

Special Inspections & Masonry

Part 1: Plan ahead for success...

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Special Inspections have been a requirement for most new building projects in New York and other states since the adoption of the 2000 *International Building Code* (IBC). Inspection of unit masonry requires a high level of field observation since masonry elements are generally assembled on-site. Ideally, the Special Inspector is a Structural Engineer familiar with masonry design and construction. Sampling and testing of masonry materials are performed by a Testing Agent.

In some instances, the Testing Agent (TA) is hired as a subconsultant or agent by the Structural Engineer acting as Special Inspector (SI). In other cases the TA is hired directly by the Owner to perform testing. Either way, coordination and cooperation is required between the SI, TA, and Registered Design Professional (RDP) to expedite the flow of information, particularly when construction issues require input from the RDP.

As a Structural Engineer performing Special Inspections for masonry, it is important to know your role as well as the roles of the RDP, the TA, and the Contractor. Communication between the Owner, RDP, SI, and TA should begin as soon as contracts are awarded.

One method of getting everyone on the same page is to hold a masonry pre-installation conference with the Owner, Architect, RDP, SI, TA, Code-Enforcement Official, Construction Manager or General Contractor, and the Masonry Subcontractor. Oftentimes, the RDP will write this into the Unit Masonry Specification as a project requirement.

The Registered Design Professional's Responsibilities

The RDP generates the Contract Drawings, Specifications, and Special Inspection program for masonry work. The RDP specifies which type and strength of mortar, grout, and unit masonry are to be used and generates the Schedule of Special Inspections which indicates the level (1 or 2) of masonry inspection as well as the frequency of material verification, testing, and inspection of masonry assemblies.

Testing and verification requirements for masonry materials tend to raise many questions from both the SI and TA. It is

important for the RDP to communicate these requirements clearly in both the specifications and the Schedule of Special Inspections.

As a minimum, the IBC requires the following in the Special Inspection program:

- Mortar proportions must be verified on-site.
- Grout proportions must be verified on-site.
- Construction of mortar joints must be verified for compliance.
- Grout placement must be verified for compliance.
- Preparation of any required specimens must be observed.

Depending on the project requirements, the RDP may require field sampling and testing of mortar and grout, as well as prism testing of masonry assemblies to verify specified performance criteria (compressive strength, consistency, etc.) are being met. However, these tests add cost to the Special Inspection contract and may not be necessary to achieve adequate quality assurance.



Steel roof framing with slotted clip connection to CMU wall

To satisfy the minimum code requirements, mortar and grout materials must conform to ASTM C 270 and ASTM C 476, respectively. ASTM C 270 *Standard Specification for Mortar for Unit Masonry* and ASTM C 476 *Standard Specification for Grout for Masonry* require that mortar and grout (respectively) meet one of two criteria:

- **Proportions:** The quantities of cement, hydrated lime, and aggregate meet tabulated volumetric proportions given in the ASTM specifications. Preconstruction testing is not required for mixes meeting the proportions specification.
- **Properties:** The quantities of cement, hydrated lime, aggregate,



CMU bearing wall under construction

and admixtures (if applicable), yield specified performance characteristics verified through laboratory testing prior to construction.

As the RDP, it is important to realize the difference between preconstruction and quality control testing. Preconstruction testing is typically performed by a testing lab hired by the Contractor to prove compliance with ASTM standards and project specifications. Quality control testing is performed during construction and is part of the Special Inspection program, paid for by the Owner. Field sampling and testing during construction are required if specified in the Contract Documents. Proportion verification is required regardless of whether the proportions or properties specification is used.

The RDP reviews and accepts submittals for mortar and grout mixes, masonry reinforcement, veneer ties and anchorages, etc. Review and acceptance of these submittals should occur prior to the masonry preinstallation conference so proportion verification procedures and testing requirements (if required) can be discussed.

Masonry Contractors often use preblended mortar and grout materials so they don't have to field-measure and combine the individual components. Just add water!! Material submittals for preblended mortar and grout usually include certification which refers to ASTM C 270 and ASTM C 476, respectively. Actual volumetric proportions must be given in these submittals so the RDP can determine which specification (proportions or properties) is being met. If the properties specification is used, the submittal must include preconstruction test data.

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Once construction is underway, the RDP is responsible for responding to non-conformance issues that may arise during Special Inspections and testing. Responses should be sent to the Owner, SI, Contractor, and sometimes the Code-Enforcement Official.

