Architecture, Engineering, and Construction Division

Civil and Structural Testing

 and

Inspection Services Guidelines

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 with questions or suggestions for improvement.

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All previous versions of this document are obsolete.

Contact AEC with questions, feedback, or suggestions for improvement.

Salt Lake City, Utah

Civil and Structural Testing and Inspection Services Guidelines

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**Civil and Structural Testing and Inspection Services Guidelines**

# Introduction

This document contains guidelines, recommendations and requirements for civil and structural engineering testing and inspection. The following topics are covered:

* Definitions
* Design team responsibilities
* Testing and inspection agency responsibilities
* Testing guidelines
* Inspection guidelines
* Example
* Tables for testing and inspections for various project types

An example illustrating how to determine the testing and inspection requirements for a Heritage98 style meetinghouse is provided. The example and the attachments provide further insight regarding the minimum number of tests and inspections recommended and expected. Note that this is an example to provide rough estimates and the actual testing and inspection requirements will vary from site to site.

The tables provide miscellaneous information and the minimum number of tests and inspections recommended and expected for meetinghouses, seminaries, institutes, bishops' storehouses, and Deseret Industries.

It should be noted that the standard plan contract documents do not use the term “special” for any code required tests or inspections to not use terminology that can be confusing to the design team or the construction team. The contract documents include elements/systems required by code to be tested (special tests) or inspected (special inspections) but also elements/ systems required by the Owner to be tested and inspected.

# Defin**i**tions

**Contract Documents or Construction Documents**: The engineering and architectural drawings and specifications issued for construction, including any clarification drawings, addenda, approved change orders, responses to requests for information, and contractor designed elements.

**Field Quality Assurance:** Testing and special testing, inspections and special inspections provided for by the Owner.

**Field Quality Control**: Testing and special testing, inspections and special inspections provided by the General Contractor.

**General Contractor:** The company or person with a formal contract to perform a specific job, supplying labor and materials and providing and overseeing staff if needed. The company is responsible for the fulfillment of the contract document requirements.

**Inspection or Special Inspection**: Inspection of the materials, installation, fabrication, erection or placement of components and connections requiring special expertise to ensure compliance with approved contract documents and referenced standards.

An inspection is not required by code provisions but may be required by the contract documents. A special inspection is required by code provisions or the authority having jurisdiction and by the contract documents. The level of expertise and required documentation needed to perform an inspection or a special inspection is the same.

* **Inspection or Special Inspection, Continuous:** The full-time observation of work requiring inspection by an approved special inspector present in the area where the work is being performed.
* **Inspection or Special Inspection, Periodic:** The part-time or intermittent observation of work requiring inspection or special inspection by an approved special inspector who is present in the area where the work has been or is being performed and at the completion of the work.

**Inspector or Special Inspector:** The licensed individual or firm that implements the inspection program for the project.

**Project Architect (PA):** The architectural design professional overseeing the project design. The PA becomes the architect of record.

**Project Civil Engineer (PCE):** The civil engineering design professional in charge of the analysis and design of the civil engineering aspects of a project. The PCE becomes the civil engineer of record.

**Project Manager (PM):** The Owner’s designated representative. The Owner is the “Corporation of the Presiding Bishop of The Church of Jesus Christ of Latter-day Saints, a Utah Corporation sole.”

**Project Structural Engineer (PSE):** The structural engineering design professional in charge of the analysis and design of the structural engineering aspects of a project. The PSE becomes the structural engineer of record.

**Service Provider (SP):** An agency or firm qualified to perform field and laboratory tests and to provide inspection services for civil and structural elements to determine the characteristics and quality of the civil and structural materials and of the workmanship. Testing and inspection services are provided by the SP. The Service Provider (SP) is the Testing and Inspection Agency (TA).

Note that it is not required that the same agency or firm provide all the testing and inspection services. Several different agencies or firms can be employed to provide different tests and inspections on the same project. However, it is suggested that the same service provider be used for all testing and inspection services whenever possible. It is beneficial to have the same firm that provided the geotechnical evaluation report provide all testing and inspection services for the earthwork operations.

**Structural Observation:** The visual observation of the structural system by a registered structural engineer for general conformance to the approved construction documents at significant construction stages and at completion of the structural system. Structural observations do not include or waive the requirements for inspections or special inspections.

**Test or Special Test:** Field or laboratory tests to determine the characteristics and quality of building materials and workmanship. A test is not required by code provisions but may be required by the contract documents. A special test is required by code provisions or the authority having jurisdiction and by the contract documents.

**Testing and Inspection Agency (TA):** An agency or firm engaged to perform tests, inspections, or both. Testing and inspection services are provided by the TA.

* Prior to the start of construction, the TA is required to provide written documentation to the building official demonstrating that the testers and inspectors are qualified individuals who demonstrate competence, and relevant experience and training, for the testing and inspection of the construction or operation requiring testing or inspection.
* Per code, special tests and special inspections must be performed by a “third-party.” The TA is to be employed by the Owner for quality assurance and not by the general contractor unless the owner is also the contractor. The standard plan contract documents omit the term “special” for code required tests and inspections to simplify the language of the contract documents.
* The Owner will judge the competence of the TA but ensuring the competence of the testing agency has always been and continues to be the responsibility of the building official.
* The registered design professional in responsible charge and the engineer(s) of record involved in the design of the project are permitted to act as the approved TA, and their personnel are permitted to act as inspectors for the work designed by them, provided those personnel are qualified to perform the inspections and are approved by the building official.

**Testing Laboratory:** An agency or firm qualified to perform field and laboratory tests to determine the characteristics and quality of building materials and workmanship.

# Site Adapt Design Team Responsibilities

The site adapt design team is responsible for site adapting the testing and inspection requirements of the contract drawings and specifications. The FIELD QUALITY CONTROL sections of the specifications in Divisions 03, 04, 05, 06, 31 and 32 are reviewed and site adapted by the design team. The specifications are used by the TA to complete Attachments “A” and “B” of the *Agreement Between Owner and Testing Agency US* or *Agreement Between Owner and Testing Agency CN*. The TA provides a testing and inspection services proposal per the contract documents, except that if contract documents are not available, the testing and inspections services proposal would use the information of Tables 1 through 5.

