

SECTION 03 30 25
CONCRETE SLAB ON METAL DECK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of contract, including general and supplementary conditions and Division 1 specification sections, apply to this section.
- B. Section 03 30 00: Cast-In-Place Concrete

1.2 DESCRIPTION OF WORK

- A. This section supplements Section 03 30 00: Cast-In-Place Concrete, with specific emphasis on concrete slabs on metal deck. The general requirements of Section 03 30 00 pertain to this section unless otherwise specified in this section.

1.3 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. ACI 302 "Guide for Concrete Floor and Slab Construction."
- B. Hold a slab preconstruction meeting at least 14 days prior to the initial planned date of slab placement. Discussion shall include but not be limited to: reinforcing and dowel placement, slab joints, concrete mix designs, and procedures for concrete placement, finishing, curing, and protection. Attendees shall include the Contractor, Placement Subcontractor, Concrete Supplier, Special Inspector, Testing Agency, Engineer, and Architect.
 - 1. If embedments such as conduit and pipe are to be embedded in slabs on metal deck, the installing Contractor shall also attend the slab preconstruction meeting.
- C. Provide protection for the slab on metal deck from direct exposure to sun, wind, precipitation, and excessive cold or hot temperatures starting during placement and lasting until end of curing period.
 - 1. Contractor shall be responsible for cost of repairing slab defects resulting from deficient protection methods.
 - 2. One method of protection is installing roof membrane and roof drains prior to installing slab on metal deck.

1.4 SPECIAL INSPECTIONS

- A. Refer to Specification Section 01 45 29 and Schedule of Special Inspections.

1.5 MATERIAL EVALUATION/QUALITY CONTROL

- A. Secure the services of a company field advisor from manufacturer of concrete surface treatment products including sealers, hardeners, sealants, and finishes. Field advisor shall be certified in writing by manufacturer to be technically qualified in installation of product(s). Personnel involved solely in sales do not qualify. Field advisor shall be present at beginning of installation of product and as required during duration of Project for the purpose of:
 - 1. Rendering technical assistance to Contractor regarding installation procedures of the product to satisfy warrantee or guarantee requirements.
 - 2. Providing specialized training in use of product to Contractor's personnel.
 - 3. Verifying surface preparation procedures and suitable substrates for material application.

4. Verifying proper mixing proportions and procedures for product.
 5. Verifying proper temperature and other environmental controls.
 6. Verifying proper tools and application procedures.
 7. Verifying proper curing and protection of installed product.
 8. Familiarizing Contractor/Owner/Architect/Engineer with aspects of system, including inspection techniques.
 9. Answering questions that may arise.
- B. Field advisor shall prepare written report summarizing information listed above. Report shall be submitted to Contractor, Owner, Architect, and Engineer.
- C. Contractor shall be responsible for expenses of field advisor.

1.6 SUBMITTALS

- A. Comply with Section 03 30 00.
- B. Submit option for slab placement (see Part 3 of this section) and layout of slab joints.
- C. Prior to slab placement, submit to the Special Inspector and Engineer for information only a written protection program for slab on metal deck.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Portland Cement: ASTM C 150, Type II or Type I/II only.
- B. Reinforcement: ASTM A 615, Grade 60, for uncoated deformed bars.
- C. Supports for Reinforcement: Chairs.
- D. Minimum 16-gauge annealed tie wire, ASTM A 82.
- E. Aggregates: NYSDOT-approved, Section 703-02 (normal weight), one source and as herein specified:
 1. Fine Aggregate: Coarse, clean, sharp, uniformly graded natural sand free of loam, clay, lumps or other deleterious substances; less than 10 percent passing the No. 100 sieve and less than 3 percent passing the No. 200 sieve.
 2. Lightweight Coarse Aggregate: ASTM C 330, Size 3/4-inch to #4. Dry unit weight of concrete shall be a maximum 120 pcf from a batch weight of 120 to 124 pcf, presoaked to achieve a damp condition according to ACI 211.2; limit shrinkage to 0.03 percent at 28 days.
- F. Water: Clean, fresh, drinkable.
- G. Fly Ash: ASTM C 618, Type F, with a loss on ignition of less than 4 percent.
- H. Ground-Granulated, Blast-Furnace Slag: ASTM C 989, Grade 120.
- I. Air Entraining: ASTM C 260.
- J. Set-Control Admixtures: Not permitted.
- K. Calcium Chloride: Not permitted.
- L. High-Range, Water-Reducing Admixture (Superplasticizer): "Eucon 37" by Euclid Chemical Co; or "Sikament" by Sika Chemical Corp. Admixture shall conform to ASTM C 494, Type F or G, and not contain more chloride ions than in municipal drinking water.
- M. Water-Reducing Admixture: ASTM C 494, Type A.