The Testing Agent's Responsibilities

The TA must be certified and experienced in performing sampling and testing of masonry materials required by the specifications and the Schedule of Special Inspections. In general, the industry standards for testing of masonry materials are:

- ASTM C 270 *Standard Specification for Mortar for Unit Masonry.*
- ASTM C 476 *Standard Specification for Grout for Masonry.*
- ASTM C 780 *Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.*
- ASTM C 1019 *Standard Test Method for Sampling and Testing Grout.*
- ASTM C 1314 REV B *Standard Test Method for Compressive Strength of Masonry Prisms.*

During construction, the TA coordinates the requirements of the Contract Documents, specifications, and the Schedule of Special Inspections with the SI and Contractor to ensure that testing is being performed as work proceeds. The TA also distributes reports to the project team and notifies the Contractor and SI immediately of non-conforming work not corrected while the agent is on-site.

The Contractor's Responsibilities

The Contractor is responsible for timely submission of shop drawings, mix designs for grout and mortar, and field mock-ups if required. Ideally, submittals and mock-ups are reviewed and accepted by the RDP prior to the masonry preinstallation conference. For most projects, the Contractor is in charge of scheduling inspections and testing.

The Special Inspector's Responsibilities

The SI coordinates and implements the Special Inspection program and serves as the communication hub between the RDP, TA, and Contractor during construction. The SI performs inspections and reviews reports submitted by the TA. The SI should be familiar with procedures for required tests, and hot and cold weather masonry construction.



Six-story CMU bearing wall structure

The SI distributes reports to the project team and to the RDP who addresses non-conforming work. The SI has no directive authority on a job site. If the requirements of the Contract Documents are questioned during inspections, the SI cannot interpret the requirements or direct the Contractor to cease or commence construction if non-conforming work is observed. Such interpretations run the risk of conflicting with the RDP's intent. Instead, the SI should contact the RDP immediately to resolve or clarify non-conforming work.

The SI monitors outstanding non-conformance issues and communicates with the TA to ensure all of the scheduled verifications and testing are being performed as construction progresses. Once construction is complete and outstanding issues are resolved, the SI will assemble the field and test reports into a Final Report of Special Inspections to be submitted to the Owner, Code-Enforcement Official, Architect (if applicable), and RDP.

Masonry Preinstallation Conference

The preinstallation conference is an important component of a successful Special Inspection program. Generally, the Construction Manager or General Contractor arranges and runs the meeting. The Owner, Architect, RDP, SI, TA, Code-Enforcement Official, and Masonry Subcontractor should be in attendance.

The required verification, sampling, testing, and on-site inspection of masonry should be discussed, including the scheduled frequency of each and who will schedule testing. Ideally, the Contractor schedules Special Inspections and testing since they have their finger on the pulse of construction progress. However, in some cases the SI will communicate daily with the Contractor and will schedule the TA's work.

During the conference, the Contractor should disclose which method of grouting

(high or low lift) will be used. The Contractor should also disclose how they intend to address hot- or cold-weather masonry construction procedures. If the Contractor has prepared field mock-ups prior to the meeting, any comments or questions should be addressed then.

Decide who will receive interim field and test reports during construction. Sometimes, the Owner and Code-Enforcement Official will opt not to receive interim reports. However, the Final Report of Special Inspections (that includes a record of all field and test reports) must be distributed to both as a condition of obtaining the Certificate of Occupancy.

Establishing a procedure for distributing information is extremely important to properly address non-conformance issues. At the conclusion of the meeting, the SI and TA should know the accepted procedures for reporting non-conformance issues. Depending on the project, they could be as follows:

- Discuss the non-conformance with the Contractor and provide them an opportunity to correct the non-conformance during inspections.
- If the non-conformance is not corrected or if interpretation of the Contract Documents is required, notify the Construction Manager or General Contractor and the RDP verbally while on-site.
- Communicate the RDP's response verbally to the Contractor and allow the RDP to follow-up with a formal response.
- Distribute field reports within seven days.

Be sure all parties agree to these procedures. The RDP, SI, and TA should take meeting minutes and compare them at the conclusion of the meeting.

Good communication from the beginning is necessary to achieve a successful Special Inspections program. Overall, the responsibility of the RDP, SI, and TA is to ensure that masonry construction conforms to the requirements of the Contract Documents.

Now that all the preliminary details have been worked out, what needs to be done once masonry work is underway? Let's save that for Part 2... ■

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