

October 19, 2013

Iowa City VA Healthcare System
601 Highway 6 West
Iowa City, Iowa 52246

400 Car Parking Garage
Description of Deductive Alternates

Deduct Alternate 1

Sketches and revised specification sections relating to Deduct Alternate 1 follow this page.

Item 1 Division 03 - Concrete

Delete all references to class A finish – no rubbing of concrete is required – as cast smooth-formed finish is acceptable.

Exterior surfaces exposed to view to be class B finish, and interior concrete surfaces to be class C finish.

Note: Surface irregularities, fins and bumps with up to a 1/4" projection are allowed in a class B finish. Projections to a 1/2" are allowed in a class C finish.

See revised Concrete Specification: 03 30 00

See architectural sketch: A-SK-01 10.01.13

Item 2 Division 09 - Finishes

Delete all interior painting of concrete at stair enclosures and elevator lobbies.

See revised finish schedule: 09 06 00, and specification section: 09 91 00

Item 3 Division 09 - Finishes

Delete all exterior architectural concrete coating from the project scope.

See revised finish schedule: 09 06 00, and specification section: 09 91 00

Item 4 Division 33 - Utilities

Delete extension of the sanitary line, work to be done in another contract by others.

Refer to Civil Sketch C-SK 03 for revised scope

Item 5 Division 03 - Concrete

Delete concrete construction on all levels, between column lines 15 and 16A at A-A'

See structural sketches: S-SK 08- 10.18.13 thru S-SK 15- 10.18.13

See architectural sketches: A-SK 10.09.13 A1, A-SK 10.09.13 A6 and A-SK 10.09.13 A10

See Architectural Graphics sketches: AG SK 01- 10.18.13 thru AG SK 04- 10.18.13

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies cast-in-place structural concrete and materials and mixes for other concrete.

1.2 RELATED WORK:

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Concrete roads, walks, and similar exterior site work: Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.
- C. Waterproofing treatment of slabs: Section 07 18 00, TRAFFIC COATINGS & 07 19 00 TRAFFIC BEARING WATER REPELLENTS.
- D. Sealants at joints: Section 07 92 00, JOINT SEALANTS.
- E. Pavement Traffic and Warning Markings: Section 32 17 23, PAVEMENT MARKINGS.

1.3 TESTING AGENCY FOR CONCRETE MIX DESIGN:

- A. Testing agency retained and reimbursed by the Contractor and approved by Project Manager.
- B. Testing agency maintaining active participation in Program of Cement and Concrete Reference Laboratory (CCRL) of National Institute of Standards and Technology. Accompany request for approval of testing agency with a copy of Report of Latest Inspection of Laboratory Facilities by CCRL.
- C. Testing agency shall furnish equipment and qualified technicians to establish proportions of ingredients for concrete mixes.

1.4 TOLERANCES:

- A. Formwork: ACI 117, except the elevation tolerance of formed surfaces before removal of shores is +0 mm (+0 inch) and -20 mm (-3/4 inch).
- B. Reinforcement Fabricating and Placing: ACI 117, except that fabrication tolerance for bar sizes Nos. 10, 13, and 16 (Nos. 3, 4, and 5) (Tolerance Symbol 1 in Fig. 2.1(a), ACI, 117) used as column ties or stirrups is +0 mm (+0 inch) and -13 mm (-1/2 inch) where gross bar length is less than 3600 mm (12 feet), or +0 mm (+0 inch) and -20 mm (-3/4 inch) where gross bar length is 3600 mm (12 feet) or more.

- C. Cross-Sectional Dimension: ACI 117, except tolerance for thickness of slabs 12 inches or less is +20 mm (+3/8 inch) and - 6 mm (-1/4 inch). Tolerance of thickness of beams more than 300 mm (12 inch) but less than 900 mm (3 feet) is +20 mm (+1/2 inch) and -10 mm (-3/8 inch).
- D. Slab Finish Tolerance : ACI 301, Paragraph 5.3.4.2 and ACI 117, paragraph 4.5.7: The gap at any point between the straightedge and the floor (and between the high spots) shall not exceed 0.5 in. In addition, floor surface shall not vary more than plus or minus 0.75 in. from elevation noted on Drawings anywhere on floor surface.

1.5 REGULATORY REQUIREMENTS:

- A. ACI SP-66 - ACI Detailing Manual.
- B. ACI 318 - Building Code Requirements for Reinforced Concrete.
- C. ACI 301 - Standard Specifications for Structural Concrete.

1.6 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Submittals and Resubmittals: Project Manager will review each of Contractor's shop drawings and/or submittal data the initial time and, should resubmittal be required, one additional time to verify that reasons for resubmittal have been addressed by Contractor and corrections made. Resubmittal changes/revisions/corrections shall be circled. Project Manager will review only circled items and will not be responsible for non-circled changes/revisions/corrections and additions. Should additional resubmittals be required, Contractor shall reimburse Owner for all costs incurred, including the cost of Engineer's services made necessary to review such additional resubmittals. Owner will in turn reimburse Engineer.
- C. Requests for Information:
 - 1. Engineer reserves the right to reject, any Request for Information (RFI) that the Engineer, at its sole discretion, deems frivolous.
 - 2. Engineer reserves the right to reject, any RFI that the Engineer, at its sole discretion, deems already answered in the Contract Documents.
 - 3. RFI process shall not be used for requesting substitutions. Procedures for substitutions are clearly specified elsewhere in the contract documents.
- D. Submit evidence of licensure in Iowa for professional engineer providing professional services as required for Contractor in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures.

1. Contractor's responsibilities include formwork, shoring and re-shoring procedures, and other work described in Article "Contractors Professional Design Services", Article "Formwork", and Article "Shores and Re-Shores".
2. Performance and design criteria are shown on the Drawings and in Article "Contractor's Professional Services - Performance and Design Criteria".
3. Contractor's Professional Engineer shall furnish Owner a Certificate of Professional Liability Insurance in minimum amount of \$1,000,000 per claim.

E. Shop Drawings: Reinforcing steel: Complete shop drawings

1. Prepare placing drawings that detail fabrication, bending and placement of concrete reinforcement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hook spacing, and supports for concrete reinforcement. Comply with ACI SP-66, "ACI Detailing Manual." Include special reinforcement required for openings through concrete structures.

F. Mill Test Reports:

1. Reinforcing Steel.
2. Cement.

G. Manufacturer's Certificates:

1. Abrasive aggregate.
2. Air-entraining admixture.
3. Chemical admixtures, including chloride ion content.
4. Waterproof paper for curing concrete.
5. Liquid membrane-forming compounds for curing concrete.
6. Non-shrinking grout.
7. Waterstops.
8. Expansion joint filler.
9. Adhesive binder.
10. Form materials and form release agents.
11. Steel reinforcement and accessories.

12. Fiber reinforcement.
 13. Vapor Barriers.
 14. Repair materials.
 15. Submit certification that evaporation reducer, if used, is compatible with sealer specified in Division 7 Section "Traffic Bearing Water Repellents", and Traffic Coatings specified in Division 7 "Traffic Coatings", and sealant specified in Division 7 Section "Joint Sealants.
 16. Submit certification that evaporation reducer is compatible with pavement marking specified in Division 32 Section "Pavement Markings."
- H. Testing Agency for Concrete Mix Design: Approval request including qualifications of principals and technicians and evidence of active participation in program of Cement and Concrete Reference Laboratory (CCRL) of National Institute of Standards and Technology and copy of report of latest CCRL, Inspection of Laboratory.
- I. Submit concrete mixture proportions to Project Manager for each concrete mixture. Submit alternate mixture proportions when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
1. Provide mixture proportions not less than four weeks before placing concrete and not less than one week before pre-installation conference (pre-concrete meeting).
 2. Proportion mixtures as defined in ACI 301 Section 4 header "Proportioning," Mixtures shall be proportioned by party other than Testing Agency responsible for testing Project concrete.
 3. Use mixture proportions submission form at end of this Section for each concrete mixture. Any other mixture proportion submission form needs to identify submittal of all items listed in the specification submittal form and the following:
 - a. Mixture Proportion Identification and use.
 - b. Method used for documentation of required average compressive strength, (ACI 301 Section 4 - Field test data or Trial mixtures).
 - c. Gradation of fine and coarse aggregates.
 - d. Proportions of all ingredients including all admixtures added either at time of batching or at job site.
 - e. Water/cementitious materials ratio.
 - g. Certification of the chloride content of admixtures.
 - h. Density (unit weight) of concrete, ASTM C 138.

- i. Water soluble chloride ion content of concrete: ASTM C 1218.
- j. Certificate of analysis of coal fly ash or processed ultra fine fly ash: Comply with ASTM C618, Class C or F.
- J. Testing Agency: Promptly report all field concrete test results to Project Manager, Contractor and Concrete Supplier. Include following information:
 - 1. See Article "Quality Assurance."
 - 2. Density (unit weight) of concrete, ASTM C 138.
 - 3. Slump, ASTM C 143.
 - 4. Slump flow, ASTM C 1611 (for SCC).
 - 5. Concrete temperature at placement time. ASTM C 1064
 - 6. Air temperature at placement time.
 - 7. Strength determined in accordance with ASTM C 39.
- K. Contractor: Submit grout temperature limitations with grout submittal.
- L. Submit current certification of welders.

1.7 DELIVERY, STORAGE, AND HANDLING:

- A. Conform to ACI 304. Store aggregate separately for each kind or grade, to prevent segregation of sizes and avoid inclusion of dirt and other materials.
- B. Deliver cement in original sealed containers bearing name of brand and manufacturer, and marked with net weight of contents. Store in suitable watertight building in which floor is raised at least 300 mm (1 foot) above ground. Store bulk cement and fly ash in separate suitable bins.
- C. Deliver other packaged materials for use in concrete in original sealed containers, plainly marked with manufacturer's name and brand, and protect from damage until used.
- D. Store all formwork and formwork materials clear of ground, protected, to preclude damage.
- E. Deliver reinforcement to Project site bundled, tagged and marked. Use metal clips indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.
- F. Store concrete reinforcement materials at site to prevent damage and accumulations of dirt or excessive rust.
- G. Avoid damaging coatings on epoxy coated reinforcement:
 - 1. Contact areas of handling and hoisting systems shall be padded or be

- made of nylon or other acceptable material.
2. Use spreader bars to lift bundles of coated bars to prevent bar-to-bar abrasion.
 3. Pad bundling bands or fabricate of nylon or other acceptable material.
 4. Store coated bars on padded or wooden cribbing.
 5. Do not drag coated bars.
 6. After replacement, restrict traffic on coated bars to prevent damage.
 7. Repair damaged epoxy coatings according to ASTM D 3963.
- H. Concrete transported by truck mixer or agitator shall be completely discharged within one and one half-hours (one hour for hot weather concreting) after water has been added to cement or cement has been added to aggregate. Schedule deliveries to allow for delays due to weather, traffic, etc.

1.8 PRE-CONCRETE CONFERENCE:

- A. General: At least 15 days prior to submittal of design mixes, conduct a meeting to review proposed methods of concrete construction to achieve the required results.
- B. Agenda: Includes but is not limited to:
1. Submittals.
 2. Coordination of work.
 3. Availability of material.
 4. Concrete mix design including admixtures.
 5. Methods of placing, finishing, and curing.
 6. Finish criteria required to obtain required flatness and levelness.
 7. Timing of floor finish measurements.
 8. Material inspection and testing.
 9. A summary of concrete procedures to protect fresh concrete from rain.
- C. Attendees: Include but not limited to representatives of Contractor; subcontractors involved in supplying, conveying, placing, finishing, and curing concrete; admixture manufacturers; Project Manager; Consulting Engineer; Contractor retained testing laboratories for concrete testing and finish verification.

D. Minutes of the meeting: Contractor shall take minutes and type and distribute the minutes to attendees within five days of the meeting.

1. The minutes shall include a statement by the Concrete Contractor indicating that the proposed mixture proportions and placing/finishing/curing techniques can produce the concrete quality required by these specifications.

1.9 CONTRACTOR'S PROFESSIONAL SERVICES - PERFORMANCE AND DESIGN CRITERIA

- A. Provide professional services for temporary conditions during construction and portions of the Work required to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Specific requirements and criteria include, but are not limited to the following:
1. Design, erect, shore, brace, and maintain formwork, according to ACI 301 and ACI 347 to support vertical, lateral, static and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads. The contractor is responsible for layout and design, reviews, approvals, and inspections.
 2. Design formwork, shoring, bracing, and other conditions for structural requirements and stability during construction until final structure is completed and accepted.
 - a. Comply with ACI 347.2 for design, installation, and removal of shoring and reshoring.
 - b. Superimposed loads to the concrete structure, slab-on-grade, and soil shall be less than the design loads as shown on Drawings.
 - c. Plan sequence of removal of shores and reshores to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excess stress or deflection.

1.10 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed concrete work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer Qualification: An experienced supplier who is experienced in manufacturing ready-mixed concrete products complying with ASTM C94 requirement for production facilities and equipment. Manufacturer shall also be certified according to the National Ready Mixed Concrete Association's Certifications of Ready Mixed Concrete Production Facilities.
- C. Codes and Standards: Comply with provisions of following codes, specifications, and standards, except where more stringent requirements are shown or specified:

1. ACI 301, "Specifications for Structural Concrete."
 2. ACI 318, "Building Code Requirements for Structural Concrete and Commentary."
 3. ACI 117, "Standard Specifications for Tolerances for Concrete Construction and Materials."
 4. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice."
- D. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in Iowa and who is experienced in providing professional engineering services of the kind indicated. See Article "Contractor's Professional Services Performance and Design Criteria".
- E. Welders and welding procedures shall conform to requirements of AWS D1.4. Except where shown Drawings, welding of reinforcing steel is prohibited unless accepted by Project Manager in writing.
- F. Submit steel producers certificates of mill analysis, tensile tests, and bend tests for reinforcing steel. Coordinate with welders and welding procedures.
- G. Inspection of concrete steel reinforcement is required in accordance with International Building Code Section 109. Inspections shall be conducted by an inspection agency employed by Contractor and approved by Project Manager. Inspector shall provide report in approved format to Owner with copy to Project Manager and Contractor. Inspection agency has authority to reject reinforcing not meeting Contract Documents. Inspections for all reinforcing steel for conformance to shop drawings and Contract Documents shall be completed prior to concrete placement.
- H. Epoxy coated reinforcement, ASTM A775 and A884:
1. Coating applicator shall have quality control program to assure that coated reinforcement comply with requirements of Specifications.
 2. Submit proof of current certification for rebar coating plant from Concrete Reinforcing Steel Institute.
- I. Submit following information on Inspection of Reinforcement.
1. Project name and location.
 2. Contractor's name.
 3. Inspection Agency's name, address, and phone number.
 4. Date and time of inspection.
 5. Inspection Agency technician's name.
 6. Fabricator's name.

7. Weather data:

- a. Air Temperatures.
- b. Weather.
- c. Wind speed.

8. Inspection location within structure.

9. Reinforcement inspection data (including but not limited to):

- a. Bar size, spacing, cover, and grade.
- b. Splices, bends, anchorages, welding.
- c. Epoxy coating or galvanizing as required.
- d. Support methods and construction sequencing.

10. Diary of general progress of Work.

J. Testing Agency Qualifications:

- 1. Independent agency, acceptable to authorities having jurisdiction, the Project Manager and acceptable to Engineer of Record, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
- 2. Testing laboratory shall submit documented proof of ability to perform required tests.
- 3. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 4, according to ACI CP-1 or an equivalent certification program.

K. Testing Agency is responsible for conducting, monitoring and reporting results of all tests required under this Section. Testing Agency shall immediately report test results showing properties that do not conform to Project Specification requirements to General Contractor's authorized on-site representative and to Owner's authorized on-site representative.

L. Submit following Field Test information for Project Concrete:

- 1. Project name and location.
- 2. Contractor's name.
- 3. Testing Agency's name, address, and phone number.
- 4. Concrete supplier.
- 5. Date of report.
- 6. Testing Agency technician's name (sampling and testing).

7. Placement location within structure.
8. Time of batching.
9. Time of testing.
10. Elapsed time from batching at plant to discharge from truck at site.
11. Concrete mixture data (quantity and type):
 - a. cement
 - b. Fine aggregates.
 - c. Coarse aggregates.
 - d. Water.
 - e. Water-reducing admixture and high-range water-reducing admixture.
 - f. Other admixtures, including supplementary cementitious materials.
 - g. Supplementary cementitious materials.
12. Weather Data:
 - a. Air temperatures.
 - b. Weather
 - c. Wind Speed.
13. Field test data:
 - a. Date, time and place of test.
 - b. Slump.
 - c. Air content.
 - d. Concrete Temperature.
 - e. Density (Unit weight).
14. Compressive test data:
 - a. Cylinder number.
 - b. Age of concrete when tested.
 - c. Date and time of cylinder test.
 - d. Curing time (field and lab).
 - e. Cross-sectional area of cylinder.

f. Compressive strength.

g. Type of failure (at break).

- M. All concrete flatwork finishers on Project shall hold current ACI Concrete Flatwork Finisher certification. Submit certification for each concrete flatwork finisher at Concrete Pre-construction Conference and obtain Project Manager's written acceptance.
- N. Mockups: Before casting concrete, build mockups to verify selections made under sample submittals and to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
1. Build one acceptable test panels approximately 600 sq. ft. for flatwork in parking drive areas slab-on-grade in the location indicated or, if not indicated, submit a request for acceptance of the proposed location at the project site.
 2. Stains, bugholes or other surface blemishes that deviate from the mockup will not be acceptable.
 3. Demonstrate curing, cleaning, and protecting of cast-in-place architectural concrete, finishes, and contraction joints, as applicable.
 4. Obtain Project Manager's acceptance of mockups before casting concrete with specified finishes.
 5. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- O. Fly ash supplier shall make available qualified individual, experienced in placement of fly ash concrete, to aid Contractor. Qualification of supplier's representative shall be acceptable to Owner. Representative shall attend pre-construction meeting, and shall be present for all trial placements, initial startup and then as required by Owner.
- P. Provide certification that evaporation reducer are compatible with sealer and traffic topping specified in Division 7, and sealant specified in Division 7, Section "Joint Sealants".
- Q. At all times during high-evaporation conditions, maintain adequate supply of evaporation reducer at site. Do not use evaporation reducer as finishing aid. See Part 3.
- R. Testing Agency: Identify those trucks of concrete supplier's which meet requirements of NRMCA Quality Control Manual. Permit only those trucks to deliver concrete to Project.

1.11 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. American Concrete Institute (ACI):

117-06.....	Tolerances for Concrete Construction and Materials
211.1-02.....	Selecting Proportions for Normal, Heavyweight, and Mass Concrete
211.2-04.....	Selecting Proportions for Structural Lightweight Concrete
214R-02.....	Evaluation of Strength Test Results of Concrete
301-05.....	Structural Concrete
304R-2000.....	Guide for Measuring, Mixing, Transporting, and Placing Concrete
305R-06.....	Hot Weather Concreting
306R-(2002).....	Cold Weather Concreting
308R-(2001).....	Standard Practice for Curing Concrete
309R-05.....	Guide for Consolidation of Concrete
31808.....	Building Code Requirements for Reinforced Concrete and Commentary
347R-04.....	Guide to Formwork for Concrete
362.1.....	Guide for the Design of Durable Parking Structures
SP-66-04.....	ACI Detailing Manual

C. American National Standards Institute and American Hardboard Association (ANSI/AHA):

A135.4-2004.....	Basic Hardboard
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D. American Society for Testing and Materials (ASTM):

A82/A82M-07.....	Steel Wire, Plain, for Concrete Reinforcement
A185/185M-07.....	Steel Welded Wire Fabric, Plain, for Concrete Reinforcement

A615/A615M-08.....Deformed and Plain Billet-Steel Bars for
Concrete Reinforcement

A653/A653M-07.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-
Iron Alloy-Coated (Galvannealed) by the Hot-Dip
Process

A706/A706M-06.....Low-Alloy Steel Deformed and Plain Bars for
Concrete Reinforcement

A767/A767M-05.....Zinc-Coated (Galvanized) Steel Bars for
Concrete Reinforcement

A820-06.....Steel Fibers for Fiber-Reinforced Concrete

A996/A996M-06.....Rail-Steel and Axle-Steel Deformed Bars for
Concrete Reinforcement

B633.....Standard Specification for Electrodeposited
Coatings of Zinc on Iron and Steel

C31/C31M-08.....Making and Curing Concrete Test Specimens in
the field

C33-07.....Concrete Aggregates

C39/C39M-05.....Compressive Strength of Cylindrical Concrete
Specimens

C94/C94M-07.....Ready-Mixed Concrete

C138.....Standard Test Method for Unit Weight, Yield and
Air Content of Concrete

C143/C143M-05.....Slump of Hydraulic Cement Concrete

C150-07.....Portland Cement

C171-07.....Sheet Materials for Curing Concrete

C172-07.....Sampling Freshly Mixed Concrete

C173-07.....Air Content of Freshly Mixed Concrete by the
Volumetric Method

C192/C192M-07.....Making and Curing Concrete Test Specimens in
the Laboratory

C231-08.....Air Content of Freshly Mixed Concrete by the
Pressure Method

C260-06.....Air-Entraining Admixtures for Concrete

C309-07.....Liquid Membrane-Forming Compounds for Curing
Concrete

C311.....Standard Test Methods for Sampling and Testing
Fly Ash or Natural Pozzolans for use as a
Mineral Admixture in Portland Cement Concrete

C330-05.....Lightweight Aggregates for Structural Concrete

C494/C494M-08.....Chemical Admixtures for Concrete

C496-06.....Splitting Tensile Strength of Cylindrical
Concrete Specimens

C567-05.....Density of Structural Lightweight Concrete

C618-08.....Coal Fly Ash and Raw or Calcined Natural
Pozzolan for Use as a Mineral Admixture in
Concrete

C666/C666M-03.....Resistance of Concrete to Rapid Freezing and
Thawing

C881/C881M-02.....Epoxy-Resin-Base Bonding Systems for Concrete

C989.....Standard Specification for Ground Granulated
Blast-Furnace Slag for Use in Concrete and
Mortars

C1077.....Standard Practice for Laboratories Testing
Concrete and Concrete Aggregate for Use in
Construction and Criteria for Laboratory
Evaluation

C1107/1107M-07.....Packaged Dry, Hydraulic-Cement Grout (Non-
shrink)

C1116.....Standard Specification for Fiber-Reinforced
Concrete and Shotcrete

C1315-08.....Liquid Membrane-Forming Compounds Having
Special Properties for Curing and Sealing
Concrete

D6-95(R2006).....Loss on Heating of Oil and Asphaltic Compounds

D297-93(R2006).....Rubber Products-Chemical Analysis

D1751-04.....Preformed Expansion Joint Filler for Concrete
Paving and Structural Construction (Non-
extruding and Resilient Bituminous Types)

D4397-02.....Polyethylene Sheeting for Construction,
Industrial and Agricultural Applications

E96/E96M.....Standard Test Methods for Water Vapor
Transmission of Materials

E1155-96(R2008).....Determining F_F Floor Flatness and F_L Floor Levelness Numbers

E1643.....Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs

E1745.....Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs

F1637 02.....Standard Practice for Safe Walking Surfaces

E. American Welding Society (AWS):

D1.1.....Structural Welding Code - Steel

D1.4-05.....Structural Welding Code - Reinforcing Steel

F. Concrete Reinforcing Steel Institute (CRSI):

Manual of Standard Practice (MSP)

G. National Cooperative Highway Research Program (NCHRP):

Report On.....Concrete Sealers for the Protection of Bridge Structures

H. U. S. Department of Commerce Product Standard (PS):

PS 1.....Construction and Industrial Plywood

PS 20.....American Softwood Lumber

I. U. S. Army Corps of Engineers Handbook for Concrete and Cement:

CRD C513.....Rubber Waterstops

CRD C572.....Polyvinyl Chloride Waterstops

J. Prestressed Concrete Institute (PCI):

MNL 116, "Manual for Quality Control for Plants and Production of Precast Prestressed Concrete Products."

