

#### DISCLAIMER

This Guide Specification contains information and recommendations for coordinating differential surface tolerances and work results that occur between Division 03 – Concrete and Division 09 – Finishes.

Information represents a potential solution developed with input and review from many industry experts associated with the concrete finishers and floorcoverings installers, and recommendations from the referenced standards in this document.

Usage of the information is at the editor's own risk based on their own expertise and experience, exercising reasonable diligence in determining appropriate incorporation of this specification into their project documents, and does not represent advice for any specific project situation.

The author of the document and the National Floor Covering Association of Canada are not liable in any event for any claims or damages arising from or in connection with the use of this information.

**SPEC NOTE:** Content of this Section and subsequent coordination with RELATED REQUIREMENTS is based on information provided by the [National Floor Covering Association of Canada \(NFCA\)](#) and [Concrete Canada: Forming, Placing, Finishing and Repair Association](#). Supporting technical guidance associated with Consultant coordination and responsibilities was provided by the American Society of Concrete Contractors (ASCC), American Concrete Institute (ACI) and Canadian Standards Association (CSA).

**SPEC NOTE:** This Section makes specific reference to the NFCA Floor Covering Reference Manual, which is available as a hardcopy or digital online version for a nominal cost for non-NFCA Members. Links in this specification to NFCA are available for people that have a subscription to the online NFCA Floor Covering Reference Manual.

**SPEC NOTE:** This Section contains SPEC NOTES prepared using hidden text, that can be viewed by using the MS Word | File | Options | Display and selecting the checkbox for Display Hidden Text.

**SPEC NOTE:** Use this section when the project requires a high confidence level that concrete substrates are finished to meet improved concrete finishing tolerances. Guidance ACI 117.1R-14 indicates that the Consultant is responsible for the following coordinating differential construction tolerances as follows:

- **Identifying Tolerance Information:** Tolerance information comes from building codes, standards, industry organizations, manufacturers, designers and contractors.
  - Tolerances for Division 03 have different measurement outcomes than tolerances for Division 09 and are frequently contradictory to each other; it is the Consultant's responsibility to identify and select the correct tolerance based on end use of the floor slab, the Consultant manages tolerance expectations for the project and does not force correction of otherwise compliant outcomes onto other trades.
    - Standards described for Division 03 work describe quantitative tolerance outcomes within 3 days of concrete placement, and prior to removal of formwork for suspended slabs.
    - Standards described for Division 09 work describe qualitative tolerance expectations immediately prior to installation of floorcoverings [and applied finishes].
    - Consultant is responsible for aligning tolerances described in the specification and including appropriate technical content to address differential tolerances.

- Observational tolerances required for DIVISION 09 have no formalized testing requirements to ascertain acceptability of concrete substrates, and incorrectly reference practical tolerances required for Division 03, which often leads to unattainable site condition requirements.
- This Section describes coordination between interfacing tolerances associated with concrete, forming, supply, placing and finishing and sections associated with applied flooring and floorcovering materials.
- ***Evaluate Tolerance Information:*** Analyze required tolerance information required for the Project, identify potential conflicts between interfacing components, and establish solutions that account for the differential between measurement systems:
  - Concrete has a finite period of adjustability and response time from the installing Subcontractors, having the greatest influence on successful tolerance outcomes while having the least ability to make corrections.
  - Concrete is a dynamic building element and will change over a period of time. What was measured as meeting appropriate design tolerances within 3 days of concrete placement will be between 30% and 50% off tolerance by the time floorcoverings are installed.
  - Correction of concrete substrates is based on local deviation from the specified practical tolerance and will consist of grinding high spots and filling low spots. Local deviations are not considered deficient until they are greater than 40% less than tolerance expectations for the measured area.
- ***Generate Acceptable Tolerance Compatibility:*** The Consultant is responsible for establishing appropriate technical content to overcome differential performance expectations between Division 03 and Division 09 to reduce or control the number of tolerance conflicts, and must recognize contributions of Subcontractors and the Constructor's involvement with describing appropriate direction for means and methods to their Subcontractors.
  - The Consultant must be aware of restrictive tolerances that fail to recognize or that disregards the practicalities of actual construction contributed by the components of the Work:
    - This is the reason why this Section includes requirements for the Constructor's Quality Management Program to verify the practical limitations associated with the Work.
    - Restrictive tolerances can be achieved; which when contemplated, should be based on consultation with fabricators, installers and erectors local to the Project.
    - Restrictive tolerances can have significant consequences to the project schedule and budgets, and must be discussed and accepted by the Owner before including in project specifications.
    - Restrictive tolerances are those that are not contained or described as forming practical construction results that are described within the written standards established by installers, fabricators, and manufacturers contributing to the Work of the Project.

- This Section is included in Division 01, recognizing that the work results described within the specification span multiple Divisions and relies on many contributors to the Work of the Project to achieve success, and recognizes that Division 03 procurement may occur substantially earlier than Division 09 procurement, leaving no opportunity to describe improved or more restrictive tolerances in fast tracked projects.
- Describing the best solution requires communication between all contributors to the Work, and design flexibility that recognizes quality of workmanship available at the Place of the Work.
- The solution must account for construction scheduling and costs, potential for additional materials for grinding and filling, additional reinforcing steel to limit slab curl and deformation, adjustment of structural connections, and account for project participants ability to collaborate on implementing mitigation strategies in early stages of construction before permanent structures are installed on top of horizontal concrete substrates.

## 1 General

### 1.1 INTENT

**SPEC NOTE:** The terms [Constructor] and [Trade Description] are used in this document to identify contract participants. The Specifier should modify the document to include appropriate reference to the participants described in the Contract; substituting the words Contractor, Construction Manager or Design-Builder for [Constructor], and Subcontractor or Trade Contractor for [Trade Description].

- 1.1.1 The intent of this Section is to establish guidance for the [Constructor]'s role in developing a quality management program that promotes cooperative and collaborative approaches to achieving specified finishing tolerance of concrete substrates (concrete flatwork) that are appropriate for applied finishes and floorcoverings required for the Project; it is not intended to establish policies for policing-the-work and punitive-measures to enforce the Contract.
- 1.1.2 The intent of this Section is to establish quality management procedures associated with performance of concrete slab placing and finishing that will receive [cementitious underlayments] [,] [cementitious toppings] [ground and polished concrete finishes] [burnished concrete finishes] [applied finishes] [floorcoverings] [high-build resinous finishes] [and] [insert other surface dependent floor finish] requiring contributions from multiple divisions of the Work.

## 1.2 SUMMARY

- 1.2.1 Work of this Section includes requirements for developing content relating to construction of concrete [slabs-on-grade] [and] [suspended slabs] (concrete flatwork) for the [Constructor]'s Quality Management Program (QMP) specified in Section 01 45 00 – Quality Control that documents the [Constructor]'s policies and organizational structure to achieve specified concrete finishing tolerances for concrete substrates associated with the following:

**SPEC NOTE: Concrete mix design is a critical requirement that has potential to affect bond between interior floorcoverings and the concrete slab. Discuss the following with the structural engineer and include appropriate language in RELATED REQUIREMENTS to offset construction risk associated with critical concrete floor tolerances:**

- **Mix designs and water/cement ratio help decrease curling of slabs-on-grade, and reduce the amount of rework when curing methods are not consistent with managing drying of concrete slabs.**
- **Mix designs can include shrinkage compensating admixtures for concrete, and slab design can include shrinkage compensating reinforcement to reduce the amount of movement and cracking associated with slab shrinkage.**

1.2.1.1 Concrete Mix Design: Prepare concrete mix design that accounts for appropriate workability (slump and flow) based on performance requirements for the Project, [sustainability,] and that accounts for concrete trades' requirements to achieve specified concrete tolerances including adjustment for slump and consolidation on site [and] [,] [inclusion of shrinkage compensating admixtures] [and applied floorcovering manufacturers'] requirements.

1.2.1.2 Concrete Formwork: Prepare formwork erection drawings for suspended slabs in accordance with CSA A23.1, Item 6.5.2 and verify that perimeter ( $F_L$ ) of horizontal concrete slabs and blocked-out openings through slabs are at the same level [; including service and crane block-outs in suspended slab construction, accounting for formwork camber]; and verify that construction schedule accounts for specified strength gain before removal and relocation.

**SPEC NOTE: Coordinate requirements for concrete reinforcing, additional layer of temperature steel can offset or prevent curling and shrinkage cracking for slabs-on-grade and can reduce the amount of post-formwork removal camber for suspended slabs.**

- **Curling, cracking and camber affect installation of applied finishes and floorcoverings, and can greatly reduce the amount of surface mitigation (grinding and filling) of slab surfaces; performed by the Constructor.**
- **Constructor is responsible for work associated with aligning tolerances required to mitigate differences between measured tolerances of Division 03 and required observational tolerances of Division 09.**

1.2.1.3 Concrete Reinforcement: Schedule installation of concrete reinforcement to allow sufficient time for Consultant's review and acceptance before scheduling delivery of concrete to project site.

1.2.1.4 Concrete Delivery: Control delivery of concrete to maintain concrete mix design properties accepted by the Consultant at time of discharge, without use of unscheduled additives and water by the transit mix operator and onsite personnel.

1.2.1.5 Concrete Finishing: Coordinate with Section 03 31 00 and [Section 03 35 11] [Section 03 35 11] for specified  $F_F$ :  $F_L$  tolerances and locations of different  $F_F$ :  $F_L$  outcomes (the footprint), that account for admixtures required to attain optimal concrete workability for placers and finishers, and that are compatible with adhesives used for applied finishes and floorcoverings.

- 1.2.1.6 Concrete Protection: Describe methods to protect newly placed and finished concrete from rain and snow, freezing conditions, wind, heat and differential shading until concrete is cured sufficiently to prevent damage to surface finish, and confirm methods to limit loads on new concrete slabs until sufficient strength is attained to support construction loads.
- 1.2.1.7 Concrete Curing: Describe methods for managing application and removal of Products used to aid the concrete curing process, with the goal to minimize the use of surface applied curing compounds, sealer/hardeners and moisture retarders that may be detrimental to [surface adhesion for [surface coatings] [and] floorcoverings] [and] [bonding of cementitious [toppings] [and] [underlayments] [,] [and] polished concrete].
- 1.2.1.8 Concrete Surface Preparation: Describe methods for managing removal of incompatible curing compounds and providing concrete surface profiles acceptable for bonding of floorcovering adhesives.
- 1.2.1.9 [Concrete [Toppings] [and] [Underlayments]: Describe concrete [toppings] [and] [underlayments] proposed for use, and methods achieving specified tolerances using specified Unit Price Allowance.].

### 1.3 RELATED REQUIREMENTS

**SPEC NOTE: Refer to [NFCA Floor Covering Reference Manual: Chapter AA3 – Specification Guide 02 42 10 – Existing Flooring Removal](#) to describe selective demolition associated with removing existing flooring, salvaging existing materials and preparing substrates ready for installation of new or reclaimed applied finishes and floor coverings. Content of this section can be included with your flooring materials specifications when the scope is limited to only floor covering removal and reinstallation.**

- 1.3.1 [Section 02 41 19 – Selective Interior Demolition](#): Removal [and salvage] of existing flooring materials ready for installation of new [and reclaimed] applied finishes and floorcoverings.

**SPEC NOTE: Bonded concrete topping compounds used and repair damaged, abraded and worn concrete substrates exposed to light-wheeled, heavy-wheeled and pedestrian traffic wear usage, and to correct or restore surface tolerances of existing concrete slabs in preparation for new applied finishes or floorcoverings.**

- Refer to [Section 03 35 13](#) for bonded concrete toppings used to improve final concrete finishing tolerances subjected to pedestrian, light wheeled, or heavy wheeled traffic conditions for new construction.

- 1.3.2 [[Section 03 01 30 – Rehabilitation of Cast-In-Place Concrete](#): Requirements for restoration of existing concrete slabs ready for work described in this Section.]

**SPEC NOTE: Concrete testing and inspection procedures can be identified as a common work result, or be included as a part of Section 03 31 00 site quality control requirements.**

- 1.3.3 [[Section 03 08 30 – Concrete Observation, Review and Testing Procedures](#): Source and site quality control requirements associated with validation of structural concrete strength gain and reporting of site observations.]

**SPEC NOTE: Concrete formwork establishes the overall levelness of concrete slabs; edge forms for slabs-on-grade; edge forms, camber and shoring for suspended concrete slabs; and scheduling for removal of forms and shoring for suspended concrete slabs.**

- 1.3.4 [Section 03 11 13 – Structural Cast-In-Place Concrete Forming](#): Requirements for conventional formwork and accessories of suspended concrete slabs.
- 1.3.5 [Section 03 11 16 – Architectural Cast-In-Place Concrete Forming](#): Requirements for architectural formwork and accessories for as-cast [and decorative] concrete finishes.