- N. Mid-Range Water Reducer/Finish Enhancer: ASTM C 494, Type A/F. "Daracem 55" or "Daracem 65" by W.R. Grace or accepted equivalent.
- O. Construction Joint Form: Square-edge form only. Keyed joint not permitted.
- P. Joint Sealant for Interior Slabs: "Sikadur 51SL" by Sika; "Spec-Joint CJ" by Conspec Manufacturing Co.; "Masterfill CJ" by Master Builders, Inc.; "Euco 600" by Euclid Chemical Co.; or accepted equivalent.
- Q. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 ounces a square yard and complying with AASHTO M 182, Class 2.
- R. Curing-Sheet Materials: ASTM C 171. Waterproof paper, polyethylene film, or polyethylene-coated burlap.
 - 1. For slabs exposed to view, provide one of the following or accepted equivalent:
 - a. "HydraCure S16" by PNA Construction Technologies.
 - b. "UltraCure NCF/SUN" by McTech Group.
- S. Evaporation Retarder: Monomolecular, film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss. "Aquafilm" by Conspec Manufacturing Co.; "Eucobar" by Euclid Chemical Co.; "Confilm" by Master Builders, Inc.; or accepted equivalent.
- T. Crack Repair Material: "Sika Pronto 19" by Sika; "Crack-Fill 4" by Metzger/McGuire; or accepted equivalent.
- U. Hardener: "Lapidolith" by Sonneborn Building Products or accepted equivalent for exposed slabs.

2.2 PROPORTIONING AND MIX DESIGN

A. Concrete Quality:

Location	Required 28-Day Compressive Strength (psi)	Approximate Cement Content (pounds)	Maximum Water/Cement Ratio	Percent Entrained Air
Interior slabs on metal deck	3,500	611	0.5 (300 pounds maximum total water)	2*

* Do not add air-entraining admixtures. Air entrainment occurs as a result of mixing.

Exception: Air-entraining admixtures may be added to lightweight concrete that is pumped. Entrained air content shall not exceed 4 percent.

- B. Slump: 5-inch maximum for normal and mid-range, water-reduced mixes.
- C. Concrete containing a high-range, water-reducing admixture (superplasticizer) shall have maximum slump of 6 inches unless otherwise accepted by Engineer. Concrete shall arrive at job site at a slump of 2 to 3 inches, shall be verified, then high-range, water-reducing admixture added to increase slump as required for placement and workability.
- D. Use six sacks maximum of cement a cubic yard for slabs and minimum sand content.

- E. For lightweight concrete, provide a minimum of 700 pounds of lightweight coarse aggregate (saturated, surface dry) per cubic yard of concrete.
- F. Pozzolans:
1. Pozzolans may be substituted for cement in concrete for interior slabs, including fly ash at a maximum rate of 20 percent by weight or ground-granulated, blast-furnace slag at a maximum rate of 35 percent by weight.
 2. Submittals shall include actual mix design, including percentage of pozzolans and test results showing mix meets specified 7-day compressive strength where indicated, 28-day compressive strength, and air content.
 3. Protect and heat concrete containing pozzolans during cold weather conditions. Maintain protection and heat until 70 percent of specified design strength is achieved.
- G. Pumping of concrete is permitted only if mix designs specifically prepared and used previously for pumping are submitted. Mix designs not previously used for anticipated pump line lengths shall be tested by Contractor to verify suitability for project before use at site. Pump line shall have 5-inch-minimum inside diameter and be used with 5-inch pumps.

PART 3 - EXECUTION

3.1 GENERAL

- A. Examine conditions under which work shall be performed. Do not proceed with work until unsatisfactory conditions are corrected.
- B. Whenever possible, air temperature should be rising after concrete placement. Attempt to schedule slab placements according to favorable weather reports.

3.2 OPTION FOR SLAB PLACEMENT

- A. For placement of slabs that will be exposed in final structure, construction and contraction joints shall be placed as shown in drawings or as recommended by ACI 302 if not shown.
- B. For placement of slabs that will be subsequently concealed with an architectural finish material, Contractor has two options. Option 1 is to place slabs with few joints. Option 2 is to place slabs with construction and contraction joint spacings as recommended by ACI 302, "Guide for Concrete Floor and Slab Construction." Contractor shall submit Option to be used and joint layout to Architect and Engineer for review.
- C. If Option 1 is selected, shrinkage cracking will likely occur but potential for curling will be reduced. Contractor shall be responsible for repairing cracks and curled areas. If Option 2 is selected, probability of shrinkage cracking will be less but probability of curling will increase. Contractor shall be responsible for repairing cracks and curled areas.