The PM retains a TA to test the material quality and inspect the work during construction. The PM usually assigns responsibility for administering the testing and inspection program to the PA.

The PM and PA are responsible for the proper implementation of these testing and inspection guidelines. The PA reviews these guidelines with the PCE and the PSE. The PA, PCE and PSE review and site adapt the contract documents to provide the needed tests and inspections for the project.

The PM (or the PA if assigned to do so by the PM) provides the TA a set of the contract documents (plans and specifications) from which the TA can provide an accurate testing and inspection proposal using the *Agreement Between Owner and Testing Agency US* or *Agreement Between Owner and Testing Agency CN* and Attachments "A" and "B". The TA’s testing and inspection proposal is reviewed by the PM and the PA.

The GC notifies the PA and the TA at least 24 hours prior to the time that a test or inspection is needed. This arrangement is allowed to be modified, if desired, by the PA with the approval of the PM. Testing and inspection services are provided by certified professionals, with special expertise, employed by testing and inspection agencies. Tests and inspections ensure compliance of the construction with the project contract documents, referenced standards and building code requirements. The PM, PA, PCE, PSE, GC, building officials and city inspectors do not provide inspections. The PCE and PSE provide thorough site observations to verify and document that the civil and structural portions of a project are constructed in general conformance to the project contract documents at significant construction stages per the project *Agreement Between Owner and Testing Agency US* or *Agreement Between Owner and Testing Agency.*

# Testing and Inspection Agency (TA) Responsibilities

If the TA finds that the GC is not ready for a test or inspection, the TA should (1) stay and wait for the construction to be ready or, (2) leave and return when the construction is ready. The TA is reimbursed for a single trip to the site by the PM, but the GC is responsible for the cost of the TA's downtime.

The TA sends the results of tests and inspections to the PM, PA, the associated project engineer (PCE or PSE) and GC within two business days of the completion of a test or inspection.

If any item fails to meet the requirements of the contract documents, the TA first notifies the GC. If the GC does not or cannot remedy the deficiency, the TA notifies the PA and the associated project engineer (PCE or PSE) before completion of that phase of the work. The PA, the associated project engineer (PCE and/or PSE) and the PM immediately decide if the deficiency or the failed test indicates unacceptable materials or workmanship. If the materials or workmanship are not acceptable, the GC corrects the problem as directed by the PA and then retests or re-inspects as directed by the PA. The cost of the additional tests or inspections and additional design work, due to failed tests or discovered deficiencies, is paid for by the PM. The PM is reimbursed for these costs by the GC.

The design and /or specification of remedial measures are the responsibility of the PA and the associated project engineer (PCE and/or PSE).

# General Philosophy for Tests and Inspections

## Wood Framed Meetinghouses and Other Wood Framed Projects

Only code required, and some Owner required, tests and inspections are provided on wood framed meetinghouses and other wood framed projects. Building codes generally require testing and inspections of engineered fill and other earthwork operations. The Owner requires full-time testing and inspection of asphalt and concrete paving. The Owner requires testing and inspection, to various degrees, of concrete foundations, site work concrete, masonry, steel, and wood.

## Welfare Services Projects

More extensive tests and inspections are required on welfare services projects (bishops’ storehouses, canneries, Deseret Industries). Engineered fill and other earthwork operations, asphalt and concrete paving, concrete foundations, site work concrete, masonry, steel, and wood all require testing and inspection.

# Testing Guidelines

The TA provides all testing services.

## Engineered Fill and Earthwork Operations

Testing of engineered fill is required for all projects.

While testing, the TA also inspects and ensures that soil materials, densities and lift thicknesses are in accordance with the requirements of the code, plans, specifications, and the geotechnical evaluation report. Testing and inspection services for earthwork operations are performed and provided at the same time. Ideally, testing and inspection services for engineered fill and other earthwork operations are provided by the geotechnical firm that prepared the report.

Test Specimen Rates:

* Testing should provide the following (unless indicated otherwise in the geotechnical evaluation report, which sometimes requires more testing than indicated below):
* One moisture-maximum density relationship test for each type of engineered fill material.
* The most conservative result of the following two paragraphs should be followed:
	+ - * One written compaction test for every 100 yd3 (about the volume of a one car garage) of engineered fill placed within the paved/concreted and building pad areas.
			* One written compaction test per 10,000 ft2 (about twice the area of a basketball court) of surface area and for each lift of engineered fill placed in paved/concreted areas. One written compaction test per 2,500 ft2 of surface area and for each lift of engineered fill placed in the building pad area.
			* One written compaction test per 40 lineal feet of footing and for each lift of engineered fill placed under continuous (strip) footings.
			* One written compaction test for each footing and for each lift of engineered fill placed under spot (spread) footings.
			* One written compaction test per 100 lineal feet of trench and for each lift of engineered fill.
			* Two written tests of topsoil per Specification Section 32 9001.

## Concrete for Wood Framed Meetinghouses and Other Wood Framed Projects

Testing of concrete is generally not required by building codes for wood framed meetinghouses and other wood framed projects. However, the design team may choose to have testing provided.

Projects Over 9,000 ft2:

* The Owner requires some minimal amount of testing consisting of two concrete test specimens for footings and foundation walls and interior slabs on grade and six concrete test specimens for exterior site work concrete (excluding paving) for projects over about 9,000 ft2 (Fayette, Heritage98, Legacy, Heritage 09T, Independence 170 (and larger) style meetinghouses, and larger seminary and institute buildings). These basic requirements are found in the standard plan specifications deemed appropriate by the PA, PCE and PSE.

Projects Under 9,000 ft2:

* The Owner does not require concrete test specimens for footings, or foundation walls, or interior slabs on grade but does require three concrete test specimens for exterior site work concrete (excluding paving) for projects under about 9,000 ft2 (Sharon, Independence 130 (and smaller) style meetinghouses, and smaller seminary and institute buildings). These basic requirements are found in the standard plan specifications deemed appropriate by the PA, PCE and PSE.

## Concrete for Welfare Services Projects

Testing of all concrete is required for welfare services projects. For welfare services projects, concrete test specimens to verify the strength of each class of concrete placed each day are to be taken for each day’s pour of each concrete mixture exceeding five cub yds but less than 25 yd3 plus one sample for each 50 yd3 or fraction thereof. For all projects, each test specimen should consist of four cylinders (one cylinder is tested at seven days, two cylinders are tested at 28 days (about 4 weeks) and one cylinder is held in reserve).

