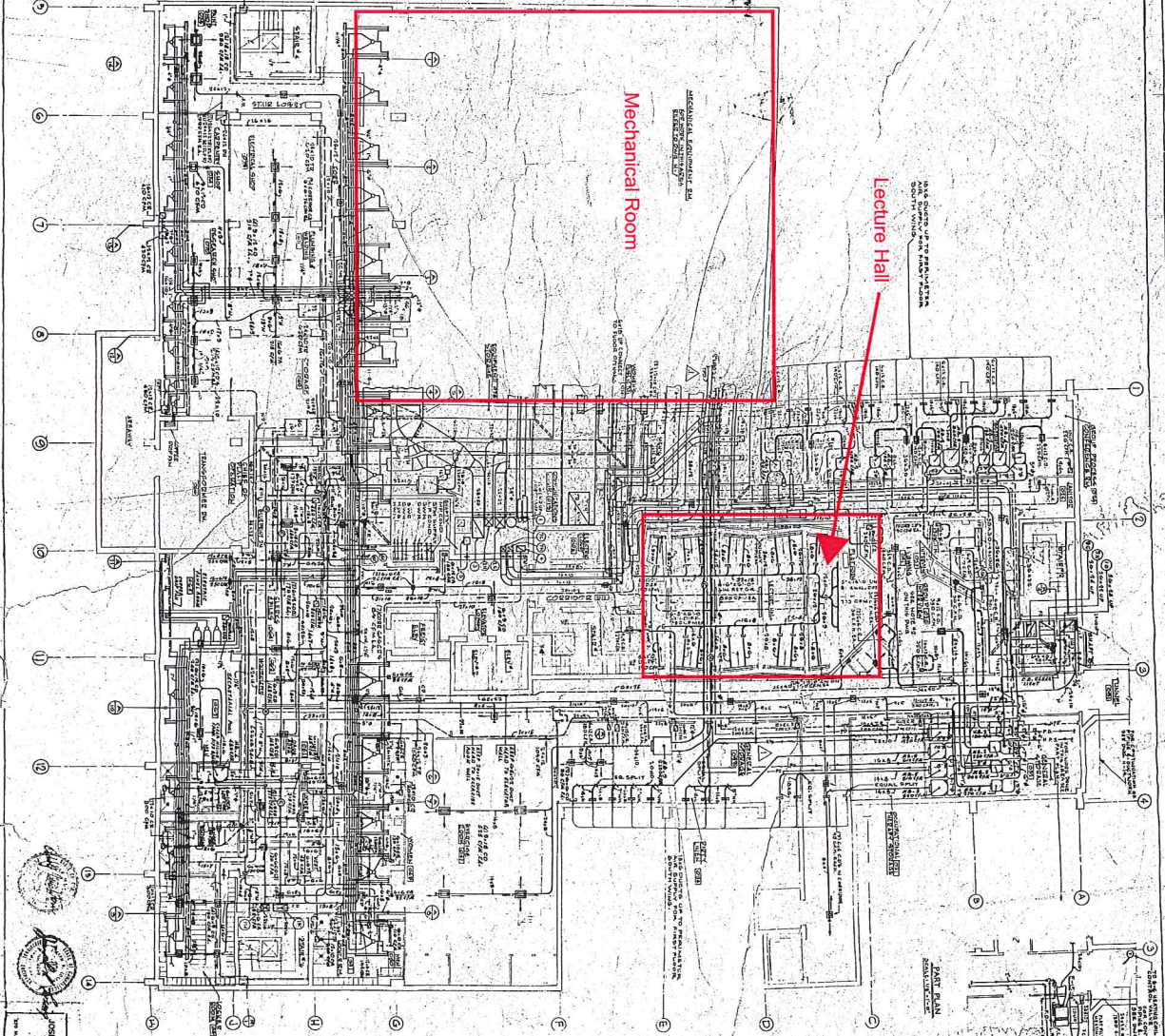
- A. Concrete surfaces shall be cleaned of objectionable stains as determined by the Engineer. Materials containing acid in any form or methods which will damage "skin" of concrete surfaces shall not be employed, except where otherwise specified.

3.17 QUALITY CONTROL

- A. The testing laboratory will analyze the proposed concrete design mix and sample and test aggregate and concrete as follows:
1. Fine Aggregate Tests: Organic content, sieve analysis, fineness modulus.
 2. Coarse Aggregate Tests: Sieve analysis
 3. Mix Design: Refer to Section 033000-1.3 and 2.5 for requirements and submittal format.
- B. The Testing Laboratory will perform the following field tests:
1. Secure samples in accordance with ASTM C 172 except modified for slump to comply with ASTM C 94.

2. Slump: ASTM C 143, one test for each 100 cubic yards, or fraction thereof, at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
 3. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete. ASTM C 231 pressure method for normal weight concrete, one for each day's pour of each type of air-entrained concrete.
 4. Concrete Temperature: Test hourly when air temperature is 40 deg F (4 deg C) and below, and when 80 deg F (27 deg C) and above, and each time a set of compression test specimens made.
 5. Compression Test Specimen: ASTM C 31; one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.
 6. Compressive Strength Tests: ASTM C 39; one set for each day's pour exceeding 5 cu. yds. plus additional sets for each 100 cu. yds. Of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.
 7. When frequency of testing will provide less than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.
 8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedure for protecting and curing the in-place concrete.
 9. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.
- C. Test results will be reported in writing to the Structural Engineer and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength and type of break for both 7-day tests and 28-day tests.
1. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by the Engineer. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests when unacceptable concrete is verified.
- A. Reinforcing: The testing service will inspect the location and installation details of all reinforcing steel for compliance with the approved drawings, specifications and ACI 318.

END OF SECTION 033000



I certify the accuracy of the above information.
 Date: _____

BASEMENT FLOOR PLAN
H 1

HEATING, VENTILATING & AIR CONDITIONING
 STATE OF CONNECTICUT
 PUBLIC WORKS DEPARTMENT
 COMMISSIONER

DESIGNED BY	JOSEPH R. LOBBE & ASSOCIATES CONSULTING ENGINEERS
DATE	1964
PROJECT	CONNECTICUT MENTAL HEALTH CENTER
PREPARED BY	PERDREY & TILNEY
DATE	1964

H. L. ...
 ...

1. THIS DRAWING IS TO BE USED IN CONNECTION WITH THE ...
 2. ...
 3. ...
 4. ...