3.3 REINFORCEMENT PLACEMENT

- A. Place slab reinforcing 1 inch below top surface of slab. Support reinforcement by metal chairs, runners, or bolsters as required.
- B. Dedicate workers to placement of reinforcement to continuously monitor and adjust reinforcement location during concrete placement.

3.4 INSTALLATION OF NON-STRUCTURAL EMBEDDED ITEMS

- A. General: Notify other trades to permit installation of their work and coordinate with requirements of this section. Cooperate with other trades in setting work as required.
- B. Do not embed aluminum items unless coated to prevent galvanic reaction with concrete and steel.
- C. Do not embed conduit or other nonstructural items that are larger than the lesser of the following unless otherwise detailed:
 - 1. One-inch diameter.
 - 2. One-third the thickness of concrete slab above metal deck.
- D. Avoid embedding conduit or other nonstructural items wherever possible. If unavoidable, limit size as noted above and install embedded item following the guidelines below.
 - 1. Space at least 18 inches apart.
 - 2. Place so nonstructural items do not cross each other.
 - 3. Provide at least 1-inch concrete cover between items and slab surface. Provide minimum 3/4-inch concrete cover between items and deck, screed angles, edge forms, or reinforcing bars. Do not lay items on deck or reinforcing bars. In exterior slabs, provide at least 1½-inches concrete cover between items and exposed surfaces.
 - 4. Provide at least 1-inch concrete cover between embedded items and shear connectors in composite beam construction.
 - 5. Securely position items by wire tying to support chairs.
- E. Items such as trench ducts and electrical floor boxes require special consideration. Known conditions are detailed in drawings. Notify Architect and Engineer of discrepancies or locations not detailed.
- F. Install PVC sleeves at plumbing penetrations. Do not core-drill unless accepted by Engineer. Cut deck after slab has cured 28 days or after slab reaches its design strength.

3.5 ISOLATION JOINTS

- A. Construct isolation joints in slabs on metal deck at points of contact with vertical surface and elsewhere as indicated.
- B. Use two layers of polyethylene film as bond breaker.

3.6 CONSTRUCTION JOINTS

- A. Locate and install construction joints not shown in drawings so as not to impair strength and appearance of structure as acceptable to Engineer.

3.7 CONTRACTION JOINTS

- A. Saw cut contraction joints as soon as possible after finishing, generally within 4 to 16 hours. Make sample cut to determine if concrete surface is firm enough so that it is not torn or damaged by the blade.
- B. Use soft-cut contraction joints. Depth of cut shall be one-fifth of the slab cover over the metal deck, with a maximum depth of 3/4 inch.
- C. Obtain permission from Engineer if diamond blade cutting is to be used.

3.8 PLACING CONCRETE SLABS

- A. Place slabs by wet screeding and verify correct elevation after initial strike off with aid of laser level. Completely "rough-fill" each bay with concrete to remove camber before proceeding with screeding.

- B. Maximum 2 1/2 gallons a cubic yard of total mix design water can be added in field. Water must be added prior to discharging and testing concrete. At no time shall total water exceed amount listed in accepted mix design.
- C. Place concrete in direction opposite to direction metal deck sheets were placed.
- D. Deposit and consolidate concrete in continuous operation within limits of construction joints until placing of panel or section is completed.
- E. During placement, avoid overloading metal deck or supporting structural members.
- F. Consolidate concrete during placing operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
- G. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, leaving it free of humps or hollows. Do not sprinkle water on plastic surface. Do not disturb slab surfaces before beginning finishing operations.
- H. Maintain reinforcement in proper position during concrete placement operations. See requirements for reinforcement placement.
- I. For floor areas with drains, Contractor shall be responsible for finishing concrete slabs to proper elevations to ensure surface moisture will drain freely to floor drains and no puddle areas exist. Reference elevations shown in drawings.
- J. Cost of corrections to provide for positive drainage shall be responsibility of Contractor.
- K. Steel floor structure will deflect under weight of wet concrete. Placement of additional concrete may be required after initial wet screeding. Where indicated, camber will reduce but not eliminate need for placing additional concrete. Place varying-thickness concrete slab to maintain required finished-floor elevation. Placement sequence and joint locations are critical and shall be reviewed at slab preconstruction meeting.