Test Specimen Rates:

* For sidewalks and curbs, specimens are often taken at a rate of one test specimen per 5,000 ft2 (about the area of a basketball court) of surface area.
* For interior slabs, specimens are often taken at a rate of one test specimen per10,000 ft2 (about twice the area of a basketball court) of surface area.
* For foundations, specimens are often taken at a rate of one test specimen per 50 yd3 of concrete needed. Sometimes, one test specimen per100 yd3 (about the volume of a one car garage) or 150 yd3 is used.

The PM, at his discretion, and with the input of the PA’s design team, may require additional testing for more quality control. The design team would incorporate this into the project drawings and specifications.

## Concrete Vapor Emissions and Alkalinity Levels at Interior Concrete Slabs on Grade

Testing of vapor emissions and alkalinity levels for interior concrete slabs on grades is generally not required by codes. However, the Owner requires testing of vapor emissions and alkalinity levels for interior concrete slabs on grade receiving floor finishes that use moisture sensitive adhesives (tile, carpeting, sheet carpeting, resilient tile flooring, resinous flooring system, seamless flooring system, wood athletic flooring, etc.).

Testing for concrete moisture vapor emissions can be performed either by calcium chloride tests or RH tests. Test locations must include at least one test (minimum) for each type of flooring system. It is required that three to six tests be performed for all new projects. Alkalinity tests for PH levels are performed at the same location and time, as the concrete moisture vapor emission tests are performed. Testing for existing projects will be more extensive. For existing projects, use three test locations for areas up to 1,000 ft2 with one additional test for each 1,000 ft2 or fraction thereof.

## Post Installed Concrete or Masonry Anchors

Testing of post installed anchors in concrete or masonry is required whenever they are used.

Test Specimen Rates:

* A pull test is to be performed on 10% of the anchors, or as otherwise required by the ICC Report for the anchor.

## Structural Masonry

Testing of structural masonry is required whenever it is used (principally used on welfare service’s projects). Testing of masonry used in screen walls is not required.

Prior to construction, certificates for materials used in masonry construction indicating compliance with the contract documents are submitted by the contractor to the PA. This is the “Unit Strength Method” approach.

Test Specimen Rates:

* During construction, the TA tests the masonry units, masonry grout, masonry mortar and masonry prisms for every 5,000 ft2 (about the area of a basketball court), or portion thereof, of masonry constructed. This testing guideline is slightly different from what codes technically require.

## Structural Steel Welding, Including the Attachment of Steel Deck

Structural testing of welds, including the attachment of steel deck, is not normally required for any meetinghouse, seminary, institute, or welfare service project.

## Wood Framing (Sheathing, Joists, Trusses, Etc.)

Testing of wood (sheathing, joists, trusses, etc.) is not normally required for any project.

## Asphalt Paving

Testing of asphalt paving is generally not required by codes. However, the Owner requires testing of asphalt paving for all projects. The TA is to provide nuclear density field testing to validate the testing being performed by the GC.

Field test reports should show compliance with the contract documents regarding the type of aggregate base used, the depth and density of the aggregate base, the thickness and density of the asphalt paving, and the materials used. During field tests, the compaction effort required, and the temperature of the paving as delivered and as placed are also recorded.

In addition to field tests, laboratory tests are required. Pavement thickness and final densities are determined using cores.

Test Specimen Rates:

* One written field test report for each 10,000 ft2 (about twice the area of a basketball court) of paving (minimum of three written field tests)
* One written laboratory test on cores taken at a rate of one core per 10,000 ft2 (minimum of three written laboratory tests)

## Concrete Paving

Testing of concrete paving is generally not required by codes. However, the Owner requires testing of concrete paving for all projects. Concrete test specimens to verify the strength of each class of concrete placed each day are to be taken for each day’s pour of each concrete mixture exceeding five yd3 but less than 25 yd3, plus one test specimen for each 50 yd3 or fraction thereof. For all projects, each test specimen should have four cylinders (one cylinder is tested at seven days, two at 28 days (about 4 weeks) and one held in reserve). Slump and air content, temperature and unit weight are also tested.

For all projects, each test specimen should consist of four 6 inch diameter cylinders (or more but smaller cylinders as allowed by ACI). One cylinder is tested at seven days, two at 28 days (about 4 weeks), and one in reserve. Slump, air content, temperature and unit weight are also tested.

Test Specimen Rates:

* Concrete test specimens to verify the strength of each class of concrete placed each day are to be taken for each day’s pour of each concrete mixture exceeding five yd3 but less than 25 yd3, plus one test specimen for each 50 yd3 or fraction thereof.

# Inspection Guidelines

The TA provides all inspection services.

## Engineered Fill and Earthwork Operations

Full time inspection of engineered fill and other earthwork operations is required for all projects by code. The geotechnical evaluation report for the project should also provide additional information for earthwork inspection requirements. The PA should request this information from the geotechnical engineer if it is not provided in the geotechnical evaluation report.

Provide periodic site inspections before engineered fill is placed. The inspector reviews all subgrades and excavations and determines if the site has been prepared in accordance with the geotechnical evaluation report prior to placing any engineered fill or other site materials.

Provide continuous inspection of engineered fill placement and other earthwork operations. The inspector ensures that soil materials, densities and lift thicknesses are in accordance with the requirements of the code, plans, specifications, and the geotechnical evaluation report.

Ideally, testing and inspection services for engineered fill and other earthwork operations are provided by the same person. It is beneficial to have these services be provided by the geotechnical engineer.

## Concrete for Wood Framed Meetinghouses and Other Wood Framed Projects

Most foundation concrete for buildings less than three stories, including footings, frost walls, and slabs-on-grade, are exempt from code required inspections. Also, the concrete strength used in most standard plan designs is 2,500 psi, further reducing the need for testing and inspections of concrete and reinforcing steel placement.

Inspection of concrete is not required for wood framed meetinghouses and other wood framed projects either by code or by the Owner. The PM, at his discretion, and with the input of the PA, can decide to require inspections.

## Concrete for Welfare Services Projects

Periodic and continuous inspection of concrete placement is required for welfare services projects.

