SECTION 033549

REFINED CONCRETE FINISHING

Provided by the National Concrete Refinement Institute (NCRI), this document serves as a reference for developing project-specific specification sections. Users should align the content to suit individual project requirements and adjust the numbering of remaining sections accordingly to maintain proper sequence.

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Refined concrete systems for [new] and [existing] floor slabs.

B. Related Requirements:
   1. Section 033000: Concrete materials and placement.

1.2 REFERENCES

A. Abbreviations and Acronyms:
   1. CPC: Concrete Polishing Council.
   2. DOI: Distinctness of image.
   3. DCOF: Dynamic coefficient of friction.
   4. FF: Floor flatness.
   5. FL: Floor levelness.
   6. NCRI: National Concrete Refinement Institute.
   7. NFSI: National Floor Safety Institute.
   8. NMC: Nano-modified concrete.
   9. Ra: Average roughness.
   10. SCOF: Static coefficient of friction.
   11. VOC: Volatile organic compound.

B. Definitions:
   1. Refined Concrete: A modified concrete surface using wet mechanical processing and chemical consolidation to strengthen and densify the top layer of cementitious material. The refining process reactivates unhydrated cement to achieve a more durable surface meeting specified benchmarks for surface roughness (Ra), hardness (Mohs), and image clarity (DOI).
   2. Nano-Modified Concrete: Concrete enhanced with nanomaterials to improve strength, durability, and performance.

C. Reference Standards:
   1. ASME B46.1 Surface Texture (Surface Roughness, Waviness, and Lay).
   2. ASTM E1155 Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers.
   3. ASTM C1895 Standard Test Method for Determination of Mohs Scratch Hardness.

4. ANSI/NFSI B101.1 Test Method for Measuring Wet SCOF of Hard-Surface Walkways; 2022.
5. ANSI/NFSI B101.3 Test Method for Measuring the Wet DCOF of Hard Surface Walkways; 2020.
6. ASTM D5767 Standard Test Method for Instrumental Measurement of DOI Gloss of Coated Surfaces.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination Procedures:
   1. Coordinate Work results of this section, including FF and FL values and testing, with Section 033000.
      a. Exclusions unacceptable for Floor Flatness on new slab work.

B. Preinstallation Meeting Attendees and Procedures:
   1. Conduct meeting [one month] and [two months], minimum, before starting concrete placement Work.
   2. Attendees: Contractor, concrete Supplier, refinement Installer, manufacturer representative, and NCRI project representative.
   3. Additional Agenda Items:

Coordinate with Section 033000 Cast-in-Place Concrete preinstallation meeting due to limited timing of refinement after concrete placement.

      a. Review refining schedule, phasing, slab pour access and sequence of work for floor slabs.
      b. Mockup schedule, location, and required benchmark measurements.
      c. Perform preconstruction mockup to train and certify subcontractor in execution of the work specified in this section.
      d. Identify diamond tooling and refinement progression sequence required to achieve work results.
      e. Assign Site Supervisor to maintain benchmark testing and log, review materials, and execute protection plan.
      f. Concrete slab protection before and after refinement.
      g. Limiting overhead trade activity in slab areas scheduled for refinement.

C. Scheduling Procedures:
   1. Schedule refinement work to align with concrete placement.
      a. New concrete to achieve Mohs of 7, minimum and 75 percent design strength, minimum.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including diamond tooling, joint fillers, and chemical component materials.

B. Shop Drawings: Plan showing refined concrete surfaces and schedule of refining operations for each area. Include locations of all joints.

C. Samples:
   1. Color samples for concrete stain.
   2. Color samples for approved joint treatment materials exposed to view.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: Signed by the manufacturer.
   1. Joint treatment materials.
   2. Concrete activator.
   3. Concrete stain.

B. Manufacturer instructions.

C. Field Quality Control Submittals: Field test reports.
   1. Submit field mockup surface benchmark readings.
   2. Submit preliminary surface benchmark readings.
   3. Submit surface benchmark log at each construction progress meeting.

D. Qualification Statements: Manufacturer and Installer.

E. Concrete Protection Plan: Written plan outlining materials, equipment, and processes for maintaining floor after initial refinement physical benchmarks are achieved for remainder of construction.

F. Concrete Repair Plan: Written description of materials, methods, equipment, and sequence of operations for repairing concrete, including protection of surrounding materials.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For refined concrete finish, including list of acceptable and prohibited cleaning materials, equipment, and processes for maintenance to preserve surface benchmark readings.

1.7 QUALITY ASSURANCE

A. Qualifications:
   1. Installer Qualifications: Experienced refined concrete installer, with five years documented experience, specializing in finishes similar to this Project in material, design, and extent, and approved by refinement system manufacturer.
      a. Include locations, descriptions and photographs of 3 completed projects, including name of Architect.