**SPEC NOTE: Structural engineer must consider the effects of reinforcing to reduce or eliminate tolerance losses arising from drying shrinkage and slab curling. Tolerances for concrete floor finishes must consider the requirements for floorcoverings and other applied finishes.**

- 1.3.6 **Section 03 21 00 – Reinforcement Bars:** Requirements for steel reinforcing bars for [slabs-on-grade] [and] [suspended slabs].
- 1.3.7 **Section 03 24 00 – Fibrous Reinforcing:** Requirements for [steel] [synthetic] fibrous reinforcing for [slabs-on-grade] [and] [suspended slabs].

**SPEC NOTE: Many manufacturers establish a limitation on the quantity of fly-ash in concrete, because fly-ash increases density of concrete which subsequently reduces the mechanical bond of floorcovering adhesives to substrates.**

- Confirm with floorcovering manufacturers for fly-ash limitations; based on adhesive types.
  - Fly-ash limitations can be as low as 10% to as high as 20% to 25% replacement of cementing materials.
    - NFCA and floorcovering manufacturers indicate that fly-ash content greater than 10% to 15% decreases the surface porosity of concrete; potentially decreasing adhesive bond of floor covering materials, and may require additional mechanical floor preparation to achieve acceptable bond strength.
    - Higher fly-ash concrete can be used provided the specifier includes additional mechanical floor preparation within the technical specifications, and that the concrete finisher is made aware of this requirement so that they can adjust their approach to working with the affected concrete.
    - Fly-ash changes the surface density and porosity of concrete and can affect bond between cementitious-based or gypsum-based overlayment or underlayment materials, which may require similar additional mechanical preparation as stated for floorcoverings.
  - High fly-ash may delay release of moisture from concrete and extend the period of time before floorcovering manufacturers' recommended RH for bonding moisture impermeable floorcovering materials is achieved.
  - Weigh the sustainable benefits of adding fly-ash to concrete with the carbon content associated with bonded concrete toppings that may be required when specifying high supplementary concrete materials in the concrete mix design.
  - Discuss concrete mix design with structural engineer to establish maximum limit of fly-ash in concrete slabs when it is used as a part of the sustainable concrete project deliverables.
- 1.3.8 **Section 03 31 00 – Structural Concrete:** Establish requirements for maximum surface density of placed concrete when using supplementary cementing materials [and shrinkage compensating admixtures] to achieve floorcovering manufacturer's requirements for effective adhesive bond.

**SPEC NOTE:** Surface hardeners can be applied during concrete floor finishing as a final finish for high traffic, wear resistant slabs.

- Hardness of concrete is measured using the MOH Scale of Hardness, with standard concrete having a  $\pm 5.25$  to  $\pm 5.5$  MOH, concrete with surface applied liquid cure/hardener having  $\pm 5.5$  to  $\pm 5.75$  MOH, and liquid applied densified concrete having  $\pm 5.75$  to  $\pm 6.25$  MOH, by comparison the following dry shake hardeners provide better armoring for floor subject to significant impact and abrasion loads:
  - Trap Rock (Basalt) =  $\pm 6.5$  MOH, comparative abrasion resistance is 2X better than plain concrete.
  - Silica (Quartz) =  $\pm 7.0$  MOH, comparative abrasion resistance is 3X better than plain concrete.
  - Emery (Corundum) =  $\pm 8.0$  MOH, comparative abrasion resistance is 4X better than plain concrete.
  - Metallic (Iron) =  $\pm 8.5$ , comparative abrasion resistance is 5X better than plain concrete.

**SPEC NOTE:** Corrections to out-of-tolerance optimal concrete surface profile, measured within the first three days of placing in accordance with ASTM E1155 are specified in [Section 03 35 11](#). This section includes repair compounds consisting of trowellable mortar patching materials formulated to correct surface depressions; delaminated areas; filling holes, voids and gouges; spalled and unsound surfaces, and other hollow deficiencies necessary to meet the three day tolerance standard for concrete placing and finishing work.

- 1.3.9 [Section 03 35 11 – Concrete Floor Finishing](#): Conventional concrete [slab-on-grade] [and] [suspended slab] floor finishing methods to achieve specified Concrete Quantitative Tolerance ( $F_F, F_L$ ).

**SPEC NOTE:** Include the following requirement for specialty concrete slabs such as those required for polished concrete, warehouse flooring where high lift picking equipment is used, or when automatic guided vehicles and air pallet systems are used.

- Do not specify high-tolerance concrete floor finishing to achieve flatness requirements for floorcoverings; this will add unnecessary cost to the project, and require the use of specialty finishing materials and advanced mechanical finishing equipment.
- Specify high-tolerance concrete floor finishing for hospitals, laboratories, institutional buildings, Class A office towers and other building types when floor flatness has been identified as an absolute requirement exceeding  $F_F 35_{MIN}$ .

- 1.3.10 [\[Section 03 35 13 – High-Tolerance Concrete Floor Finishing](#): Specialty concrete slab-on-grade floor finishing methods to achieve enhanced Concrete Quantitative Tolerance ( $F_F, F_L$ ) required for specified high-tolerance finishing classifications.]

**SPEC NOTE:** Indicate limitations of densified concrete floor finishes on Drawings, and limit to only those areas that require this treatment.

- Densified concrete may affect the porosity of concrete substrates and impede bond of many water-based adhesives for many floorcovering products.
- Additional floor preparation and grinding may be required when surface densifiers are applied to achieve a suitable profiled finish for adhesion, or require an aggressive surface profiling and full cementitious underlayment or topping when light profiling does not solve adhesion concerns.
- Densified concrete floor finishes are marginally harder than plain concrete, and are typically comprised of Lithium or Sodium Silicates, providing  $\pm 6.0$  MOH, comparative abrasion resistance is 1.3X better than plain concrete.

- 1.3.11 [\[Section 03 35 41 – Densified \[and Burnished\] Concrete Floor Finishing](#): Concrete mix and substrate tolerances required for specified surface finish.]

1.3.12 [Section 03 35 43 – Polished Concrete Finishing: Concrete mix and substrate tolerances required for specified mechanically polished surface finish.]

**SPEC NOTE:** The specifier should make themselves aware of different materials used to cure concrete, wet curing through misting or retaining a water layer using coverings provides the most reliable curing conditions that have minimal affect on subsequent installation of applied finishes and floorcoverings.

- Curing compounds tend to be film forming, residual films from curing compounds can decrease bond strength of mortars and adhesives used to install applied finishes and floorcoverings.
- Additional floor preparation and grinding may be required when curing compounds are applied to achieve a suitable profiled finish for adhesion, or require an aggressive surface profiling and full cementitious underlayment or topping when light profiling does not solve adhesion concerns.
- Curing compounds are described as hardeners, sealers, cure/seals and similar names that denote a specific type of curing outcomes.
  - Hardeners break surface-tension of mix water, breaking up balls of cement so that more cement particles can react with available water and provide a denser surface finish and slightly improves the surface hardness of concrete.
  - Sealers cover and seal capillary channels and pores in the concrete surface; retaining mix water to complete curing of concrete, can be combined with surfactant to improve surface hardness.
  - Internal curing compounds reduce the formation of capillary channels and pores as an integral component of the concrete mix, and retain mix water more effectively to reduce contraction cracking and curling, and produce a dense surface.
  - Densifiers described above are reactive and introduce silicates that react with free-lime to seal capillary channels and pores, and provide hard and dense surfaces that resist wear and significantly improve hardness of concrete.
- Curing compound removal is described in this section as a part of a unit price cash allowance, where the Constructor has indicated that wet curing is not practical because of temperature concerns, or construction schedule limitations.

1.3.13 Section 03 39 00 – Concrete Curing: Curing of horizontal concrete surfaces receiving [mechanically applied finish treatments] [,] [applied floorcoverings] [and] [high performance coatings].

**SPEC NOTE:** Section 03 53 19 includes cementitious compounds formulated to resurface concrete slabs to achieve a high-tolerance concrete surfaces that will remain as the primary wear surface, or that will form a part of a decorative concrete such as ground and polished finishes, and stained finishes.

1.3.14 [Section 03 53 19 – Concrete Overlayment: Concrete-based toppings, exposed in final configuration, and that achieve required surface tolerance for specified surface finish.]

**SPEC NOTE:** Self-levelling underlayment compounds are typically used to improve conventional concrete substrate having between  $F_F 20:F_L 15$  and  $F_F 35:F_L 25$  to attain  $F_F 50:F_L 30$  and better; self-levelling underlayment should not be used as a first choice when trained and qualified concrete finishers are available for the project.

- Self-levelling underlayment compounds are not typically measured using ASTM E1155 FF:FL System:
  - FF:FL is only described to provide specifier with information to associate expected outcomes to a similarly highly finished concrete slab-on-grade.
  - The material properties of self-levelling underlayments means that gravity will spread compounds to a smooth and even profile with minimal handwork.
- Improved FF:FL are often required for institutional projects such as hospitals, clinical and diagnostic facilities, athletic facilities, Class A office occupancies and similar buildings when identified by the Owner.
- Self-levelling underlayments will not support wheeled traffic or pedestrian contact and must be finished with floorcoverings described in Division 09.
- Although FL does not apply to suspended concrete slabs, use self-levelling compounds to achieve improved concrete finishing tolerances for these substrates.
- Engineering design must account for weight of self-levelling compounds.
- Architectural design must indicate extent of areas affected by this work so that construction details are in place to contain self-levelling compounds.
- Self-levelling compounds will spread under their own weight and influence from gravity and may pose risk of overflow through openings and edges of slabs if not contained appropriately.

**SPEC NOTE:** Include the following requirement when improved surface tolerances are required for building operations and maintenance such as hospitals, clinical and diagnostic facilities, athletic facilities, Class A office occupancies and similar occupancies.

- Confirm compatibility of gypsum cement underlayments with requirements of floorcovering manufacturers for conditions affecting bonding of adhesives to substrate.
- Confirm compatibility of gypsum cement underlayments with floor loading requirements, where compressive strength is critical to support point loads or rolling loads.
- Gypsum cement underlayments must meet manufacturer minimum compressive testing, typically in the range of 20 kPa (3000 PSI) or greater.
- Gypsum cement underlayment materials will require a mechanically prepared surface profile of between CSP-3 and CSP-5 specified in [Section 09 05 58](#).
- Gypsum cement underlayment materials can also be specified [Section 03 01 30](#) based on the type of repairs required for the project at the choice of the Specifier.

**SPEC NOTE:** Refer to [NFCA Floor Covering Reference Manual: Chapter AA1 – Specification Guide 03 54 12 – Gypsum Underlayment](#) when a self-levelling cementitious underlayment is required over substrate surfaces to provide an acceptable surface for installation of applied finishes and floor coverings.

- 1.3.15 [[Section 03 54 13 – Gypsum Cement Underlayment](#): Gypsum-based, lightweight self-levelling underlayments required to achieve surface tolerance required for specified surface finish.]

**SPEC NOTE:** Include the following requirement when improved final concrete finishing tolerances is required for building operations and maintenance such as hospitals, clinical and diagnostic facilities, athletic facilities, Class A office occupancies and similar occupancies.

- Confirm compatibility of hydraulic cement underlayments with requirements of floorcovering manufacturers for conditions affecting bonding of adhesives to substrate.
- Hydraulic cement underlayment materials will require a mechanically prepared surface profile of between CSP-3 and CSP-5 specified in [Section 09 05 58](#).
- Hydraulic cement underlayment materials can also be specified [Section 03 01 30](#) based on the type of repairs required for the project at the choice of the Specifier.

**SPEC NOTE:** Refer to [NFCA Floor Covering Reference Manual: Chapter AA1 – Specification Guide 03 54 15 – Hydraulic Cement Underlayment](#) when a self-levelling cementitious underlayment is required over substrate surfaces to provide an acceptable surface for installation of applied finishes and floor coverings.

- 1.3.16 [[Section 03 54 16 – Hydraulic Cement Underlayment](#): Cement-based, self-levelling underlayments required to achieve surface tolerance required for specified surface finish.]

**SPEC NOTE:** Discuss floor stiffness based on types of floor finishing products anticipated for the project with structural engineer during early design stages:

- Standard structural design allows for L/240 to L/360 slab deflection depending on use, which may need to be revised to L/360 or L/480 when installing rigid floor finishing materials to reduce slab curvature between load bays, and reduce lippage and damage between large tile or slab products.
- Stiffening the concrete slab design may impact on the cost of the structure, and structural engineer may be able to suggest other design solutions to accommodate slab curvature, including application of reverse camber applied to joists or formwork to compensate for plastic deformation that contributes to slab curvature.

- 1.3.17 [[Section 05 21 00 – Steel Joist Framing](#): Management of camber associated with composite concrete and steel decking required to minimize negative deflection and curvature of horizontal floor slabs between structural bays.]