Provide periodic inspections for the following:

* Reinforcing steel placement
* Rebar welding
* Headed bolts, studs, embeds and inserts
* Concrete mix design
* Concrete placement
* Concrete finishing
* Curing procedures
* Formwork and formwork removal
* Protection of concrete during cold or hot weather

Provide continuous inspections for concrete placement.

## Post-Installed Concrete or Masonry Anchors

Inspection of post-installed concrete or masonry anchors is required for all projects where post-installed anchors are used.

Provide periodic inspections of drilled hole preparation, diameters, depths, and hole cleanout.

## Structural Masonry

Written inspections are required for all structural masonry (masonry screen walls are not required). These inspections are required by code.

Provide written periodic inspections of the following:

* Proportions of site-prepared mortar
* Construction of mortar joints
* Location of reinforcement and connectors
* Size and location of structural elements
* Type, size, location, and placement of anchors
* Size, grade, type, and placement of reinforcement
* Verify that grout space is clean prior to grouting
* Protection of masonry during cold/hot weather

Provide written continuous inspections of the following:

* Grout placement
* Preparation of any required grout specimens, mortar specimens and prisms

## Structural Steel Welding, Including the Attachment of Steel Deck

Written, periodic inspection of structural steel welding, including the attachment of steel deck, is required for all projects. These inspections are required by code but are typically only needed on welfare services projects. Where fabrication of structural load bearing members and assemblies is performed on the premises of a fabricator’s shop, periodic inspections of the fabricated items are required unless the fabricator is “approved”.

Provide written periodic inspections of field performed welds and single-pass fillet welds.

Provide written periodic inspections of the attachment of steel deck, whether welded or mechanically fastened to the structure.

## Wood Framing (Sheathing, Joists, Trusses, Etc.)

Inspection of prefabricated metal plate wood trusses (and other engineered wood products) is not required if the manufacturer of the trusses is certified. The fabricator must maintain approved detailed fabrication and quality control procedures that provide a basis for control of the workmanship and the fabricator’s ability to conform to approved construction documents and the code. The standard specifications require certification of the prefabricated metal plate wood truss manufacturer. If the manufacturer is not certified, then inspection of the trusses is required. This would also apply to the manufacturers of engineered wood products.

Inspection of wood shear walls and diaphragms, including nailing, bolting, anchoring and other fastening to other components of the seismic force resisting system is not required by code unless the fastener spacing is 4 inches or less on center. Where nails are spaced at 4 inches on center or less, inspections are required.

Where the truss clear span is 60 feet or greater, the IBC requires the inspector to verify that the temporary installation of restraint/bracing and that the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.

The IBC specifies generally that all wood inspections be “periodic” as opposed to “continuous” except for field gluing operations of the main wind force-resisting system in certain high wind areas and of the seismic force-resisting system in seismic areas. Inspection frequency is usually left to the inspector’s discretion unless the structural engineer specifies a specific frequency.

## Asphalt Paving

Continuous inspection of asphalt paving placement is required by the Owner for all projects, although inspections are not required by codes.

Written inspection of asphalt placement procedures, performed during asphalt paving field testing, are required for all projects although they are not required by codes.

## Concrete Paving

Continuous inspection of concrete paving placement is required by the Owner for all projects, although inspections are not required by codes.

Provide inspections for the following:

* Reinforcing steel placement
* Concrete mix design
* Concrete placement
* Concrete finishing
* Concrete curing procedures
* Formwork and formwork removal
* Protection of concrete during cold or hot weather

# Example of Testing and Inspection Requirements for a Heritage Style Meetinghouse

## Basic Information

The following is assumed for this example:

* The site is approximately 2.54 acres (approximately 110,642 ft2).
* The meetinghouse is approximately 16,558 ft2 (about half the area of a large mansion).
* 16” of engineered fill, excluding the 6” base, is required under the paving.
* 24” of engineered fill, excluding the 4” base, is required under the building pad.
* Assume that a 16” deep x 36” wide section of fill is required beneath approximately 515 lineal feet of continuous footings.
* Concrete sidewalks are approximately 10,000 ft2 (about twice the area of a basketball court).
* 75 yd3 of concrete is used in the footings and 40 yd3 (about the volume of a large U-Haul truck)of concrete are used in the foundation walls.
* Asphalt paving is approximately 70,000 ft2 (about twice the area of a large mansion).
* The building is not in an area subject to freezing and thaw cycles.

## Engineered Fill and Earthwork

Tests for engineered fill (compacted fill and aggregate base):

* Testing is based upon one test per 8” lift (or portion thereof) per 10,000 ft2 (about twice the area of a basketball court) of surface area at paved areas; one test per 8” lift (or portion thereof) per 2,500 ft2 of surface area under the building pad; one test per 8” lift (or portion thereof) per 40’ of footing length.
* Two 8" lifts (16" total) of engineered fill and one 6" lift of aggregate base are needed under paved areas.
* Three 8" lifts (24" total) of engineered fill and one 4" lift of aggregate base are needed under the building.
* Two 8" lifts (16" total) of fill are needed under the continuous footings.

Required number of engineered fill tests is as follows:

(2 lifts) (70,000 ft2)/ (10,000 ft2) + (3 lifts) (16,558 ft2)/ (2,500 ft2) + (2 lifts) (515’)/ (40’) = 59.6 tests. Require 60 written tests.

Required number of aggregate base tests is as follows:

* 6" thick under paved areas and 4" thick under the building pad.

(70,000 ft2)/ (10,000 ft2) + (16,558 ft2)/ (2,500 ft2) = 13.6 tests. Require 14 written tests.

Approximately 74 written tests are expected in this example.

In Table 1 - Quality Assurance Guidelines for Meetinghouses, these values have been adjusted. The minimum number of tests required for the aggregate base under paved areas is four, and the minimum number of tests required for the aggregate base under interior concrete slabs on grade is two.

Tests and inspections ideally occur at the same time and by the same person.

