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INSPECTION OF MASONRY CONSTRUCTION You Get What You Inspect - Not Necessarily What You Expect

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ABSTRACT

To ensure that a masonry project is constructed in the most proficient manner, diligent inspection must be undertaken.

Inspection takes the form of knowledgeable examination of the prepared drawings and specification; the investigation through an inquiring mind to ensure that the construction details and specifications can be executed on the construction site, and by the scrutiny of the inspector at the construction site through critical observations of the project.

Project problems are minimized when professionals provide constructible drawings and specifications, and when constructors make use of a qualified workforce along with a large supply of common sense.

The following subject outline will be developed and presented in the proposed paper:

- Adherence to the building code
- Adherence to applicable standards
- Insurance that the recommended construction practices are used
- Knowledge of the proposed masonry wall design
- Requirements of any special wall details are understood and can be executed
- Observation of possible construction concerns
- Knowledge of construction sequence
- Technical information source availability

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INTRODUCTION

There is a real and accepted need for inspection throughout the construction of a masonry project. It is an unfortunate observation that due to the nature of the human being and the psychology of the individual, that there is a real need for inspectors to oversee the masonry construction.

An inspector may or may not have a professional education, however most of the construction know-how will have been gained through observation and job site experience.

To ensure that the project constructors follow the drawings and specifications with understanding and also with appreciation, the inspector is the best value that money can buy.

Acting as a watch dog or guardian, the inspector ensures that the materials and workmanship on the project site relates to the drawings, details and specification which have been prepared by the professional. There are also masonry industry recommended practices and methods of installation that must be observed to ensure satisfactory construction procedures during the scope of the project.

The role of the inspector is to ensure that the project is constructed as smoothly as possible without extra costs normally involved when a project gets mired in the negotiation of alternative products, varying methods of construction and job site meeting confrontations.

In a nut shell, the inspector must display the knowledge, experience and integrity required along with a copious amount of common sense.

BACKGROUND

Inspectors have been referenced in biblical stories as well as early monumental projects such as the pyramids where there were working scribes as well as overseers.

Prior to the industrial revolution, the inspector was required to check the masonry products that were to be installed, however the inspector also made certain that they were installed according to the project requirements.

Mass was the construction method involved, the walls acting as the structural element and the enclosure. Due to the massive wall construction required, there were no concerns of possible heat or cold transfer through the wall.

Moisture penetration of the wall was generally also of no concern because of the wall thickness. The only concern using this type of construction was the height limitation of the structure due to the massive footings required to bear the above grade masonry dead load.

After the industrial revolution the inspection requirements increased as new masonry products and other building product lines were produced. New structural products that were now developed took their place in the construction field, relegating the masonry industry into being a team player rather than being the only player for the construction of walls.

Masonry products could still be used as structure, however with new structural competitive products on the market, masonry would also now be used as wall infill between other structural product lines.

Now it became a requirement that the masonry inspector understand the possibility of construction concerns that might occur when masonry products butted against or were installed above or below other wall materials. When placed in the proximity of the masonry wall, knowledge of the various products and their actions and reactions were now a requirement for an inspector. Comprehension was also required as to possible load transference, moisture penetration possibilities and movement activities. The assumption that the new thinner masonry walls were as waterproof as the pre revolution massive walls was now not necessarily correct.

The new product lines that interacted with the masonry wall materials required slip planes or the need for control of material movement through construction movement joints. There was also the need to include moisture penetration control within the wall.

INSPECTION GENERALLY

What, then are the present day requirements and the responsibilities that go along with the job of being an inspector. The dictionary indicates the following information regarding the words inspector, to inspect and inspection.

Inspector is one who inspects, is an examining officer, a censor, a critic.

To Inspect is to view narrowly and critically, to examine officially, to look into, to pry into.

Inspection is an official examination, careful survey, scrutiny, investigation, supervision.

It would be reasonable to assume that the inspector should be involved in the complete project development process and long before any construction starts at the site.

There are a number of items that must be attended to and to be aware of, such as being conversant with the project drawings, specifications and when possible, assisting in the recommendation of qualified masonry sub trades to tender the particular project. The applicable codes for the jurisdictional area of the project and the relevant masonry standards must be understood.