3.9 MONOLITHIC SLAB FINISHES

- A. Scratch Finish: Apply scratch finish to monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo, other bonded applied cementitious finish-flooring material, and as otherwise indicated. After placing slabs, plane surface to tolerance for floor flatness (F_F) of 15. Slope uniformly to drains where required. Roughen surface before final set with stiff brushes, brooms, or rakes.
- B. Power-Float Finish: Apply power-float finish to slab surfaces that will subsequently be trowel-finished or covered with waterproofing membrane. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Using float blade or float shoes only, begin floating when surface water has disappeared, when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Check surface plane to overall tolerance of F_F 18 and minimum local tolerance of F_F 13. Cut down high spots, and fill low spots. Uniformly slope surface to drains. Immediately after leveling, refloat surface to uniform, smooth, granular texture.

- C. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin-film finish-coating system. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation. Surface shall be free of trowel marks, uniform in texture and appearance, and leveled to overall tolerance of F_F 35 and minimum local tolerance of F_F 25 for exposed slabs and thin-set finishes and overall tolerance of F_F 25 and minimum local tolerance of F_F 17 for other finishes. Grind smooth surface defects that would telegraph through applied floor-covering system. Overtrowel exposed surfaces to "burn" surface to dense, hard, dark finish.
- D. Trowel and Fine-Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified. Immediately follow with fine brooming to slightly scarifying surface.
- E. Delay finishing as long as possible. Allow bleed water to evaporate before finishing.
- F. Finish slabs to specified tolerances given. Patching low spots not permitted. Perform grinding as soon as possible, preferably within 3 days, but not until concrete is sufficiently strong to prevent dislodging coarse aggregate particles.

3.10 COLD-WEATHER CONCRETING

- A. Comply with Section 03 30 00.
- B. Provide temporary heat with vented heaters only.
- C. Use foggers to maintain humidity at 50 percent minimum.

3.11 HOT-WEATHER CONCRETING

- A. Comply with Section 03 30 00.

3.12 CURING AND PROTECTION

- A. Protect freshly placed slabs from premature drying and excessive cold or hot temperature. Maintain without drying at a relatively constant temperature for a period of time necessary for cement hydration and proper hardening.
- B. Cure slabs by sheet-curing by covering slabs with curing sheet material for at least 7 days and avoiding rapid drying at end of curing period. Place curing cover in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair holes or tears in cover during curing period.
- C. Do not allow foot or other traffic over slabs during 7-day curing period.
- D. Cure slabs or pads a minimum of 14 days before placing equipment.
- E. Interior Nonexposed Slabs:
 - 1. Place finish toppings, coatings, tile, and other materials to be bonded to slabs when the following have been satisfied:
 - a. Slabs have cured 90 days minimum.
 - b. Acceptable moisture vapor emission and alkalinity test results have been achieved.
 - c. Acceptable 72-hour bond test results have been achieved. Bond test by floor finish installer.

F. Interior Exposed Slabs:

1. Apply two coats of hardener after slabs have cured 28 days minimum at a rate of 100 square feet/gallon in accordance with manufacturer's recommendations.

3.13 JOINT SEALANT

- A. Install joint sealant in exposed construction, isolation, and contraction joints in accordance with manufacturer's recommendations.
- B. Clean joints thoroughly before applying sealant.
- C. Apply sealant after slabs have cured a minimum of 90 days.

3.14 REPAIR OF SURFACES

- A. Contractor shall be responsible for cost of repairing slab defects.
- B. Repair cracks only when slab is more than 90-days old. Use crack repair material. For cracks over 1/8 inch, fill crack with oven-dried sand prior to application of crack repair material as recommended by manufacturer. Contractor also has option to remove and rebuild areas of cracking. Mask cracks to limit crack-repair material to crack only.
- C. Repair curling only when slab is more than 90-days old.
- D. Curling at slab edges which exceeds 1/8 inch when measured with a 10-foot straightedge shall be made level by grinding or planing. Locate straightedge with its end at slab edge, and measure space between straightedge and slab.
- E. If curling exceeds 1/4 inch, level slab by grinding or planing as stated above. In addition, core-drill slab 10 inches from joint at 2 foot intervals alternating each side of joint, and inject nonshrink grout to fill void beneath slab.
- F. Repair edge spalls occurring from shrinkage cracking or from Contractor's operations with methods acceptable to Engineer.

- - - END - - -