MNL 120, "Design Handbook Precast Prestressed Concrete."

MNL 129, "Parking Structures-Recommended Practice for Design and Construction."

MNL 135, "Tolerances for Precast and Prestressed Concrete Construction."

"Code of Standard Practice for Precast Concrete."

K. Contractor shall have following ACI publications at Project construction site:

1. ACI SP-15, "Field Reference Manual: Standard Specifications for Structural Concrete ACI 301 with selected ACI References."
2. ACI 302.1R, "Guide for Concrete Floor and Slab Construction."
3. ACI 305R, "Hot Weather Concreting."
4. ACI 306.1, "Cold Weather Concreting."

L. International Code Council (ICC):

1. IBC "International Building Code 2009".

PART 2 - PRODUCTS:

2.1 FORMS:

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Exterior grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
- B. Wood: PS 20 free from loose knots and suitable to facilitate finishing concrete surface specified; tongue and grooved.
- C. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- D. Forms for Textured Finish Concrete: Unit of face design, size, arrangement, and configuration to match control sample. Provide solid backing and form supports to ensure stability of textured for liners.
- E. Form Coatings: Provide commercial formulation form-coating compounds with a maximum VOC of 350 grams/liter that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces, including but not limited to water-curing, curing compound, stains or paints.
- F. Chamfer strips: Wood, metal, PVC, or rubber strips. 0.75 inch by 0.75 inch minimum unless noted otherwise.
- G. Form Ties: Develop a minimum working strength of 13.35 kN (3000 pounds) when fully assembled. Ties shall be adjustable in length to permit tightening of forms and not have any lugs, cones, washers to act as spreader within form, nor leave a hole larger than 20 mm (3/4 inch) diameter, or a depression in exposed concrete surface, or leave metal closer than 40 mm (1 1/2 inches) to concrete surface. Wire ties not permitted. Cutting ties back from concrete face not permitted.
- H. Nails for P-T Anchors: Stainless steel ring shank nails.
 - 1. Clendenin Brothers, Baltimore, MD.
 - 2. Or Equal.

2.2 MATERIALS:

- A. Ready Mixed Concrete: Obtain concrete from plant with current certification from at least one of the following:
 - 1. Concrete Materials Engineering Council.

2. Iowa Department of Transportation.
 3. National Ready Mixed Concrete Association.
- B. Portland Cement: ASTM C150 Type I or II. Use one cement supplier throughout project.
- C. Fly Ash: ASTM C618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalis, and loss on ignition (LOI) not to exceed 5 percent.
1. Testing: ASTM C311.
 2. Percentage of fly ash in Mixture Proportion shall be by weight, not by volume. Water/cement ratio will be calculated as water/cementitious (total cement and fly ash) ratio.
 3. Prohibited: Fly ash in same mix with Type IP blended cement.
 4. If strength or air content varies from value specified by more than specified tolerances, Project Manager or designated representative shall reject that concrete.
 5. Submit all fly ash concrete Mixture Proportions per ACI 301.
- D. Slag - (Ground Granulated Blast-Furnace Slag - GG BFS):
1. ASTM C 989, Grade 100 or higher.
 2. Percentage of GGBF slag in Mixture Proportion shall be by weight, not by volume. Water-cement ratio shall be calculated as water-cementitious (total portland cement + GGBF slag) ratio.
 3. If strength or air content varies from value specified by more than specified tolerances, Project Manager or designated representative shall reject that concrete.
 4. Submit all GGBF slag concrete mixture proportions per ACI 301.
- E. Normal Weight Aggregates (ACI 301, Section 4 header "Aggregates"):
1. Normal weight concrete aggregates:
 - a. Coarse aggregate: Crushed and graded limestone or approved equivalent conforming to ASTM C33 except as noted here, minimum class designations as listed below:
 - 1) Below grade construction and below frost line: Class 1S.
 - 2) Walls not exposed to public view: Class 3S.
 - 3) Walls exposed to public view: Class 5S.
 - 4) Slabs on ground: Class 4S.

- 5) All other concrete: Class 5S.
 - b. No deleterious materials such as, but not limited to, chert or opaline.
 - c. Fine aggregate: Natural or Manufactured sand conforming to ASTM C 33 and having preferred grading shown for normal weight aggregate in ACI 302.1R, Table 5.2.1.
 - d. Coarse Aggregate shall not contain crushed hydraulic-cement concrete.
2. Coarse aggregate: Nominal maximum sizes indicated below, conforming to ASTM C 33, Table 2:
- a. Footings/Foundations: Size number 57 or 357.
 - b. Toppings and washes less than 3 in. thick: Size number 7 or 67.
 - c. Slab on grade: Size number 57.
 - d. All other members: Size number 67.
3. Chloride Ion Level: ASTM C 1218. Chloride ion content of cement, aggregates and all other ingredients: tested by laboratory making trial mixes.
4. Maximum size of coarse aggregates not more than one-fifth of narrowest dimension between sides of forms, one-third of depth of slabs, nor three-fourth of minimum clear spacing between reinforcing bars.
- F. Mixing Water: Fresh, clean, and potable.
- G. Admixtures:
- 1. Water Reducing Admixture: ASTM C494, Type A and not contain more chloride ions than are present in municipal drinking water.
 - 2. Water Reducing, Retarding Admixture: ASTM C494, Type D and not contain more chloride ions than are present in municipal drinking water.
 - 3. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C494, Type F or G, and not contain more chloride ions than are present in municipal drinking water.
 - 4. Non-Corrosive, Non-Chloride Accelerator: ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. Admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory of at least one year duration using an acceptable accelerated corrosion test method such as that using electrical potential measures.
 - 5. Air Entraining Admixture: ASTM C260.

6. Concrete supplier and manufacturer shall verify via trial mixes and certify compatibility (no effect on workability, strength, durability, entrained air content, etc.) of all ingredients in each Mixture. Use admixtures in strict accordance with manufacturer's recommendations.
7. Calcium Nitrite corrosion inhibitor: ASTM C494 Type C.
8. Prohibited Admixtures: Calcium chloride, thiocyanate or admixtures containing more than 0.05 percent chloride ions are not permitted.
9. Certification: Written conformance to the requirements above and the chloride ion content of the admixture prior to mix design review.
- H. Vapor Barrier: Provide vapor barrier which conforms to ASTM E 1745, Class A. The membrane shall have a water-vapor transmission rate less than or equal to 0.008 gr./ft²/hr when tested, in accordance with ASTM E96. Vapor barrier shall be no less than 15 mils thick. The vapor barrier shall be placed over prepared base material where indicated below slabs on ground.
 1. New ISO certified virgin resins, polyolefin based maximum.
 2. Vapor barrier shall be provided below all stair tower, elevator tower, and accessory room slab on ground.
- I. Reinforcing Steel: ASTM A615, or ASTM A996, deformed, grade as shown.
- J. Welded Wire Fabric: ASTM A185 fabricated from as-drawn steel wire into flat sheets (roll stock prohibited).
- K. Reinforcing Bars to be Welded: ASTM A706.
- L. Galvanized Reinforcing Bars: ASTM A767.
- M. Epoxy-Coated Fabricated Reinforcing Bars: ASTM A 934, and as follows:
 1. Steel Reinforcement: ASTM A 615, Grade 60, deformed bars.
- N. Provide in Bid ten additional tons of placed reinforcement bars or welded wire reinforcement for inclusion in Project as Project Manager directs. Return cost of unused portion to Owner at unit price stated on Bid Form. Submit to Project Manager breakdown of use each month.
- O. For mechanical tension splices of reinforcement:
 1. All splices to develop 125 percent of specified yield strength of bars, or of smaller bar in transition splices.
- P. Compression splices: Mechanically coupled splices in accordance with ACI 318, Chapter 12.
- Q. Bar supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports according to CRSI's

"Manual of Standard Practice" from all plastic of greater compressive strength than concrete, and as follows:

1. Bar and welded wire reinforcement supports shall be fabricated to resist overturning during construction operations.
2. For slabs on ground, use all-plastic supports with sand plates or horizontal runners where base materials will not support chair legs. All supports shall have sufficient surface area in contact with ground so that they shall not allow clearance loss when reinforcement installed or concrete placed.
3. For concrete surfaces exposed to view where bar supports contact forms, supports shall have minimal contact, shall not cause voids and shall not cause damage to surrounding concrete. Use all-plastic supports conforming to CRSI Class 1 protection requirements.
4. Chairs shall be sized and spaced to prevent cover loss during construction operations.

R. Epoxy Coating Materials for Reinforcement: ASTM A 775 and A 884:

1. Supplier shall be certified currently under CRSI Fusion Bonded Epoxy Coating Applicator Plant Certification Program.

S. Joint Filler:

1. Joint filler in slabs and curbs: Asphalt impregnated fiber board; as shown on Drawings. ASTM D 1751.
2. Joint filler used vertically to isolate walls from columns or other walls: White molded polystyrene beadboard type.
3. Joint cover used to bridge gap between columns and grade walls, retaining walls, or basement walls: Minimum width: Gap width plus 4 in. for gaps over 3 inches wide, protect cover with protection board sized to span gap satisfactorily.

T. Curing Materials:

1. Evaporation Reducer: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
2. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.
3. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
4. Water: Potable.

U. Penetrating Sealer: See Section 07 19 00 Traffic Bearing Water Repellents

V. Non-Shrink Grout:

1. ASTM C1107, pre-mixed, produce a compressive strength of at least 18 MPa at three days and 35 MPa (5000 psi) at 28 days. Furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent bearing under a 1200 mm x 1200 mm (4 foot by 4 foot) base plate.
2. Where high fluidity or increased placing time is required, furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent under an 450 mm x 900 mm (18 inch by 36 inch) base plate.

2.3 RELATED MATERIALS:

- A. Bonding Additive: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- B. Epoxy-Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:
 1. Type II, non-load bearing, for bonding freshly mixed concrete to hardened concrete.
 2. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
 3. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- C. Reglets: Fabricate reglets of not less than 0.0217-inch- thick galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- D. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.
- E. Mechanical and chemical anchors shall be manufactured by Hilti Fastening Systems, Tulsa Oklahoma, ITW Ramset/Red Head, Wood Dale, IL, Simpson Anchor Systems, Columbus, OH, or accepted equivalent. Anchor bolt composition shall be from one or more of carbon steel and stainless steel, lead, Zamac alloy, nylon, plastic, polypropylene, and jute fiber.
 1. Strength of all anchors shall comply with ICC-ES-AC 58CR or ICC-ES AC308 and ACI 318-05 Appendix D.
 2. Carbon steel anchors shall be either zinc plated in accordance with ASTM B 633, or hot-dipped galvanized in accordance with ASTM A-153-78. Provide mill test reports and manufacturer's quality control certification upon Project Manager's request.
 3. Stainless steel anchors shall be manufactured from ASTM A304, or A663 stainless steel. Provide mill test reports and manufacturer's quality control certification upon Project Manager's request.

4. Plastic, lead, or Zamac alloy anchors shall not be used for overhead applications. Chemical anchors shall not be used to resist pullout forces in overhead and wall installations unless proper consideration is given to fire conditions. For chemical anchors, consult with manufacturer's engineer.
5. Safety Factors: Static loads 4:1 minimum. Static load safety factors shall be per manufacturer's published data. Critical load (vibratory, overhead, etc. or more) safety factors shall be 10:1 minimum. Chemical anchors are not permitted for critical loads and where resistance to direct sustained tension is required.
 - a. If necessary for purposes of determining tensile and/or shear capacity in questionable base material, testing shall be done prior to actual anchor installation. A maximum of five tension and/or shear tests shall be performed by manufacturer's engineer. Anchors shall be proof loaded in tension and/or shear to assure that working load capacity is within specified allow-able load limit as published by manufacturer.
6. Anchor spacing and edge distance per manufacturer's limits. Loading and cluster spacing shall be as established by minimum industry standards for anchors, except as follows: Anchor loading, cluster spacing and edge distances shall be as published in manufacturer's literature. Consult with manufacturer's engineer for specific requirements.
7. Anchor installation shall be as required by manufacturers written instructions.

F. Inserts and Coil Rods:

1. Yield strength: 65,000 psi minimum.
2. Galvanizing: Where indicated, electrodeposited zinc coating, ASTM B 633, Service condition 1, Type III.
3. Epoxy coating: Where indicated.
4. Details shown on drawings are based on Dayton/Richmond Concrete Accessories, Inc. products and their respective capacities. Other products may be used only if contractor submits calculations, sealed by professional engineer or structural engineer licensed in Iowa, substantiating strength of connection with other product. Calculations are subject to Project Manager's acceptance before fabrication is to proceed.

G. Flexible Rubber Waterstops: CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

1. Profile: Flat, dumbbell with center bulb.

2.4 CONCRETE MIXES:

- A. Mix Designs: Proportioned in accordance with Section 5.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318.
1. If trial mixes are used, make a set of at least 6 cylinders in accordance with ASTM C192 for test purposes from each trial mix; test three for compressive strength at 7 days and three at 28 days.
 2. Submit a report of results of each test series, include a detailed listing of the proportions of trial mix or mixes, including cement, fly ash, admixtures, weight of fine and coarse aggregate per m³ (cubic yard) measured dry rodded and damp loose, specific gravity, fineness modulus, percentage of moisture, air content, water-cement -fly ash ratio, and consistency of each cylinder in terms of slump.
 3. Prepare a curve showing relationship between water-cement -fly ash ratio at 7-day and 28-day compressive strengths. Plot each curve using at least three specimens.
 4. If the field experience method is used, submit complete standard deviation analysis.
- B. After approval of mixes no substitution in material or change in proportions of approval mixes may be made without additional tests and approval of Project Manager or as specified. Making and testing of preliminary test cylinders may be carried on pending approval of cement and fly ash, providing Contractor and manufacturer certify that ingredients used in making test cylinders are the same. Project Manager may allow Contractor to proceed with depositing concrete for certain portions of work, pending final approval of cement and fly ash and approval of design mix.
- C. Cement Factor: Maintain minimum cement factors in Table I regardless of compressive strength developed above minimums. Fly ash may be substituted for up to 20 percent of the minimum cement factor at option of Contractor, except fly ash may not be used in concrete designated as architectural concrete.

TABLE I - CEMENT AND WATER FACTORS FOR CONCRETE*

Concrete Strength		Non-Air- Entrained	Air-Entrained	
Min. 28 Day Comp. Str. MPa (psi)	Min. Cement kg/m ³ (lbs/c. yd)	Max. Water Cement Ratio	Min. Cement kg/m ³ (lbs/c. yd)	Max. Water Cement Ratio
35 (5000) ^{1,3}	375 (630)	0.45	385 (650)	0.40
30 (4000) ^{1,3}	325 (550)	0.45	340 (570)	0.45

1. If trial mixes are used, the proposed mix design shall achieve a compressive strength 8.3 MPa (1200 psi) in excess of f'c. For concrete strengths above 35 Mpa (5000 psi), the proposed mix design shall achieve a compressive strength 9.7 MPa (1400 psi) in excess of f'c.

2. For concrete exposed to high sulfate content soils maximum water cement ratio is 0.44.

* Maximum water cement ratios shown in the structural general notes takes precedence over these values.

D. Maximum Slump: Maximum slump, as determined by ASTM C143 with tolerances as established by ASTM C94, for concrete to be vibrated shall be as shown in AND THE Structural General Notes.

E. Air-Entrainment: Air-entrainment of normal weight concrete shall conform with the Structural General Notes. Determine air content by either ASTM C173 or ASTM C231.

1. See General Notes on Drawings for total average air content (percent by volume).

2. Average air content shall exceed value stated in General Notes on Drawings.

3. Permissible variation for any one test result from specified average total air content: plus or minus 1.5 percent.

4. Hardened concrete shall have an air void spacing factor of 0.0080 in. maximum. Specific surface (surface area of air voids) shall be 600 in² per cu in. of air-void volume, or greater. Concrete mixes not meeting these values as determined by ASTM C 457 may require adjustments unless accepted in writing by Engineer. Refer to Part 1 Article "Submittals."

F. High early strength concrete, made with Type III cement or Type I cement plus non-corrosive accelerator, shall have a 7-day compressive strength equal to specified minimum 28-day compressive strength for concrete type specified made with standard Portland cement.

G. Concrete slabs placed at air temperatures below 10 degrees C (50 degrees Fahrenheit) use non-corrosive, non-chloride accelerator. Concrete required to be air entrained use approved air entraining admixture. Pumped concrete, synthetic fiber concrete, architectural concrete, concrete required to be watertight, and concrete with a water/cement ratio below 0.50 use high-range water-reducing admixture (superplasticizer).

H. Enforcing Strength Requirements: Test as specified in Section 01 45 29, TESTING LABORATORY SERVICES, during the progress of the work. Seven-day tests may be used as indicators of 28-day strength. Average of any three 28-day consecutive strength tests of laboratory-cured specimens representing each type of concrete shall be equal to or greater than

specified strength. No single test shall be more than 3.5 MPa (500 psi) below specified strength. Interpret field test results in accordance with ACI 214. Should strengths shown by test specimens fall below required values, Project Manager may require any one or any combination of the following corrective actions, at no additional cost to the Government:

1. Require changes in mix proportions by selecting one of the other appropriate trial mixes or changing proportions, including cement content, of approved trial mix.
 2. Require additional curing and protection.
 3. If five consecutive tests fall below 95 percent of minimum values given in Table I or if test results are so low as to raise a question as to the safety of the structure, Project Manager may direct Contractor to take cores from portions of the structure. Use results from cores tested by the Contractor retained testing agency to analyze structure.
 4. If strength of core drilled specimens falls below 85 percent of minimum value given in General Notes, Project Manager may order load tests, made by Contractor retained testing agency, on portions of building so affected. Load tests in accordance with ACI 318 and criteria of acceptability of concrete under test as given therein.
 5. Concrete work, judged inadequate by structural analysis, by results of load test, or for any reason, shall be reinforced with additional construction or replaced, if directed by the Project Manager.
- I. Supplementary cementitious materials: Maximum weight of fly ash, natural pozzolans, silica fume, processed ultra fine fly ash or slag included in concrete shall not exceed percentages of total weight (see footnotes for ACI 301 Part 4 Table "Requirements for Concrete Exposed to Deicing Chemicals") of cementitious materials as follows:
1. Fly Ash or other pozzolans conforming to ASTM C 618: 25 percent.
 2. Slag conforming to ASTM C 989: 50 percent.
 3. Total of fly ash or other pozzolans and slag: 50 percent.
- J. Chloride Ion Content of Mixture:
1. Water soluble chloride ion content of concrete shall not exceed 0.06 percent by weight of cement for pre-stressed concrete and 0.15 percent for reinforced concrete. (ACI 318 Chapter 4 Table 4.4.1 "Maximum Chloride Ion Content for Corrosion Protection of Reinforcement") Test to determine chloride ion content shall conform to ASTM C 1218.
 2. Concrete chloride ion content shall be determined by Testing Agency prior to placement. Cast samples from current production of concrete mix proposed for superstructure.

3. Concrete not meeting the requirements of paragraph "Water soluble chloride ion content of concrete..." above, shall contain appropriate amount of calcium nitrite. Concrete supplier shall provide laboratory test results showing the amount of excess chloride ion content in the concrete mixture contributed by the aggregates. For each pound of chloride ion in excess of the amount allowed, mix shall contain calcium nitrite (30 percent, plus or minus 2 percent, solids content) on one-to-one basis (one gallon of calcium nitrite for one lb of excess chloride ion). Maximum of 1.5 lb of chloride ion per cubic yard may be offset in this manner.

K. Alkali content of mixture shall not exceed 5 lb/cu. yd.

L. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Consider using water-reducing admixture or high-range water-reducing admixture (Superplasticizers), OR admixtures that achieve self-consolidating concrete, as required, for placement, workability, finishing and when required, increased flowability.
2. Consider using water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use high range water-reducing admixture in pumped concrete, concrete for parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio of 0.45 or less. Use normal or mid-range water reducing admixture for concrete with water-cementitious materials ratio greater than 0.45.

M. Shrinkage (Length Change):

1. Determine length change of hardened concrete test specimens in accordance with ASTM C 157, except as noted in paragraph below. Existing test data from previous project with same materials may be acceptable.
2. Test specimens shall be moist cured, including period in molds for 7 days. Then store specimens in air for period of 28 days.
3. Utilize concrete materials and mix proportions submitted, for use in floor slab beam, in accordance with Part 1 Article "Submittals".
4. Report length change of specimens after periods of air drying after curing of 4, 7, 14, 21, and 28 days.
5. Average length change after 28 days shall be limited to 0.04%, unless otherwise accepted by Engineer. Values exceeding 0.04% shall be rejected.

N. Self-Consolidating Concrete:

1. Minimum flow of 24 in. to 28 in. or as required by the successful test placement. All self-consolidating concrete shall contain the

specified high-range water-reducing admixture and viscosity-modifying admixture as required.

2. Measure slump flow using slump cone upright or inverted in accordance with ASTM C1611. Measured flow shall be greater than 24 inches and consistent with submitted mixture test parameters plus or minus 2 in.
 3. Measure passing ability in accordance with ASTM C 1621/C 1621M. Use the slump cone in the same way as in the slump flow test. Difference in average slump flow between slump flow and passing ability tests shall not exceed 2 in.
 4. Determine the static segregation (stability) in accordance with ASTM C 1610/C 1610M. Segregation factor of the mixture shall not be more than 15 percent.
- O. Project Manager's acceptance of mixture proportions shall not relieve Contractor from responsibility for any variation from requirements of Contract Documents unless Contractor has in writing called Project Manager's attention to each such variation at time of submission and Project Manager has given written approval of each such variation.
- P. Adjustment to Concrete Mixtures: Adjustments to mixture proportions may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Project Manager. Laboratory test data for revised mixture and strength results shall be submitted to and accepted by Project Manager before using in work.