- 1.3.18 [[Section 05 31 00 – Steel Decking](#): Management of loading and spreading of concrete associated with composite concrete and steel decking to minimize deflection of steel decking between joists and achieve Concrete Quantitative Tolerance ( $F_F: F_L$ ).]

- 1.3.19 [[Section 07 18 00 – Traffic Toppings](#): Minimum Concrete Quantitative Tolerance ( $F_F: F_L$ ) required for installation of resinous traffic toppings.]

**SPEC NOTE:** Include [Section 09 05 58](#) to improve bond between adhesives and concrete having fly-ash content, concrete surfaces that have a smooth trowelled finish (that has a 'closed' surface profile), or to remove curing compounds from concrete slabs that have potential to affect bond of adhesive materials.

- The concrete finisher can achieve a concrete surface profile in the range of CSP-2 to CSP-3 when required to achieve acceptable bond for adhered floorcoverings.
- Concrete surface profile in the range of CSP-3 to CSP-5 will require mechanical surface preparation for applied finishes such as liquid applied resinous flooring and high performance coatings.
- Concrete toppings, gypsum cement underlayments and hydraulic cement underlayments also require CSP-3 to CSP-5 or greater based on manufacturer recommendations for surface preparation.
- Concrete surface profiles are described within the specifications listed in the RELATED REQUIREMENT, and are based on defined level of preparation by the International Concrete Repair Institute (IRCI).

1.3.20 [[Section 09 05 58 – Mechanical Preparation of Floorcovering Substrates:](#) Mechanical preparation of Concrete Surface Profile (CSP) to substrates receiving [bonded] cementitious [topping] [,] [overlayment] [underlayment] compounds] [and] [adhered floorcoverings].]

**SPEC NOTE:** [Section 09 05 61](#) includes for skim coating compounds that are used to smooth concrete substrates and correct minor surface inconsistencies that affect long-term maintenance and corrects visual appearance of thin floorcoverings, and to achieve final concrete finishing tolerances without the need for additional patching and repairing materials.

- Skim coating compounds consist of trowellable substrate filler materials formulated to smooth and fill minor depressions, voids and holes, and prepare in-tolerance concrete slab surfaces ready for installation of floorcovering materials.
- Skim coating compounds are not used to repair out-of-tolerance concrete substrates associated with work specified in [Section 03 35 11](#) or [Section 03 11 13](#).
- Specifier can specify overlayment and underlayment compounds specified in [Section 03 53 19](#), [Section 03 54 13](#) or [Section 03 54 16](#) to improve the final concrete finishing tolerances to a more planar finish.

**SPEC NOTE:** [Section 09 05 61](#) includes for moisture mitigation compounds, that are typically surface applied materials formulated to reduce moisture vapour emission rate (MEVR) of [new] [and] [existing] concrete slabs prior to installation of floorcoverings to meet floorcovering manufacturers' recommended RH.

**SPEC NOTE:** Components of common work results are described in the [NFCA Floor Covering Reference Manual: Chapter A10 – Acceptable Conditions](#), and can be used as a guide when coordinating the work for Division 09 – Finishes and the extent of flooring preparation common to all specified floor finishes. This section is intended for use where extensive materiality and repetitious work is required to describe project work, and can be incorporated into individual specification sections when there are fewer finishes or the project is less complex.

1.3.21 [[Section 09 05 61 – Common Work Results for Flooring Preparation:](#) Preparation of concrete slab surfaces using cementitious repair and filling materials [,] [moisture mitigation compounds] [and] [surface grinding] required to achieve Floorcovering Qualitative Tolerances (*Straightedge*) ready for installation of floorcoverings [and applied finishes].]

**SPEC NOTE:** Coordinate the following RELATED REQUIREMENTS and include product specific content associated with achieving specified floor finishing tolerances for concrete substrates, expand content to MasterFormat third and fourth level numbers and titles to improve communications of specific types of finishes.

**SPEC NOTE:** The Terrazzo, Tile and Marble Association of Canada publishes a **Specifications Guide 09 30 00 and Tile Installation Manual** available as a hardcopy or digital download for a nominal cost for non-TTMAC Members.

- 1.3.22 [Section 09 30 00 – Tiling: Minimum surface tolerances required for installation of tiling products.]

**SPEC NOTE:** Refer to **NFCA Floor Covering Reference Manual: Part E – Laminate Flooring, Chapter E06 – Specification Guide 09 62 19 – Laminate Flooring** when specifying solid or engineered strip, plank or parquet hardwood flooring.

- 1.3.23 [Section 09 62 19 – Laminate Flooring: Minimum surface tolerances required for installation of laminate flooring products.]

**SPEC NOTE:** Refer to **NFCA Floor Covering Reference Manual: Part D – Hardwood Flooring, Chapter D06 – Specification Guide 09 64 29 – Hardwood Flooring** when specifying solid or engineered strip, plank or parquet hardwood flooring.

- 1.3.24 [Section 09 64 00 – Wood Flooring: Minimum surface tolerances required for installation of resilient wood floorcovering assemblies.]

**SPEC NOTE:** Refer to **NFCA Floor Covering Reference Manual: Part B – Resilient Flooring, Chapter B06A – Specification Guide 09 65 00 – Resilient Flooring** when specifying resilient sheet and tile finishes, sports floors, stair coverings, bases and trims.

**SPEC NOTE:** Refer to **NFCA Floor Covering Reference Manual: Part B – Resilient Flooring, Chapter B06B – Specification Guide 09 65 30 – Static Control Flooring** when specifying static control resilient sheet and tile and accessories.

- 1.3.25 Section 09 65 00 – Resilient Floorcoverings and Accessories: Minimum surface tolerances required for installation of resilient floorcoverings.

**SPEC NOTE:** The Terrazzo, Tile and Marble Association of Canada publishes a **Specifications Guide 09 66 00 Terrazzo Installation Manual** available as a hardcopy or digital download for a nominal cost for non-TTMAC Members.

- 1.3.26 [Section 09 66 00 –Terrazzo Flooring: Minimum surface tolerances required for installation of portland cement terrazzo flooring.]

- 1.3.27 [Section 09 67 00 Fluid-Applied Flooring: Minimum surface tolerances required for installation of tile carpeting.]

**SPEC NOTE:** Refer to **NFCA Floor Covering Reference Manual: Part C – Carpet, Chapter C06A – Specification Guide 09 68 16 – Carpet Flooring** when specifying sheet carpeting and accessories.

**SPEC NOTE:** Refer to **NFCA Floor Covering Reference Manual: Part C – Carpet, Chapter C06B – Specification Guide 09 68 13 – Carpet Tile Flooring** when specifying modular or carpet tile flooring and accessories.

- 1.3.28 Section 09 68 00 – Carpeting: Minimum surface tolerances required for installation of tile carpeting.

- 1.3.29 [Section 09 96 00 – High Performance Coatings: Minimum surface tolerances required for installation of high performance coatings.]

- 1.3.30 [Division 21 – Fire Suppression: Requirements for finishing concrete floor surfaces to minimize slab concrete finishing tolerance deviations at blocked-out locations, pipe and pipe fittings, and other materials penetrating concrete floor assemblies.]
- 1.3.31 Division 22 – Plumbing: Requirements for finishing concrete floor surfaces to minimize slab concrete finishing tolerance deviations at blocked-out openings, pipe and pipe fittings, and other materials penetrating concrete floor assemblies.
- 1.3.32 Division 23 – Heating, Ventilation and Air Conditioning: Requirements for finishing concrete floor surfaces to minimize slab concrete finishing tolerance deviations at blocked-out openings for ductwork penetrating concrete floor assemblies.
- 1.3.33 [Division 25 – Integrated Automation: Requirements for finishing concrete floor surfaces to minimize slab concrete finishing tolerance deviations at conduit and other materials penetrating concrete floor assemblies].
- 1.3.34 Division 26 – Electrical: Requirements for finishing concrete floor surfaces to minimize slab concrete finishing tolerance deviations at blocked-out openings, conduit and other materials penetrating concrete floor assemblies.
- 1.3.35 Division 27 – Communications: Requirements for finishing concrete floor surfaces to minimize slab concrete finishing tolerance deviations at conduit and other materials penetrating concrete floor assemblies.
- 1.3.36 [Division 28 – Electronic Safety and Security: Requirements for finishing concrete floor surfaces to minimize slab concrete finishing tolerance deviations at conduit and other materials penetrating concrete floor assemblies.]

**SPEC NOTE: Athletic surfaces require the similar surface tolerances and concrete placement and surface mitigation described in this Section for interior floor finishing. Modify requirements of this section when exterior surface preparation is required for the Project. Concrete finishing tolerances is critical to athletic performance and safety, and requires implementation of specific surface profile tolerances described by the sporting associations that govern games and athletic facility standards.**

**SPEC NOTE: This Section does not address the specific requirements for flatness of sports surfacing. Additional information is available for the specifier from ISO recognized organizations listed below; additional research is required when specifying performance of these concrete substrates.**

- BSI 7044, Sports Surfaces
- CEN-EN 15330 Series, Surfaces for Sports Areas
- DIN 18035 Series, Synthetic Sports Surfaces
- World Athletics (IAAF) Performance Specifications for Synthetic Surfaced Athletic Tracks

- 1.3.37 [[Section 32 12 16 – Athletic Asphalt Paving] [32 18 23 – Athletic Surfacing]: Minimum Concrete Quantitative Tolerance ( $F_F: F_L$ ) for application of [athletic asphaltic paving] [,] [sheet-type athletic surfacing] [and] [liquid applied athletic surfacing].]

**SPEC NOTE: ANSI A108/A118/A136.1:2017, American National Specifications for the Installation of Ceramic Tile and ACI 117.1R-14, Guide for Tolerance Compatibility in Concrete Construction recommends using a cash allowance to manage work results associated with the different flatness measurement tolerances used to measure as-placed horizontal concrete and those for floorcoverings and other applied finish manufacturers.**

**This Section identifies a fixed price component for floor preparation that can be accounted for based on the amount of movement that can be expected of horizontal concrete that is placed when using appropriate quality management controls, curing methodologies and experienced trades associated with the concrete work result.**

- **The cash allowance described in this Section accounts for potential differences between the calculated deformation that occurs from the time concrete is placed until the floorcoverings are ready for installation.**
- **The actual deformation that occurs as concrete hydrates and deforms is inherent in the material and cannot be completely prevented.**
- **The extent of deformation may also be different than the calculated deformation, and which the cash allowance is used to correct those unforeseen conditions provided the quality of concrete is managed appropriately.**
- **The cash allowance is not used to repair out-of-tolerance concrete placement, that remains the responsibility of the concrete trades as directed by the Constructor.**

**SPEC NOTE: Price and Payment Procedures must be coordinated to each of the floorcovering specification sections forming a part of the project manual and that are listed in the RELATED REQUIREMENTS. Close coordination is essential to complete communication of the General Requirements with each of the trades affected by the work described in this Section.**

**SPEC NOTE: Inclusion of Price and Payment Procedures must be discussed with the Owner, they must be informed of the conditions that lead to use of additional floor preparation and the uncertainty of maintaining Concrete Quantitative Tolerances ( $F_F:F_L$ ) for the duration of the construction period.**

- **The only certainty involved with the Unit Price Allowance is that concrete will be different between the first measurements and the measurements taken at the time floorcoverings are installed.**
- **Price and payment procedures includes for known, unforeseen conditions and must be dealt with in the same way that other known, unforeseen conditions are handled (extent of hazardous materials abatement, subgrade conditions in brownfield sites).**

**SPEC NOTE: Delete Price and Payment Procedures only when the Owner expectation states that prices for this work is included as a component of the submitted Bids. Modify this specification to indicate that Unit Price Allowances are mandatory floor preparation requirements. This will affect the Bid Price, with the trade off being price certainty for the Owner.**

#### 1.4 [PRICE AND PAYMENT PROCEDURES]

1.4.1 Unit Price Allowances: Materials described in this Section form a part of unit pricing for a supply and installation cash allowance specified in [Section 01 21 00 – Allowances](#), as follows:

- 1.4.1.1 [Concrete Mix Modifiers: Include unit price allowance based on volume ( $\$/m^3$ ) of concrete delivered to site for admixture components forming a part of approved mix design, for modifications at point of discharge to account for hot weather, cold weather and between seasons temperature conditions that maintain workability of concrete for placing and finishing.]

**SPEC NOTE:** Discuss methods and products associated with curing of concrete with the structural engineer, and include appropriate content or editing to [Section 03 39 00 – Concrete Curing](#). Use unit price allowance for abrasive floor preparation based on the following considerations:

Preference from an applied floorcovering perspective is for moist cure and impermeable coverings, but that approach is not always practical from a construction scheduling or protection procedures for freezing weather conditions.