## Concrete

Tests for concrete (no concrete paving in this example):

* For exterior concrete sidewalks and curbs, require one test specimen (4 cylinders) per 5,000 ft2 (about the area of a basketball court) of surface area. For meetinghouses under about 9,000 ft2 (about twice the area of a basketball court), require three test specimens. Require six test specimens for larger projects. This is arbitrary but provides some guidance.
* For interior concrete slabs on grade, one test specimen (4 cylinders) per 10,000 ft2 (about twice the area of a basketball court) of surface area. For meetinghouses under about 9,000 ft2 (about twice the area of a basketball court), test specimens are not required. Require two test specimens for larger projects. This is arbitrary but provides some guidance.
* For foundations, one test specimen (4 cylinders) is required for each 150 yd3 of concrete. For meetinghouses under about 9,000 ft2 (about twice the area of a basketball court), test specimens are not required. Require two test specimens for footings and for walls for larger projects. This is arbitrary but provides some guidance.
* Use three moisture and alkalinity tests for projects under about 9,000 ft2 (about twice the area of a basketball court) and six tests for larger projects.

Required number of test specimens for exterior concrete is as follows:

* (10,000 ft2)/ (5,000 ft2) = 2.0 tests. Require 2 test specimens.

Required number of test specimens for interior concrete is as follows:

* (16,558 ft2)/ (10,000 ft2) = 1.6 tests. Require 2 test specimens.

Required number of test specimens for foundations is as follows:

* (75 yd3)/150 yd3 = 0.5 tests. Require 1 test specimen for footings.

(40 yd3)/150 yd3 = 0.3 tests. Require 1 test specimen for walls.

Approximately 8 concrete tests would be expected per this example.

Provide 6 concrete moisture vapor emission and alkalinity tests.

In Table 1 - Quality Assurance Guidelines for Meetinghouses, these values have been adjusted. Six test specimens have been required for exterior concrete, two for footings, walls, and interior slabs.

## Post-Installed Concrete or Masonry Anchors

Testing of post-installed concrete or masonry anchors is not required in this example.

## Structural Masonry

Testing of masonry is not required. Testing of masonry in any screen walls is not required in this example.

## Structural Steel Welding

Testing of structural welding, including the attachment of steel deck is not required in this example.

## Wood Framing (Panels, Joists, Trusses, Etc.)

Testing of wood or wood assemblies is not required (wood shear walls, wood roof diaphragms, trusses) is not required in this example.

## Asphalt Paving

Testing for asphalt paving:

* One written field test per 10,000 ft2 (about twice the area of a basketball court) of surface area.
* One laboratory test per 10,000 ft2 (about twice the area of a basketball court) of surface area.

(70,000 ft2)/ (10,000) = 7.0 tests. Use seven tests.

Required number of written field tests is as follows:

* (70,000 ft2)/ (10,000 ft2) = 7.0 tests. Require 7 written field tests

Required number of laboratory tests is as follows:

* (70,000 ft2)/ (10,000 ft2) = 7.0 tests. Require 7 laboratory tests

Approximately 14 asphalt tests are expected in this example.

Tests and inspections ideally occur at the same time and by the same person.

# Table 1. Testing and Inspection Guidelines – Site Adapt

|  |  |
| --- | --- |
|  |  |
|  | 90-1Sharon | 130-2Sharon | 170-2Fayette | 230-2Fayette | 230-3Fayette | 300-3 SCLegacy 98 |
| **Building Size** | 4,683 SF | 5,718 SF | 11,000 SF | 13,973 SF | 14,153 SF | 24,460 SF |
| **Site Area (Estimated)** | 1.02 Acres(46,267 SF) | 1.10 Acres(47,916 SF) | 1.86 Acres(81,022 SF) | 1.86 Acres(81,022 SF) | 2.25 Acres(98,010 SF) | 3.52 Acres(153,331 SF) |
| **Paved Area (Estimated)** | 20,000 SF | 24,000 SF | 25,000 SF | 45,000 SF | 60,000 SF | 87,000 SF |
|  |  |  |  |  |  |  |
| **TESTS:** |  |  |  |  |  |  |
| Engineered Fill (soils): |  |  |  |  |  |  |
|  Fill: | 102 | 122 | 192 | 262 | 292 | 472 |
|  Base under Paving: | 43 | 43 | 43 | 53 | 63 | 93 |
|  Base under Interior  Slabs: | 24 | 34 | 54 | 64 | 64 | 104 |
|  Fill under Footings: | 1412 | 1612 | 2112 | 2412 | 2412 | 3212 |
|  |  |  |  |  |  |  |
| Concrete: |  |  |  |  |  |  |
|  Site Cast (sidewalks, etc.): | 35 | 35 | 65 | 65 | 65 | 65 |
|  Interior Concrete Slabs: | 06 | 06 | 26 | 26 | 26 | 26 |
|  Footings: | 07 | 07 | 27 | 27 | 27 | 27 |
|  Foundation Walls: | 08 | 08 | 28 | 28 | 28 | 28 |
| Moisture/ph testing | 321 | 321 | 621 | 621 | 621 | 621 |
|  |  |  |  |  |  |  |
| Asphalt Paving: | 49 | 69 | 69 | 109 | 129 | 189 |
| Concrete Paving: | 722 | 822 | 822 | 1422 | 1922 | 2722 |
|  |  |  |  |  |  |  |
| Welding/Steel Deck: | Not Required | Not Required | Not Required | Not Required | Not Required | Not Required |
|  |  |  |  |  |  |  |
| Masonry: | Not Required | Not Required | Not Required | Not Required | Not Required | Not Required |
|  |  |  |  |  |  |  |
| Wood (Note 15): | Not Required | Not Required | Not Required | Not Required | Not Required | Not Required |
|  |  |  |  |  |  |  |
| Post Installed Anchors: | Not Required10 | Not Required10 | Not Required10 | Not Required10 | Not Required10 | Not Required10 |
|  |
| **INSPECTIONS:** |  |  |  |  |  |  |
| Engineered Fill (soils): |  |  |  |  |  |  |
|  Fill: | Note 2 | Note 2 | Note 2 | Note 2 | Note 2 | Note 2 |
|  Base under Paving: | 114 | 114 | 114 | 114 | 114 | 114 |
|  Base under Interior  Slabs: | Note 4 | Note 4 | Note 4 | Note 4 | Note 4 | Note 4 |
|  Inspect Site and Excavations Before Fill  Placement: | 111 | 111 | 111 | 111 | 111 | 111 |
| Concrete: |  |  |  |  |  |  |
|  Site Cast (sidewalks, etc.): | Not Required | Not Required | Not Required | Not Required | Not Required | Not Required |
|  Interior Concrete Slabs: | Not Required | Not Required | Not Required | Not Required | Not Required | Not Required |
|  Footings: | Not Required | Not Required | Not Required | Not Required | Not Required | Not Required |
|  Foundation Walls: | Not Required | Not Required | Not Required | Not Required | Not Required | Not Required |
|  |  |  |  |  |  |  |
| Asphalt or Concrete Paving: | Notes 9, 13 | Notes 9, 13 | Notes 9, 13 | Notes 9, 13 | Notes 9, 13 | Notes 9, 13 |
|  |  |  |  |  |  |  |
| Masonry: | Not Required | Not Required | Not Required | Not Required | Not Required | Not Required |
|  |  |  |  |  |  |  |
| Wood (Note 15): | Not Required | Not Required | Not Required | Not Required | Not Required | Not Required |
|  |  |  |  |  |  |  |
| Post-Installed Anchors: | Not Required10 | Not Required10 | Not Required10 | Not Required10 | Not Required10 | Not Required10 |