There must be the organization and follow through of a project site meeting with the architects representative, the general contractor superintendent and the masonry contractor foreman with the inspector for the review of the masonry job site

requirements, itemizing of the products and materials that are acceptable and to discuss any limitations or possible obstructions that may occur on the site. The locations permitted for on site storage of required materials and products should be assessed so that there will be no last minute concerns or problems when the project gets underway.

Reference should be made to any possible overlap or required co-ordination with other trades during construction to allow for a smooth and complete installation of the project.

A word to the wise must be given that the masonry construction job site techniques are to follow the recommended methods and limitations of good construction practices.

INSPECTION - ON SITE

The inspector must be involved at the project site well in advance of any masonry material arriving and certainly prior to any masonry installation being contemplated.

Once the project gets started, inspection must begin by ensuring that the location of the above grade masonry will rest on a preset rigid foundation support.

From this point on the inspector must be able to look at and critically view any particular phase of the project and prepare written reports and records to reflect fully all job site observation. Each report or record of observation should include the following information:

- the date
- the time of day
- the weather conditions
- the exact location involved in the report
- the reason for and what was observed
- the number of workers involved
- the equipment, if any, being used

The reports or records of observation would then be supplied to the authority under which the inspector is employed.

Observation of the job site installation procedures must be with such sufficient frequency as to ensure that the work proceeds in accordance with the job site and document requirements.

The inspector must not accept any workmanship, products or materials that do not adhere to the contract documents.

As the project progresses, each stage of the construction must be inspected, including the job mobilization, temporary construction requirements and safety measures, among other routine duties.

The materials and products that arrive on the site must be checked to confirm that they adhere to the specification requirements and as the masonry work gets underway, that

the proper installation procedures are performed in accordance with the project demands and applicable recommended masonry practices.

MASONRY WALL CONSTRUCTION

The available types of masonry walls are suited to the requirements of various masonry projects. The designer will call for the applicable wall system fitting the requirements of the client. The inspector must understand the various masonry wall types, their usefulness and limitations as to function and also must understand the reasoning for the construction requirements.

There are three basic masonry walls, single wythe, composite and cavity type construction.

The details presented with this paper indicate the various walls possible within the three basic masonry wall construction types.

Single Wythe Walls

- A non load bearing wythe with a structural backup support using another product line. This wall type usually involves the rain screen principle.
- A load bearing or infill single wythe acting as the wall and using lateral support mechanisms to maintain the wall in place.

Composite Walls

- A load bearing or infill wall of two or more wythes using lateral support mechanisms. This type of wall is also referred to as a solid wall.

Cavity Walls

- A load bearing or infill wall where the outer rain screen wythe is non load bearing and the inner wythe acts as the load bearing or infill backup support.

Construction details should always be included where masonry walls are vulnerable to excess moisture penetration, to material movement and differential movement interaction and construction joint requirements.

Within the wall type details, there are various concerns. It will be observed that there are a number of products or materials having a valid reason for being within the wall.

The inspector must understand why the various items are involved and the reasons for their participation. Some participants and their reason for being there are mentioned herein.

Ties and connectors required to restrain wall movement, to connect masonry wythes or masonry veneer to its structural backing.

Construction joints are designed to allow expansion into a void or to allow wall shrinkage along a controlled plane. The joints must extend the full height of the masonry wall or along a horizontal plane.

Slip plane bond breakers are materials that do not allow the transfer of bond between products or materials. They eliminate damage from movement variation by different products. The vertical load transfer is maintained.

Deflection space a void into which a material or product may move through shrinkage, twisting, settlement action without changing the structural loading pattern. A lateral supporting system is required for the masonry wall involved.

Lateral Support supplied by ties and connectors when wythes are to support each other or by channels or angles to support a free standing masonry wall.

Damp proof courses act as bond breakers, however their prime function is to stop moisture migration at that location.

Drips wheresoever a flashing or capping material ends, a drip section must be involved to deflect gathered moisture away from the masonry wall immediately below. Remember any drip can save the masonry wall appearance.

Corners of opening in the masonry walls openings in the masonry walls are considered as weak points. The inspector must ensure that reinforcing is placed at the corners of any opening within the wall construction.

WALL ACCESSORIES

There are a number of accessories that are attached to or pass through the masonry wall. These must be inspected. Some items and the concerns of installation are listed for the inspector to take heed and for which are normally beyond the control of the masonry sub trade.