Membrane forming curing compounds can be used to address scheduling and weather condition concerns, and there are two applicable standards associated with membrane forming curing compounds that must be considered when specifying curing materials in [Section 03 39 00](#):

ASTM C309 product manufacturers often state that their products are self-removing through the action of wind, rain and UV exposure, and do not require additional surface preparation for installation of adhered floorcoverings, and that differs from floorcovering manufacturers written requirements requiring surface preparation:

Construction process and temporary enclosure of concrete slabs do not allow sufficient exposure to natural weathering to permit removal of curing membrane remnants and will require surface grinding to allow bonding between slab and underlayments, toppings and floorcovering adhesives.

Delete requirement for unit price allowance associated with slab grinding, and specify grinding and surface preparation as a project requirement in [Section 09 05 58 – Mechanical Preparation of Floorcovering Substrates](#) when specifications include ASTM C309 curing and sealing products.

ASTM C1315 product manufacturers test their products for compatibility with many adhesives commonly used with floorcoverings and state that their products do not require surface grinding and preparation for installation of adhered floorcoverings:

Many underlayment, topping and adhesive manufacturers have not tested adhesion with this type of curing membrane and will require confirmation of adhesive bond to concrete substrate using test methods described in [Section 09 05 61 – Common Work Results for Flooring Preparation](#).

Include requirement for unit price allowance associated with slab grinding to cover additional work when testing shows adhesion does not meet underlayment, topping and adhesive manufacturers stated adhesive bond strength.

Include [Section 09 05 58 – Mechanical Preparation of Floorcovering Substrates](#), stating that work of that Section forms a part of a unit price allowance for removal of curing compounds when testing shows insufficient adhesion between concrete slab and underlayments, toppings and adhesives used for the project.

- 1.4.1.2 [Abrasive Floor Preparation: Include unit price allowance based on area (\$/m<sup>2</sup>) for abrasive floor preparation that will be used if concrete surface profile does not develop required bond with adhesive materials used for installation of floorcoverings and other applied finishes as specified in [Section 09 05 58](#).]

**SPEC NOTE: Moisture mitigation treatments are typically only required for concrete slabs-on-grade, but may be required when suspended concrete is installed during high-humidity temporary heat settings.**

- Moisture content of slabs-on-grade can remain high as a consequence of poorly installed or incorrect moisture mitigation layers below the slab, and can only be corrected by application of topical treatments.
- Moisture content is not tied to the 28 or 56 day curing time required for strength gain; drying can take 4 to 6 months (or longer) to release excess moisture acceptable to floorcovering installation.
  - Typical rate of moisture release is 1 day for each millimetre of concrete thickness, meaning that a 150 mm thick slab will require a minimum of 150 days to achieve an acceptable RH when environmental conditions are suitable for release of moisture.
  - Slabs that are exposed during cold weather, or that are subjected to temporary heating will delay the drying potential to achieve an acceptable RH required by floorcovering manufacturers.
  - The drying potential will require 1 day for each day that the slab is not subjected to permanent HVAC system, meaning that a 4 month exposure to unconditioned heating conditions will add an additional 120 days to the time period associated with RH reduction.
- Surface applied (topical) treatments are available to balance Moisture Vapour Emission Rate (MVER) from high RH concrete slabs into a range that does not affect adhesion of floorcoverings and other applied finishes.

1.4.1.3 [Moisture Mitigation Compounds: Include unit price allowance based on area (\$/m<sup>2</sup>) for supply and installation of moisture mitigation compounds required to lower excessive concrete slab moisture emission to a rate required by [floorcovering] [and] [applied finish] manufacturers as specified in [Section 09 05 61.](#)]

**SPEC NOTE: Institutional buildings such as hospitals, laboratories and clinics, and sports facilities may have concrete finishing tolerances that are more restrictive than those required by floorcovering and other applied finish manufacturers. Specify cementitious underlayments or bonded concrete toppings to achieve the more restrictive tolerances, and remove requirements for unit price allowance associated with self-levelling underlayment.**

**SPEC NOTE: Include [Section 03 54 16](#) or [Section 03 54 13](#) for other building types and include unit price allowance for self-levelling underlayment; the appropriate section remains applicable to the work of the Project and forms a part of the floor preparation work associated with achieving the calculated surface tolerances, and include a statement indicating that unit price allowance will be used to adjust the quantity of self-levelling underlayment when observed final surface elevation is different than the calculated surface tolerances.**

1.4.1.4 Self-Levelling Underlayments: Include unit price allowance based on volume (\$/m<sup>3</sup>) for supply and installation of cementitious self-levelling underlayment specified in [[Section 03 54 16](#)] [[Section 03 54 13](#)]; including underlayment manufacturer's required primer, that are required to achieve Floorcovering Qualitative Tolerance (*Straightedge*) based on differential between calculated concrete finishing tolerances and observed concrete finishing tolerances.

**SPEC NOTE: Include Section 03 53 19 for concrete slabs that will not be covered with floorcoverings or other applied finishes. Concrete toppings are load bearing and intended to be left as an exposed floor finish. Concrete toppings can also be polished and densified similarly as other concrete slabs.**

- 1.4.1.5 [Concrete Toppings: Include unit price allowance based on volume ( $\$/m^3$ ) for supply and installation of concrete toppings specified in Section 03 53 19; including topping manufacturer's required primer, that are required to achieve Floorcovering Qualitative Tolerance (*Straightedge*) based on differential between calculated concrete finishing tolerances and observed concrete finishing tolerances.]
- 1.4.2 Unit Price Submission with Bid: Identify unit price allowances in [Section 00 43 22 – Unit Prices Form] and submit with Bids; unit price allowances submitted by the [Constructor] [[Trade Description] responsible for the described work] must account for the following:
  - 1.4.2.1 Unit price allowances are determined by the [Trade Description] responsible for the described work.
  - 1.4.2.2 Unit price allowances account for variation between calculated deformation of concrete slabs described in this Section, and observed deformation at time of installation of floorcoverings and other applied flooring products.
  - 1.4.2.3 Unit price allowances for the components of work described above are firm until date of Substantial Performance of the Work.
  - 1.4.2.4 Unit price allowances are limited to adjusting Contract Price where adjustments are required for Work arising from differential deformation only, and will not be used to correct deficiencies in the Work that are the responsibility of the [Trade Description]s responsible for the deficient component of work.
  - 1.4.2.5 Unit price allowances include required labour, material, equipment, supervision, transportation, financing, overhead and fees to complete the work associated;
  - 1.4.2.6 Do not include amounts for value added taxes; [GST [and PST]] [HST] will be administered as a component of the Contract Price adjustment.
- 1.4.3 Adjustment Price Format: Submit Unit price allowances for Additional work, and for Reduction of work as follows:
  - 1.4.3.1 Addition Prices include for [Trade Description]s' additional overhead and profit associated with unit price work and that was not originally contained in the Stipulated Price Bid.
  - 1.4.3.2 Deletion Prices do not include overhead and profit; [Trade Description]s are entitled to retain overhead and profit originally contained in the Stipulated Price Bid.

## 1.5 DEFINITIONS

**SPEC NOTE:** Specifier should confirm that their source documents contain references to Quality Management documentation as a part of the quality management text. Identifying some form of formal quality control process is essential to achieving flooring tolerances specified in this Section.

Most Constructors use some form of written QMP to manage quality expectations and deliverables to the Owner, and will often make the QMP available to Subcontractors, Consultants and Owners when specified.

This specification uses the following guidance for quality management processes:

- **Quality Assurance:** These are Validation Procedures performed by the Constructor and include activities, actions, and procedures performed before and during execution of the Work by the Constructor to protect against defects and deficiencies and validate that construction is consistent with regulatory requirements, performance requirements, qualification statements and certification requirements listed within the Contact Documents.
- **Quality Control:** These are Verification Procedures performed by the Constructor and include tests, inspections, procedures, and related actions performed by the Constructor during and after execution of the Work using an independent inspection and testing agency acceptable to Owner and Consultant to verify that completed construction complies with specified standards and technical requirements within the Specifications.
- **Quality Audit:** These are Validation Procedures performed by the Owner and can include tests, inspections, procedures and related actions performed by the Owner's third-party Quality Auditor (inspection agency) during and after execution of the Work to establish that work complies with Specifications, and are typically additional to quality control and quality assurance activities performed by the Constructor.

1.5.1 Quality Management Program (Documentation by [Constructor]): As described in Section 01 45 00 – Quality Management; QMP requirements described in this Section can form a part of the overall QMP required for the Project, and that address the following:

1.5.1.1 Quality Assurance (Validation Procedures by [Constructor]): As described in Section 01 45 00; [Trade Description]s are required to contribute to [Constructor]'s concrete floor finishing validation procedures described in this Section.

1.5.1.2 Quality Control (Verification Procedures by [Constructor]): As described in Section 01 45 00.

1.5.1.3 Quality Audit (Validation Procedures by [Owner]): As described in Section 01 45 00.

**SPEC NOTE:** Definitions described in this Section do not create new words or different interpretations to existing accepted terminologies, the definitions listed in this Section use existing standards and terms to differentiate between the disconnect caused by differential tolerance standards that exists between measurements used by Division 03, Division 07 and Division 09 requirements.

1.5.2 Floorcoverings: Surface finishes that are directly adhered to concrete substrates such as resilient flooring, carpeting, wood flooring, laminate flooring, and other similar flexible premanufactured finishes.

1.5.3 Applied Finishes: Surface finishes that are applied to concrete such as exposed architectural concrete finishing (polished, burnished or densified), tile flooring, masonry flooring, terrazzo flooring and similar rigid finish materials, supported wood flooring, fluid applied flooring, and other flooring treatments that are not otherwise defined as floorcoverings.

- 1.5.4 Concrete Surface Profile (CSP): Topographical contour, surface texture of exposed concrete surfaces or substrates as defined by the International Concrete Repair Institute (ICRI), and are required to establish acceptable mechanical bond between floorcoverings, applied finishes, mortar setting materials, fluid applied flooring, or cementitious coatings with individual material CSP requirements specified in RELATED REQUIREMENTS.

**SPEC NOTE: Alignment of the language used to describe flatness outcomes for concrete and floorcoverings is currently missing from applicable standards. Content in this section is based on ASTM F710 which describes acceptable concrete substrates as being smooth, free from irregularities and roughness, or other defects that could telegraph through resilient flooring, and addresses correction of flatness through application of smoothing materials and selective grinding, and from ICRI definition for finishing that is described as levelling, smoothing, consolidating and surface treatments to produce the desired appearance for concrete surfaces.**

**SPEC NOTE: ACI 117.1R, states that it is the specifiers choice to specify concrete flatness tolerances using Flatness/Levelness ( $F_F:F_L$ ) in accordance with ASTM E1155, Surface Waviness Index in accordance with ASTM E1486 or Straightedge Gap Measurements for concrete finishing operations, but CSA A23.1 only recognizes the use of Flatness/Levelness ( $F_F:F_L$ ) in accordance with ASTM E1155.**

- **ASTM F710 states a preference for the use of the same  $F_F:F_L$  testing procedures, but recognizes that Straightedge Gap Measurements required by floorcovering and applied flooring manufacturers can also be used.**
- **This specification uses ASTM E1155 to establish acceptable concrete placement and ACI 117.1R Straightedge measurement to establish acceptable substrate profile for application of floorcoverings to recognize that concrete is a natural product and surface tolerances will change based on the time measurements are taken. The longer the time span, the greater the potential difference between preliminary surface tolerance measurements (measured within 3 days of concrete finishing) and final surface tolerance measurements (measured before installing applied finishes and floorcoverings).**

- 1.5.5 Concrete Finishing Tolerances: The relative flatness and levelness of horizontal concrete surfaces identified to receive floorcoverings or other applied finishes, and that have different measurement standards and tolerances based on the component of the work and time of installation:

- 1.5.5.1 Concrete Quantitative Tolerance ( $F_F:F_L$ ): Concrete flatness ( $F_F$ ) and levelness ( $F_L$ ), based on quantitative results using [ASTM E1155](#) measurements and surface tolerances described in [CSA A23.1, Table 21: Slab and Floor Finish Classifications](#), that are specified in [\[Section 03 35 11\]](#) [and] [\[Section 03 35 13\]](#), and that are measured within 3 days of placement before to removal of concrete forms.
- 1.5.5.2 Floorcovering Qualitative Tolerance (*Straightedge*): Concrete flatness based on qualitative evaluation of observed gap measured along a 3 m unlevelled straightedge placed randomly, and that are similar to other satisfactory existing floors described in [ASTM F710](#) and [ACI 117.1R](#), that are specified in individual RELATED REQUIREMENTS, and that are measured immediately before application of floorcoverings and other applied finishes.