##

# Table 2. Testing and Inspection Guidelines – Site Adapt

|  |  |
| --- | --- |
|  |  |
|  | IND 50 | IND 90 | IND 130 | IND 170 | IND 230 | IND 230 SC  |
| **Building Size** | 2,361 SF | 4,532 SF | 5,468 SF | 11,303 SF | 15,597 SF | 16,986 SF  |
| **Site Area (Estimated)** | 0.50 Acres(21,780 SF) | 0.67 Acres(29,185 SF) | 0.89 Acres(38,768 SF) | 1.79 Acres(77,972 SF) | 2.50 Acres(108,900 SF) | 3.61 Acres(157,252 SF) |
| **Paved Area (Estimated)** | 6,976 SF | 9,856 SF | 16,560 SF | 26,275 SF | 53,210 SF | 81,462 SF |
|  |  |  |  |  |  |  |
| **TESTS:** |  |  |  |  |  |  |
| Engineered Fill (soils): |  |  |  |  |  |  |
|  Fill: | 52 | 82 | 102 | 192 | 302 | 372 |
|  Base under Paving: | 43 | 43 | 43 | 43 | 63 | 73 |
|  Base under Interior  Slabs: | 24 | 24 | 34 | 54 | 74 | 83 |
|  Fill under Footings: | 1012 | 1412 | 1512 | 2212 | 2712 | 2812 |
|  |  |  |  |  |  |
| Concrete: |  |  |  |  |  |  |
|  Site Cast (sidewalks, etc.): | 35 | 35 | 35 | 65 | 65 | 65 |
|  Interior Concrete Slabs: | 06 | 06 | 06 | 26 | 26 | 26 |
|  Footings: | 07 | 07 | 07 | 27 | 27 | 27 |
|  Foundation Walls: | 08 | 08 | 08 | 28 | 28 | 28 |
| Moisture/ph testing | 321 | 321 | 321 | 621 | 621 | 621 |
|  |  |  |  |  |  |
| Asphalt Paving: | 49 | 49 | 49 | 69 | 129 | 189 |
| Concrete Paving: | 322 | 322 | 522 | 822 | 1622 | 2522 |
|  |  |  |  |  |  |
| Welding/Steel Deck: | Not Required | Not Required | Not Required | Not Required | Not Required | Not Required |
|  |  |  |  |  |  |
| Masonry: | Not Required | Not Required | Not Required | Not Required | Not Required | Not Required |
|  |  |  |  |  |  |
| Wood (Note 15): | Not Required | Not Required | Not Required | Not Required | Not Required | Not Required |
|  |  |  |  |  |  |
| Post Installed Anchors: | Not Required10 | Not Required10 | Not Required10 | Not Required10 | Not Required10 | Not Required10 |
|  |
| **INSPECTIONS:** |  |  |  |  |  |  |
| Engineered Fill (soils): |  |  |  |  |  |  |
|  Fill: | Note 2 | Note 2 | Note 2 | Note 2 | Note 2 | Note 2 |
|  Base under Paving: | 114 | 114 | 114 | 114 | 114 | 114 |
|  Base under Interior  Slabs: | Note 4 | Note 4 | Note 4 | Note 4 | Note 4 | Note 4 |
|  Inspect Site and Excavations Before Fill  Placement: | 111 | 111 | 111 | 111 | 111 | 111 |
| Concrete: |  |  |  |  |  |  |
|  Site Cast (sidewalks, etc.): | Not Required | Not Required | Not Required | Not Required | Not Required | Not Required |
|  Interior Concrete Slabs: | Not Required | Not Required | Not Required | Not Required | Not Required | Not Required |
|  Footings: | Not Required | Not Required | Not Required | Not Required | Not Required | Not Required |
|  Foundation Walls: | Not Required | Not Required | Not Required | Not Required | Not Required | Not Required |
|  |  |  |  |  |  |
| Asphalt or Concrete Paving: | Notes 9, 13 | Notes 9, 13 | Notes 9, 13 | Notes 9,13 | Notes 9,13 | Notes 9,13 |
|  |  |  |  |  |  |
| Masonry: | Not Required | Not Required | Not Required | Not Required | Not Required | Not Required |
|  |  |  |  |  |  |
| Wood (Note 15): | Not Required | Not Required | Not Required | Not Required | Not Required | Not Required |
|  |  |  |  |  |  |
| Post-Installed Anchors: | Not Required10 | Not Required10 | Not Required10 | Not Required10 | Not Required10 | Not Required10 |