Through Wall Vents where ventilation or exhaust fan vents project through the masonry to the exterior face of the wall, a drip section will protect the masonry wall directly below from moisture staining.

Window Sills must have end caps or risers at the sill ends to direct accumulated moisture over the front of the sill onto the sill drip section.

Hose Bibs should have a drip section along the base of the fixture to deflect moisture away from the wall immediately below.

Eavestroughs and Downspouts must function to retain accumulated moisture. Roof water should not cascade onto the masonry wall.

CONCERNS

For special areas of concern, the inspector must be aware that the materials and their installation are correct, include the following:

- Temporary wall bracing required until the permanent bracing material is installed.
- Wall cleaning material and the method of cleaning the masonry work.
- Incompleted walls are to be racked back and covered when not under construction.
- All flashings are to be continuous and are to extend beyond the face of the wall to form a drip section.
- Severe weather condition requirements for hot or cold weather recommendations must be complied with for all site conditions.
- Application of a breathing sealer or paint to the masonry wall where and when required.
- Air barrier continuation at the location of window and door frame construction within the masonry wall area.

IN CONCLUSION

The inspector, then, must have the knowledge and understanding for the various methods of masonry wall construction and the reasoning for the recommended installation procedures along with the requirements set out in the contract documents to satisfactorily complete a masonry project.

And so when all is said and done, when the documents are clear and the sub trade has adhered to all the construction requirements, the job of inspection will have been an enjoyable one.

TECHNICAL INFORMATIONAL SOURCES

Advice and recommendations for masonry wall construction may be found in technical literature, available slide, film and tape presentations from various masonry related associations and from the 4C sheet series available through the Ontario Masonry Contractors' Association.

The building code requirements and the Canadian Standards Association masonry standards recommendations must be addressed and accepted by both the designer and the constructor and adhered to by the inspector.

The Canadian Standards Association has issued the following standards relating to masonry construction for reference and use by the inspector.

A179 Mortar and Grout for Unit Masonry

There are two types of mortar recommended for construction.

Type "S" - for loadbearing masonry walls and for below grade applications.
Type "N" - for all above grade work except where type "S" mortar is required.

All applications of mortar must be weaker than the units involved allowing any wall stress to be released within the mortar joints.

A370 Connectors for Masonry

- various types for wall requirements
- restrains wall shrinkage or expansion movement
- ties masonry wythes and structure together

A371 Masonry Installation

- indicates acceptable tolerances in masonry walls for out of plumb and out of level
- indicates acceptable variances in vertical and horizontal mortar joint alignment

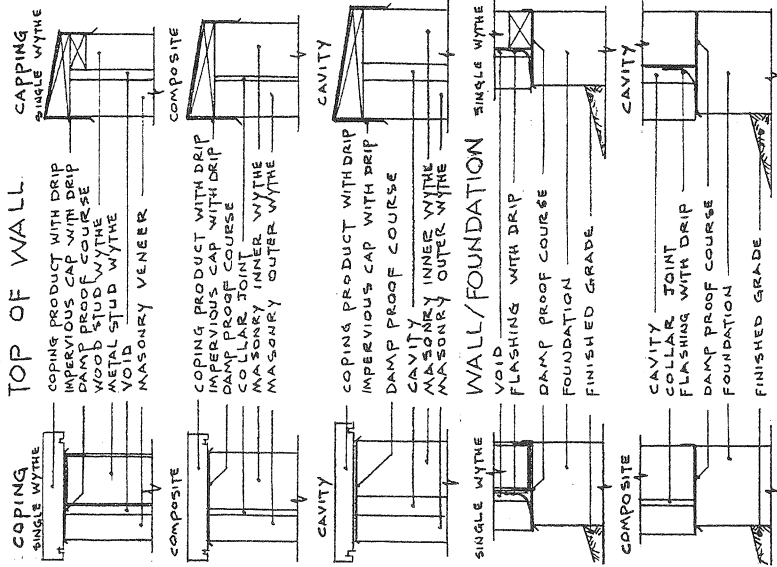
A405 Design and Construction of Masonry Chimneys and Fire Places

A443 Terms and Definitions for use in C.S.A. Masonry Standards

S304 Masonry Design for Buildings

The C.S.A. standards relate to engineering and architectural design requirements, to construction practices, and to temporary requirements and needs during the construction of a project.

DIAGRAMMATIC WALL DETAILS



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