- 1.5.6 Concrete Floor Finishing Tolerances: Concrete finishing tolerances generally apply to entire slab areas; materials and methods associated with achieving tolerances vary based on when they are measured, and which [Trade Description] is directed by the [Constructor] to perform work to achieve the specified tolerance as follows:

**SPEC NOTE: Conventional tolerance concrete floor finishing to achieve specified Concrete Quantitative Tolerance ( $F_F:F_L$ ) without employing specialized materials and methods associated with high-tolerance concrete finishing.**

- Conventionally finished concrete slabs are appropriate for most projects and may require additional materials to account for localized high-tolerance floor finishing procedures within rooms or floor areas to meet Floorcovering Qualitative Tolerance (*Straightedge*) required for application of floorcoverings and other applied finishes.
- Conventionally finished concrete slabs are usually performed as a “divided-source” work result, with the Constructor procuring supply and installation of the contributing components between the different trades associated with constructing concrete floors.
- Greater assurance of outcomes can be achieved by bringing all trades associated with concrete floor construction, and the floorcoverings [and applied finishes] trades to a pre-construction meeting before any concrete is ordered... preferably before any work on site starts when using the “divided-source” approach to procurement.

- 1.5.6.1 Conventional Tolerance Concrete Floor Finishing: Concrete slabs having finishing tolerances for concrete substrates ranging between  $F_F$  20:  $F_L$  15 and  $F_F$  35:  $F_L$  25 specified in Section 03 35 11.

**SPEC NOTE: Delete the following paragraph when high-tolerance concrete floor finishing is not required for the project.**

- High-tolerance concrete floor finishing is generally applied to slabs having exposed architectural concrete finishes (polished, burnished, patterned), hospital and healthcare facilities, high-lift warehouse facilities, sports facilities and ice rinks, and when bonded concrete toppings are required for ultra-flat and specialized slabs.
- High-tolerance concrete floor finishing should be identified as a ‘coordinated-source’ responsibility that includes supply and installation of formwork, concrete mix design, concrete placing and finishing, and concrete curing.
- Greater assurance of outcomes may also require pre-qualification of concrete flooring contractors, meeting certification requirements described by the Concrete Floor Contractors Association and Section 03 35 13– High-Tolerance Concrete Floor Finishing.

- 1.5.6.2 [High-Tolerance Concrete Floor Finishing: Concrete slabs having finishing tolerances for concrete substrates [ $F_{MIN}$  35] [ $F_{MIN}$  50] and greater specified in Section 03 35 13.]

## 1.6 REFERENCE STANDARDS

### 1.6.1 American Concrete Institute (ACI):

1.6.1.1 ACI 117.1R-14, Guide for Tolerance Compatibility in Concrete Construction

### 1.6.2 ASTM International (ASTM):

1.6.2.1 ASTM E1155-20, Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers

1.6.2.2 ASTM F710-19e1, Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring

- 1.6.3 Canadian Standards Association (CSA):
  - 1.6.3.1 CSA A23.1:19/A23.2:19, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete
- 1.6.4 National Floor Covering Association of Canada (NFCA):
  - 1.6.4.1 NFCA Floor Covering Reference Manual
  - 1.6.4.2 [NFCA Quality Assurance Program (QAP)]

#### 1.7 ADMINISTRATIVE REQUIREMENTS

**SPEC NOTE: ACI 117.1R describes the Consultant's responsibility for coordinating concrete work tolerances with tolerance requirements of other trades whose work adjoins the concrete work, and identifying conditions that require coordination between those different trades.**

- ACI also states that finish and architectural details should be compatible with concrete tolerances.
- Inclusion of this statement makes a balanced risk statement and indicates to the Constructor and trades associated with the work that there are no 'hidden' design requirements that may be identified during the construction phase.
- It is the Consultant's responsibility to identify and detail components that are affected by coordination with concrete installation tolerances, several examples of this coordination and potential detailing are included in ACI 117.1R.

- 1.7.1 Consultant's Specified Requirements: Consultant researched and incorporated appropriate measurement tolerances for materials, components, accessories and assemblies affecting performance outcomes associated with interior floor finishing during the design and documentation phases of the Project; and included descriptions within the Drawings and Specifications issued by the Consultant where appropriate.

**SPEC NOTE: ACI 117.1R describes Constructors responsibility for coordinating the work of the trades contributing to the work associated with interior floor finishing that includes establishing a preconstruction tolerance coordination meeting, and assigning responsibilities for achieving construction tolerances to the trades contributing to the work, and assigning responsibility to trades for correction of deficiencies when they are encountered.**

- The following item includes content based on the assumption that Constructors have a quality management plan.
- The specification content includes guidance for coordinating the trades that contribute to floor finishing performance requirements that have direct impact on outcomes on the overall success of achieving the tolerances specified for the project.
- It is critical to maintain the separation between the Consultant and the Constructor's role when modifying the following content, and that content should not state specific means and methods.
- The specifications identify what work is required, the Constructor determines how that work is performed.

- 1.7.2 [Constructor]'s Quality Management Program (QMP): Submit QMP indicating standardized approach to managing quality of materials and workmanship during execution of the work associated with achieving concrete finishing tolerances identified in the Specifications including the following:
  - 1.7.2.1 Preconstruction Quality Planning: Develop preconstruction activities forming a part of the QMP in accordance with CSA A23.1, Article 7.1 and requirements of this Section.

- 1.7.2.2 Quality Assurance: Activities, actions, corrective remedies and procedures performed before and during execution of the Work by the [Constructor] to protect against defects and deficiencies, and confirming that construction is consistent with specified performance requirements listed within the Specification.
  - 1.7.2.3 Quality Control: Observations, procedures, and related actions performed by the [Constructor] during and after execution of the Work to verify that completed construction complies with specified performance requirements, standards and technical requirements listed within the Specifications
  - 1.7.2.4 Limitations: Quality management activities performed by the [Constructor] do not include contract administration and reporting performed by the [Consultant] [or Quality Auditing activities performed by the [Owner]].
- 1.7.3 [Trade Description] Contribution: [Trade Description]s will coordinate requirements described in this section with the [Constructor] to identify installation conditions affecting concrete placing and finishing, and that affect compatibility of floorcoverings [and applied finishes] discussed during the pre-construction meetings described below, [Constructor] will incorporate comments as a part of the QMP.

**SPEC NOTE: Consultant should limit the number of different concrete finishing tolerances applied across floor plates to match the recommended tolerances of many different floorcoverings.**

- **It is more effective to specify the most restrictive achievable tolerance that will satisfy the majority of tolerances required for the project when multiple finishing tolerances for concrete substrates are required.**
- **Specify cementitious underlayments as a required component for floor levelling when specifying the most restrictive tolerance is not practical for standard concrete forming and construction methods.**
- **Remove requirements for floor levelling unit price allowances when making cementitious underlayments a required component for floor levelling.**

- 1.7.4 Pre-Construction Tolerance Coordination Meetings: Conduct pre-construction tolerance coordination meetings in accordance with [Section 01 31 19 – Project Meetings](#), attended by Owner, Consultant, [Constructor] and [Trade Description]s whose work is affected by work of this Section to discuss the following before starting any concrete related construction:
- 1.7.4.1 [Sustainable concrete mix design, and confirmation of concrete properties that address and maintain specified concrete finishing tolerances;]
  - 1.7.4.2 Calculated changes to floor flatness profiles arising from natural changes to concrete such as shrinkage, curling, creep or plastic deformation that will occur between performing measurements for Concrete Quantitative Tolerances and measurements for Floorcovering Qualitative Tolerances;
  - 1.7.4.3 Methods for aligning measurement tolerances for individual trade contributions to the work, to those required by other parts of the work;
  - 1.7.4.4 Confirming concrete density, absorption and surface profile required for installation of applied finishes and floorcoverings;
  - 1.7.4.5 Identify any conflicts between adjacent components of the work that have potential to affect achieving the measurement tolerances required for individual contributions to the work;
  - 1.7.4.6 Resolve issues and implement management controls associated with meeting specified tolerances;
  - 1.7.4.7 Management of unit price allowances described by this Section associated with meeting specified tolerances;

**SPEC NOTE: Temporary heating sources can change throughout the construction period, and is typically controlled by the Constructor. Part 3 of this Section includes guidance of the types of temporary heating that could be used to prevent floorcovering installation failures and that improve ability to maintain specified concrete tolerances.**

- 1.7.4.8 Management of temporary heating to maintain optimal concrete curing, and management of temperature and humidity required for installation of applied finishes and floorcoverings; and
- 1.7.4.9 Other topics affecting the work described in this Section.
- 1.7.5 Pre-Construction Meetings: Conduct pre-construction meetings starting approximately [1 month] before starting concrete work, and throughout the construction phase as necessary to achieve specified performance requirements in accordance with [Section 01 31 19 – Project Meetings](#), attended by Owner, Consultant, [\[Constructor\]](#) and [\[Trade Description\]](#)s whose work is affected by work of this Section to discuss the following:
  - 1.7.5.1 Best Practices Meetings: Confirm best practices relating to workmanship required to achieve specified floor finishing performance including the following:
    - 1.7.5.1.1 Sequence of work and confirmation of compatibility of installed materials and substrates;
    - 1.7.5.1.2 Using forming methods that limit potential deviation from specified performance requirements;
    - 1.7.5.1.3 Using placing and finishing methods that limit potential deviation from specified performance requirements;
    - 1.7.5.1.4 Responsibility for completion of substrate preparation and ambient weather measurements performed by [\[Constructor\]](#) before start of [\[Trade Description\]](#) work described in this Section;
    - 1.7.5.1.5 Responsibility for measurements and testing performed by [\[Trade Description\]](#)s work described in this Section;
    - 1.7.5.1.6 Installation follow-up procedures to reduce or eliminate substrate and installation deficiencies;
    - 1.7.5.1.7 Using experienced, trained or certified [\[Trade Description\]](#)s for components critical to achieving specified performance requirements;
    - 1.7.5.1.8 Other procedures identified during best practices meetings that affect work results described in this Section.

**SPEC NOTE: Point cloud surveying provides a more visual colour coded appearance of entire floor plates and better interpretation for areas that may require remedial work to align concrete substrate performance expectations to specified tolerances.**

- Flatness/levelness measurements are statistical and may not provide the accuracy required to confirm that Final Finishing tolerances for concrete substrates meet specified tolerances for application of floorcoverings and other applied finishes.
- Flatness/levelness measurements are required to show conformance with structural tolerances; point cloud survey measurements are additional to standard QA/QC requirements and must be evaluated against the Owner's expectations for quality of floor substrate smoothness.

- 1.7.5.2 Flatness/Levelness Surveying: Confirm access and survey frequency for collection of finishing tolerances for concrete substrates specified in [\[Section 03 35 11\]](#) [and] [\[Section 03 35 13\]](#);
- 1.7.5.3 [Point Cloud Surveying: Confirm access and survey frequency for collection of point cloud finishing tolerances for concrete substrates specified in [Section 01 71 26 – Point Cloud Surveying](#);

- 1.7.5.4 [Construction Joint Curvature Tolerance: Confirm that reinforcing methods for forming construction joints in concrete slabs described in [Section 03 21 00](#) and [Section 03 31 00](#) are consistent with maintaining specified surface curvatures specified in [\[Section 03 35 11\]](#) [and] [\[Section 03 35 13\]](#)];
- 1.7.5.5 Concrete Quantitative Tolerance ( $F_F$ :  $F_L$ ): Confirm that Concrete Quantitative Tolerance meets requirements specified in [\[Section 03 35 11\]](#) [and] [\[Section 03 35 13\]](#) prepared at time of concrete placement;
- 1.7.5.6 Floorcovering Qualitative Tolerance (*Straightedge*): Confirm that Floorcovering Qualitative Tolerance meets requirements for floorcoverings [and applied finishes] listed in RELATED REQUIREMENTS, accounting for natural changes to flatness profile arising from shrinkage, curling or plastic deflection of concrete slabs, and installation of self-levelling compounds and surface preparation products;
- 1.7.5.7 Condition of Substrates: Confirm that concrete substrate conditions are acceptable to floorcovering [and applied finishes] manufacturer requirements for relative humidity, mechanical bond and porosity, smoothness and other conditions affecting quality of floorcovering [and applied finishes] installation;
- 1.7.5.8 Measurement and Testing Frequency: Determine frequency and timing of site testing and observation reporting of floorcoverings substrates to confirm acceptability for manufacturers installation requirements; and
- 1.7.5.9 Other topics affecting work described in this Section.
- 1.7.6 Coordination: Coordinate [qualification requirements and] contributions from [Division 03](#) and requirements from [Division 09](#) associated with interior concrete floor finishing performance as follows:
  - 1.7.6.1 Coordinate concrete mix design and confirm workability of mix to achieve finishing tolerances for concrete substrates specified in [\[Section 03 35 11\]](#) [and] [\[Section 03 35 13\]](#), and confirm compatibility with bonding performance required by products specified in RELATED REQUIREMENTS.
  - 1.7.6.2 Coordinate with concrete floor finishing [\[Trade Description\]](#) and confirm they employ sufficient numbers of qualified and experienced personnel during concrete placement operations to achieve finishing tolerances for concrete substrates specified in [\[Section 03 35 11\]](#) [and] [\[Section 03 35 13\]](#).
  - 1.7.6.3 Coordinate concrete curing methods proposed for use on the Project as specified in [Section 03 39 00](#) with RELATED REQUIREMENTS and confirm that curing methods and materials, and substrate remediation methods are compatible with installation of floorcoverings and other applied finishes.
  - 1.7.6.4 Coordinate requirements for measurements, testing and preparation of concrete substrates as specified in [\[Section 03 35 11\]](#) [, [Section 03 35 13\]](#) and [Section 09 05 61](#).