# Table 3. Testing and Inspection Guidelines – Site Adapt

|  |
| --- |
|  |
|  | Her09T  | Her09T SC | 300-3Heritage 98 |
| **Building Size** | 19,402 SF | 21,043 SF | 16,558 SF |
| **Site Area (Estimated)** | 2.71 Acres(118,048 SF) | 3.43 Acres(149,411 SF) | 2.54 Acres(110,642 SF) |
| **Paved Area (Estimated)** | 67,860 SF | 79,555 SF | 70,000 SF |
|  |  |  |  |
| **TESTS:** |  |  |  |
| Engineered Fill (soils): |  |  |  |
|  Fill: | 372 | 422 | 342 |
|  Base under Paving: | 73 | 83 | 73 |
|  Base under Interior Slabs: | 84 | 94 | 74 |
|  Fill under Footings: | 2812 | 3012 | 2612 |
|  |  |  |  |
| Concrete: |  |  |  |
|  Site Cast (sidewalks, etc.): | 65 | 65 | 65 |
|  Interior Concrete Slabs: | 26 | 26 | 26 |
|  Footings: | 27 | 27 | 27 |
|  Foundation Walls: | 28 | 28 | 28 |
| Moisture/ph testing | 621 | 621 | 621 |
|  |  |  |  |
| Asphalt Paving: | 149 | 169 | 149 |
| Concrete Paving: | 2122 | 2522 | 2222 |
|  |  |  |  |
| Welding/Steel Deck: | Not Required | Not Required | Not Required |
|  |  |  |  |
| Masonry (Material Testing): | Not Required | Not Required | Not Required |
|  |  |  |  |
| Wood (Note 15): | Not Required | Not Required | Not Required |
|  |  |  |  |
| Post Installed Anchors: | Not Required10 | Not Required10 | Not Required10 |
|  |
| **INSPECTIONS:** |  |  |  |
| Engineered Fill (soils): |  |  |  |
|  Fill: | Note 2 | Note 2 | Note 2 |
|  Base under Paving: | 114 | 114 | 114 |
|  Base under Interior Slabs: | Note 4 | Note 4 | Note 4 |
|  Inspect Site and Excavations Before Fill Placement: | 111 | 111 | 111 |
| Concrete: |  |  |  |
|  Site Cast (sidewalks, etc.): | Not Required | Not Required | Not Required |
|  Interior Concrete Slabs: | Not Required | Not Required | Not Required |
|  Footings: | Not Required | Not Required | Not Required |
|  Foundation Walls: | Not Required | Not Required | Not Required |
|  |  |  |  |
| Asphalt and Concrete Paving: | Notes 9, 13 | Notes 9, 13 | Notes 9, 13 |
|  |  |  |  |
| Masonry: | Not Required | Not Required | Not Required |
|  |  |  |  |
| Wood (Note 15): | Not Required | Not Required | Not Required |
|  |  |  |  |
| Post-Installed Anchors: | Not Required10 | Not Required10 | Not Required10 |

# Table 4. Testing and Inspection Guidelines – Site Adapt

|  |  |
| --- | --- |
|  **Small Seminary Buildings** |  **Large Seminary Buildings** |
|   | SEM07-01 | SEM07-02 | SEM07-03 | SEM07-04 | SEM08-06 | SEM07-08 |
| **Building Size** | 1.740 SF | 3,598 SF | 4,902 SF | 6,207 SF | 9,406 SF | 11,727 SF |
| **Site Area (Estimated)** | 0.30 Acres(13,068 SF) | 0.62 Acres(27,007 SF) | 0.62 Acres(27,007 SF) | 0.62 Acres(27,007 SF) | 1.05 Acres(45,738 SF) | 1.05 Acres(45,738 SF) |
| **Paved Area (Estimated)** | 4,900 SF | 10,125 SF | 10,125 SF | 10,125 SF | 17,152 SF | 17,152 SF |
|  |
| **TESTS:** |  |  |  |  |  |  |
| Engineered Fill (soils): |  |  |  |  |  |  |
|  Fill: | 32 | 52 | 82 | 102 | 152 | 182 |
|  Base under Paving: | 43 | 43 | 43 | 43 | 43 | 43 |
|  Base under Interior  Slabs: | 24 | 24 | 24 | 34 | 44 | 54 |
|  Fill under Footings: | 912 | 1212 | 1412 | 1612 | 2012 | 2212 |
|  |
| Concrete: |  |  |  |  |  |  |
|  Site Cast (sidewalks, etc):  | 35 | 35 | 35 | 35 | 65 | 65 |
|  Interior Concrete Slabs | 06 | 06 | 06 | 06 | 26 | 26 |
|  Footings: | 07 | 07 | 07 | 07 | 27 | 27 |
|  Foundation Walls: | 08 | 08 | 08 | 08 | 28 | 28 |
| Moisture/ph testing: | 321  | 321 | 321 | 321 | 621 | 621 |
|  |
| Asphalt Paving: | 49 | 49 | 49 | 49 | 49 | 49 |
| Concrete Paving: | 222 | 322 | 322 | 322 | 622 | 622 |
|  |
| Welding/Steel Deck: | Not Required | Not Required | Not Required | Not Required | Not Required | Not Required |
|  |
| Masonry: | Not Required | Not Required | Not Required | Not Required | Not Required | Not Required |
|  |
| Wood (Note 15): | Not Required | Not Required | Not Required | Not Required | Not Required | Not Required |
|  |
| Post-Installed Anchors: | Not Required10 | Not Required10 | Not Required10 | Not Required10 | Not Required10 | Not Required10 |
|  |
| **INSPECTIONS:** |  |  |  |  |  |  |
| Engineered Fill (soils): |  |  |  |  |  |  |
|  Fill: | Note 2 | Note 2 | Note 2 | Note 2 | Note 2 | Note 2 |
|  Base under Paving: | 114 | 114 | 114 | 114 | 114 | 114 |
| Base under Interior Slabs:  | Note 4 | Note 4 | Note 4 | Note 4 | Note 4 | Note 4 |
|  Inspect Site and  Excavations Before Fill Placement: | 111 | 111 | 111 | 111 | 111 | 111 |
| Concrete: |  |  |  |  |  |  |
|  Site Cast (sidewalks, etc.) | Not Required | Not Required | Not Required | Not Required | Not Required | Not Required |
|  Interior Concrete Slabs: | Not Required | Not Required | Not Required | Not Required | Not Required | Not Required |
|  Footings: | Not Required | Not Required | Not Required | Not Required | Not Required | Not Required |
|  Foundation Walls: | Not Required | Not Required | Not Required | Not Required | Not Required | Not Required |
|  |
| Asphalt or Concrete Paving: | Notes 9, 13 | Notes 9, 13 | Notes 9, 13 | Notes 9, 13 | Notes 9, 13 | Notes 9, 13 |
|  |
| Masonry: | Not Required | Not Required | Not Required | Not Required | Not Required | Not Required |
|  |
| Wood (Note 15): | Not Required | Not Required | Not Required | Not Required | Not Required | Not Required |
|  |
| Post-Installed Anchors: | Not Required10 | Not Required10 | Not Required10 | Not Required10 | Not Required10 | Not Required10 |