2.5 BATCHING AND MIXING:

- A. General: Concrete shall be "Ready-Mixed" and comply with ACI 318 and ASTM C94, except as specified. Batch mixing at the site is permitted. Mixing process and equipment must be approved by Project Manager. With each batch of concrete, furnish certified delivery tickets listing information in Paragraph 16.1 and 16.2 of ASTM C94. Maximum delivery temperature of concrete is 38°C (100 degrees Fahrenheit). Minimum delivery temperature as follows:

Atmospheric Temperature	Minimum Concrete Temperature
-1. degrees to 4.4 degrees C (30 degrees to 40 degrees F)	15.6 degrees C (60 degrees F.)
-17 degrees C to -1.1 degrees C (0 degrees to 30 degrees F.)	21 degrees C (70 degrees F.)

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

2.6 TOOLS:

A. Slab Jointing

1. Concrete groovers: For tooled joints in concrete:
 - a. For concrete not exceeding 4 in. thickness, use groover with 1 in. deep v-cut bit, 0.5 in. surface width and 3/16 in. to 1/4 in. edge radius.
 - b. For concrete exceeding 4 in. thickness, use groover with 1.5 in. deep v-cut bit, 0.5 in. surface width and 3/16 in. to 1/4 in. edge radius.
2. Saw Cut Joints:
 - a. Not Permitted.

PART 3 - EXECUTION

3.1 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 concrete structure can support such loads and in accordance with Article 1.9 "Contractor's Professional Services - Performance and Design Criteria".
- B. General: Design in accordance with ACI 347 is the responsibility of the Contractor. The Contractor shall retain a registered Professional Engineer to design the formwork, shores, and reshores.
 1. Form boards and plywood forms may be reused for contact surfaces of exposed concrete only if thoroughly cleaned, patched, and repaired and Project Manager approves their reuse.
 2. Provide forms for concrete footings unless Project Manager determines forms are not necessary.
 3. Corrugated fiberboard forms: Place forms on a smooth firm bed, set tight, with no buckled cartons to prevent horizontal displacement, and in a dry condition when concrete is placed.
- C. Treating and Wetting: Treat or wet contact forms as follows:
 1. Coat plywood and board forms with non-staining form sealer. In hot weather, cool forms by wetting with cool water just before concrete is placed.
 2. Clean and coat removable metal forms with light form oil before reinforcement is placed. In hot weather, cool metal forms by thoroughly wetting with water just before placing concrete.

3. Use sealer on reused plywood forms as specified for new material.
- D. Size and Spacing of Studs: Size and space studs, wales and other framing members for wall forms so as not to exceed safe working stress of kind of lumber used nor to develop deflection greater than $1/270$ of free span of member.
- E. Unlined Forms: Use plywood forms to obtain a smooth finish for concrete surfaces. Tightly butt edges of sheets to prevent leakage. Back up all vertical joints solidly and nail edges of adjacent sheets to same stud with 6d box nails spaced not over 150 mm (6 inches) apart.
- F. Lined Forms: May be used in lieu of unlined plywood forms. Back up form lining solidly with square edge board lumber securely nailed to studs with all edges in close contact to prevent bulging of lining. No joints in lining and backing may coincide. Nail abutted edges of sheets to same backing board. Nail lining at not over 200 mm (8 inches) on center along edges and with at least one nail to each square foot of surface area; nails to be 3d blued shingle or similar nails with thin flatheads.
- G. Architectural Liner: Attach liner as recommended by the manufacturer with tight joints to prevent leakage.
- H. Wall Form Ties: Locate wall form ties in symmetrically level horizontal rows at each line of wales and in plumb vertical tiers. Space ties to maintain true, plumb surfaces. Provide one row of ties within 150 mm (6 inches) above each construction joint. Space through-ties adjacent to horizontal and vertical construction joints not over 450 mm (18 inches) on center.
1. Tighten row of ties at bottom of form just before placing concrete and, if necessary, during placing of concrete to prevent seepage of concrete and to obtain a clean line. Ties to be entirely removed shall be loosened 24 hours after concrete is placed and shall be pulled from least important face when removed.
 2. Coat surfaces of all metal that is to be removed with paraffin, cup grease or a suitable compound to facilitate removal.
- I. Inserts, Sleeves, and Similar Items: Flashing reglets, steel strips, masonry ties, anchors, wood blocks, nailing strips, grounds, inserts, wire hangers, sleeves, drains, guard angles, forms for floor hinge boxes, inserts or bond blocks for elevator guide rails and supports, and other items specified as furnished under this and other sections of specifications and required to be in their final position at time concrete is placed shall be properly located, accurately positioned, and built into construction, and maintained securely in place.
1. Locate inserts or hanger wires for furred and suspended ceilings only in bottom of concrete joists, or similar concrete member of overhead concrete joist construction.
 2. Install sleeves, inserts and similar items for mechanical services in accordance with drawings prepared specially for mechanical services. Contractor is responsible for accuracy and completeness

of drawings and shall coordinate requirements for mechanical services and equipment.

3. Do not install sleeves in beams, joists or columns except where shown or permitted by Project Manager. Install sleeves in beams, joists, or columns that are not shown, but are permitted by the Project Manager, and require no structural changes, at no additional cost to the Government.
4. Minimum clear distance of embedded items such as conduit and pipe is at least three times diameter of conduit or pipe, except at stub-ups and other similar locations.
5. Provide recesses and blockouts in floor slabs for door closers and other hardware as necessary in accordance with manufacturer's instructions.

J. Construction Tolerances:

1. Set and maintain concrete formwork to assure erection of completed work within tolerances specified and to accommodate installation of other rough and finish materials. Accomplish remedial work necessary for correcting excessive tolerances. Erected work that exceeds specified tolerance limits shall be remedied or removed and replaced, at no additional cost to the Government.
2. Permissible surface irregularities for various classes of materials are defined as "finishes" in specification sections covering individual materials. They are to be distinguished from tolerances specified which are applicable to surface irregularities of structural elements.

K. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117, except as modified below:

1. Pier Caps:

- a. Variation of center from specified plan location: 0.5 in.
- b. Variation of bearing surface from specified location: Plus or minus 0.5 in.
- c. Variation from specified dimensions in plan: Plus 2 in. minus 0 in.
- d. Variation decrease from specified thickness: 0.5 in.

2. Footings:

- a. Footings other than those to receive masonry construction:
Variation of bearing surface from specified elevation: Plus or minus 0.5 in.
- b. Footings to Receive Masonry Construction:

- 1) Variation of center from specified location in plan: Plus or minus 0.25 in. in any 10 ft but not to exceed plus or minus 0.5 in.
 - 2) Variation of bearing surfaces for specified elevation: Plus or minus 0.25 in. in any 10 ft but not to exceed plus or minus 0.5 in.
3. Piers, Columns, Walls, Beams, and Slabs:
- a. Variation in cross-sectional dimensions of piers, beams and columns and in thickness of walls and slabs: 12 in. or less: Plus 0.375 in., minus 0.25 in. Greater than 12 in.: Plus 0.5 in., minus 0.375 in.
 - b. Variation in elevation from specified elevation for piers, columns and walls: Plus or minus 0.5 in.
4. Permissible variations from plumb and designated building lines for portions of buildings more than 100 feet above ground: height/1000.
5. Anchor bolts: concrete contractor shall place anchor bolts within tolerances stated under heading "Anchor Bolts and Bearing Plates" of PCI "Code of Standard Practice for Precast Concrete."
- L. 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. Kerf wood inserts for easy removal.
 3. Do not use rust-stained steel form-facing material.
- M. 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.
- N. 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.
- O. Chamfer exterior corners and edges of permanently exposed concrete.
- P. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- Q. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

- R. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- S. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 PLACING REINFORCEMENT:

- A. General: Details of concrete reinforcement in accordance with ACI 318 and ACI 315, unless otherwise shown.
- B. Placing: Place reinforcement conforming to CRSI DA4 and CRSI's "Manual of Standard Practice," unless otherwise shown.
 - 1. Place reinforcing bars accurately and tie securely at intersections and splices with 1.6 mm (16 gauge) black annealed wire. Use Epoxy-Coated Tie Wire with Epoxy-Coated Reinforcing. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces. Secure reinforcing bars against displacement during the placing of concrete by spacers, chairs, or other similar supports. Portions of supports, spacers, and chairs in contact with formwork shall be made of plastic in areas that will be exposed when building is occupied. Type, number, and spacing of supports conform to ACI 315.
 - 2. Install welded wire reinforcement in longest practicable lengths on continuous bar supports spaced at 2 ft. o.c., maximum. Lap edges and ends of adjoining sheets per ACI 318 and as follows:
 - a. Lap welded wire fabric at least 1-1/2 mesh panels plus end extension of wires not less than 300 mm (12 inches) in structural slabs.
 - b. Lap welded wire fabric at least 1/2 mesh panels plus end extension of wires not less than 150 mm (6 inches) in slabs on grade.
 - 3. Splice column steel at no points other than at footings and floor levels unless otherwise shown.
 - 4. Repair cut and damaged Epoxy-Coating with Epoxy Repair Coating according to ASTM D 3963
- C. Spacing: Minimum clear distances between parallel bars, except in columns and multiple layers of bars in beams shall be equal to nominal diameter of bars. Minimum clear spacing is 25 mm (1 inch) or 1-1/3 times maximum size of coarse aggregate.
- D. Splicing: Splices of reinforcement made only as required or shown or specified. Accomplish splicing as follows:
 - 1. Provide standard reinforcement splices by lapping ends, placing bars in contact, and tying with wire. Comply with requirements of ACI 318 for minimum lap of spliced bars.
 - 2. For Mechanical tension splices of reinforcement:

- a. Column bar lengths shall not exceed 30 ft between splices. In any bar, no splices shall occur at any floor level.
 - b. Exercise care to assure that no reduction of cross-sectional area of reinforcement occurs.
 - c. For all mechanical splices, perform splicing in strict accordance with manufacturer's requirements and instructions.
 - d. Stagger splices in adjacent bars.
 - e. Except where shown on Drawings, welding of reinforcement prohibited without prior written authorization by Engineer.
3. Mechanical Splices: Develop in tension and compression at least 125 percent of the yield strength (f_y) of the bars. Stresses of transition splices between two reinforcing bar sizes based on area of smaller bar. Provide mechanical splices at locations indicated. Use approved exothermic, tapered threaded coupling, or swaged and threaded sleeve. Exposed threads and swaging in the field not permitted.
- a. Initial qualification: In the presence of Project Manager, make three test mechanical splices of each bar size proposed to be spliced. Contractor retained testing laboratory will perform load test.
 - b. During installation: Furnish, at no additional cost to the Government, one companion (sister) splice for every 50 splices for load testing. Contractor retained testing laboratory will perform the load test.
- E. Bending: Bend bars cold, unless otherwise approved. Do not field bend bars partially embedded in concrete, except when approved by Project Manager.
- F. Cleaning: Metal reinforcement, at time concrete is placed, shall be free from loose flaky rust, mud, oil, or similar coatings that will reduce bond.
- G. Future Bonding: Protect exposed reinforcement bars intended for bonding with future work by wrapping with felt and coating felt with a bituminous compound unless otherwise shown.

3.3 VAPOR BARRIER:

- A. Except where membrane waterproofing is required, interior concrete slab on grade shall be placed on a continuous vapor barrier.
- 1. Place 100 mm (4 inches) of fine granular fill over the vapor barrier to act as a blotter for concrete slab.

2. Vapor barrier joints lapped 150 mm (6 inches) and sealed with compatible waterproof pressure sensitive tape.
3. Patch punctures and tears.
4. Vapor barrier shall be provided below all stair tower, elevator tower, and accessory room slab on ground.

3.4 CONSTRUCTION JOINTS:

- A. Unless otherwise shown, location of construction joints to limit individual placement shall not exceed 24,000 mm (80 feet) in any horizontal direction, except slabs on grade which shall have construction joints shown. Allow 48 hours to elapse between pouring adjacent sections unless this requirement is waived by Project Manager.
- B. Construction, control and isolation joints are located and detailed on Drawings:
 1. Tool joints at time of finishing. Tool: Part 2 Article "Tools."
 2. Saw Cut Joints: Not Permitted
 3. Isolation joints: Interrupt structural continuity resulting from bond, reinforcement or keyway.
 4. Construction and control joints in walls: Space joints at 20 ft on center unless smaller spacing is shown on Drawings.
 5. Construction or control joints in floor slabs on ground: Maximum slab area controlled by jointing 400 sq ft. Space joints at 18 ft on center maximum unless different spacing is shown on Drawings.
 6. Coordinate configuration of tooled joints with control joint sealants.
- C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as otherwise indicated. Do not continue reinforcement through sides of strip placements.
- D. Use bonding grout, containing the specified bonding admixture, on existing concrete surfaces that will be joined with fresh concrete.
- E. 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 unless detailed otherwise.
 1. Joint filler and sealant materials are specified in Division 7 Sections of these Specifications.
- F. Contraction (Control) Joints in Slabs-on-Ground: Construct contraction joints in slabs-on-ground to form panels of patterns as shown.

1. Tool contraction joints.
 2. If joint pattern not shown, provide joints not exceeding 18 ft in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).
- G. Joint sealant material is specified in Division 7 Sections.
- H. Flexible Waterstops: Install in construction joints as indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of Work. Field-fabricate joints in waterstops according to manufacturer's written instructions.
- I. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, bonding or mechanically fastening and firmly pressing into place. Install in longest lengths practicable.

3.5 EXPANSION JOINTS:

- A. Clean expansion joint surfaces before installing premolded filler and placing adjacent concrete.
- B. Install polyvinyl chloride or rubber water seals, as shown in accordance with manufacturer's instructions, to form continuous watertight seal.

3.6 PLACING CONCRETE:

- A. Preparation:
1. Remove hardened concrete, wood chips, shavings and other debris from forms.
 2. Remove hardened concrete and foreign materials from interior surfaces of mixing and conveying equipment.
 3. Have forms and reinforcement inspected and approved by Project Manager before depositing concrete.
 4. Provide runways for wheeling equipment to convey concrete to point of deposit. Keep equipment on runways which are not supported by or bear on reinforcement. Provide similar runways for protection of vapor barrier on coarse fill.
- B. Bonding: Before depositing new concrete on or against concrete which has been set, thoroughly roughen and clean existing surfaces of laitance, foreign matter, and loose particles.
1. Preparing surface for applied topping:

- a. Remove laitance, mortar, oil, grease, paint, or other foreign material by sand blasting. Clean with vacuum type equipment to remove sand and other loose material.
 - b. Broom clean and keep base slab wet for at least four hours before topping is applied.
 - c. Use a thin coat of one part Portland cement, 1.5 parts fine sand, bonding admixture; and water at a 50: 50 ratio and mix to achieve the consistency of thick paint. Apply to a damp base slab by scrubbing with a stiff fiber brush. New concrete shall be placed while the bonding grout is still tacky.
- C. Conveying Concrete: Convey concrete from mixer to final place of deposit by a method which will prevent segregation. Method of conveying concrete subject to approval of Project Manager.
- D. Placing: For special requirements see Paragraphs, HOT WEATHER and COLD WEATHER.
1. Do not add water to concrete during delivery, at Project site, or during placement, unless approved by Project Manager.
 - a. Do not add water to concrete after adding high-range water-reducing admixtures to mix.
 2. Do not place concrete when weather conditions prevent proper placement and consolidation, or when concrete has attained its initial set, or has contained its water or cement content more than 1 1/2 hours.
 3. Deposit concrete in forms as near as practicable in its final position. Prevent splashing of forms or reinforcement with concrete in advance of placing concrete.
 4. Do not drop concrete freely more than 3000 mm (10 feet) for concrete containing the high-range water-reducing admixture (superplasticizer) or 1500 mm (5 feet) for conventional concrete. Where greater drops are required, use a tremie or flexible spout (canvas elephant trunk), attached to a suitable hopper.
 5. Discharge contents of tremies or flexible spouts in horizontal layers not exceeding 500 mm (20 inches) in thickness, and space tremies such as to provide a minimum of lateral movement of concrete.
 6. Continuously place concrete until an entire unit between construction joints is placed. Rate and method of placing concrete shall be such that no concrete between construction joints will be deposited upon or against partly set concrete, after it's initial set has taken place, or after 45 minutes of elapsed time during concrete placement.
 - a. Maintain reinforcement in position on chairs during concrete placement.

- b. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - c. Slope surfaces uniformly to drains where required.
 - d. Begin initial floating using highway bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
7. On bottom of members with severe congestion of reinforcement, deposit 25 mm (1 inch) layer of flowing concrete containing the specified high-range water-reducing admixture (superplasticizer). Successive concrete lifts may be a continuation of this concrete or concrete with a conventional slump.
- E. Consolidation: Conform to ACI 309. Immediately after depositing, spade concrete next to forms, work around reinforcement and into angles of forms, tamp lightly by hand, and compact with mechanical vibrator applied directly into concrete at approximately 450 mm (18 inch) intervals. Mechanical vibrator shall be power driven, hand operated type with minimum frequency of 5000 cycles per minute having an intensity sufficient to cause flow or settlement of concrete into place. Vibrate concrete to produce thorough compaction, complete embedment of reinforcement and concrete of uniform and maximum density without segregation of mix. Do not transport concrete in forms by vibration.
- 1. Use of form vibration shall be approved only when concrete sections are too thin or too inaccessible for use of internal vibration.
 - 2. Carry on vibration continuously with placing of concrete. Do not insert vibrator into concrete that has begun to set.

3.7 HOT WEATHER:

- A. Follow the recommendations of ACI 305 or as specified to prevent problems in the manufacturing, placing, and curing of concrete that can adversely affect the properties and serviceability of the hardened concrete. Methods proposed for cooling materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by Project Manager.
- 1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.

3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.8 COLD WEATHER:

- A. Follow the recommendations of ACI 306 or as specified to prevent freezing of concrete and to permit concrete to gain strength properly. Use only the specified non-corrosive, non-chloride accelerator. Do not use calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions. Methods proposed for heating materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by Project Manager.
 1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

3.9 PROTECTION AND CURING:

- A. Conform to ACI 308: Initial curing shall immediately follow the finishing operation. Protect exposed surfaces of concrete from premature drying, wash by rain and running water, wind, mechanical injury, and excessively hot or cold temperatures. Keep concrete not covered with membrane or other curing material continuously wet for at least 7 days after placing, except wet curing period for high-early-strength concrete shall be not less than 3 days. Keep wood forms continuously wet to prevent moisture loss until forms are removed. Cure exposed concrete surfaces as described below. Other curing methods may be used if approved by Project Manager.
 1. Plastic sheets: Apply as soon as concrete has hardened sufficiently to prevent surface damage. Utilize widest practical width sheet and overlap adjacent sheets 50 mm (2 inches). Tightly seal joints with tape.
- B. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.
- C. Evaporation Reducer: Apply evaporation reducer to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft./h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing. Do not finish immediately after evaporation reducer applied. Wait until after (green, if Confilm used - pink, if Eucobar used) film disappears.

D. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

- a. Tepid (within 20 deg F of concrete temperature) water.
- b. Continuous water-fog spray.
- c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

E. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

- a. Tepid (within 20 deg F of concrete temperature) water.
- b. Continuous water-fog spray.
- c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

- a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
- b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
- c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.

3.10 REMOVAL OF FORMS:

- A. Remove in a manner to assure complete safety of structure after the following conditions have been met.
 - 1. Where structure as a whole is supported on shores, forms for beams and girder sides, columns, and similar vertical structural members may be removed after cumulative curing at not less than 50 degrees F. for 24 hours, provided concrete has hardened sufficiently to prevent surface damage and curing is continued without any lapse in time as specified for exposed surfaces.
 - 2. Take particular care in removing forms of architectural exposed concrete to insure surfaces are not marred or gouged, and that corners and arises are true, sharp and unbroken.
- B. Control Test: Use to determine if the concrete has attained sufficient strength and curing to permit removal of supporting forms. Cylinders required for control tests taken in accordance with ASTM C172, molded in accordance with ASTM C31, and tested in accordance with ASTM C39. Control cylinders cured and protected in the same manner as the structure they represent. Supporting forms or shoring not removed until strength of control test cylinders have attained at least 70 percent of minimum 28-day compressive strength specified. For post-tensioned systems supporting forms and shoring not removed until stressing is completed. Do not place additional loads on structure until concrete has been properly reshored. Exercise care to assure that newly unsupported portions of structure are not subjected to heavy construction or material loading.
- C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Project Manager.

3.11 SHORES AND RESHORES:

- A. Reshoring: Reshoring is required if superimposed load plus dead load of the floor exceeds the capacity of the floor at the time of loading.
- B. Comply with ACI 347.2, ACI 318 and ACI 301, for design, installation, and removal of shoring and reshoring and in accordance with Article 1.5 "Contractor's Professional Services - Performance and Design Criteria" at no additional cost to the Government.
 - 1. Do not remove shoring until measurement of slab tolerances is completed.

- C. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.
- D. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.12 CONCRETE SURFACE PREPARATION:

- A. Metal Removal: Unnecessary metal items cut back flush with face of concrete members.
- B. Patching: Maintain curing and start patching as soon as forms are removed. Do not apply curing compounds to concrete surfaces requiring patching until patching is completed. Use cement mortar for patching of same composition as that used in concrete. Use white or gray Portland cement as necessary to obtain finish color matching surrounding concrete. Thoroughly clean areas to be patched. Fill form tie holes which extend entirely through walls from unexposed face by means of a pressure gun or other suitable device to force mortar through wall. Wipe excess mortar off exposed face with a cloth.
- C. Upon removal of forms, clean vertical concrete surface that is to receive bonded applied cementitious application with wire brushes or by sand blasting to remove unset material, laitance, and loose particles to expose aggregates to provide a clean, firm, granular surface for bond of applied finish.
- D. Defective Concrete: Repair and patch defective areas when approved by Project Manager. Remove and replace concrete that cannot be repaired and patched to Project Manager's approval.
- E. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing. Use this repair procedure only with Project Manager's approval.
- F. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2-inch in any dimension in solid concrete but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with specified bonding agent. Fill and compact with specified patching mortar before specified bonding agent has dried. Fill form-tie voids with specified patching mortar.
 - 2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area on

- mockup, or if none, at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Project Manager.
- G. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, pop-outs, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of $\frac{1}{4}$ inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 5. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least $\frac{3}{4}$ -inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 6. Repair single holes 1 inch or less in diameter with patching mortar. Cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
 7. Repair isolated random cracks that have little movement and single holes not over 1 in. in diameter in accordance with procedures and materials specified in Division 7 Section "Joint Sealants." Receive Project Manager's written acceptance of methods and materials selected prior to application.

- a. Repair isolated random horizontal cracks less than 0.01 in. wide, using silane sealer product specified in Division 7 "Traffic Bearing Water Repellents".
 - b. Repair isolated random horizontal cracks 0.01 in. to less than 0.03 in. wide, using methylmethacrylate product specified in Division 7 "Traffic Coating."
 - c. Repair isolated random horizontal cracks 0.03 in. to 0.06 in. wide: route and seal with specified sealant product in Division 7 "Joint Sealants."
 - d. Repair isolated random vertical cracks more than 0.01 in. wide, using epoxy injection product specified in part 2 heading "Related Materials" of this section.
- H. Perform structural repairs of concrete, subject to Project Manager's approval, using epoxy adhesive and patching mortar.
- I. Repair materials and installation not specified above may be used, subject to Project Manager's approval.