**SPEC NOTE: Modify coordination options with unit price allowance and mock-up requirements for the Project.**

- 1.7.6.5 Coordinate with [\[Trade Description\]](#)s responsible for cementitious [topping and] underlayments [\[Trade Description\]](#) [and confirm methods for unit price allowance management] [, contributions to floor finishing mock-up specified in this Section] [and] confirm products proposed for use.
- 1.7.6.6 [Coordinate [\[Trade Description\]](#)s contributing to floor finishing mock-up described in this Section.]

- 1.7.7 Scheduling: Schedule concrete placing and finishing [, form removal and shoring] to account for floor finishing performance requirements described in this Section and required by RELATED REQUIREMENTS, and as follows:
- 1.7.7.1 Schedule delivery of concrete to prevent use of unscheduled water and additives being added to the mix during transport or as a consequence of delays at time of discharge without prior approval from Consultant.
  - 1.7.7.2 Schedule concrete formwork removal in accordance with [Section 03 11 13](#), early removal of formwork will not be permitted unless specifically directed by the Consultant.
  - 1.7.7.3 Schedule concrete placing and finishing operations to minimize exposure to adverse weather conditions in accordance with [CSA A23.1, Article 7.6](#).
  - 1.7.7.4 Schedule measurements and testing performed by [[Trade Description](#)]s responsible for work results specified in RELATED REQUIREMENTS.
- 1.8 SUBMITTALS
- 1.8.1 Provide required information in accordance with [Specifier Selection Required](#).
  - 1.8.2 Information Submittals: Provide the following submittals during the course of work of this Section:
    - 1.8.2.1 Concrete Placing and Finishing Records: Submit written records for each concrete placement including the following:
      - 1.8.2.1.1 Volume, location and date of concrete placement relating to gridlines indicated on Drawings;
      - 1.8.2.1.2 Weather conditions on date of concrete placement;
      - 1.8.2.1.3 Building enclosure conditions on date of concrete placement;
      - 1.8.2.1.4 Temperature of granular base for slabs-on-grade, or ambient temperature of formwork substrate; and
      - 1.8.2.1.5 Any unusual observations or conditions affecting concrete placement.
    - 1.8.2.2 Substrate Condition and Compatibility Report: Submit confirmation that substrate conditions and applied curing agents [,] [toppings] and [underlayments] are acceptable for specified [applied finishes] [and] [floorcoverings].
    - 1.8.2.3 Survey Data: Submit [point cloud] [and] [floor flatness/floor levelness] reports in format described in [[Section 01 71 26](#)] [,] [and] [[Section 03 35 11](#)] [and] [[Section 03 35 13](#)] at intervals specified in this Section.

**SPEC NOTE: Refer to [NFCA Floor Covering Reference Manual: Part A – General Requirements, Chapter A04 – Quality Assurance Program](#) for information governing administration of the QAP, which is only applicable in jurisdictions where the Provincial Floor Covering Association adopts and underwrites the program, and only applies to the flooring materials included in the NFCA Floor Covering Reference Manual.**

**SPEC NOTE: Confirm which entity is receiving QAP Report in the following two subparagraphs.**

- Owner can directly contract with NFCA and should receive documents when this is the case.
- Constructor can also receive documents when QAP forms a part of their project cost deliverables.
- Consultant should always receive a copy of the QAP Report and is the only entity that issues additional instructions to the Constructor and Subcontractor/Trade Contractor when QAP Report describes non-conforming work.

**SPEC NOTE:** The NFCA Floorcoverings Quality Assurance Program is an additional quality checkpoint for the project additional to the Constructor's overall Quality Management Program.

- The Owner also has the option of engaging with a third-party inspection agency to ascertain quality of concrete work, and conduct site observations and reporting instead of the NFCA QAP.
- This specification uses the terms "Owner's Quality Auditor" and "NFCA Accredited Quality Assurance Provider" when choice is required for selection of appropriate terms.

- 1.8.2.4 [Floorcoverings Quality Assurance Program: Submit a copy of QAP Request for Review Form to NFCA before starting work associated with floorcoverings, with a copy of the completed Request for Review Form sent to Consultant [,] [Owner] and [Constructor].]
- 1.8.2.5 [[NFCA Floorcovering QAP Reports] [Third-Party Observation Reports (Owner's Quality Auditor)]: Submit site observations prepared by NFCA Accredited Quality Assurance Provider] [Owner's Quality Auditor] to the [Owner] [,] [Consultant] [and [Constructor]]; Consultant will distribute report and instructions (if any) to [[Constructor] and] [Trade Description]s when recommendations are reviewed and accepted.]

**SPEC NOTE:** Sustainable-design is a key performance requirement for many projects and requires documentation to validate contributions for most green construction rating systems. Specifier should confirm that their source documents contain appropriate references for sustainable reporting associated with work of this Section.

- 1.8.3 [Sustainable-Design Submittals: Submit project sustainable-design data in accordance with Section 01 33 29 – Sustainability-Design Reporting; coordinate SUSTAINABILITY CHARACTERISTICS described in this Section as a single grouping of documents associated with work described under RELATED REQUIREMENTS.]

## 1.9 QUALIFICATIONS

**SPEC NOTE:** Specifier must make themselves aware of how concrete and concrete finishing work is affected by the various trades that contribute to this work. There is a fine line between telling the Constructor how to perform the Work of the Contract, and describing what is required for successful outcomes.

The Pre-Qualification for concrete finishers must be closely coordinated with [Section 03 35 11] [and] [Section 03 35 13], and with full disclosure to the Owner identifying the reasons associated with selection of competent trades. Include the Construction Manager or Design-Builder for projects that require close coordination of trades when floorcoverings and other applied finishes are dependent on consistent concrete substrate.

- **Divided-Source Responsibility:** Describes work results for concrete floor finishing trades that are only performing part of the concrete floor work or supplying part of the concrete floor materials.
  - Responsibilities are divided between a number of different trades to construct the concrete floor.
  - The specifier can choose to include language in the documents to prequalify members of the Concrete Floor Contractors Association to perform concrete placing, finishing, curing and jointing without the supply of the concrete materials.
  - Pre-construction tolerance planning and coordination between the divided-source trades and active coordination of work results performed by floorcovering trades is essential to achieving concrete floor finishing performance requirements described in this Section.

- **Coordinated-Source Responsibility:** Describes work results for concrete floor finishing trades for the full concrete floor assembly including supply of concrete materials and workmanship to prequalified members of the Concrete Floor Contractors Association.
  - Disconnects, breakdown in coordination and other communication issues associated with planning and coordination are reduced when responsibility for entire concrete floor assembly is assigned to a concrete floor finishing trade that can take on the responsibility for organizing and constructing the entire concrete floor assembly.
  - Pre-construction tolerance meetings and active coordination between concrete floor finishing trade and floorcovering trades is more consistent, making it easier to identify associated work required to achieve concrete floor finishing performance requirements described in this Section.
  - Any concrete floor surface may be constructed using the coordinated-source approach when floor flatness is critical to performance requirements, but should be considered as essential for any concrete slab that is dependent on achieving consistent finishing tolerances for concrete substrates such as the following floor types:
    - Exposed architectural concrete finishes such as mechanically polished finishes, densified and burnished finishes, stained and patterned finishes.
    - Ice rink and sport facility slabs, hospital and laboratory slabs, high-lift and high-stack warehousing and other facilities that require super flat surfaces.
    - Any concrete slab that requires bonded concrete toppings.
- Warranty term described below for concrete floor finishing is also affected by coordinated-source responsibility for delivery of these work results.

**SPEC NOTE:** Only include Concrete Finisher qualifications when the project is using a coordinated-source arrangement for multiple trade contributions to the single work result.

- 1.9.1 [Concrete Finisher Qualifications: Engage [Trade Description]s that can coordinate supply and installation of concrete formwork and reinforcing steel, concrete placing and finishing, curing and jointing in a coordinated-source arrangement, and as specified in [Section 03 35 11] [and] [Section 03 35 13].]

**SPEC NOTE:** Confirm that NFCA QAP is available in the region where the project is located, and confirm with the Owner that they are aware of the benefits of the QAP prior to including the following in the project manual.

**SPEC NOTE:** NFCA QAP Accredited Quality Assurance Provider is a different entity from the Owners third-party quality auditing service.

- The Owner can elect to use the NFCA QAP, or a third-party quality auditing service to conduct site observations, and report of conformance and non-conformance issues, the primary difference between these entities is as follows:
  - The NFCA Accredited Quality Assurance Provider is engaged by the NFCA and provides a report on the quality of installation *that permits issuance* of the NFCA QAP Maintenance Bond.
  - The Owner's Quality Auditor provides an independent review of the quality of installation, that provides the Owner with validation that the work complies with the specification, but *does not permit issuance* of the NFCA QAP Maintenance Bond.
- The Owner can also elect to use both NFCA QAP and third-party quality auditing service based on the complexity and quality expectations for the project.
- QAP Accredited Quality Assurance Provider is only required when Warranty Maintenance Bond is required under Special Warranty described in this Section.

**SPEC NOTE:** Red Seal designations are recognized across Canada as providing testing and designations for trades; some provinces and territories provide apprenticeship training, and most provinces have a defined number of hours for the apprenticeship term. Saskatchewan is the only province that has no requirement for Red Seal or apprenticeship training.

- 1.9.2 Floorcovering Installer Qualifications: Engage floorcovering [Trade Description]s that maintain membership in the National Floor Covering Association of Canada [and that participate in the NFCA Quality Assurance Program (QAP)] [,] [and] [that employs Red Seal Floorcovering Installers experienced with the materials specified for the Project] [, and as follows:] [.]

**SPEC NOTE:** Include the following two paragraphs when NFCA QAP forms a part of the project specification.

- 1.9.2.1 [Trade Description]'s Responsibility: Perform work of this section in accordance with requirements of NFCA QAP and make application and submittals required by QAP accredited quality assurance provider.
- 1.9.2.2 QAP Accredited Quality Assurance Provider: Use QAP accredited quality assurance provider recognized by NFCA inspection and reporting requirements.

**SPEC NOTE:** Include requirements for mock-ups when project budget and complexity of project derives a benefit from the cooperation between contributing trades; delete mock-ups for low complexity projects where floor tolerance expectations can be addressed through concrete substrate preparation requirements described in this Section.

1.10 [MOCK-UP]

- 1.10.1 Provide required Mock-Ups in accordance with Section 01 45 00 – Quality Control.
- 1.10.2 Coordinated Floor Finishing Mock-Up: Comprised of materials and methods used for concrete placement, finishing and curing, and that describes subsequent work results critical to performance of floorcoverings and other applied finishes listed in RELATED REQUIREMENTS for confirmation of the following:
- 1.10.2.1 Concrete mix design that is compatible with bonding requirements for adhesives used by floorcoverings and other applied finishes;
- 1.10.2.2 Methods for achieving specified concrete finishing tolerances;

- 1.10.2.3 Concrete curing methods proposed for use and demonstrate compatibility with bonding requirements for floorcoverings and other applied finishes;
- 1.10.2.4 Demonstrate materials and methods proposed for use with concrete slab patching and repairs;
- 1.10.2.5 Demonstrate sealant and backing materials proposed for saw-cut joint filling [;] [; and]
- 1.10.2.6 Demonstrate crack injection products proposed for use;
- 1.10.2.7 [Application of [toppings] [and] [underlayments] to confirm bonding to concrete slab [;] [; and]
- 1.10.2.8 [Application of [densified and burnished] [polished] [stained] [dyed] [patterned] [imprinted] [exposed aggregate] architectural concrete finishes [; and] [.]
- 1.10.2.9 Application of floorcoverings [and other applied finishes] to confirm bonding between [concrete slab] [,) [toppings] [and] [underlayments].