See thencri.com for current certification requirements and regional availability of Certified Refinement Installers. NCRI was formed in 2024, so certified installers may not be available in all areas. If an Installer meets the experience requirements, they may be able to achieve NCRI Certification. NCRI evaluates and trains Contractors interested in pursuing certification for specific projects. Requests for training and certification evaluation must be submitted prior to start of work and are subject to NCRI approval. Contact: admin@nationalconcreterefinementinstitute.org.

b. NCRI Certified Refinement Installer.
1) Supervisor: NCRI Certified Refinement Installer.

2. Testing Agencies: Walkway Auditor certified by NFSI to test bonded abrasive refined concrete floors for dynamic and static coefficient of friction per ANSI/NFSI B101.1 and ANSI/NFSI B101.3.

Section 014000 covers general mockup requirements to demonstrate materials and workmanship. Approved mockups establish work results standard; protect mockups until removal is authorized.

B. Mockups: Construct for each finish type using approved mix design.
1. New Concrete: Demonstrate one concrete saw cut control joint with joint filler and one repair patch of a 1/4 inch surface void. Include concrete column leave-out infilled and refined to match adjacent finish.
2. Existing Concrete: Perform initial surface benchmark testing of existing slab. Select mockup area in location with benchmark margin farthest from project goal, include a saw cut control joint. Repair patch an existing surface void and refine concrete area to achieve project benchmarks.
3. Location: [Field], [Architect selected areas to be covered by floor finishes], and [Architect selected areas].
4. Size: [250 square feet, minimum] and [Architect selected].

Include if Owner is providing any testing. DCOF and SCOF are typically tested by a third party, NFSI Walkway Auditor.

5. Notify Owner testing agency when mockup is ready for field testing.

Important to test and verify all benchmarks on the mockup to establish the quality level and keep the mockup in place to refer back to if questions or concerns arise. -DCOF and SCOF are typically tested by a third party, NFSI Walkway Auditor; can add some cost.

6. Mockup approval will be based on color, aggregate exposure, repair patch, and also used to establish project specific physical benchmark testing for Mohs, Ra, DOI, DCOF and SCOF.
a. Leave mockups in place and protect in approved condition until Substantial Completion.
b. Clean and protect half of mockup for review and approval of protection plan.

1.8 FIELD CONDITIONS

A. Damage and Stain Prevention: Take precautions to prevent damage and staining of concrete surfaces to be refined.
1. Prohibit use of markers, spray paint, and soapstone.
2. Prohibit application of liquid membrane film forming curing compounds.
3. Prohibit vehicle parking over concrete surfaces. Inspect wheels for embedded items prior to driving on refined areas.
4. Prohibit pipe cutting operations over concrete surfaces.
5. Prohibit storage of any items over concrete surfaces for not less than 28 days after concrete placement.
6. Prohibit ferrous metals storage over concrete surfaces.
7. Protect from petroleum, oil, hydraulic fluid, or other liquid dripping from equipment working over concrete surfaces.
8. Protect from acids and acidic detergents contacting concrete surfaces.

9. Protect from painting activities over concrete surfaces.

PART 2 PRODUCTS

2.1 REFINED CONCRETE SYSTEMS

A. Refining system includes NMC chemicals and diamond tooling to mechanically process the concrete surface to meet defined physical benchmarks. Include joint filler, color stain, matching repair materials, protection, and maintenance materials.
   1. Manufacturers and Products:
      a. Finisher's Choice.
      b. G3 Wagman.
      c. Hydrocrete.
   2. Substitutions: [Not Permitted] or [Permitted].
      a. Partial substitutions are not allowed.

Coordinate with Section 033000 and structural notes, which commonly include patching materials which may not be compatible with refining systems. Refining systems typically include an approved patch material.

   3. Repair Material: As recommended by approved refinement system manufacturer. Resins, epoxy, grouts and coatings are prohibited.
   4. Refining Pads: As recommended by approved refinement system manufacturer. Material that will not bond to or coat the surface of concrete.
   5. Penetrating Stain: Product recommended by refining system manufacturer to work with cutting agent.
      a. Provide low VOC product for existing enclosed interior spaces.
      b. Color: [See Drawings] or [Architect selected].
   6. Protection: Provide refined concrete finish protection cleaning agents and equipment as part of a complete system for maintaining specified benchmarks, and protection against damage and staining.
   7. Grind and seal, or hybrid refinement processes are prohibited.
   8. Topical clear coats, burnished floors, resinous diamond tooling, grout coats, and silicate systems are prohibited.