3.13 CONCRETE FINISHES:

A. Vertical and Overhead Surface Finishes:

- 1. Unfinished areas: Vertical and overhead concrete surfaces exposed in pipe basements, elevator and dumbwaiter shafts, pipe spaces, pipe trenches, above suspended ceilings, manholes, and other areas concealed from public view.
 - a. Rough Form Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding limits for class of surface specified.
 - b. Provide class C finish as described in ACI 347, for surfaces permanently concealed from public view, unless otherwise noted in the Contract Documents. Class C permits gradual or abrupt irregularities of 1/2 inch.
- 2. Interior and exterior exposed areas, interior of stair and elevator enclosure, and perimeter columns on all four sides: Remove fins, burrs and similar projections on surfaces flush, and smooth by mechanical means approved by Project Manager.
 - a. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding limits for class of surface specified.
 - b. Provide Class C finish as described in ACI 347 for surfaces permanently exposed to public view. Class C permits gradual or abrupt irregularities of 1/2 inch.

- c. Apply to concrete surfaces exposed to public view (unless noted otherwise) or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
- 3. Exterior exposed spandrels and their top and bottom returns, and exterior of stair and elevator enclosures: Give a grout finish of uniform color and smooth finish treated as follows:
 - a. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding limits for class of surface specified.
 - b. Provide Class B finish as described in ACI 347 for surfaces permanently exposed to public view. Class B permits gradual or abrupt irregularities of 1/4 inch.
- 4. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

B. Slab Finishes:

- 1. Monitoring and Adjustment: Provide continuous cycle of placement, measurement, evaluation and adjustment of procedures to produce slabs within specified tolerances. Monitor elevations of concrete structure in key locations before and after concrete placement to establish typical deflection patterns for the concrete structure. Determine elevations of cast in place slab soffits prior to removal of shores. Provide information to Project Manager and floor consultant for evaluation and recommendations for subsequent placements.
- 2. Set perimeter forms to serve as screed using either optical or laser instruments. For slabs on grade, wet screeds may be used to establish initial grade during strike-off, unless Project Manager determines that the method is proving insufficient to meet required finish tolerances and directs use of rigid screed guides. Where wet screeds are allowed, they shall be placed using grade stakes set by optical or laser instruments. Use rigid screed guides, as opposed to wet screeds, to control strike-off elevation for all types of elevated (non slab-on-grade) slabs. Divide bays into halves or thirds by hard screeds. Adjust as necessary where monitoring of previous placements indicates it is needed.
- 3. Place slabs monolithically. Once slab placement commences, complete finishing operations within same day. Slope finished slab to floor drains where they occur, whether shown or not.
- 4. Use straightedges specifically made for screeding, such as hollow magnesium straightedges or power strike-offs. Do not use pieces of

dimensioned lumber. Strike off and screed slab to a true surface at required elevations. Use optical or laser instruments to check concrete finished surface grade after strike-off. Repeat strike-off as necessary. Complete screeding before any excess moisture or bleeding water is present on surface. Do not sprinkle dry cement on the surface.

5. Immediately following screeding, and before any bleed water appears, use a 3000 mm (10 foot) wide highway straightedge in a cutting and filling operation to achieve surface flatness. Do not use bull floats or darbys, except that darbying may be allowed for narrow slabs and restricted spaces.
6. Wait until water sheen disappears and surface stiffens before proceeding further. Do not perform subsequent operations until concrete will sustain foot pressure with maximum of 6 mm (1/4 inch) indentation.
7. Steel Trowel Finish: Concrete surfaces to receive resilient floor covering or carpet, monolithic floor slabs to be exposed to view in finished work, future floor roof slabs, applied toppings, and other interior surfaces for which no other finish is indicated. Steel trowel immediately following floating. During final troweling, tilt steel trowel at a slight angle and exert heavy pressure to compact cement paste and form a dense, smooth surface. Finished surface shall be smooth, free of trowel marks, and uniform in texture and appearance.
8. Broom Finish: Finish exterior slabs, ramps, and stair treads with a bristle brush moistened with clear water after surfaces have been floated. Brush in a direction transverse to main traffic. Match texture approved by Project Manager from sample panel.
9. Flatwork in Parking, Drive Areas, and Stair Towers (BROOM Finish, ACI 301, Section 5 header "Broom or Belt Finish":
 - a. Bullfloat immediately after screeding. Complete before any excess moisture or bleed water is present on surface (ACI 302.1R, Article 8.3.3).
 - b. After excess moisture or bleed water has disappeared and concrete has stiffened sufficiently to allow operation, give slab surfaces coarse transverse scored texture by drawing broom across surface. Texture shall be as accepted by Project Manager from sample panels.
 - c. Finish tolerance: ACI 301, Paragraph 5.3.4.2 and ACI 117, paragraph 4.5.7: The gap at any point between the straightedge and the floor (and between the high spots) shall not exceed 0.5 in. In addition, floor surface shall not vary more than plus or minus 0.75 in. from elevation noted on Drawings anywhere on floor surface.
 - d. Before installation of flatwork and after submittal, review, and approval of concrete mixture proportions, Contractor shall fabricate two acceptable test panels simulating finishing

techniques and final appearance to be expected and used on Project. Test panels shall be minimum of 20 ft. by 30 ft. in area and shall be reinforced and cast to thickness of typical parking and drive area wearing surface in Project. (Maximum thickness of test panels need not exceed 6 in.) Test panels shall be cast from concrete supplied by similar concrete batch, both immediately after addition of superplasticizer or water-reducing admixture, and at maximum allowed time for use of admixture-treated concrete in accordance with Specifications. Intent of test panels is to simulate both high and low workability mixes, with approximate slump at time of casting of test panels to be 6 in. and 3 in., respectively. Contractor shall finish panels following requirements of paragraphs above, and shall adjust finishing techniques to duplicate appearance of concrete surface of each panel. Finished panels (one or both) may be rejected by Project Manager, in which case Contractor shall repeat procedure on rejected panel(s) until Project Manager acceptance is obtained. Accepted test panels shall be cured in accordance with Specifications and may be incorporated into Project. Accepted test panels shall serve as basis for acceptance/rejection of final finished surfaces of all flatwork.

- e. Finish all concrete slabs to proper elevations to ensure that all surface moisture will drain freely to floor drains, and that no puddle areas exist. Contractor shall bear cost of any corrections to provide for positive drainage.
 - f. Flatwork at areas noted on plans to be "California" finish with light broom.
10. Flatwork in and enclosed, Finished Areas (Float Finish, ACI 301, Paragraph 5.3.4.2.b):
- a. Give slab floated finish. Texture shall be as accepted by Project Manager from sample panels.
 - b. Finishing tolerance ACI 301, Section 5 header "Measuring Tolerances for Slabs" and ACI 117, paragraph 4.5.7: The gap at any point between the straightedge and the floor (and between the high spots) shall not exceed 5/16 in. In addition, floor surface shall not vary more than plus or minus 1/4 in. from elevation noted on Drawings anywhere on floor surface.
11. Flatwork in Stair towers and Parking Garage floor subject to pedestrian traffic:
- a. Concrete surfaces at all walking areas subject to pedestrian traffic shall provide a smooth, slip resistant walking surface for pedestrians with these minimum requirements:
 - 1. Shall provide walking surfaces in accordance with ASTM - F 1637 Standard Practice for Safe Walking Surfaces and the "Uniform Federal Accessibilities Standards" (UFAS) and ICC A117.1.

2. Adjoining walkway surfaces shall be flush and meet the following minimum requirements:
 - a) Changes in level of less than 1/4-inch in height may be without edge treatment as shown in UFAS Figure 7(c) and on the Drawings.
 - b) Changes in Level between 1/4-inch and 1/2-inch in height shall be beveled with a slope no greater than 1:2 as shown in UFAS Figure 7(d) and on the Drawings.
 - c) Changes in level greater than 1/2-inch in height are not permitted unless they can be transitioned by means of a ramp with minimum requirements shown on the Drawings.
 - d) Openings in floor or ground surfaces shall not allow passage of a sphere more than 1/2-inch diameter except as allowed for elevators and platform lifts as shown in UFAS Figure 8(g) and 8(h) and on the Drawings.

3. Walkway surfaces shall provide a slip resistant surface.

- a) Concrete surfaces shall be finished to provide a slip resistant finish.
 - b) Contractor shall provide sample area with slip resistant surface finish.
 - c) Static coefficient of friction for walking surfaces shall be measured on a dry surface by the NBS - Brungraber machine using a silastic sensor shoe and shall be 0.6 or larger for a level surface and 0.8 or larger for ramps.

12. Measurements

- a. Contractor retained testing laboratory will take measurements as directed by Project Manager, to verify compliance with finish requirements. Measurements will occur within 72 hours after completion of concrete placement (weekends and holidays excluded). Make measurements before shores or forms are removed to insure the "as-built" levelness is accurately assessed. Profile data for above characteristics may be collected using a laser level or any Type II apparatus (ASTM E1155, "profileograph" or "dipstick"). Contractor's surveyor shall establish reference elevations to be used by Contractor retained testing laboratory.

13. Remedial Measures for Rejected Slabs: Correct rejected slab areas by grinding, planing, surface repair with underlayment compound or repair topping, retopping, or removal and replacement of entire rejected slab areas, as directed by Project Manager, until a slab finish constructed within specified tolerances is accepted.

3.14 SURFACE TREATMENTS:

- A. Non-Slip Finish: Except where safety nosing and tread coverings are shown, apply non-slip abrasive aggregate to treads and platforms of concrete steps and stairs, and to surfaces of exterior concrete ramps and platforms. Broadcast aggregate uniformly over concrete surface at rate of application of 8% per 1/10th m² (7.5 percent per square foot) of area. Trowel concrete surface to smooth dense finish. After curing, rub treated surface with abrasive brick and water to slightly expose abrasive aggregate.

3.15 RETAINING WALLS:

- A. Expansion and contraction joints, waterstops, weep holes, reinforcement and railing sleeves installed and constructed as shown.
- B. Exposed surfaces finished to match adjacent concrete surfaces, new or existing.
- C. Place porous backfill as shown.

3.16 MISCELLANEOUS CONCRETE ITEMS:

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still workable and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.17 FIELD QUALITY CONTROL

- A. Contractor will employ a testing laboratory to perform tests and to submit test reports.
- B. Sample concrete in accordance with ASTM C 172.
- C. Temperature:
 - 1. Test temperature of concrete in accordance with ASTM C 1064/C 1064M and ACI 301 each time cylinders are taken or as directed by the Project Manager.
- D. Slump Test:

1. Conduct one slump test in accordance with ASTM C 143/C 143M per truck load of ready-mixed concrete delivered to Project at truck for superstructure concrete.
2. Conduct slump test in accordance with ASTM C143/C 143M and ACI 301 for foundation concrete.
3. When high-range water-reducing admixture (superplasticizer) is used, initial slump must be verified by Testing Agency.

E. Air Content:

1. General Contractor: Coordinate all parties involved to produce conforming concrete.
2. Sample freshly-mixed concrete at point of final placement in accordance with ASTM C 172 and conduct one air content test in accordance with ASTM C 231 or ASTM C 173 for each truck of ready-mix, air entrained concrete delivered to Project.
3. Sample fresh concrete immediately following placement and screeding and conduct air content tests in accordance with ASTM C 231 or ASTM C 173 at rate of one for every 10 truck loads of ready-mix, air-entrained concrete delivered to Project. For small or half-loads, obtain Project Manager's acceptance of procedure 2 weeks before situation arises.

F. Concrete Compressive Strength:

1. Mold test cylinders in accordance with ASTM C 31 and test in accordance with ASTM C 31 as follows:
 - a. Take minimum of six cylinders for each 100 cu yd or fraction thereof, of each Mixture of concrete placed in any one day.
 - b. Additional cylinders shall be taken under conditions of cold weather concreting per Part 3 Heading "Protection and Curing."
 - c. At Contractor's option and cost, cylinders may be taken to verify concrete strength prior to form removal.
 - d. Testing Agency: Provide and maintain site cure box for cylinders.
2. Cover specimens properly, immediately after finishing. Protect outside surfaces of cardboard molds, if used, from contact with sources of water for first 24 hours after molding.
3. Cure test cylinders per ASTM C 31 as follows:
 - a. To verify compressive strength prior to post-tensioning or form removal or for additional test cylinders required due to cold weather concreting conditions:
 - 1) Store test specimens on structure as near to point of sampling as possible and protect from elements in same manner as that given to portion of structure as specimen represents.

- 2) Transport to test laboratory no more than 4 hours before testing. Remove molds from specimens immediately before testing.
- b. To verify 28-day compressive strength:
 - 1) During first 24 hours after molding, store test specimens under conditions that maintain temperature immediately adjacent to specimens in range of 60 to 80 degrees F. and prevent loss of moisture from specimens.
 - 2) Remove test specimens from molds at end of 20 +/- 4 hours and store in moist condition at 73.4 +/- 3 degrees F. until moment of test. Laboratory moist rooms shall meet requirements of ASTM C 511.
4. Compression test for non-prestressed concrete:
 - a. Test 2 cylinders at 7 days.
 - b. Test 2 cylinders at 28 days.
 - c. Test 2 cylinders at 56 days for concrete strength requirement of 6000 psi or greater, otherwise hold 2 cylinders in reserve for use as Project Manager directs.
5. Compression test for post-tensioned concrete:
 - a. Test 2 cylinders immediately before tensioning.
 - b. Test 2 cylinders at 28 days.
 - c. Hold one set of cylinders in reserve for use as Engineer directs.
6. Unless notified by Project Manager, reserve cylinders may be discarded without being tested after 56 days.
- G. Report all nonconforming test results to Project Manager and others on distribution lists via fax or email. Follow up with colored paper copies to flag the non-conformances.
- H. Monthly, submit a graph showing distribution of compressive strength test results and air content test results.

3.18 EVALUATION AND ACCEPTANCE OF CONCRETE

- A. Concrete Compression test will be evaluated by Project Manager in accordance with ACI 301. If number of tests conducted is inadequate for evaluation of concrete or test results for any type of concrete fail to meet specified strength requirements, core tests may be required as directed by Project Manager. Air content and parameters of air-void system shall meet requirements of this Section.
- B. Core tests, when required, in accordance with ASTM C42 and ACI 301.

- C. Should tested hardened concrete meet Specifications, Owner will pay for coring and testing of hardened concrete. Should tested hardened concrete not meet Specifications or should concrete have to be tested because Contractor did not conform to Project specifications, Contractor shall pay for coring and testing of hardened concrete and for any corrective action required for unaccepted concrete.

3.19 ACCEPTANCE OF STRUCTURE

- A. Acceptance of completed concrete Work will be according to provisions of ACI 301.
- B. "RAPIDLOAD" testing is acceptable, by Structural Preservation Systems, Baltimore, MD.

- - - END - - -

CONCRETE MIXTURE PROPORTIONS SUBMITTAL FORM

Mixture #

Project Name:

I. GENERAL INFORMATION:	
Project:	City:
General Contractor:	
Concrete Supplier:	
Mixture Identification No.:	Concrete Grade:
Use (Describe) ¹ :	

¹ example: Footings, interior flatwork, floor slabs, topping, columns, etc.

II. MIXTURE PROPORTIONING DATA:		
Proportioning Based on (Check only one):		
<p>Standard Deviation Analysis: _____(see section VIII)</p> <p>or Trial Mix Test Data: _____ (see Section IX)</p>		
Mixture Characteristic s: (see Mixtures in Drawings General Notes)	Density: pcf;	Air: _____ % specified
	Slump _____ in. before superplasticizer	Slump _____ in. after superplasticizer Or for SCC: Spread _____ in.
	Strength: psi (28 day);	

W A L K E R A C C E P T A N C E S T A M P

CONCRETE MIXTURE PROPORTIONS SUBMITTAL FORM

Mixture #

Project Name:

III. MATERIALS:		
Aggregates: (size; type; source; gradation report; specification)		
Coarse:		
Fine:		
Other Materials:	<u>Type</u>	<u>Product-Manufacturer</u> (Source)
Cement:		
Flyash, slag, or other pozzolan:		
Silica Fume		
Processed Ultra Fine Fly Ash		
HRM		
Air Entraining Agent:		
Water Reducer		
High Range Water Reducer (HRWR / superplasticizer)		
Non-Corrosive Accelerator		
Retarder		
Fibers		
Other(s):		

CONCRETE MIXTURE PROPORTIONS SUBMITTAL FORM

Mixture #

Project Name:

IV. <u>MIX PROPORTIONS</u> ⁽²⁾		
	WEIGHT (lbs.) (per yd ³)	ABSOLUTE VOL. (cu. ft.) (per yd ³)
Cement:		
Fine Aggregate: ⁽³⁾		
Coarse Aggregate: ⁽³⁾		
Flyash, slag, or other pozzolan:		
Silica Fume		
Processes Ultra Fine Fly Ash		
HRM		
Water: ⁽⁴⁾ (gals. & lbs)		
Entrained Air: (oz.)		
Fibers:		
(Other) :		

TOTALS:		
NOTES: ⁽²⁾ Mix proportions indicated shall be based on data used in section VII or IX. ⁽³⁾ Based on saturated surface dry weights of aggregates. ⁽⁴⁾ Includes ALL WATER, including added water and free water contained on aggregates.		

CONCRETE MIXTURE PROPORTIONS SUBMITTAL FORM

Mixture #

Project Name:

V. <u>RATIOS</u>		VI. SPECIFIC GRAVITIES	
Water ⁽¹⁾	lb	Fine Aggregate:	
	=		
Cementitious Material ⁽²⁾	lb	Coarse Aggregate:	
	=		
Fine Agg.	lb		
	=		
Total Agg.	lb		
NOTES: ⁽¹⁾ Includes ALL water, including added water and free water contained on aggregates. ⁽²⁾ Cementitious materials include cement, fly ash, slag, silica fume, HRM, Processed Ultra Fine Fly Ash or other pozzolan.			

VII. <u>ADMIXTURES</u>				
Air Entraining Agent (A.E.A.):	oz.	per yd ³	oz.	per 100# cement
Superplasticizer	oz.	per yd ³	oz.	per 100# cement
Water Reducer	oz.	per yd ³	oz.	per 100# cement
Non-corrosive Accelerator	oz.	per yd ³	oz.	per 100# cement
Retarder	oz.	per yd ³	oz.	per 100# cement
Other	oz.	per yd ³	oz.	per 100# cement
Lithium Nitrate	gal.	per yd ³		

CONCRETE MIXTURE PROPORTIONS SUBMITTAL FORM

Mixture #

Project Name:

VIII. <u>STANDARD DEVIATION ANALYSIS:</u>		<u>Yes</u>	<u>N/A</u>
(Complete this section only if Mixture was developed using standard deviation analysis of previous project test results. If other method was used, check "N/A".)			
<u>Number of Tests Evaluated:</u>		<u>Standard Deviation:</u>	
<u>(One test is average of two cylinder breaks)</u>		<u>(Single Group)</u>	
<u>Attach copy of test data considered:</u>		<u>Standard Deviation:</u>	
		<u>(Two Groups)</u>	
Required average compressive strength: $f'_{cr} = f'_c +$ psi			
<p>NOTE:</p> <p>Mixture shall be proportioned in accordance with ACI 301 section 4.2.3 to achieve average compressive strength f'_{cr} equal to or greater than the larger of one of the following equations:</p> <p>(4.-3) $f'_{cr} = f'_c + 1.34ks$ [s= calculated standard deviation]</p> <p>or</p> <p>(4-4) $f'_{cr} = f'_c + 2.33ks - 500$</p> <p>or</p> <p>(4-5) $f'_{cr} = 0.9f'_c + 2.33ks$ (for $f'_c > 5,000$ psi)</p> <p>(Refer to ACI 301 for required average when data are not available to establish standard deviation. For post-tensioning projects, see also special requirements for strength required to apply initial post-tensioning.)</p>			
MIXTURE CHARACTERISTICS (As shown on drawings)			
Slump = in.		Air Content = %	
Unit Wet Wt. = pcf		Unit Dry Wt. = pcf	
MIXTURE CHARACTERISTICS (Based on proportioning data)			
Initial Slump = in.		Final Slump in.	
Unit Wet Wt.= pcf.		Unit Dry Wt. = pcf.	
Air Content = %			

CONCRETE MIXTURE PROPORTIONS SUBMITTAL FORM

Mixture #

Project Name:

IX. <u>TRIAL MIXTURE TEST DATA:</u>		<u>Yes</u>	<u>N/A</u>
(Complete this section only if Mixture Proportion is based on data from trial test mixture(s) batched by testing agency or Contractor. If other method was used, check "N/A".)			
<u>Age</u> (days)	<u>Mix #1</u> (comp. str.)	<u>Mix #2</u> (comp. str.)	<u>Mix #3</u> (comp. str.)
<u>7</u>			
<u>7</u>			
<u>28</u>			
<u>28</u>			
<u>28</u>			
<u>28</u> day average com-pressive strength, psi			
<p>NOTE:</p> <p>Mixture shall be proportioned in accordance with ACI 301 section 4.2.3 to achieve average compressive strength f'_{cr} equal to or greater than the larger of one of the following equations:</p> <p>(Less than 3000) $f'_{cr} = f'_c + 1000$</p> <p>or</p> <p>(3000 to 5000) $f'_{cr} = f'_c + 1200$</p> <p>or</p> <p>(Over 5000) $f'_{cr} = f'_c + 700$</p> <p>For post-tensioning projects, see also special requirements for strength required to apply initial post-tensioning.</p>			
MIXTURE CHARACTERISTICS (as shown on drawings)			
Slump = in.		Air Content = %	
Unit Wet Wt. = pcf		Unit Dry Wt. = pcf	
MIXTURE CHARACTERISTICS (Based on proportioning data)			
Initial Slump = in.		Final Slump in.	
Unit Wet Wt.= pcf.		Unit Dry Wt. = pcf.	