**SPEC NOTE: Locate mock-ups on site in an area that has low impact on finishing and repairing permanent work such as in back-of-house locations or services spaces.**

- **Size of mock-up has to be large enough to demonstrate concrete slab finishing and installation of finishes, close alignment of expectations between structural engineer and architect/interior designer is required.**
- **Allow for alignment of mock-up size and location when this cannot be identified on the drawings as a topic for pre-construction meetings.**
- **The relatively small areas of work and coordination required for this type of mock-up makes it unlikely that the accepted installation will become a part of the final work when located in front-of-house locations.**
- **Removal and restoration of the mock-ups that cannot be located in back-of-house areas will be required because of difficulty associated with repairing affected areas to acceptable usage for the spaces affected by the mock-up.**

- 1.10.3 Location of Mock-Up: Construct site mock-up [in location and size indicated on Drawings] [at location directed by the Consultant, sized to [18 m<sup>2</sup>] [10 m<sup>2</sup>]] using materials required for the completed work.
- 1.10.4 Review of Mock-Up: Mock-up will be reviewed by Consultant, floorcovering and other applied finish [Trade Description]s to confirm acceptability of substrate conditions as follows:
  - 1.10.4.1 Notify Consultant [7] [14] days in advance of dates and times when mock-ups will be constructed.
  - 1.10.4.2 Obtain Consultant's acceptance of mock-ups before starting construction; Consultant may request modifications or corrections to the mock-up to determine acceptance.
  - 1.10.4.3 Maintain mock-up for duration of floor finishing work; mock-up will be used throughout construction period and used as standard of acceptance for subsequent concrete finishing work.

**SPEC NOTE: Retaining and repairing the mock-up helps to reduce concrete waste and contributes to sustainable construction waste management practices.**

- **Locating the mock-up in an area that will be concealed in final construction, or where the final aesthetic appearance is not critical to the project is also beneficial to sustainable construction practices when mock-up cannot be located in an area that is easily incorporated into the final construction.**
- **Limit the size of mock-up to 10 m<sup>2</sup> or less when removal is the only mock-up option to reduce the amount of construction waste being transported to landfill.**

- 1.10.4.4 [Repair] [Remove] mock-up at completion of concrete finishing work, and restore surfaces to acceptable surface profile and finish matching adjacent surfaces in the area of the mock-up.

**SPEC NOTE: Confirm availability of Special Warranties since they may not be available in all regions of Canada. All work associated with concrete floor finishing and floorcoverings forms a part of the standard 1 year construction warranty required by contract, delete the following article when Special Warranties are not required for the project.**

1.11 [WARRANTY]

**SPEC NOTE: The specification must be decisive on delivery of concrete floor finishing as a coordinated-source responsibility under QUALITY ASSURANCE described above when the Special Warranty is included for the project. Special Warranty has potential to add cost to the project, and may not be available in all jurisdictions across Canada.**

- **The Special Warranty and requirements for Coordinated-Source are usually not required for residential and commercial work associated with work results described in Section 03 35 11 unless the client has identified more restrictive quality control and quality assurance procedures.**
- **The Special Warranty and requirements for Coordinated-Source is typically only associated with High Tolerance Concrete described in Section 03 35 13 for projects that have a high dependence on surface finish of concrete such as hospitals, sports surfaces and athletic fields, high lift warehouses, museums and archive facilities, and projects that have exposed concrete as the primary architectural finish.**

1.11.1 [Special Warranty – Concrete Floor Finishing: Submit warranty covering surface deterioration, dusting and cracking for a 2 year period, starting from the date of Substantial Performance of the Work.]

**SPEC NOTE: Include Special Warranty for floorcovering materials and installation only when NFCA QAP is included as a project requirement. Coordinate this requirement with manufacturer warranties (if specified) under RELATED REQUIREMENTS.**

1.11.2 Special Warranty – Floorcovering Materials and Installation: Submit NFCA QAP [2 year] 100% Maintenance Bond before declaration for Substantial Performance of the Work.

## 2 Products

### 2.1 [SUSTAINABILITY CHARACTERISTICS]

2.1.1 Management of Project Sustainability Requirements: Sustainability characteristics of products associated with work of this Section are described in technical specifications listed under RELATED REQUIREMENTS.

### 2.2 PERFORMANCE REQUIREMENTS

2.2.1 Concrete Floor Finishing: Refer to [Section 03 35 11 for conventional tolerance] [and] [Section 03 35 13 for high-tolerance] concrete slab finishing requirements.

2.2.2 Applied Finishes Installation: Refer to RELATED REQUIREMENTS associated with applied finishes work.

2.2.3 Floorcovering Installation: Install floor preparation materials and floorcoverings products in accordance [with NFCA Floor Covering Reference Manual,] manufacturer's written instructions and requirements described in RELATED REQUIREMENTS associated with floorcovering work.

**SPEC NOTE: The following subparagraphs address identification of construction risk and can form a part of the Unit Price Allowance or identify a fixed construction risk in a stipulated price bidding environment.**

- **Use for projects that have known improved surface tolerance requirements.**
- **Allow for adjustment of unit prices when Unit Price Allowance forms a part of the bid submission.**

2.2.4 [Self-Levelling Underlayment Installation: Account for sufficient self-levelling underlayment compounds for improved surface tolerance floors as follows:]

**SPEC NOTE:** Concrete is a natural material, drying and shrinkage for concrete slabs-on-grade; and plastic deformation for suspended slabs, and contribute to changes of the surface profile and camber continuously throughout the life of the structure.

- Coordinate the percentage deviation with the structural engineer before including as a project requirement for suspended concrete slabs.
- The calculated change is variable and governed by the amount of slab reinforcement, concrete mix design and curing conditions, and control of loading applied to slabs before they have achieved their final design strength.
  - Coordinate  $F_F$  Number used for slabs-on-grade with Section 03 35 11 and Section 03 35 13, and specify a maximum of  $F_F35$  ( $F_F25$  or  $F_F20$  are also acceptable), because these slabs have lower movement potential and are affected primarily by shrinkage and curling
  - Coordinate  $F_F$  Number used for suspended slabs with Section 03 35 11 and Section 03 35 13, and specify either an  $F_F25$  or  $F_F20$ , because these tolerances are more readily achievable and are least likely to change substantially during the course of construction.
- The deflection span ratio for suspended slabs will affect the calculated floor elevation deviation as follows (information provided by American Society of Concrete Contractors, Position Statement 36); final  $F_F$  number is based on average performance after 12 months following installation.

Calculated Effect of Deflection on Floor Flatness ( $F_F$ )					
Deflection Span Ratio	Deflection of a 9 metre span	Final $F_F$ Number			
Initial ( $F_F$ ) – No Deflection		50	40	30	25
L/960	10 mm	39	34	28	24
L/480	19 mm	25	23	21	19
L/360	25 mm	20	19	19	16
Calculated Percent Decrease from Optimal Flatness					
L/960	10 mm	24%	15%	7%	4%
L/480	19 mm	51%	43%	30%	24%
L/360	25 mm	61%	53%	37%	36%

Include the following requirements for flatness critical flooring installations, and coordinate with unit price allowances described in this Section.

2.2.4.1 Calculated Floor Elevation Profile Deviation: Concrete Quantitative Tolerance specified in [Section 03 35 11] [and] [Section 03 35 13] will change between the time it was first measured (preliminary) and when measurements are taken before floorcoverings and applied finishes are installed (final) as follows:

2.2.4.1.1 Slabs-on-Grade: Account for a maximum [20%] deviation from measured Concrete Quantitative Tolerance of slabs-on-grade, and include for specified floor levelling products to re-establish Floorcovering Qualitative Tolerance (*Straightedge*) required by floorcovering [and applied finishes] manufacturers as a part of Bid Price.

2.2.4.1.2 Suspended Slabs: Account for a maximum [40%] [25%] deviation from measured Concrete Quantitative Tolerance of suspended slabs, and include specified floor levelling products to re-establish Floorcovering Qualitative Tolerance (*Straightedge*) required by floorcovering [and applied finishes] manufacturers as a part of Bid Price.

2.2.4.2 Observed Floor Elevation Profile Deviation: Confirm calculations for expected deviation from specified concrete finishing tolerances before application of specified floor levelling products and adjust quantity using unit price allowances submitted with Bid to establish final surface profile required for specified floorcoverings [and applied finishes]:

2.2.4.2.1 Unit price allowance will be used adjust cost for specified floor levelling products based on the differential between calculated and observed concrete finishing tolerances.

2.2.4.2.2 Unit price allowance will be applied as an addition or deduction to floor levelling products included as a part of the Bid Price.

### 3 Execution

**SPEC NOTE: A more detailed description of Acceptable Substrate Conditions is contained in the [NFCA Floor Covering Reference Manual: Chapter A10 – Acceptable Conditions](#), which has specific recommendations for concrete flatness, levelness, placing and curing, testing requirements and specific coordination for concrete slab conditions.**

#### 3.1 EXAMINATION

3.1.1 Concrete Testing: Refer to [[Section 03 08 30](#)] [[Section 03 31 00](#)] for testing associated with concrete quality.

3.1.2 Substrate Testing: Refer to [Section 09 05 61](#) for testing associated with moisture emissions, surface porosity and alkalinity, and adhesive compatibility of concrete substrates before installation of floorcovering materials.

**SPEC NOTE: Site surveying and establishing control points is typically the responsibility of the Constructor and is the reason why point cloud survey is identified in this Section as a requirement.**

- **Site measurements and verification of surface tolerances are the responsibility of the Subcontractors contributing to the work of this Section.**
- **Construction Management or Design Build project delivery methods may alter surveying services to be delivered as a standalone responsibility that must be aligned with the following paragraph.**

3.1.3 Concrete Finishing Tolerances Survey: Survey concrete slabs based on concrete finishing tolerances tolerance standards applicable to the work described in individual RELATED REQUIREMENTS:

3.1.3.1 Concrete Quantitative Tolerance ( $F_F$ :  $F_L$ ) Measurements: Measure concrete substrate and confirm they meet project requirements specified in [[Section 03 35 11](#)] [and] [[Section 03 35 13](#)].

**SPEC NOTE: Confirm that point cloud surveying will be used for the project; delete the following when this measurement is not required for the project.**

**SPEC NOTE: Align requirements for point cloud surveys described in this Section with Section 01 71 26 – Point Cloud Surveying:**

- **Add requirements for establishing permanent reference points to allow for overlaying of subsequent scans and the ability to visualize the differential between each survey.**
  - **Successive surveys conducted without permanent reference points creates data that has little or no correlation to preceding surveys, and does not provide the visualization criteria necessary for determining acceptability of concrete slabs.**
- 3.1.3.2 [Point Cloud Survey: [Constructor] will validate finishing tolerances for concrete substrates using laser visualization survey in accordance with Section 01 71 26 to monitor progression of concrete slab surfaces and movements through the construction phase and as follows:]
- 3.1.3.2.1 Purpose: Results of laser scan point cloud survey will be used to determine unit price allowance adjustments based on the differential between calculated and observed surface elevations.
- 3.1.3.2.2 Repeatability: Establish permanent geomatic reference points to index laser scanning equipment and maintain correlation between each required survey; unindexed laser scans will not be acceptable.
- 3.1.3.2.3 Preparation: Remove construction related stacks of materials, debris and temporary facilities, and other items that have potential to interfere with laser scan.

**SPEC NOTE: First laser survey can be conducted before or after removal of formwork and shoring. Conduct full course of laser survey when flatness criteria for slabs is critical, such as in hospital operating rooms to prevent wheeled equipment from rolling, high-tolerance laboratory settings where wheeled measuring devices are used, or high-lift warehouse facilities.**

- **The advantage of performing a laser survey at the same time as the  $F_F:F_L$  measurements is that a direct visualization of the laser scan can be mapped to identify areas of the slab that did not form a part of the statistical  $F_F:F_L$  survey, and that may require correction by the concrete trade during the first 72 hours.**
  - **The advantage of performing the first laser survey after removal of formwork and shoring is that additional corrective actions will be assessed on the deformation that naturally occurs in concrete slabs without consideration for possible Minimum Local Variations that occur off of the line of the  $F_F:F_L$  survey.**
- 3.1.3.2.4 First Survey: Perform laser scan after completion of  $F_F:F_L$  measurements required by [Section 03 35 11] [and] [Section 03 35 13] [before formwork and shoring is removed] [after formwork and shoring is removed] to establish a record of Concrete Quantitative Tolerance.
- 3.1.3.2.5 [Second Survey: Perform laser scan after formwork and shoring is removed, indexed and overlaid to first survey to visually indicate amount of change to concrete finishing tolerances.]
- 3.1.3.2.6 [Second] [Third] Survey: Perform laser scan immediately before installation of [slab mounted racking (critical warehouse flooring)] and [wall framing], indexed and overlaid to previous surveys to visually indicate amount of change to concrete finishing tolerances.

3.1.3.2.7 Assessment of Survey: Indexed and overlaid surveys will be used by Consultant to determine differential between calculated and observed Floorcovering Qualitative Tolerance (*Straightedge*), and determine quantity of cementitious underlayment required to adjust site conditions to meet [floorcovering] [and] [applied finishes] manufacturer's required surface tolerances.