2.2 ACCESSORIES

A. Refining Equipment: As recommended by approved refinement system manufacturer.
   1. Edge machine with blades matching psi of equipment blades.
   2. Hand troweling is prohibited for new slab surfaces to receive refined finish.

2.3 PERFORMANCE

A. Ra: ASME B46.1, 30, plus or minus 5.

B. SCOF: ANSI/NFSI B101.1 0.60, minimum, for level floor surfaces.

C. DCOF: ANSI/NFSI B101.3.
   1. Greater than 0.42 for level floor surfaces.
   2. Greater than 0.45 for incline floor surfaces.

D. Mohs Hardness: ASTM C1895, 7, minimum.

E. DOI: ASTM D5767, [25, plus or minus 5].

F. Aggregate Exposure: CPC [Class A, cement fines (light sand/cream finish)], [Class B, fine aggregate (salt and pepper)], and [Class C, coarse aggregate].

G. Accessibility Requirements: Applicable provisions in [Department of Justice publication 2010 ADA Standards for Accessible Design], [ICC/ANSI A117.1], and [state accessibility code].

PART 3 EXECUTION

Confirm availability of local subcontractors before including this in project specs.

3.1 INSTALLERS

A. Approved Installers:

See thencri.com or email admin@nationalconcreterefinementinstitute.org for list of Certified Refinement Installers.
   1. Any NCRI Certified Refinement Installer.

B. Substitutions: [Permitted] and [Not Permitted].

3.2 EXAMINATION

A. Verify concrete surfaces scheduled for refinement are fully cured and free of surface sealers, curing compounds, or bond-breakers not included in the approved system.

B. Verify concrete surfaces scheduled for refinement exhibit structural integrity, are dry and free from standing water or contaminants, and are consistent with the approved mock-up.

C. Verify control joints are cut and filled per project sequence and mock-up standards.

D. Preinstallation Testing:
   1. Perform initial surface hardness readings with field Mohs hardness testing and record results at representative locations across each slab section.
   2. Perform initial surface roughness Ra readings to establish baseline conditions.
   3. Do not proceed with refinement until results confirm surface can be refined to meet project benchmarks.

3.3 PREPARATION

A. Prevent spills and physical damage to concrete slabs to receive refined finish.

B. Remove nails, screws, and other items that could become imbedded in wheels on equipment resulting in damage to refined concrete floor. Inspect tires on equipment for imbedded screws and nails prior to driving on concrete slabs.

C. Patching: Apply refined concrete finish system patch materials per manufacturer installation instructions.

3.4 REFINING

A. Refining: Finish requires multiple passes of grinds in a progression from course to finer grit, grit count as required to achieve physical benchmarks. Apply refined concrete finish system per manufacturer installation instructions, to match approved mockup.
   1. Machine grind floor surfaces to receive refined finishes level and smooth to depth required to reveal aggregate to match approved mockup.
   2. Apply system solution for refined concrete in refining sequence per manufacturer instructions, allowing recommended drying time between successive coats.
   3. Continue refining with progressively finer grit diamond pads to match approved mockup.
   4. Control and dispose of waste products produced by grinding and refining operations.
   5. Neutralize and clean refined floor surfaces.

B. Site Supervisor to perform benchmark testing and record in surface benchmark log at each grinding step prior to proceeding with next step. Include documentation of diamond grit pad types and number of passes at each step.

3.5 FIELD QUALITY CONTROL

A. Field Tests and Inspections: Owner will engage inspectors to perform tests and inspections and prepare reports. Allow inspectors access to Work areas.
   1. Failed Test Retest Cost: Contractor responsibility.
   2. Do not use materials that fail tests and inspections.

B. Ra Surface Texture: ASME B46.1.
   1. Test Location: <insert location>.
   2. Test Quantity: 5 readings per 100 square feet per week, minimum, until Substantial Completion.
   3. Test Criteria: Profilometer instrument to be calibrated on the mockup prior to testing on finished Work.

C. Mohs Hardness: ASTM C1895.
   1. Test Location: <insert location>.
   2. Test Quantity: 1 reading in each refined concrete area.

D. DCOF and SCOF: ANSI/NFSI B101.1 and B101.3.
   1. Test Location: <insert location>.
   2. Test Quantity: 5 readings in each refined concrete area.

E. Non-Conforming Work: Make corrections or replace, and re-test.

3.6 CLOSEOUT ACTIVITIES

A. Training: Demonstrate methods and materials for repair of concrete cracks, filling of voids, and refined finish system maintenance, recorded for Owner.

3.7 PROTECTION

A. Provide refined concrete finish protection as part of the approved system to maintain specified benchmarks and prevent surface damage and staining.

END OF SECTION