Air Content = %	
--------------------	--

CONCRETE MIXTURE PROPORTIONS SUBMITTAL FORM

Mixture #

Project Name:

X. <u>OTHER REQUIRED TESTS</u>		
Water Soluble Chloride Ion Content of mix:	_____ % (by weight of cement)	ASTM C 1218
Hardened Air Content (per ASTM C457):		
Air content: %	Air void spacing Factor in.	Specific surface: in ² /in ³
Chloride Ion Content of Concrete Mixture: ASTM C 1218		
Shrinkage (Length Change, Average) per ASTM C157:		
% @ 4 days	% @ 7 days	% @ 14 days
% @21 days	% @28 days	

CONCRETE MIXTURE PROPORTIONS SUBMITTAL FORM

Mixture #

Project Name:

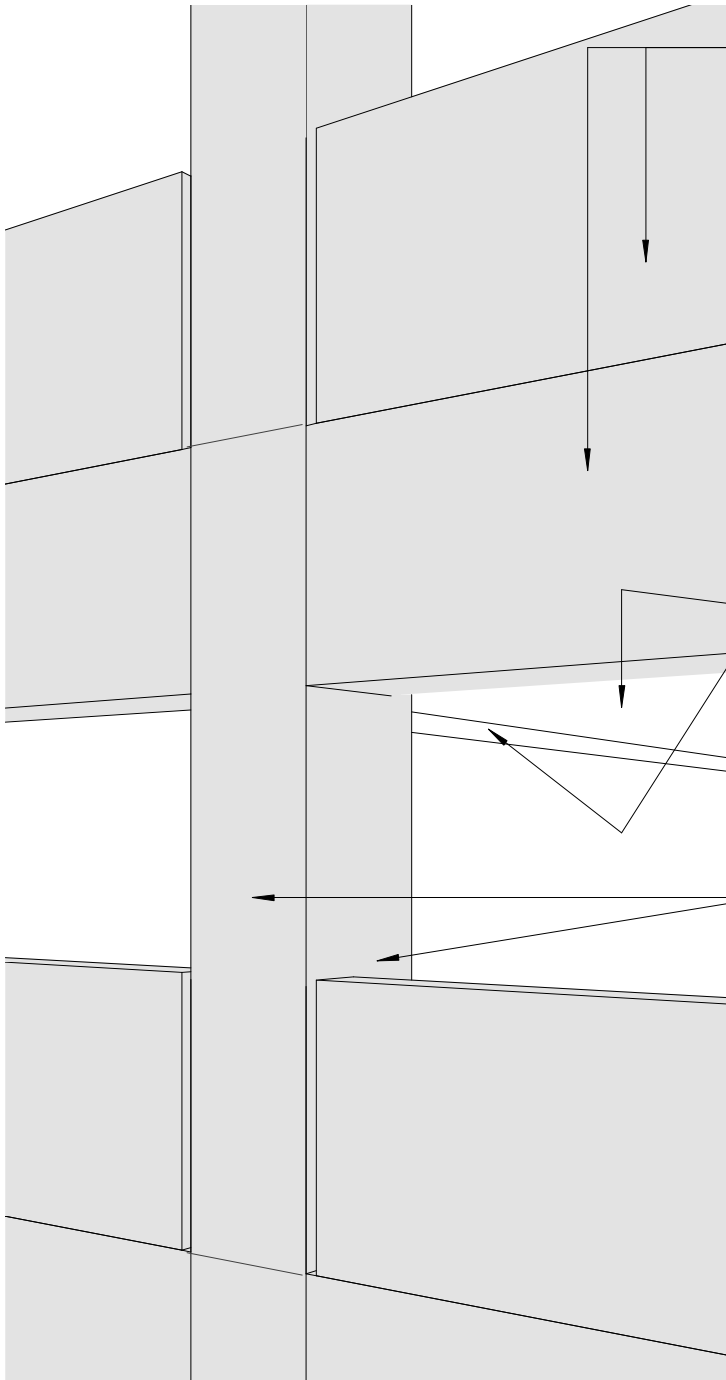
XI. <u>Remarks:</u>
Ready Mix Concrete Supplier Information
Name:
Address:
Phone Number:
Date:
Main Plant Location:
Miles from Project Site:
Secondary or Backup Plant Location:
Miles from Project Site:

My signature below certifies that I have read, understood, and will comply with the requirements of this Section.

Signature_____

Typed or Printed Name

REQUIRED ATTACHMENTS	
	Coarse aggregate grading report
	Fine aggregate grading report
	Concrete compressive strength data used for calculation of required average strength and for calculation of standard deviation
	Chloride ion data and related calculations
	Admixture compatibility certification letter
	Shrinkage information per ASTM C157
	ASTM C 457



CLASS B FINISH ON EXTERIOR FACES OF CONCRETE SPANDRELS AND BEAMS, REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION

CLASS C FINISH FOR EXPOSED CONCRETE ON INTERIOR BEAMS, AND UNDERSIDE OF SUPPORTED SLABS, REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION

CLASS B FINISH ON ALL 4 SIDES OF EXTERIOR COLUMNS

TYPICAL EXTERIOR CONCRETE SURFACES - PERSPECTIVE VIEW.

1

EXTERIOR FACES OF ELEVATOR AND STAIR ENCLOSURES - CLASS B FINISH

Loebl Schlossman & Hackl
Architecture • Planning • Interiors

233 North Michigan Avenue
Suite 3000
Chicago, Illinois 60601
312.565.5912 Facsimile
312.565.1800 Telephone

TERRACON
Geotechnical Engineer
2840 12TH STREET SW
CEDAR RAPIDS, IOWA 52404
319.386.6321 Telephone
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WALKER PARKING CONSULTANTS

Structural Engineer
605 DAVIS ROAD
ELGIN, ILLINOIS 60123
847.697.2940 Telephone
847.697.7439 Fax

GRAEF
Civil Engineer/Landscape Architect
332 SOUTH MICHIGAN, SUITE 1400
CHICAGO, ILLINOIS 60604-4367
312.582.2020 Telephone
312.699.7014 Fax

KJWW ENGINEERING CONSULTANTS
Mechanical/Electrical/Plumbing Engineer

623 26TH AVENUE
ROCK ISLAND, ILLINOIS 61201
309.788.0073 Telephone
309.785-5907 Fax

**PARKING STRUCTURE
400 CAR PARKING GARAGE**

IOWA CITY, IA
PROJECT ADDRESS

Date: OCTOBER 1, 2013

Sheet Rvsd: RFP A-SK-01

Scale: NOT TO SCALE

Drawn By: GBC

Project No.: -

Sketch No.:

**A - SK 01-
10.1.13**

SECTION 09 06 00
SCHEDULE FOR FINISHES

VAMC: Iowa City VA Healthcare System

Location: Iowa City

Project no. and Name: Parking Garage

Submission: 100% Review Contract Documents

Date: May 30, 2013

SECTION 09 06 00
SCHEDULE FOR FINISHES

PART I - GENERAL

1.1 DESCRIPTION

This section contains a coordinated system in which requirements for materials specified in other sections shown are identified by abbreviated material names and finish codes in the room finish schedule (and drawings) or shown for other locations.

1.2 MANUFACTURERS

Manufacturer's trade names and numbers used herein are only to identify colors, finishes, textures and patterns. Products of other manufacturer's equivalent to colors, finishes, textures and patterns of manufacturers listed that meet requirements of technical specifications will be acceptable upon approval in writing by contracting officer for finish requirements.

1.3 SUBMITALS

Submit in accordance with SECTION 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES—provide quadruplicate samples for color approval of materials and finishes specified in this section.

1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in text by basic designation only.
- B. MASTER PAINTING INSTITUTE: (MPI)
2001.....Architectural Painting Specification Manual

PART II - PRODUCTS

2.1 DIVISION 03 - CONCRETE

- A. SECTION 03 30 00, CAST IN PLACE CONCRETE

Surface	Finish Description
Exterior exposed face vertical walls	-
Horizontal walking surface	Light broom

Driving surface, slabs on grade and suspended slabs	Medium broom
Interior surfaces	Float finish

See Finish Schedule on Drawings for Colors

2.2 DIVISION 04 - MASONRY

A. SECTION 04 05 13, MASONRY MORTARING and Section 04 05 16, MASONRY GROUTING

Finish Code	Manufacturer	Mfg. Color Name
-	Mapei	No color

B. SECTION 04 20 00, UNIT MASONRY (Face Brick and CMU)

1. FACE BRICK (FB)				
Finish Code	Size	Pattern	Manufacturer	Mfg. Color Name/No.
BR	Modular	Running Bond	Glen-Gery	<u>Match Existing</u>

3. CMU - At Interior Areas - See Floor Plans				
Finish Code	Size	Pattern	Manufacturer	Paint Color
Medium	Modular	Running Bond	-	-

2.3 DIVISION 05 - METALS**A. SECTION 05 50 00, METAL FABRICATION**

Item	Finish
Loose Lintels / Shelf Angles	Gloss Level 2, See Finish Schedule on Drawings for Colors
Steel Plate Door Sill	-
Aluminum Plate Door Sill	Clear Anodized
Aluminum Safety Nosing	Grey
Steel Pipe Railings and Gates (not on Steel Stairs)	See Finish Schedule on Drawings for Colors

2.4 DIVISION 07 - THERMAL AND MOISTURE PROTECTION**A. SECTION 07 18 00, TRAFFIC COATINGS**

Finish	Manufacturer	Mfg. Color Name/No.
-	BASF	Grey

B. SECTION 07 19 00, TRAFFIC BEARING WATER REPELLENTS

Finish	Manufacturer	Mfg. Color Name/No.
-	BASF	Clear

C. SECTION 07 52 16, STYRENE-BUTADIENE-STYRENE ROOFING

Color	Manufacturer	Mfg. Color Name/No.
White	-	-

D. SECTION 07 60 00, FLASHING AND SHEET METAL

Item	Material	Finish
Downspouts	Aluminum	See Finish Schedule on Drawings for Color

E. SECTION 07 72 00, ROOF SPECIALITIES AND ACCESSORIES - See Finish Schedule on Drawings for Colors

Item	Material	Finish	Manufacturer	Manufacturer/Color Name/Number.
Copings	Extruded Aluminum	NA	-	Select from Manufacturers Standard Colors
Gravel Stops and Fascia System	Extruded Aluminum	NA	-	Select from Manufacturers Standard Colors
Scuppers	Extruded Aluminum	NA	-	Select from Manufacturers Standard Colors

F. SECTION 07 92 00, JOINT SEALANTS - See Finish Schedule on Drawings for Colors

Location	Color	Manufacturer	Manufacturer Color
Brick Control Joints	-	-	Match brick color
CMU Control Joints	-	-	Grey
Building Expansion Joints - Horizontal	-	-	Grey
Building Expansion Joints - Vertical at concrete	-	-	Grey
Building Expansion Joints - Vertical at concrete	-	-	-

G. SECTION 07 95 13, EXPANSION JOINT COVER ASSEMBLIES

	Material	Finish	Manufacturer	Mfg. Color Name/No.
Exterior Wall Thermoplastic Joint	Silicone face	-	EMSeal	Pecora 890NST, Limestone

Garage Floor	-	-	-	Black
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2.5 DIVISION 08 - OPENINGS

A. SECTION 08 11 13, HOLLOW METAL DOORS AND FRAMES - See Finish Schedule on Drawings for Colors

Component	Color of Paint Type and Gloss
Door	See Finish Legend on Drawings for Color
Frame	See Finish Legend on Drawings for Color

B. SECTION 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS FRAMES - See Finish Schedule on Drawings for Colors

Material	Finish	Manufacturer	Manufacturer Color Name/No.
Aluminum	Level 4	-	Dark Bronze Anodize
Glass	-	See Section 08 80 00	-

C. SECTION 08 71 00, BUILDERS HARDWARE

Item	Material	Finish
Hinges	See 08 71 00	-
Door Closers	See 08 71 00	-
Lock/ Latches	See 08 71 00	-
Kick Plates	See 08 71 00	-
Exit Device	See 08 71 00	-
Combination Push Pull Plate	See 08 71 00	-
Threshold	See 08 71 00	-

D. SECTION 08 80 00, GLAZING

Glazing Type	Manufacturer	Mfg. Color Name/No.
G-1	See Section 08 80 00	See Section 08 80 00
G-2	See Section 08 80 00	See Section 08 80 00
G-3	See Section 08 80 00	See Section 08 80 00

E. SECTION 08 44 13, GLAZED ALUMINUM CURTAIN WALLS

Component	Material	Finish	Manufacturer	Mfg. Color Name/No.
CW-1	Aluminum	NA	-	Dark Bronze Anodize
CW-2	Aluminum	NA	-	Dark Bronze Anodize
Glazing	-	-	-	See Section 08 80 00

2.6 Division 09 - FINISHES

A. SECTION 09 91 00, PAINT AND COATINGS FRAMES - See Finish Schedule on Drawings for Colors

1. MPI Gloss and Sheen Standards

		Gloss @60	Sheen @85
Gloss Level 1	a traditional matte finish-flat	max 5 units, and	max 10 units
Gloss Level 2	a high side sheen flat-"a velvet-like" finish	max 10 units, and	10-35 units
Gloss Level 3	a traditional "egg-shell like" finish	10-25 units, and	10-35 units
Gloss Level 4	a "satin-like" finish	20-35 units, and	min. 35 units
Gloss Level 5	a traditional semi-gloss	35-70 units	
Gloss Level 6	a traditional gloss	70-85 units	
Gloss level 7	a high gloss	more than 85 units	

2. Paint code	Gloss	Manufacturer	Mfg. Color Name/No.
P-1	Level 1	-	Match SW 7036 Accessible Beige
P-2	Level 4	-	Match SW 7048 Urbane Bronze
P-3	Level 5	-	Match SW 7037 Balanced Beige
P-4	Level 4	-	Match SW 6634 Copper Harbor
P-5	Level 4	-	Match SW 6452 Inland
P-6	Level 4	-	Match SW 6374 Torchlight
P-7	Level 4	-	Match SW 6516 Downpour

2.7 DIVISION 10 - SPECIALTIES

A. SECTION 10 44 13, FIRE EXTINGUISHER CABINETS

Component	Material	Finish
FEC	Aluminum	Mill finish

2.8 DIVISION 12 - FURNISHINGS

A. BOLLARDS (ORNAMENTAL)- See Section 12 93 00

Material	Finish	Style Name/ No.	Manufacturer	Mfg. Color Name/No.
Precast concrete	Exposed aggregate	Conical	Markstar by Wausau Tile	To be selected from mfr. standard color
HDPE	-	Tube	-	Fluorescent Yellow

2.9 DIVISION 14 - CONVEYING SYSTEMS

A. SECTION 14 24 00, HYDRAULIC ELEVATORS FRAMES - See Finish Schedule on Drawings for Colors

1. Passenger Elevator No. P-1	Component	Material	Color
	Hoistway Entrances	steel	P-2
	Hoistway Doors	Exterior steel	P-2
	Hoistway Doors	Interior Steel	Stainless steel
	Corridor Position Indicator	Stainless steel - manufacturer's standard	-
	Car Canopy	manufacturer's standard	Select from Manufacturers Standard Options
	Car Wainscot	Stainless Steel	-
	Panels Above Wainscot	Plastic laminate	PL-1
	Car Floor	Rubber floor tile	See Finish Schedule on Drawings
	Corridor Call Buttons	Stainless steel	-
	Car Doors	Stainless steel	-
	Car Door Frame	Stainless steel	-
	Corridor Position Indicator	Stainless steel	-
	Car Operating Panel	Stainless steel	-
Station Directories		Stainless Steel	

2.10 DIVISION 23 - HVAC

A. SECTION 23 37 00, AIR OUTLETS AND INLETS

Color	Manufacturer	Mfg. Color Name/No.
Bronze Anodized	-	-

2.11 DIVISON 26 - ELECTRICAL

A. SECTION 26 51 00, BUILDING LIGHTING INTERIOR

Fixture Type	Exterior Finish	Color
F-1 pendant	aluminum	Anodized aluminum
F-1E pendant	aluminum	Anodized aluminum
F-2 wall mounted	steel	White
F-3 down-light	aluminum	Silver
F-4 wall mounted	aluminum	White
F-4E wall mounted	aluminum	White
F-6 wall mounted	aluminum	Dark bronze
F-7 wall mounted	aluminum	Titanium Gray
F-8 pendant	aluminum	White
F-9 ceiling mounted	Fiber-glass	White
F-10 flood light	aluminum	Dark bronze
F-12 pendant	aluminum	Anodized aluminum

B. SECTION 26 56 00, SITE LIGHTING

Type and Component	Exterior Finish	Manufacturer	Color
F-5 pole mounted	aluminum	Kim	Dark bronze
F-11 bollard	aluminum	Beacon	Dark bronze

PART III EXECUTION

3.1 FINISH SCHEDULES & MISCELLANEOUS ABBREVIATIONS

FINISH SCHEDULE & MISCELLANEOUS ABBREVIATIONS	
Term	Abbreviation
Aluminum	AL
Baked On Enamel	BE
Brick Face	BR
Concrete	C

Concrete Masonry Unit	CMU
Curtain Wall	CW
Existing	E
Glass	GL
Material	MAT
Composite Metal Panel	MP
Paint	P
Storefront	SF

3.2 ROOM FINISH SCHEDULE FRAMES - SEE FINISH SCHEDULE ON DRAWINGS FOR COLORS

Room No. and Name	FLOOR		LOC	BASE		WALL		WAINSCOT		CEILING		REMARKS
	MAT	FC		MAT	FC	MAT	FC	MAT	FC	MAT	FC	
100 Ground Tier	C	-	N	-	-	C	-	-	-	C	-	
			E	-	-	C	-	-	-			
			S	-	-	C	-	-	-			
			W	-	-	C	-	-	-			
			C	-	-	C	-	-	-			
1-ST-02 NE Stair #1	C	-	N	-	-	C	-	-	-	C	-	
			E	-	-	C	-	-	-			
			S	-	-	AL/GL	CW-1	-	-			
			W	-	-	C	-	-	-			
			C									
1-ST-01 SE Stair #2	C	-	N	C	-	AL/GL	SF-1	-	-	C	-	
			E	C	-	C	-	-	-			
			S	-	-	AL/GL	CW-2	-	-			

			W	C	-	AL/GL /C	SF-1	-	-			
			C									
101 Elev. Machine Room	C	-	N	-	-	C	-	-	-	C	-	
			E	-	-	C	-	-	-			
			S	-	-	C	-	-	-			
			W	-	-	C	-	-	-			
			C									
102 Storage	C	-	N	CMU	-	CMU	-	-	-	C	-	
			E	C	-	C	-	-	-			
			S	CMU	-	CMU	-	-	-			
			W	C	-	C	-	-	-			
			C					-	-			
103 Electric	C	-	N	CMU	-	CMU	-	-	-	C	-	
			E	C	-	C	-	-	-			
			S	CMU	-	CMU	-	-	-			
			W	CMU	-	CMU	-	-	-			
			C					-	-			
104 Tech	C	-	N	CMU	-	CMU	-	-	-	C	-	
			E	CMU	-	CMU	-	-	-			
			S	CMU	-	CMU	-	-	-			
			W	CMU	-	CMU	-	-	-			
			C					-	-			
105 Water Service	C	-	N	CMU	-	CMU	-	-	-	C	-	
			E	C	-	C	-	-	-			
			S	CMU	-	CMU	-	-	-			

			W	CMU	-	CMU	-	-	-			
			C					-	-			
200 Second Tier	C		N	-	-	C	-	-	-	C	-	
			E	-	-	C	-	-	-			
			S	-	-	C	-	-	-			
			W	-	-	C	-	-	-			
			C	-	-	C	-	-	-			
2-ST-02 NE Stair #1			N	-	-	C	-	-	-	C	-	
			E	-	-	C	-	-	-			
			S	-	-	AL/GL	CW-1	-	-			
			W	-	-	C	-	-	-			
			C									
2-ST-01 SE Stair #2			N	C	-	AL/GL	SF-1	-	-	C	-	
			E	C	P-2	C	-	-	-			
			S	-	-	AL/GL	CW-2	-	-			
			W	C	P-2	AL/GL /C	SF-1	-	-			
			C					-	-			
201 Storage	C		N	-	-	C	-	-	-	C		
			E	-	-	C	-	-	-			
			S	-	-	C	-	-	-			
			W	-	-	C	-	-	-			
			C									
300 Third Tier	C	-	N	-	-	C	-	-	-	C	-	
			E	-	-	C	-	-	-			
			S	-	-	C	-	-	-			

			W	-	-	C	-	-	-			
			C	-	-	C	-	-	-			
3-ST-02 NE Stair #1			N	-	-	C	-	-	-	C	-	
			E	C	-	C	-	-	-			
			S	-	-	AL/GL	CW-1	-	-			
			W	C	-	C	-	-	-			
			C									
3-ST-01 SE Stair #2			N	C	-	AL/GL	SF-1	-	-	C	-	
			E	C	-	C	-	-	-			
			S	-	-	AL/GL	CW-2	-	-			
			W	C	-	AL/GL /C	SF-1	-	-			
			C									
301 Storage	C		N	-	-	C	-	-	-	C	-	
			E	-	-	C	-	-	-			
			S	-	-	C	-	-	-			
			W	-	-	C	-	-	-			
			C									
400 Top Tier	C		N	-	-	C	-	-	-	C	-	
			E	-	-	C	-	-	-			
			S	-	-	C	-	-	-			
			W	-	-	C	-	-	-			
			C			C	-	-	-			
4-ST-01 SE Stair #2			N	C	-	AL/GL	SF-1	-	-	C	-	
			E	C	-	C	-	-	-			
			S	-	-	AL/GL	CW-2	-	-			

			W	C	-	AL/GL /C	SF-1	-	-			
			C									
4-ST-03 Stair #3	C		N	-	-	C	-	-	-	C	-	
			E	-	-	C	-	-	-			
			S	-	-	C	-	-	-			
			W	-	-	C	-	-	-			
			C									
401 Storage	C		N	-	-	C	-	-	-	C	-	
			E	-	-	C	-	-	-			
			S	-	-	C	-	-	-			
			W	-	-	C	-	-	-			
			C									

1. Where no indication for base or wainscot is shown, the wall material, finish and color are continuous over the entire wall.

--- E N D---

**SECTION 09 91 00
PAINTING**

PART 1-GENERAL

1.1 DESCRIPTION

- A. Section specifies field painting.
- B. Section specifies prime coats which may be applied in shop under other sections.
- C. Painting includes shellacs, stains, varnishes, coatings specified, and striping or markers and identity markings.

1.2 RELATED WORK

- A. Shop prime painting of steel and ferrous metals: Division 05 - METALS, Division 08 - OPENINGS, Division 10 - SPECIALTIES, Division 14 - CONVEYING EQUIPMENT, Division 21 - FIRE SUPPRESSION, Division 22 - PLUMBING, Division 23 - HEATING, VENTILATION AND AIR-CONDITIONING, Division 26 - ELECTRICAL, and Division 27 - COMMUNICATIONS.
- B. Type of Finish, Color, and Gloss Level of Finish Coat: Section 09 06 00, SCHEDULE FOR FINISHES and drawings for color.
- C. Asphalt and concrete pavement marking: Section 32 17 23, PAVEMENT MARKINGS.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
Before work is started, or sample panels are prepared, submit manufacturer's literature, the current Master Painters Institute (MPI) "Approved Product List" indicating brand label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use subsequent MPI "Approved Product List", however, only one list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI "Approved Product List" where applicable is acceptable.
- C. Sample Panels:
 - 1. After painters' materials have been approved and before work is started submit sample panels showing each type of finish and color specified.