3.1.3.3 Floorcovering Qualitative Tolerance (*Straightedge*) Measurements: Measure concrete substrate and confirm they meet project requirements specified in [Section 09 05 61](#).

**SPEC NOTE: Exhaust gasses expelled from unvented, forced air, open flame propane heaters commonly used for temporary heating contain large quantities of H<sub>2</sub>O and CO<sub>2</sub>, which can be problematic for applied finishes and floorcoverings:**

- Increased H<sub>2</sub>O in the air delays reduction of moisture content in concrete, and also causes localized hot-spots near the heaters and generalized cool-spots throughout the heated area creating inconsistent reduction of moisture content in concrete.
  - Localized hot-spots can decrease water content prematurely, decreasing potential for cement hydration and causing weakness in concrete surfaces.
  - Inconsistent temperatures can also contribute to changes in concrete finishing tolerances arising from differential drying rates of concrete slabs.
- Increased CO<sub>2</sub> in the air contributes to increased surface density of concrete through carbonation, which contributes to reduced surface porosity and can affect bond strength between adhesives and concrete substrates.
- Exhaust gasses also contain CO, which decreases indoor air quality during the construction period and safe work practices for construction workers, and can affect consideration for credit criteria with many Sustainable-Design rating systems.
- Exhaust gasses can also delay set-up or curing of many water-based applied finishes and adhesives used for floorcovering installation.

Coordinate specification content for Temporary Facilities and include descriptions of outdoor indirect temporary heating units, which also provides more consistent temperatures with lower H<sub>2</sub>O content, and greatly improves indoor air quality during construction by eliminating exhaust gasses in the working environment:

- Gas fired, forced air, outdoor indirect heating units distribute heated air throughout interior areas using flexible easily relocatable ductwork; may not be suitable for larger projects since length of uninsulated ductwork causes lower temperatures further away from the heating units, and temperature cannot be locally adjusted with building areas.
- Gas fired, hydronic, outdoor indirect heating units distribute heated air using fan coil heat exchangers distributed throughout interior areas; temperature can be locally adjusted, multiple heat exchangers also provide more consistent heating in all areas.
- Specifier should make themselves aware of advantages and disadvantages of indirect heating sources and include appropriate direction to the Constructor.

High relative humidity will affect installation of water-based adhesives and finishes, and is a concern for most interior construction. Protection references [Section 01 50 00 – Temporary Facilities](#) because temperature and humidity are controlled at a project level, not a trade level.

- Constructors have correctly assigned specific temporary facilities such as lighting and fans to the trades requiring additional ventilation or illumination than provided for the project, because these temporary facilities tend to be isolated and easily controlled by the trades involved with the specific work result.
- Temperature and humidity cannot be controlled by individual trades, additional heating units brought to site at the time of installation of products affected by moist installation conditions cannot compensate for a whole building condition and should remain under the control of the Constructor.
- Controlled temperature and relative humidity will contribute to reducing air moisture content contributions from wet construction processes; moisture comes from many sources including concrete, gypsum board joint materials, water-based paints and applied coatings, adhesives to name a few.
- High relative humidity is a normal part of construction and is not considered a deficient condition unless it affects installation of products; and only becomes a problem when humid air encounters a temperature condition that reaches dew point and causes condensation.
- Relative humidity on construction sites can reach 60% to 80% depending on ventilation rate and air temperature; surfaces that are colder than air temperature can create conditions where dew point is a concern when water-based material are installed on those surfaces:
  - High mass materials (such as concrete) require time to heat to match air temperature; meaning that the moisture concern experienced with installation of water-based adhesives on concrete may not be associated with the concrete, but may become an issue with the water released by the adhesive when it cures and increasing the RH at the installation interface.
  - Air temperature at 20°C and RH 70% will reach dew point when it meets a surface temperature of slightly more than 14°C; or with an air RH of 80% at 16.5°C surface temperature.
  - Moisture moves from warm to cool; warm air combined with cool concrete equates to potential moisture issues, warm air combined with warm concrete greatly reduces concerns associated with dew point and additional water contained in construction materials.
- Different temporary heating sources can be employed based on the conditions that need to be maintained during construction, or based on the type of construction.
  - Healthcare projects constructed to comply with CSA Z317.13 governing infection control during construction requires negative air pressure within the construction zone, makes using a forced air, outside indirect heating sources impractical during the finishing phases of construction – they cannot generate sufficient heat to account for the exhaust requirements to meet negative air pressure requirements.
  - Forced air systems may be practical during earlier phases of construction, but will require a switch to hydronic, outdoor indirect heating units connected to multiple heat exchangers to conserve energy and maintain heating budgets.
  - [Section 01 50 00 – Temporary Facilities](#) can anticipate these issues and describe expectations to the Constructor, but the Constructor is ultimately responsible for the means and methods deployed to control temperature and humidity of the construction site.

- **Non-healthcare projects are not governed by the negative air pressure requirements of the CSA Z317.13 standard, but require similar control over temperature and humidity during the finishing construction phase, and should form a part of preconstruction meeting discussions, and confirm the Constructor's approach to maintaining appropriate environmental conditions during construction.**

### 3.1 PROTECTION

- 3.1.1 Temperature and Humidity Controls during Construction: [Constructor] will install indirect temporary heating sources for building interior spaces in accordance with Section 01 50 00 – Temporary Facilities capable of maintaining consistent and controllable temperature, and maintaining temperature of substrates at a minimum of 3°C above air dew point.
- 3.1.2 Protection of Concrete Substrates: [Constructor] will protect concrete substrate surfaces during construction to minimize surface contamination and provide a surface that is compatible with floorcovering [and applied finishes] manufacturers installation tolerances, and correct differential between Concrete Quantitative Tolerance ( $F_F: F_L$ ) and Floorcovering Qualitative Tolerance (*Straightedge*) in accordance with Section 09 05 61, free from alkali, dust and dirt, adhesives, paints and coatings, solvents and oils, grease, wax, form release agents, film forming sealers and curing aids, and film forming hardening compounds that are incompatible with flooring adhesives.

### 3.2 ALIGNING DIFFERENTIAL TOLERANCES

- 3.2.1 Consultant's Contributions: Consultant is responsible for identifying tolerances used for construction, and aligning compatibility of differing tolerances between components of the Work in accordance with ACI 117.1R and has been completed as follows:
  - 3.2.1.1 Consultant has accounted for compatibility between differing tolerances in the Drawings and Specifications, and developed content that identifies measurement standards used for concrete floor finishing, and measurements used for floorcovering [and other applied finishes].
  - 3.2.1.2 Consultant will review survey data and collaborate with Owner, [Constructor] and [Trade Description]s affected by work of this Section to determine acceptability of floor elevation profiles [and determine expenditures from unit price allowances for adjustments to floor levelling].
  - 3.2.1.3 Consultant will provide written direction to [Constructor] for interpretations arising from measurements and testing that do not meet concrete floor finishing performance requirements for interior concrete floor finishing described in this Section.

**SPEC NOTE: Delete the following when NFCA QAP does not form a part of the project specification.**

- 3.2.1.4 [Consultant will review reports submitted by Floorcovering Accredited Quality Assurance Provider to determine acceptability of floorcovering installations, and will provide written direction to [Constructor] and [Trade Description]s for interpretations arising from recommendations contained in the report.]
- 3.2.2 [Constructor]'s Contributions: [Constructor] is responsible for managing coordinated-source concrete placing, finishing and curing of concrete described in this Section in accordance with CSA A23.1, Part 7 and the following:
  - 3.2.2.1 [Constructor] will establish control points for floor measurements [and arrange for point cloud surveying] as a component of their QMP provisions to quantify amount of materials required to meet Floorcovering Qualitative Tolerance (*Straightedge*).

**SPEC NOTE: Confirm that point cloud surveying will be used for the project; delete the following when this measurement is not required for the project.**

- 3.2.2.2 [[Constructor] will perform point cloud survey described in this Section to align work performed by different and separated Divisions of the Work.]
- 3.2.2.3 [Constructor] will manage [Trade Description]s contributions for site measurements of concrete slabs to establish Concrete Quantitative Tolerance and Floorcovering Qualitative Tolerance (*Straightedge*).
- 3.2.2.4 [Constructor] will notify Owner and Consultant of differential between calculated concrete finishing tolerances to observed concrete finishing tolerances; Consultant will provide written direction for adjustment to unit price allowance.
- 3.2.2.5 [Constructor] prepares or adds content to their QMP that describes their approach for identifying and correcting deficient work.
- 3.2.3 [Trade Description]’s Contributions: [Trade Description]s are responsible for managing surface tolerance requirements contained within their RELATED REQUIREMENTS as follows:
  - 3.2.3.1 [Trade Description] will perform measurement and testing specified in RELATED REQUIREMENTS associated with their work result.
  - 3.2.3.2 [Trade Description] will confirm the [Constructor]’s QMP modifications following pre-construction meetings specified above that they require to achieve specified tolerances.
- 3.2.4 Manufacturers’ Contributions: Manufacturers will provide written instructions to [Trade Description]s identifying product installation requirements including modifications to standard procedures, measurements and testing necessary to achieve specified concrete floor finishing performance requirements.
- 3.3 SITE QUALITY CONTROL
  - 3.3.1 Measurement and Testing: Site quality control requirements are specified in RELATED REQUIREMENTS, and describes measurement and testing responsibilities of Owner, [Constructor] and [Trade Description]s.
  - 3.3.2 [Constructor]’s Quality Management: QMP will list measurements and testing, and identify [Trade Description]s responsible for site quality control requirements required to achieve floor finishing performance requirements identified in this Section.

**SPEC NOTE: Include the following when NFCA Floorcovering Quality Assurance Program is being used for the project. Coordinate with nouns used under INFORMATION SUBMITALS and use the same naming conventions for the following edits.**

- 3.3.3 [NFCA Accredited Quality Assurance Provider: NFCA Accredited Quality Assurance Provider will prepare observations of the work including non-compliant work in accordance with NFCA QAP requirements and as follows:]
  - 3.3.3.1 NFCA Accredited Quality Assurance Provider will notify [Owner] [,] Consultant and [Constructor] of observed non-conforming work, irregularities or variations from NFCA QAP requirements.
  - 3.3.3.2 [Owner] [,] Consultant and [Constructor] will discuss options for correction to non-conforming work with [Trade Description] responsible for the work to determine appropriate recommendations for correction.
  - 3.3.3.3 Consultant will prepare written communication describing acceptable correction for non-conforming work and issue to the Owner, [Constructor] and [Trade Description]s responsible for the work.
  - 3.3.3.4 The NFCA Accredited Quality Assurance Provider is not authorized to release, revoke, alter or enlarge requirements of the Contract Documents, make changes to manufacturer’s written instructions, nor approve or accept any portion of the Work.

- 3.3.3.5 The NFCA Accredited Quality Assurance Provider will not be permitted to perform any duties of the Consultant or [Constructor].

**SPEC NOTE: Include the following when Owner chooses the services of a third-party observation and testing agency. The Owner can also opt to use both the NFCA QAP and a Quality Auditor when complexity of the project requires additional observation.**

- 3.3.4 [Owner's Quality Audit: Owner may engage services of a third-party observation and testing agency to perform quality auditing services necessary to validate [Constructor]'s quality assurance and quality control procedures described in the QMP; scope of service provided by the Owner's quality auditor will be limited to the following:]

- 3.3.4.1 Quality auditor will notify Owner, Consultant [and [Constructor]] of non-conforming work, irregularities or deficiencies observed during the performance of its services.
- 3.3.4.2 [Owner] [,] Consultant and [Constructor] will discuss options for correction to non-conforming work with [Trade Description] responsible for the work to determine appropriate recommendations for correction.
- 3.3.4.3 Consultant will prepare written communication describing acceptable correction for non-conforming work and issue to the Owner, [Constructor] and [Trade Description]'s responsible for the work.
- 3.3.4.4 Quality auditor is not authorized to release, revoke, alter or enlarge requirements of the Contract Documents, make changes to manufacturer's written instructions, nor approve or accept any portion of the Work.
- 3.3.4.5 Owner's quality auditor will not be permitted to perform any duties of the Consultant or [Constructor].

#### 3.4 CLOSEOUT ACTIVITIES

- 3.4.1 Cleaning: Keep installed work clean as installation progresses in accordance with Section 01 74 13 – Progress Cleaning and perform final cleaning as required by Section 01 74 23 – Final Cleaning, coordinated cleaning activities described in RELATED REQUIREMENTS.
- 3.4.2 Demonstration [and Training]: Provide demonstration and training for Owner's personnel associated with specified [floor finishes] [and] [floorcoverings] in accordance with Section 01 79 00 – Demonstration and Training, coordinated with maintenance activities described in RELATED REQUIREMENTS.

**END OF SECTION**