2. Panels to show color: Composition board, 100 by 250 by 3 mm (4 inch by 10 inch by 1/8 inch).
 3. Panel to show transparent finishes: Wood of same species and grain pattern as wood approved for use, 100 by 250 by 3 mm (4 inch by 10 inch face by 1/4 inch) thick minimum, and where both flat and edge grain will be exposed, 250 mm (10 inches) long by sufficient size, 50 by 50 mm (2 by 2 inch) minimum or actual wood member to show complete finish.
 4. Attach labels to panel stating the following:
 - a. Federal Specification Number or manufacturers name and product number of paints used.
 - b. Specification code number specified in Section 09 06 00, SCHEDULE FOR FINISHES.
 - c. Product type and color.
 - d. Name of project.
 5. Strips showing not less than 50 mm (2 inch) wide strips of undercoats and 100 mm (4 inch) wide strip of finish coat.
- D. Sample of identity markers if used.
- E. Manufacturers' Certificates indicating compliance with specified requirements:
1. Manufacturer's paint substituted for Federal Specification paints meets or exceeds performance of paint specified.
 2. High temperature aluminum paint.

1.4 DELIVERY AND STORAGE

- A. Deliver materials to site in manufacturer's sealed container marked to show following:
1. Name of manufacturer.
 2. Product type.
 3. Batch number.
 4. Instructions for use.
 5. Safety precautions.
- B. In addition to manufacturer's label, provide a label legibly printed as following:
1. Federal Specification Number, where applicable, and name of material.
 2. Surface upon which material is to be applied.
 3. If paint or other coating, state coat types; prime, body or finish.
- C. Maintain space for storage, and handling of painting materials and equipment in a neat and orderly condition to prevent spontaneous combustion from occurring or igniting adjacent items.

- D. Store materials at site at least 24 hours before using, at a temperature between 18 and 30 degrees C (65 and 85 degrees F).

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.
- B. American Conference of Governmental Industrial Hygienists (ACGIH):
- ACGIH TLV-BKLT-2012.....Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)
- ACGIH TLV-DOC-2012.....Documentation of Threshold Limit Values and Biological Exposure Indices, (Seventh Edition)
- C. American National Standards Institute (ANSI):
- A13.1-07.....Scheme for the Identification of Piping Systems
- D. American Society for Testing and Materials (ASTM):
- D260-86.....Boiled Linseed Oil
- E. Commercial Item Description (CID):
- A-A-1555.....Water Paint, Powder (Cementitious, White and Colors) (WPC) (cancelled)
- A-A-3120.....Paint, For Swimming Pools (RF) (cancelled)
- F. Federal Specifications (Fed Spec):
- TT-P-1411A.....Paint, Copolymer-Resin, Cementitious (For Waterproofing Concrete and Masonry Walls) (CEP)
- G. Master Painters Institute (MPI):
- No. 94-12.....Exterior Alkyd, Semi-Gloss (EO)
- H. Steel Structures Painting Council (SSPC):
- SSPC SP 1-04 (R2004)....Solvent Cleaning
- SSPC SP 2-04 (R2004)....Hand Tool Cleaning
- SSPC SP 3-04 (R2004)....Power Tool Cleaning

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Exterior Alkyd, Semi-Gloss (EO): MPI 94.

2.2 PAINT PROPERTIES

- A. Use ready-mixed (including colors), except two component epoxies, polyurethanes, polyesters, paints having metallic powders packaged separately and paints requiring specified additives.

- B. Where no requirements are given in the referenced specifications for primers, use primers with pigment and vehicle, compatible with substrate and finish coats specified.

2.3 REGULATORY REQUIREMENTS/QUALITY ASSURANCE

- A. Paint materials shall conform to the restrictions of the local Environmental and Toxic Control jurisdiction.
 - 1. Volatile Organic Compounds (VOC): VOC content of paint materials shall not exceed 10g/l for interior latex paints/primers and 50g/l for exterior latex paints and primers.
 - 2. Lead-Base Paint:
 - a. Comply with Section 410 of the Lead-Based Paint Poisoning Prevention Act, as amended, and with implementing regulations promulgated by Secretary of Housing and Urban Development.
 - b. Regulations concerning prohibition against use of lead-based paint in federal and federally assisted construction, or rehabilitation of residential structures are set forth in Subpart F, Title 24, Code of Federal Regulations, Department of Housing and Urban Development.
 - c. For lead-paint removal, see Section 02 83 33.13, LEAD-BASED PAINT REMOVAL AND DISPOSAL.
 - 3. Asbestos: Materials shall not contain asbestos.
 - 4. Chromate, Cadmium, Mercury, and Silica: Materials shall not contain zinc-chromate, strontium-chromate, Cadmium, mercury or mercury compounds or free crystalline silica.
 - 5. Human Carcinogens: Materials shall not contain any of the ACGIH-BKLT and ACGHI-DOC confirmed or suspected human carcinogens.
 - 6. Use high performance acrylic paints in place of alkyd paints, where possible.
 - 7. VOC content for solvent-based paints shall not exceed 250g/l and shall not be formulated with more than one percent aromatic hydro carbons by weight.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

- A. Safety: Observe required safety regulations and manufacturer's warning and instructions for storage, handling and application of painting materials.
 - 1. Take necessary precautions to protect personnel and property from hazards due to falls, injuries, toxic fumes, fire, explosion, or other harm.

2. Deposit soiled cleaning rags and waste materials in metal containers approved for that purpose. Dispose of such items off the site at end of each days work.

B. Atmospheric and Surface Conditions:

1. Do not apply coating when air or substrate conditions are:
 - a. Less than 3 degrees C (5 degrees F) above dew point.
 - b. Below 10 degrees C (50 degrees F) or over 35 degrees C (95 degrees F), unless specifically pre-approved by the Contracting Officer and the product manufacturer. Under no circumstances shall application conditions exceed manufacturer recommendations.
2. Maintain interior temperatures until paint dries hard.
3. Do no exterior painting when it is windy and dusty.
4. Do not paint in direct sunlight or on surfaces that the sun will soon warm.
5. Apply only on clean, dry and frost free surfaces except as follows:
 - a. Apply water thinned acrylic and cementitious paints to damp (not wet) surfaces where allowed by manufacturer's printed instructions.
 - b. Dampened with a fine mist of water on hot dry days concrete and masonry surfaces to which water thinned acrylic and cementitious paints are applied to prevent excessive suction and to cool surface.

3.2 SURFACE PREPARATION

- A. Method of surface preparation is optional, provided results of finish painting produce solid even color and texture specified with no overlays.

B. General:

1. Remove prefinished items not to be painted such as lighting fixtures, escutcheon plates, hardware, trim, and similar items for reinstallation after paint is dried.
2. Remove items for reinstallation and complete painting of such items and adjacent areas when item or adjacent surface is not accessible or finish is different.
3. See other sections of specifications for specified surface conditions and prime coat.
4. Clean surfaces for painting with materials and methods compatible with substrate and specified finish. Remove any residue remaining from cleaning agents used. Do not use solvents, acid, or steam on concrete and masonry.

C. Ferrous Metals:

1. Remove oil, grease, soil, drawing and cutting compounds, flux and other detrimental foreign matter in accordance with SSPC-SP 1 (Solvent Cleaning).
2. Remove loose mill scale, rust, and paint, by hand or power tool cleaning, as defined in SSPC-SP 2 (Hand Tool Cleaning) and SSPC-SP 3 (Power Tool Cleaning). Exception: where high temperature aluminum paint is used, prepare surface in accordance with paint manufacturer's instructions.
3. Fill dents, holes and similar voids and depressions in flat exposed surfaces of hollow steel doors and frames, access panels, roll-up steel doors and similar items specified to have semi-gloss or gloss finish with TT-F-322D (Filler, Two-Component Type, For Dents, Small Holes and Blow-Holes). Finish flush with adjacent surfaces.
 - a. This includes flat head countersunk screws used for permanent anchors.
 - b. Do not fill screws of item intended for removal such as glazing beads.
4. Spot prime abraded and damaged areas in shop prime coat which expose bare metal with same type of paint used for prime coat. Feather edge of spot prime to produce smooth finish coat.
5. Spot prime abraded and damaged areas which expose bare metal of factory finished items with paint as recommended by manufacturer of item.

D. Zinc-Coated (Galvanized) Metal, and Aluminum Surfaces Specified Painted:

1. Clean surfaces to remove grease, oil and other deterrents to paint adhesion in accordance with SSPC-SP 1 (Solvent Cleaning).
2. Spot coat abraded and damaged areas of zinc-coating which expose base metal on hot-dip zinc-coated items with MPI 18 (Organic Zinc Rich Coating). Prime or spot prime with MPI 134 (Waterborne Galvanized Primer) or MPI 135 (Non- Cementitious Galvanized Primer) depending on finish coat compatibility.

3.3 PAINT PREPARATION

- A. Thoroughly mix painting materials to ensure uniformity of color, complete dispersion of pigment and uniform composition.
- B. Do not thin unless necessary for application and when finish paint is used for body and prime coats. Use materials and quantities for thinning as specified in manufacturer's printed instructions.

- C. Remove paint skins, then strain paint through commercial paint strainer to remove lumps and other particles.
- D. Mix two component and two part paint and those requiring additives in such a manner as to uniformly blend as specified in manufacturer's printed instructions unless specified otherwise.
- E. For tinting required to produce exact shades specified, use color pigment recommended by the paint manufacturer.

3.4 APPLICATION

- A. Start of surface preparation or painting will be construed as acceptance of the surface as satisfactory for the application of materials.
- B. Unless otherwise specified, apply paint in three coats; prime, body, and finish. When two coats applied to prime coat are the same, first coat applied over primer is body coat and second coat is finish coat.
- C. Apply each coat evenly and cover substrate completely.
- D. Allow not less than 48 hours between application of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by Project Manager.
- E. Finish surfaces to show solid even color, free from runs, lumps, brushmarks, laps, holidays, or other defects.
- F. Apply by brush, roller or spray, except as otherwise specified.
 - 1. Apply painting materials specifically required by manufacturer to be applied by spraying.
 - 2. In areas, where paint is applied by spray, mask or enclose with polyethylene, or similar air tight material with edges and seams continuously sealed including items specified in WORK NOT PAINTED, motors, controls, telephone, and electrical equipment, fronts of sterilizes and other recessed equipment and similar prefinished items.
- G. Do not paint in closed position operable items such as access doors and panels, window sashes, overhead doors, and similar items except overhead roll-up doors and shutters.

3.5 PRIME PAINTING

- A. After surface preparation prime surfaces before application of body and finish coats, except as otherwise specified.
- B. Spot prime and apply body coat to damaged and abraded painted surfaces before applying succeeding coats.

- C. Additional field applied prime coats over shop or factory applied prime coats are not required except for exterior exposed steel apply an additional prime coat.
- D. Prime rebates for stop and face glazing of wood, and for face glazing of steel.
- E. Metals except boilers, incinerator stacks, and engine exhaust pipes:
 - 1. Steel and iron: MPI 95 (Fast Drying Metal Primer).
 - 2. Zinc-coated steel and iron: MPI 134 (Waterborne Galvanized Primer).
 - 3. Aluminum scheduled to be painted: MPI 95 (Fast Drying Metal Primer).
 - 4. Machinery not factory finished: MPI 9 (Exterior Alkyd Enamel (EO)).
 - 5. Asphalt coated metal: MPI 1 (Aluminum Paint (AP)).
 - 6. Metal over 94 degrees C. (200 degrees F), Boilers, Incinerator Stacks, and Engine Exhaust Pipes: MPI 22 (High Heat Resistant Coating (HR)).
- F. Concrete Masonry Units except glazed or integrally colored and decorative units:
 - 1. MPI 4 (Block Filler) on interior surfaces.
 - 2. Prime exterior surface as specified for exterior finishes.

3.6 EXTERIOR FINISHES

- A. Apply following finish coats where specified in Section 09 06 00, SCHEDULE FOR FINISHES and Finish Schedule on Drawings for Colors.
- B. Steel and Ferrous Metal:
 - 1. Two coats of MPI 94 (Exterior Alkyd, Semi-Gloss (EO)) on exposed surfaces, except on surfaces over 94 degrees C (200 degrees F).
- C. Machinery without factory finish except for primer: MPI 94 (Exterior Alkyd, Semi-Gloss (EO)).

3.7 INTERIOR FINISHES

- A. Apply following finish coats over prime coats in spaces or on surfaces specified on drawings.
- B. Metal Work:
 - 1. Apply to exposed surfaces.
 - 2. Omit body and finish coats on surfaces concealed after installation except electrical conduit containing conductors over 600 volts.
 - 3. Ferrous Metal, Galvanized Metal, and Other Metals Scheduled:
 - a. Apply two coats of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) unless specified otherwise.
 - b. One coat of MPI 46 (Interior Enamel Undercoat) plus one coat of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) on exposed interior surfaces of alkyd-amine enamel prime finished windows.

- c. Machinery: One coat MPI 9 (Exterior Alkyd Enamel (EO)).
- d. Asphalt Coated Metal: One coat MPI 1 (Aluminum Paint (AP)).
- e. Ferrous Metal over 94 degrees K (200 degrees F): Boilers, Incinerator Stacks, and Engine Exhaust Pipes: One coat MPI 22 (High Heat Resistant Coating (HR)).

3.8 PAINT COLOR

- A. Color and gloss of finish coats is specified in Section 09 06 00, SCHEDULE FOR FINISHES and Finish Schedule on Drawings for Colors.
- B. For additional requirements regarding color see Articles, REFINISHING EXISTING PAINTED SURFACE and MECHANICAL AND ELECTRICAL FIELD PAINTING SCHEDULE.
- C. Coat Colors:
 - 1. Color of priming coat: Lighter than body coat.
 - 2. Color of body coat: Lighter than finish coat.
 - 3. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.
- D. Painting, Caulking, Closures, and Fillers Adjacent to Casework:
 - 1. Paint to match color of casework where casework has a paint finish.
 - 2. Paint to match color of wall where casework is stainless steel, plastic laminate, or varnished wood.

3.9 MECHANICAL AND ELECTRICAL WORK FIELD PAINTING SCHEDULE

- A. Field painting of mechanical and electrical consists of cleaning, touching-up abraded shop prime coats, and applying prime, body and finish coats to materials and equipment if not factory finished in space scheduled to be finished.
- B. In spaces not scheduled to be finish painted in Section 09 06 00, SCHEDULE FOR FINISHES paint as specified under paragraph H, colors.
- C. Paint various systems specified in Division 02 - EXISTING CONDITIONS, Division 21 - FIRE SUPPRESSION, Division 22 - PLUMBING, Division 23 - HEATING, VENTILATION AND AIR-CONDITIONING, Division 26 - ELECTRICAL, and Division 27 - COMMUNICATIONS.
- D. Paint after tests have been completed.
- E. Omit prime coat from factory prime-coated items.
- F. Finish painting of mechanical and electrical equipment is not required when located in interstitial spaces, above suspended ceilings, in concealed areas such as pipe and electric closets, pipe basements, pipe tunnels, trenches, attics, roof spaces, shafts and furred spaces except on electrical conduit containing feeders 600 volts or more.

G. Omit field painting of items specified in paragraph, Building and Structural WORK NOT PAINTED.

H. Color:

1. Paint items having no color specified in Section 09 06 00, SCHEDULE FOR FINISHES to match surrounding surfaces.
2. Paint colors as specified in Section 09 06 00, SCHEDULE FOR FINISHES except for following:
 - a. WhiteExterior unfinished surfaces of enameled plumbing fixtures. Insulation coverings on breeching and uptake inside boiler house, drums and drum-heads, oil heaters, condensate tanks and condensate piping.
 - b. Gray:Heating, ventilating, air conditioning and refrigeration equipment (except as required to match surrounding surfaces), and water and sewage treatment equipment and sewage ejection equipment.
 - c. Aluminum Color: Ferrous metal on outside of boilers and in connection with boiler settings including supporting doors and door frames and fuel oil burning equipment, and steam generation system (bare piping, fittings, hangers, supports, valves, traps and miscellaneous iron work in contact with pipe).
 - d. Federal Safety Red: Exposed fire protection piping hydrants, post indicators, electrical conducts containing fire alarm control wiring, and fire alarm equipment.
 - e. Federal Safety Orange: .Entire lengths of electrical conduits containing feeders 600 volts or more.
 - f. Color to match brickwork sheet metal covering on breeching outside of exterior wall of boiler house.

I. Apply paint systems on properly prepared and primed surface as follows:

1. Exterior Locations:
 - a. Apply two coats of MPI 94 (Exterior Alkyd, Semi-gloss (EO)) to the following ferrous metal items:
Vent and exhaust pipes with temperatures under 94 degrees C (200 degrees F), roof drains, fire hydrants, post indicators, yard hydrants, exposed piping and similar items.
 - b. Apply two coats of MPI 11 (Exterior Latex, Semi Gloss (AE) to the following metal items:
Galvanized and zinc-copper alloy metal.

2. Interior Locations:

- a. Apply two coats of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) to following items:
 - 1) Metal under 94 degrees C (200 degrees F) of items such as bare piping, fittings, hangers and supports.
 - 2) Equipment and systems such as hinged covers and frames for control cabinets and boxes, cast-iron radiators, electric conduits and panel boards.
 - 3) Heating, ventilating, air conditioning, plumbing equipment, and machinery having shop prime coat and not factory finished.

3. Other exposed locations:

- a. Metal surfaces, except aluminum, of cooling towers exposed to view, including connected pipes, rails, and ladders: Two coats of MPI 1 (Aluminum Paint (AP)).
- b. Cloth jackets of insulation of ducts and pipes in connection with plumbing, air conditioning, ventilating refrigeration and heating systems: One coat of MPI 50 (Interior Latex Primer Sealer) and one coat of MPI 11 (Exterior Latex Semi-Gloss (AE)).

3.10 BUILDING AND STRUCTURAL WORK FIELD PAINTING

- A. Painting and finishing of interior and exterior work except as specified under paragraph 3.11 B.
 - 1. Painting and finishing of new work including colors and gloss of finish selected is specified in Finish Schedule, Section 09 06 00, SCHEDULE FOR FINISHES and Finish Schedule on Drawings for Colors.
 - 2. Painting of disturbed, damaged and repaired or patched surfaces when entire space is not scheduled for complete repainting or refinishing.
 - 3. Painting of ferrous metal and galvanized metal.
 - 4. Painting of wood with fire retardant paint exposed in attics, when used as mechanical equipment.
 - 5. Identity painting and safety painting.
- B. Building and Structural Work not Painted:
 - 1. Prefinished items:
 - a. Casework, doors, elevator entrances and cabs, metal panels, wall covering, and similar items specified factory finished under other sections.
 - b. Factory finished equipment and pre-engineered metal building components such as metal roof and wall panels.
 - 2. Finished surfaces:

- a. Hardware except ferrous metal.
- b. Anodized aluminum, stainless steel, chromium plating, copper, and brass, except as otherwise specified.
- c. Signs, fixtures, and other similar items integrally finished.
- 3. Concealed surfaces:
 - a. Inside elevator and duct shafts, interstitial spaces, above ceilings, attics, except as otherwise specified.
 - b. Inside walls or other spaces behind access doors or panels.
 - c. Surfaces concealed behind permanently installed casework and equipment.
- 4. Moving and operating parts:
 - a. Shafts, chains, gears, mechanical and electrical operators, linkages, and sprinkler heads, and sensing devices.
 - b. Tracks for overhead or coiling doors, shutters, and grilles.
- 5. Labels:
 - a. Code required label, such as Underwriters Laboratories Inc., Inchcape Testing Services, Inc., or Factory Mutual Research Corporation.
 - b. Identification plates, instruction plates, performance rating, and nomenclature.
- 6. Galvanized metal:
 - a. Exterior chain link fence and gates, corrugated metal areaways, and gratings.
 - b. Except where specifically specified to be painted.
- 7. Metal safety treads and nosings.
- 8. Gaskets.
- 9. Concrete curbs, gutters, pavements, retaining walls, exterior exposed foundations walls and interior walls in pipe basements.
- 10. Face brick.
- 11. Structural steel encased in concrete, masonry, or other enclosure.
- 12. Structural steel to receive sprayed-on fire proofing.
- 13. Ceilings, walls, columns in interstitial spaces.
- 14. Ceilings, walls, and columns in pipe basements.

3.11 IDENTITY PAINTING SCHEDULE

- A. Identify designated service in accordance with ANSI A13.1, unless specified otherwise, on exposed piping, piping above removable ceilings, piping in accessible pipe spaces, interstitial spaces, and piping behind access panels.

1. Legend may be identified using 2.1 G options or by stencil applications.
2. Apply legends adjacent to changes in direction, on branches, where pipes pass through walls or floors, adjacent to operating accessories such as valves, regulators, strainers and cleanouts a minimum of 12 000 mm (40 feet) apart on straight runs of piping. Identification next to plumbing fixtures is not required.
3. Locate Legends clearly visible from operating position.
4. Use arrow to indicate direction of flow.
5. Identify pipe contents with sufficient additional details such as temperature, pressure, and contents to identify possible hazard. Insert working pressure shown on drawings where asterisk appears for High, Medium, and Low Pressure designations as follows:
 - a. High Pressure - 414 kPa (60 psig) and above.
 - b. Medium Pressure - 104 to 413 kPa (15 to 59 psig).
 - c. Low Pressure - 103 kPa (14 psig) and below.
 - d. Add Fuel oil grade numbers.
6. Legend name in full or in abbreviated form as follows:

PIPING	COLOR OF EXPOSED PIPING	COLOR OF BACKGROUND	COLOR OF LETTERS	LEGEND BBREVIATIONS
Blow-off		Yellow	Black	Blow-off
Boiler Feedwater		Yellow	Black	Blr Feed
A/C Condenser Water Supply		Green	White	A/C Cond Wtr Sup
A/C Condenser Water Return		Green	White	A/C Cond Wtr Ret
Chilled Water Supply		Green	White	Ch. Wtr Sup
Chilled Water Return		Green	White	Ch. Wtr Ret
Shop Compressed Air		Yellow	Black	Shop Air
Air-Instrument Controls		Green	White	Air-Inst Cont
Drain Line		Green	White	Drain
Emergency Shower		Green	White	Emg Shower
High Pressure Steam		Yellow	Black	H.P. _____*
High Pressure Condensate Return		Yellow	Black	H.P. Ret _____*
Medium Pressure Steam		Yellow	Black	M. P. Stm _____*
Medium Pressure Condensate Return		Yellow	Black	M.P. Ret _____*
Low Pressure Steam		Yellow	Black	L.P. Stm _____*
Low Pressure Condensate Return		Yellow	Black	L.P. Ret _____*
High Temperature Water Supply		Yellow	Black	H. Temp Wtr Sup
High Temperature Water Return		Yellow	Black	H. Temp Wtr Ret
Hot Water Heating Supply		Yellow	Black	H. W. Htg Sup
Hot Water Heating Return		Yellow	Black	H. W. Htg Ret

Gravity Condensate Return		Yellow	Black	Gravity Cond Ret
Pumped Condensate Return		Yellow	Black	Pumped Cond Ret
Vacuum Condensate Return		Yellow	Black	Vac Cond Ret
Fuel Oil - Grade		Green	White	Fuel Oil-Grade ____*
Boiler Water Sampling		Yellow	Black	Sample
Chemical Feed		Yellow	Black	Chem Feed
Continuous Blow-Down		Yellow	Black	Cont. B D
Pumped Condensate		Black		Pump Cond
Pump Recirculating		Yellow	Black	Pump-Recirc.
Vent Line		Yellow	Black	Vent
Alkali		Yellow	Black	Alk
Bleach		Yellow	Black	Bleach
Detergent		Yellow	Black	Det
Liquid Supply		Yellow	Black	Liq Sup
Reuse Water		Yellow	Black	Reuse Wtr
Cold Water (Domestic)	White	Green	White	C.W. Dom
Hot Water (Domestic)				
Supply	White	Yellow	Black	H.W. Dom
Return	White	Yellow	Black	H.W. Dom Ret
Tempered Water	White	Yellow	Black	Temp. Wtr
Ice Water				
Supply	White	Green	White	Ice Wtr
Return	White	Green	White	Ice Wtr Ret
Reagent Grade Water		Green	White	RG
Reverse Osmosis		Green	White	RO
Sanitary Waste		Green	White	San Waste
Sanitary Vent		Green	White	San Vent
Storm Drainage		Green	White	St Drain
Pump Drainage		Green	White	Pump Disch
Chemical Resistant Pipe				
Waste		Yellow	Black	Acid Waste
Vent		Yellow	Black	Acid Vent
Atmospheric Vent		Green	White	ATV
Silver Recovery		Green	White	Silver Rec
Oral Evacuation		Green	White	Oral Evac
Fuel Gas		Yellow	Black	Gas
Fire Protection Water				
Sprinkler		Red	White	Auto Spr
Standpipe		Red	White	Stand
Sprinkler		Red	White	Drain

7. See Sections for methods of identification, legends, and abbreviations of the following:

aa.RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Section 27 05 33, RACEWAYS
AND BOXES FOR COMMUNICATIONS SYSTEMS.

B. Fire and Smoke Partitions:

1. Identify partitions above ceilings on both sides of partitions except within shafts in letters not less than 64 mm (2 1/2 inches) high.
2. Stenciled message: "SMOKE BARRIER" or, "FIRE BARRIER" as applicable.
3. Locate not more than 6100 mm (20 feet) on center on corridor sides of partitions, and with a least one message per room on room side of partition.
4. Use semigloss paint of color that contrasts with color of substrate.

3.12 PROTECTION CLEAN UP, AND TOUCH-UP

- A. Protect work from paint droppings and spattering by use of masking, drop cloths, removal of items or by other approved methods.
- B. Upon completion, clean paint from hardware, glass and other surfaces and items not required to be painted of paint drops or smears.
- C. Before final inspection, touch-up or refinished in a manner to produce solid even color and finish texture, free from defects in work which was damaged or discolored.

- - - E N D - - -

SANITARY MH#1
DETAIL 1/43-L14.1
N=612153.94
E=2173313.18
RIM=709.10
INV(N)=699.29
INV(S)=698.96

129 LF - 8" PVC
SDR26 @ 5.50%

SANITARY MH (BY OTHERS)
RIM=709.75 +/-
INV(SW)=691.29 (V.I.F.)
CORE DRILL NEW NORTH
INVERT AT ELEV. 691.87

8" SANITARY SEWER
(BY OTHERS)

8" SANITARY SEWER
(BY OTHERS)

SCOPE REVISIONS:

- DELETE APPROX. 603 LF - 8" SANITARY SEWER AND TRENCH BACKFILL
- DELETE 7 SANITARY MANHOLES
- DELETE ASSOCIATED PAVEMENT, CURB, AND SIDEWALK PATCHING
- DELETE ASSOCIATED LANDSCAPE RESTORATION
- DELETE REMOVAL OF 3 EXISTING TREES, PROTECTION FENCING OF 4 EXISTING TREES
- DELETE APPROX. 250 LF SILT FENCE, 2 INLET FILTERS



OVERALL UTILITY PLAN

SCALE: 1"=60'-0"

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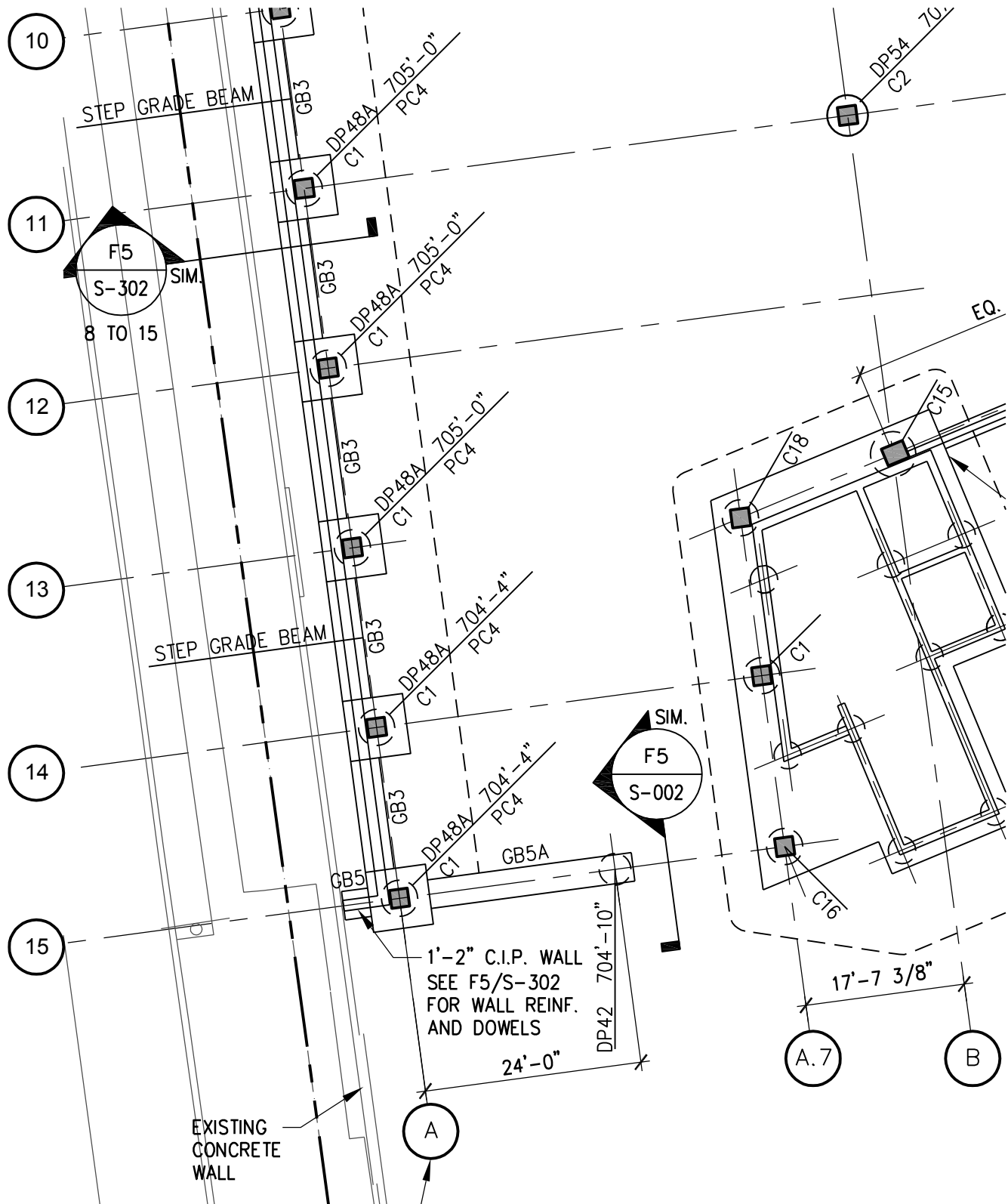
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PARKING STRUCTURE 400 CAR PARKING GARAGE

IOWA CITY, IA
PROJECT ADDRESS

Date: 10.1.13
Sheet Rvsd: 43-L10.0
Scale: AS NOTED
Drawn By: MAY
Project No.: 636-402

Sketch No.: C-SK 03



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PARKING STRUCTURE 400 CAR PARKING GARAGE

IOWA CITY, IA
PROJECT ADDRESS

Date: 10/18/13

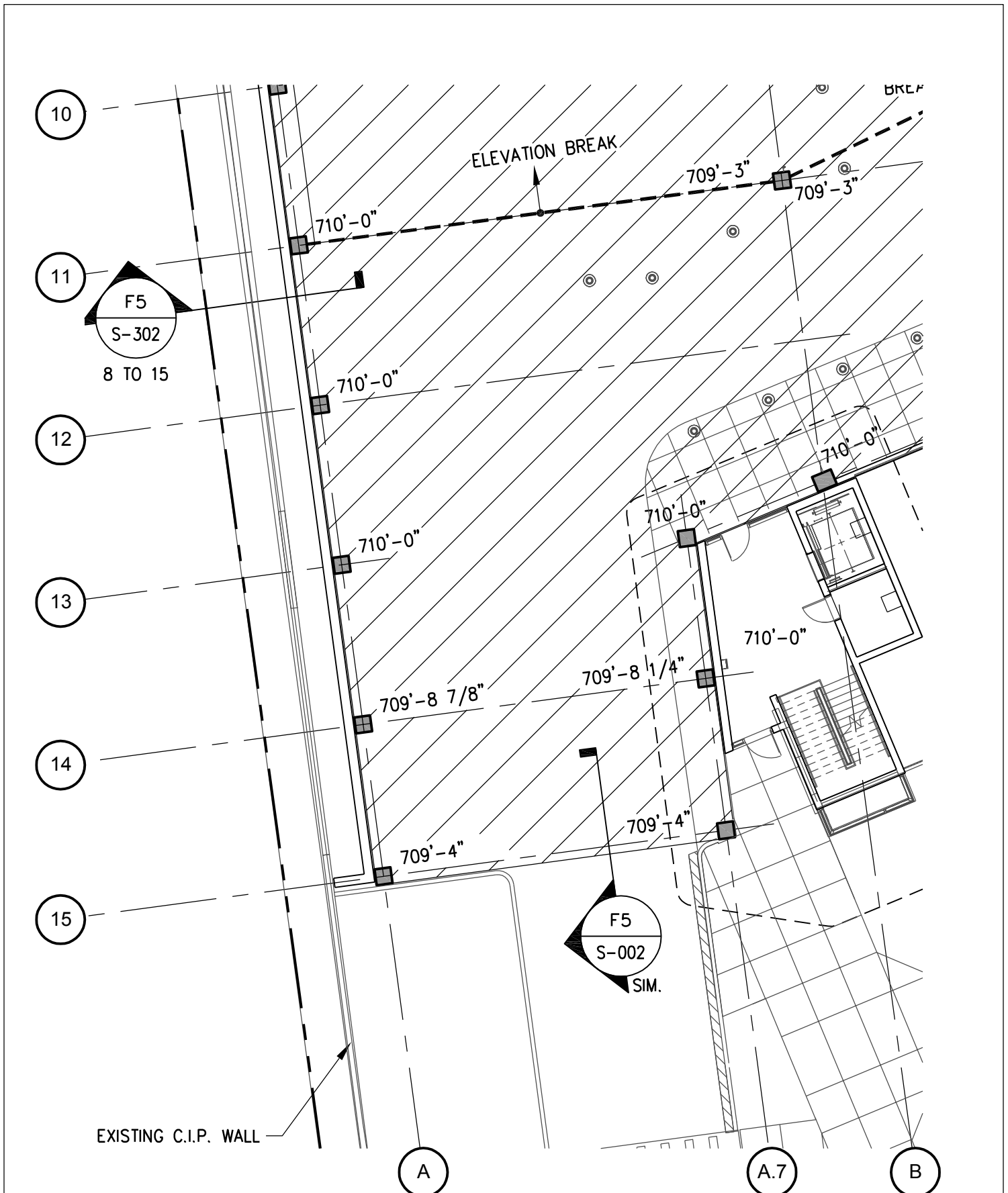
Sheet Rvsd: S-100

Scale: 1/16" = 1'-0"

Drawn By: MJK

Project No.: S-SK08-10.18.10

Sketch No.: S-SK08-10.18.13



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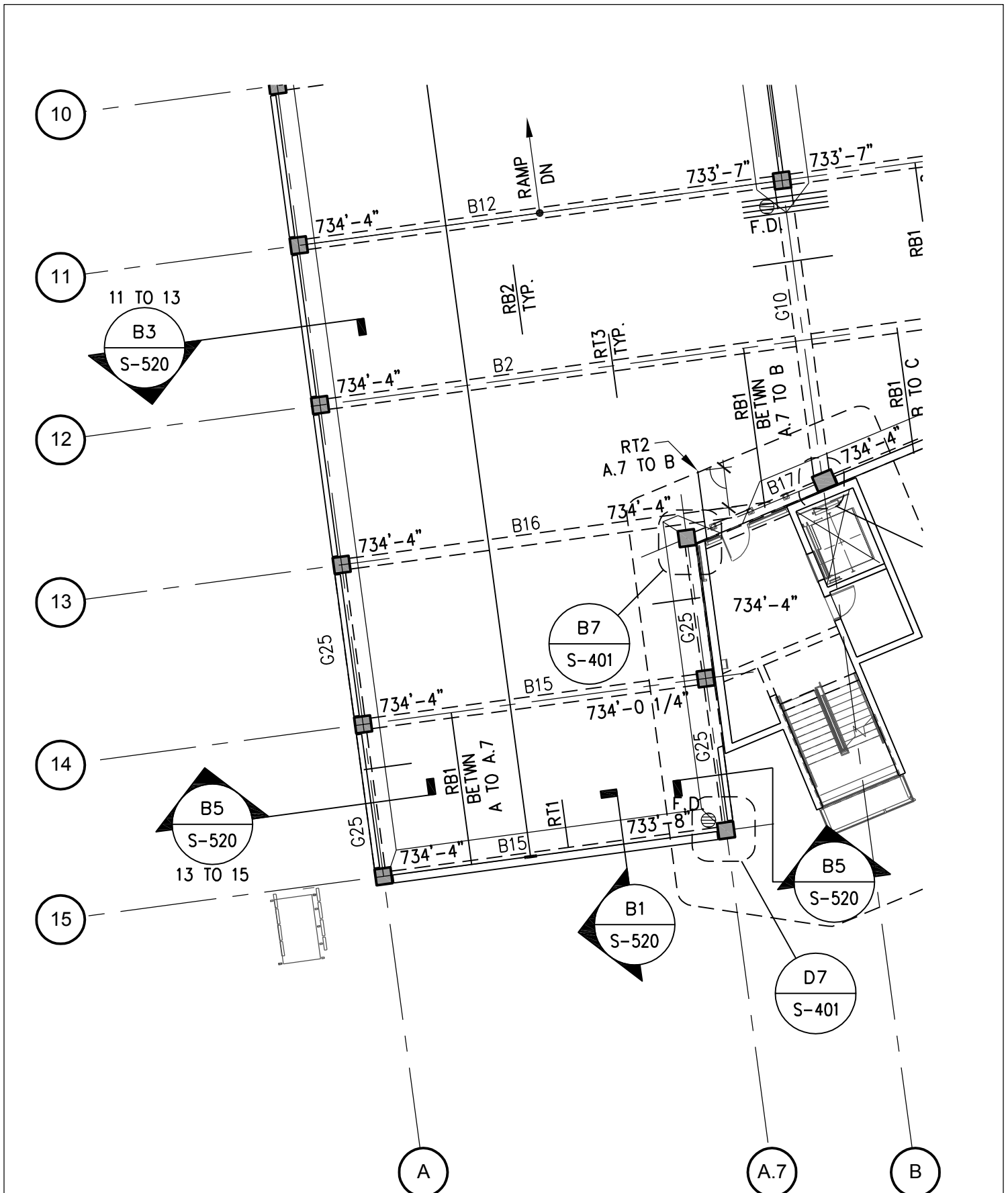
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PARKING STRUCTURE 400 CAR PARKING GARAGE

IOWA CITY, IA
PROJECT ADDRESS

Date: 10/18/13
Sheet Rvsd: S-101
Scale: 1/16" = 1'-0"
Drawn By: MJK
Project No.: 31-7141.10

Sketch No.: S-SK 09-10.18.13



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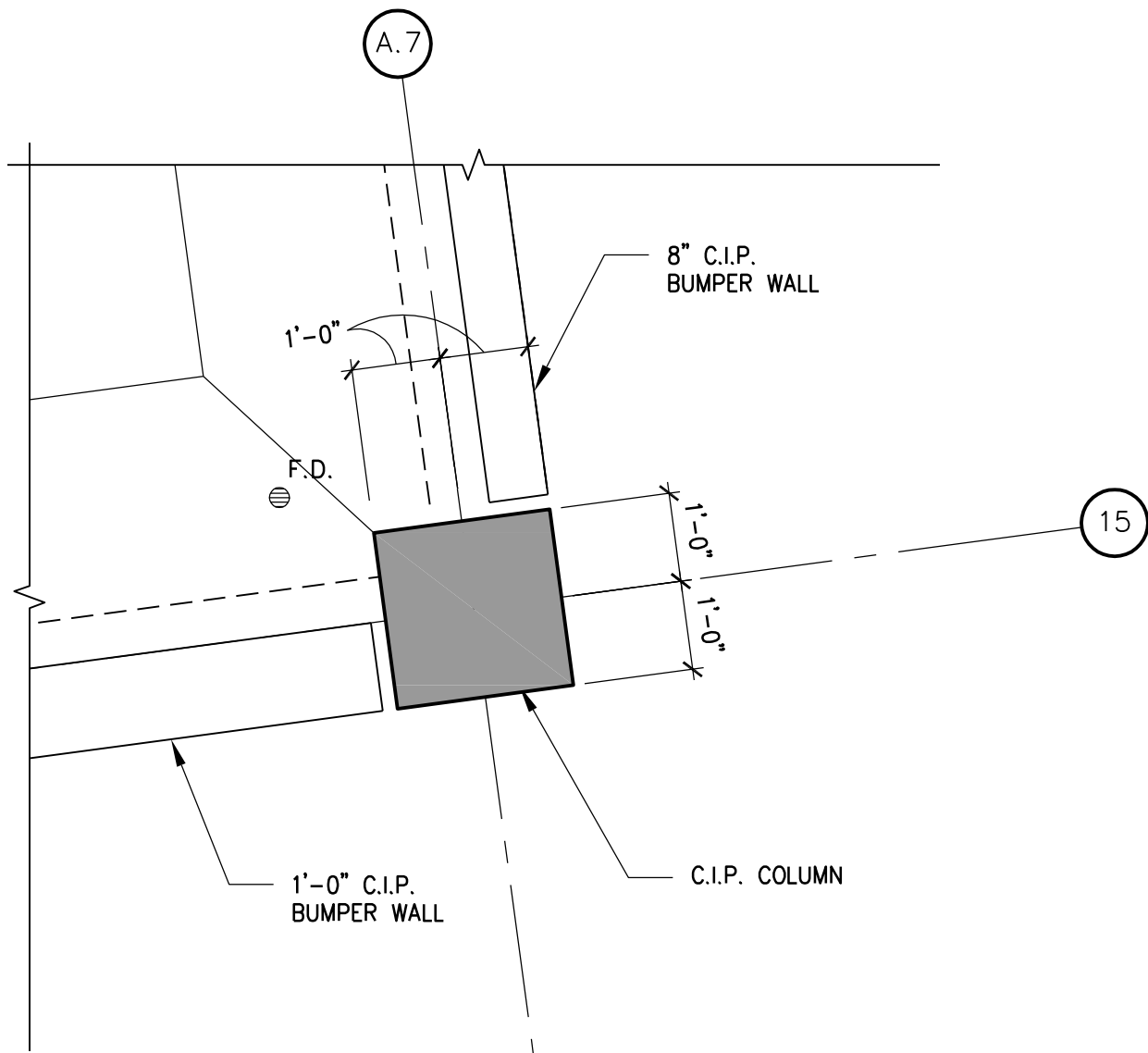
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PARKING STRUCTURE 400 CAR PARKING GARAGE

IOWA CITY, IA
PROJECT ADDRESS

Date: 10/18/13
Sheet Rvsd: S-103
Scale: 1/16" = 1'-0"
Drawn By: MJK
Project No.: 31-7141.10

Sketch No.: S-SK11-10.18.13



D7 PLAN DETAIL

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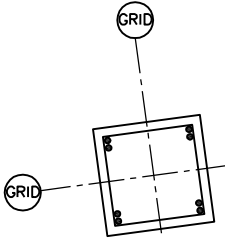

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**PARKING STRUCTURE
400 CAR PARKING GARAGE**

**IOWA CITY, IA
PROJECT ADDRESS**

Date: 10/18/13
Sheet Rvsd: S-401
Scale: NTS
Drawn By: MJK
Project No.: 31-7141.10
Sketch No.: S-SK14-10.18.13

C16	C17
SEE NOTE CN10	NOT USED
	
	

CN10. SEE SHEET S-401 FOR COLUMN SIZE, ORIENTATION AND SHAPE AT
GRIDS E/1, C/20, A.7/21, D/18, C/21, A.7/15, A/1, D/20, AND B/21.

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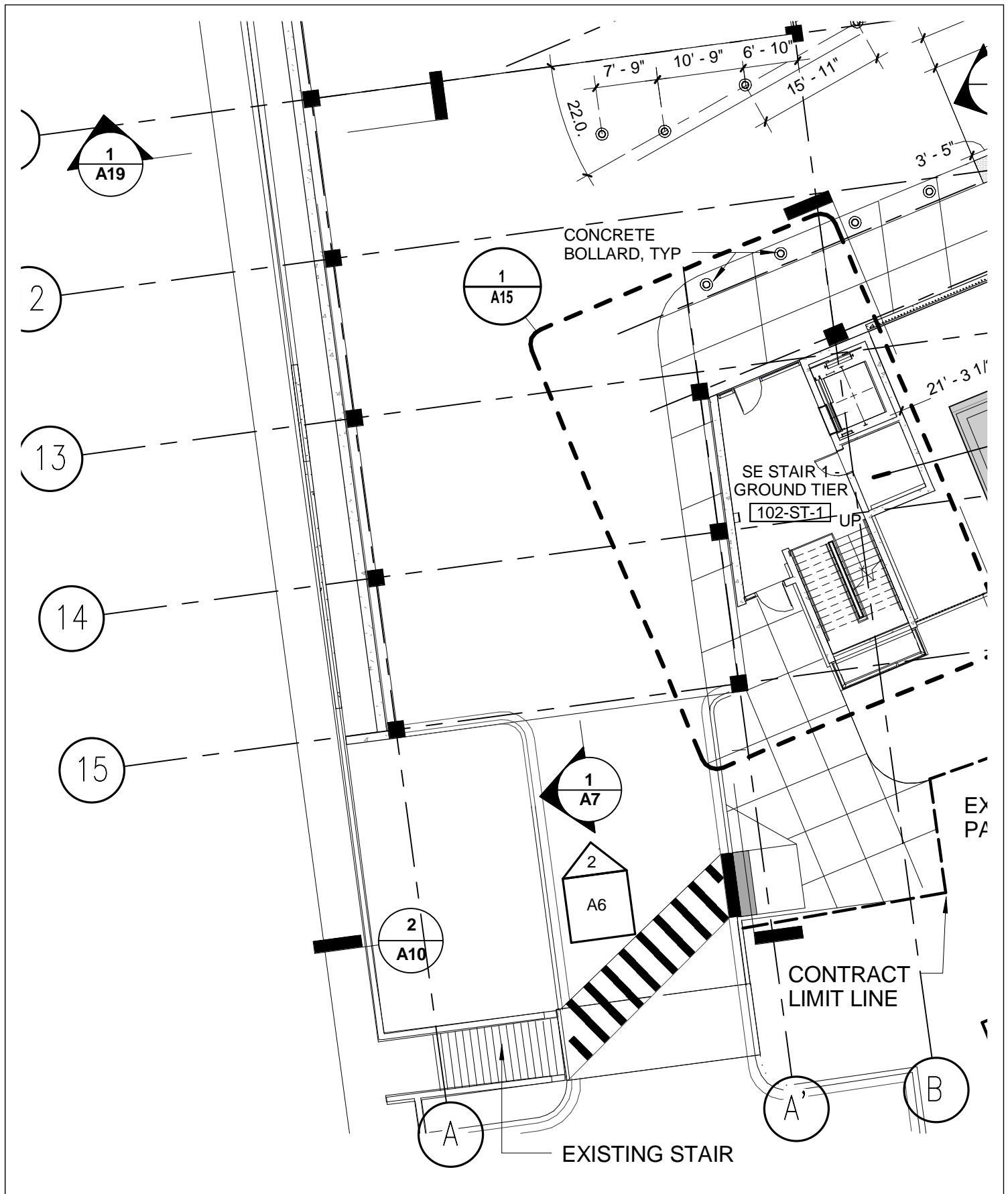
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PARKING STRUCTURE 400 CAR PARKING GARAGE

IOWA CITY, IA
PROJECT ADDRESS

Date: 10/18/13
Sheet Rvsd: S-610
Scale: NTS
Drawn By: MJK
Project No.: 31-7141.10

Sketch No.: S-SK15-10.18.13



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**PARKING STRUCTURE
400 CAR PARKING GARAGE**

IOWA CITY, IA
PROJECT ADDRESS

Date: 10/21/10

Sheet Rvsd: A1 GROUND TIER PLAN

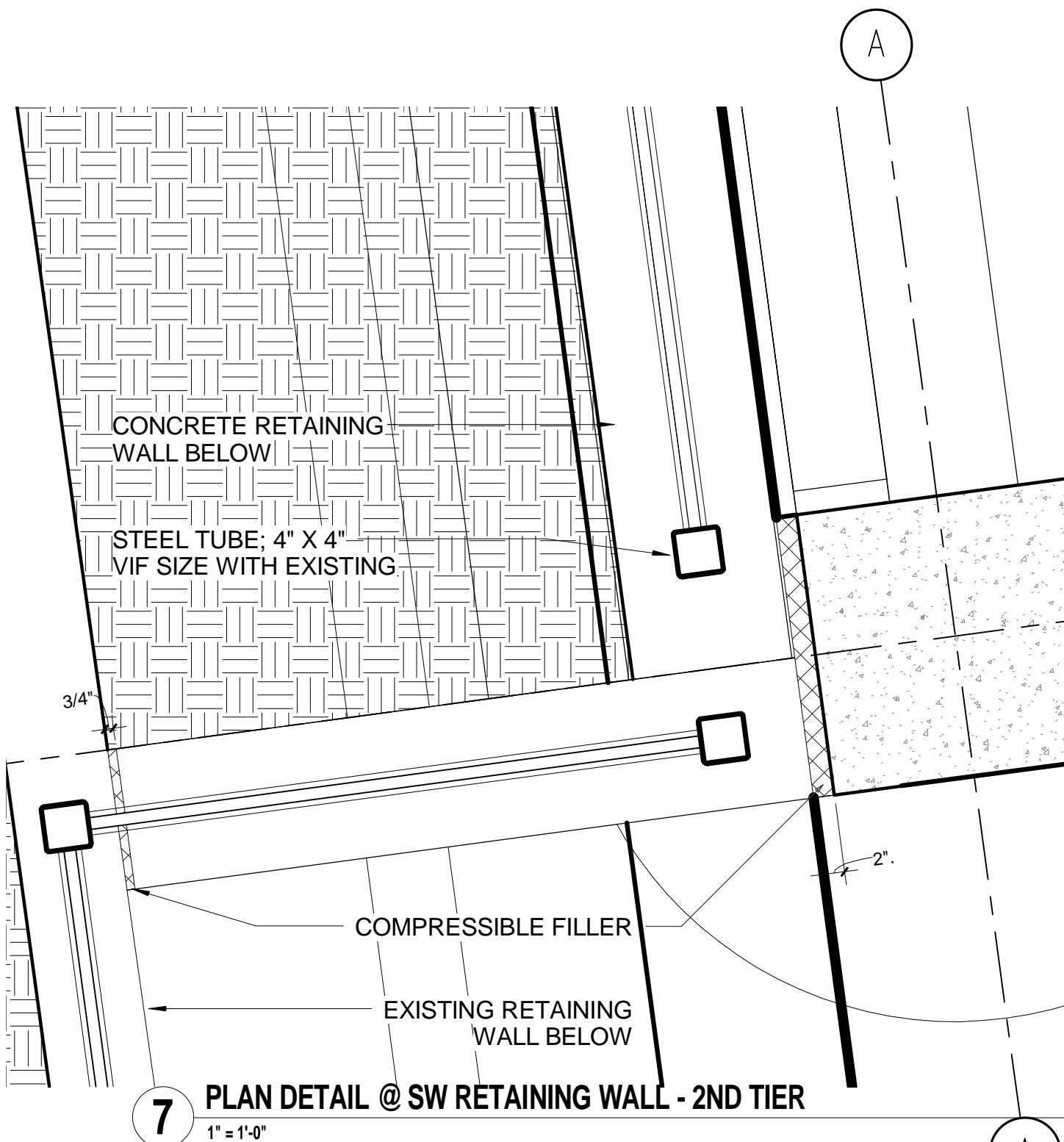
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Project No.: -

Sketch No.:

ASK
10.09.13 A1



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**PARKING STRUCTURE
400 CAR PARKING GARAGE**

IOWA CITY, IA
PROJECT ADDRESS

Date: 12/08/10

Sheet Rvsd: A10 ENLARGED PLANS & DETAILS - NORTH

Scale:

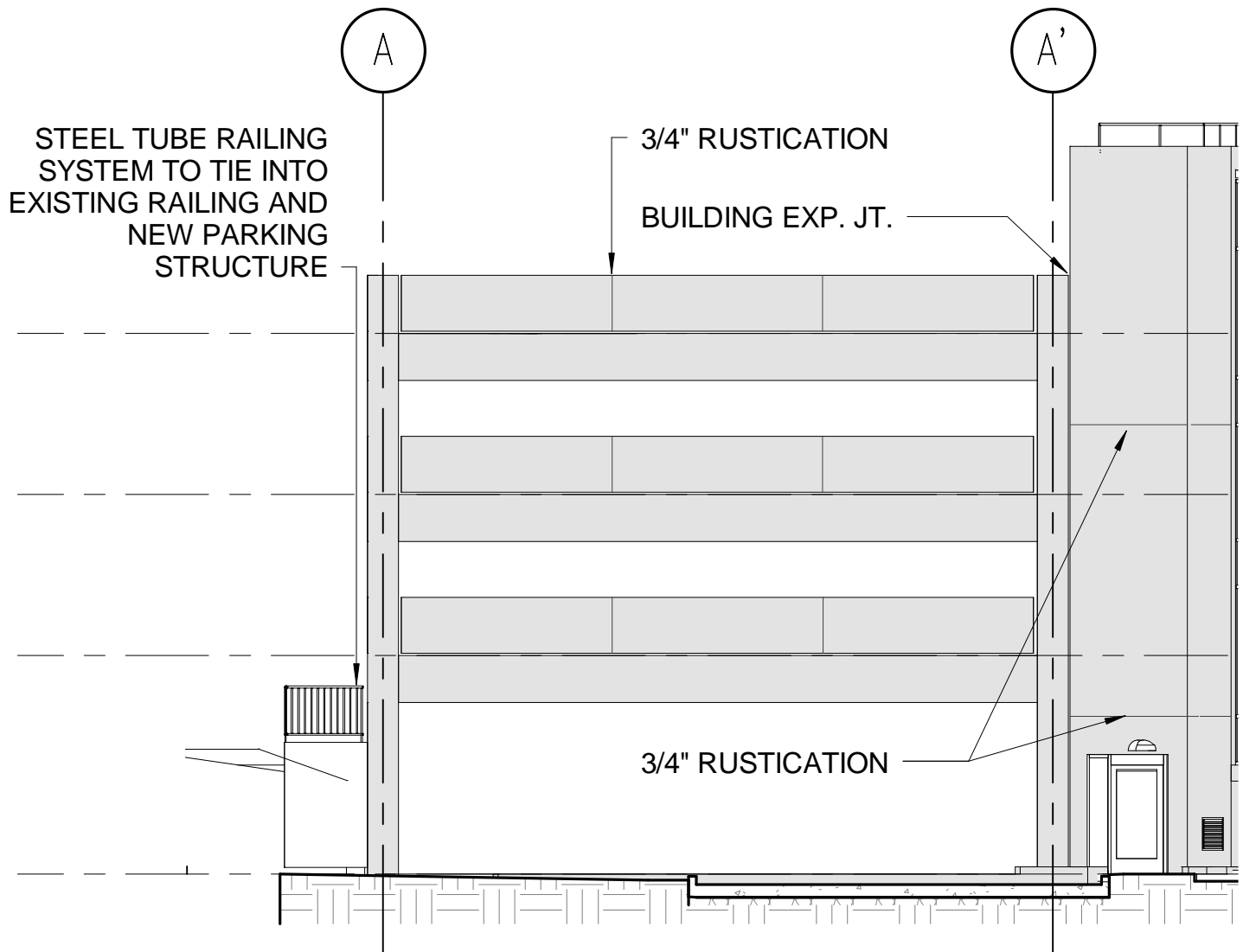
Drawn By:

Project No.: -

Sketch No.: -

10.09.13

A10



2

SOUTH ELEVATION

3/32" = 1'-0"

A1

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PARKING STRUCTURE 400 CAR PARKING GARAGE

IOWA CITY, IA
PROJECT ADDRESS

Date: 11/02/10

Sheet Rvrsd: A6 EXTERIOR ELEVATIONS

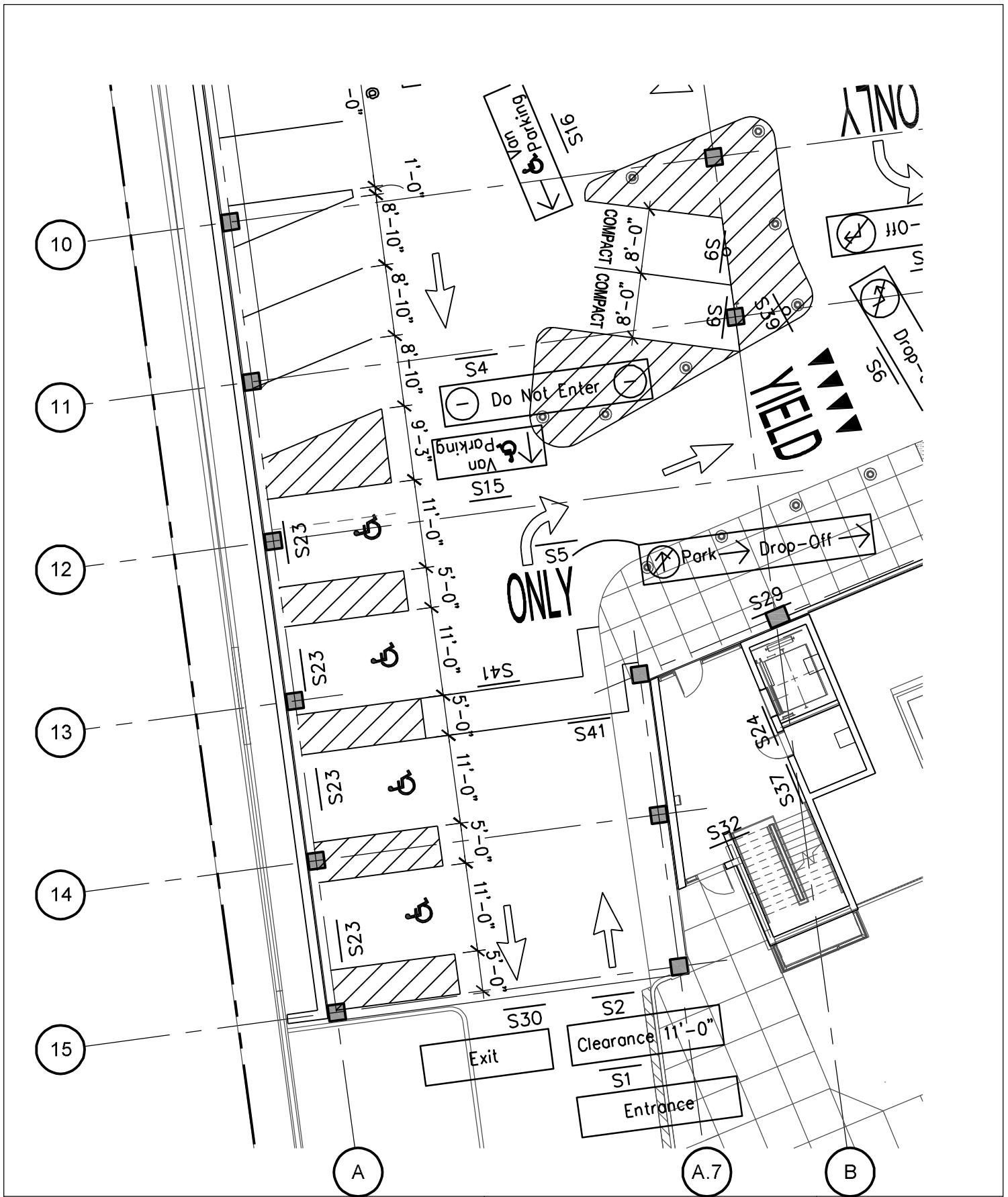
Scale:

Drawn By:

Project No.: -

Sketch No.:
10.09.13 A6

ASK
10.09.13 A6



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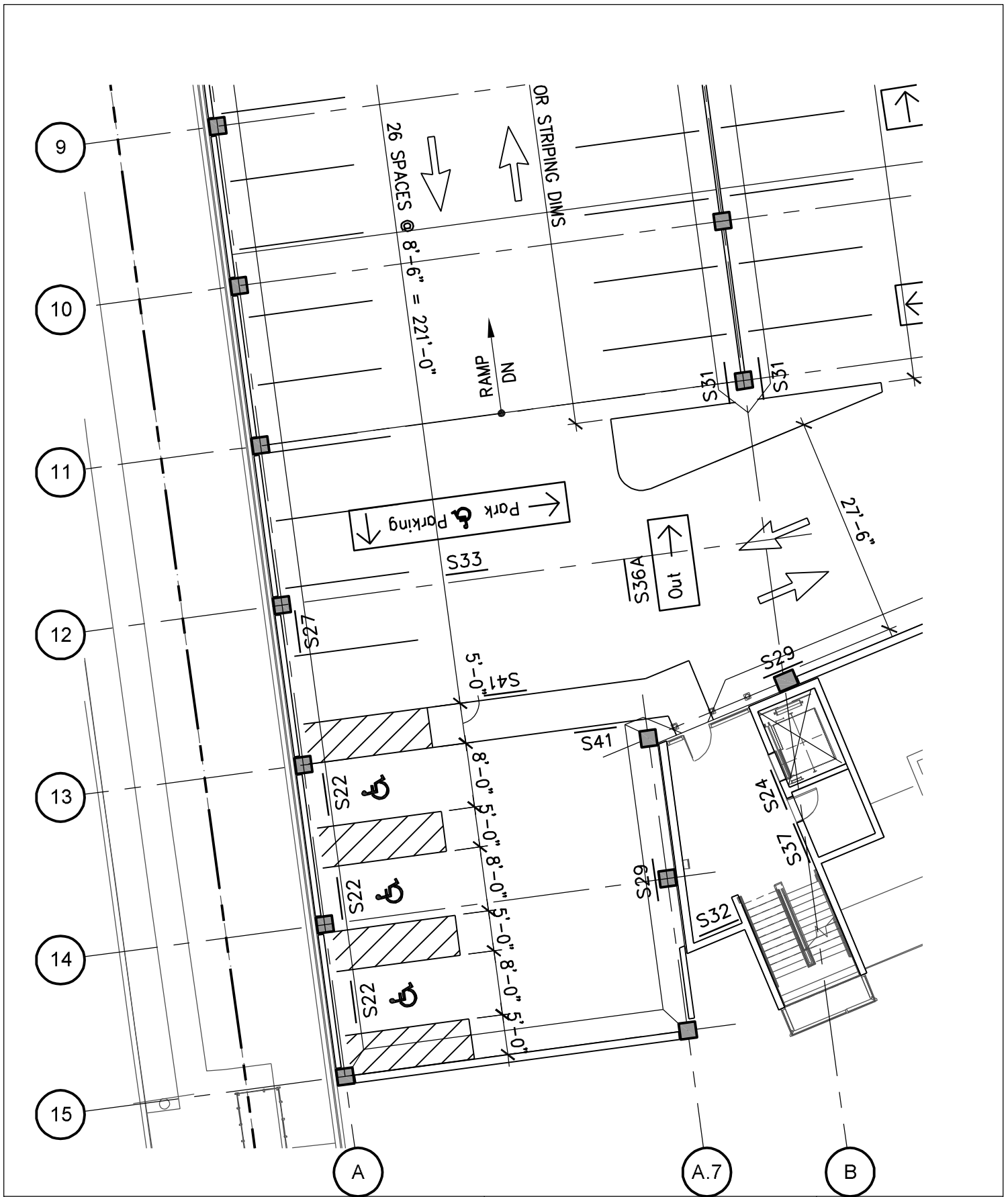
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PARKING STRUCTURE 400 CAR PARKING GARAGE

IOWA CITY, IA
PROJECT ADDRESS

Date: 10/18/13
Sheet Rvsd: AG-101
Scale: 1/16" = 1'-0"
Drawn By: MJK
Project No.: 31-7141.10

Sketch No.: AG-SK 01 - 10.18.13



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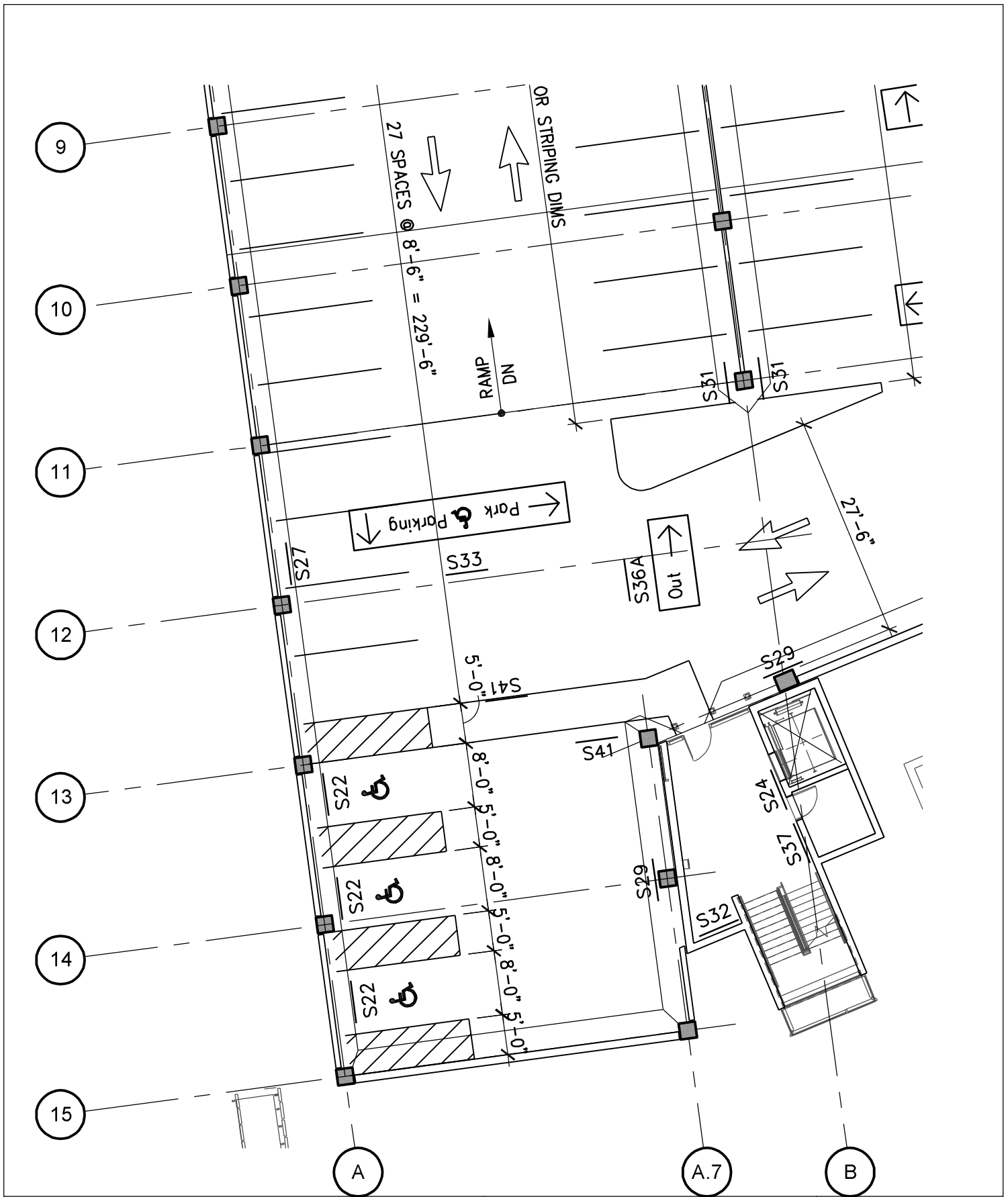
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PARKING STRUCTURE 400 CAR PARKING GARAGE

IOWA CITY, IA
PROJECT ADDRESS

Date: 10/18/13
Sheet Rvsd: AG-102
Scale: 1/16" = 1'-0"
Drawn By: MJK
Project No.: 31-7141.10

Sketch No.: AG-SK 02 - 10.18.13



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PARKING STRUCTURE 400 CAR PARKING GARAGE

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PROJECT ADDRESS

Date: 10/18/13
Sheet Rvsd: AG-103
Scale: 1/16" = 1'-0"
Drawn By: MJK
Project No.: 31-7141.10

Sketch No.: AG-SK 03 - 10.18.13