# Table 5. Testing and Inspection Guidelines – Site Adapt

|  |  |
| --- | --- |
|  **Bishop's Storehouse** |  **Deseret Industries** |
|   | **Small** | **Large** | **Medium** | **Large** |
| **Building Size** | 12,277 SF | 17,100 SF | 35,860 SF | 45,215 SF |
| **Site Area (Estimated)** | 2.20 Acres(95,832 SF) | 3.00 Acres(130,680 SF) | 6.20 Acres(270,072 SF) | 7.50 Acres(326,700 SF) |
| **Paved Area (Estimated)** | 55,250 SF | 77,000 SF | 161,000 SF | 203,000 SF |
|  |
| **TESTS:** |  |  |  |  |
| Engineered Fill (soils): |  |  |  |  |
|  Fill: | 262 | 362 | 762 | 952 |
|  Base under Paving: | 63 | 83 | 173 | 213 |
|  Base under Interior  Slabs: | 54 | 74 | 154 | 194 |
|  Fill under Footings: | 3512 | 4712 | 5212 | 5912 |
|  |
| Concrete: |  |  |  |  |
|  Site Cast (sidewalks, etc.): | 35 | 35 | 65 | 65 |
|  Interior Concrete Slabs: | 36 | 46 | 86 | 96 |
|  Footings: | 27 | 27 | 27 | 27 |
|  Foundation Walls: | 28 | 28 | 28 | 28 |
| Moisture/ph testing: | 621 | 621 | 621 | 621 |
|  |
| Asphalt Paving: | 129 | 169 | 349 | 429 |
| Concrete Paving: | 1722 | 2422 | 5022 | 6322 |
|  |
| Welding/Steel Deck: | 016 | 016 | 016 | 016 |
|  |
| Masonry: | 317 | 417 | 417 | 517 |
|  |
| Wood (Note 15): | 0 | 0 | 0 | 0 |
|  |
| Post-Installed Anchors: | Not Required10 | Not Required10 | Not Required10 | Not Required10 |
|  |
| **INSPECTIONS:** |  |  |  |  |
| Engineered Fill (soils): |  |  |  |  |
|  Fill: | Note 2 | Note 2 | Note 2 | Note 2 |
|  Base under Paving: | 114 | 114 | 114 | 114 |
|  Base under Interior  Slabs: | Note 4 | Note 4 | Note 4 | Note 4 |
|  Inspect Site and Excavations Before Fill Placement: | 111 | 111 | 111 | 111 |
| Concrete: |  |  |  |  |
|  Site Cast (sidewalks, etc): | Not Required | Not Required | Not Required | Not Required |
|  Interior Concrete Slabs: | Not Required | Not Required | Not Required | Not Required |
|  Footings: | 518 | 718 | 718 | 818 |
|  Foundation Walls: | 518 | 718 | 718 | 818 |
|  |
| Asphalt or Concrete Paving: | Notes 9, 13 | Notes 9, 13 | Notes 9, 13 | Notes 9, 13 |
|  |
| Welding/Steel Deck: | 319 | 419 | 819 | 919 |
|  |
| Masonry: | 1320 | 1720 | 1920 | 2220 |
|  |
| Post-Installed Anchors: | Not Required10 | Not Required10 | Not Required10 | Not Required10 |

# Footnotes for Tables 1 Through 5

The extent of needed testing and inspecting varies from site to site and is also dependent upon the GC's construction schedule. The design team needs to site adapt the testing and inspection requirements in each specification Division for each new project.

1. “SF” indicates “ft2.” An “acre” is 43,560 ft2 (about half the area of a Manhattan city block).
2. The amount of testing is based upon placing 16” of fill in two 8" thick lifts at paved areas and using one test per 10,000 ft2 (about twice the area of a basketball court) of surface area per lift Added to this is the amount of testing required for 24” of fill placed in three 8" thick lifts under the building pad and using one test per 2,500 ft2 of surface area per lift For these tables, it was assumed that inspections for fill placement are performed concurrently with testing.
3. This amount of testing is based upon using one test per 10,000 ft2 (about twice the area of a basketball court) of surface area at paved/concreted areas but not less than four tests. A single lift of aggregate base was used. For these tables, it was assumed that inspections for aggregate fill placement are performed concurrently with testing.
4. This amount of testing is based upon using one test per 2,500 ft2 of surface area but not less than two tests. A single lift of aggregate base used. For these tables, it was assumed that inspections for aggregate fill placement are performed concurrently with testing.
5. Testing of site cast concrete is not required on meetinghouses and other wood framed projects. For these projects, it is suggested that that three test specimens be taken for projects under about 9,000 ft2 (about twice the area of a basketball court) six test specimens be taken for larger projects. This is arbitrary and should be reviewed and adjusted for the project. In some cases, it would be acceptable to not take any test specimens. This would be reviewed by the design team.
6. Testing of concrete in interior slabs on grade is not required on meetinghouses and other wood framed projects. However, it is suggested that for projects over about 9,000 ft2 that two tests be taken. This would be reviewed by the design team.
7. Testing of concrete in footings is not required on meetinghouses or other wood framed projects. However, it is suggested that for projects over about 9,000 ft2 that two tests be taken. This would be reviewed by the design team.
8. Testing of concrete in foundation walls is not required on meetinghouses or other wood framed projects. However, it is suggested that for projects over about 9,000 ft2 that two tests be taken. This would be reviewed by the design team.
9. Asphalt testing in asphalt paving is based on one field test and one laboratory test per 10,000 ft2 of paved area with at least two field and laboratory tests.
10. Perform pull tests for 10% of the anchors. Inspection should verify that all drilled holes are of the correct size and depth prior to anchor installation. Post-Installed anchors are often used on an “as-needed” basis to replace misplaced bolts. Provide testing and inspection on an “as-needed” basis.
11. Prior to the placement of engineered fill, the inspector should review all sub grades and excavations and determine if the site is prepared in accordance with the contract documents and geotechnical report prior to placing any engineered fill (or concrete).
12. This is an estimate based upon using one test per 40 lineal feet of footing per lift. The lineal feet for this estimate was set equal to square root of the building area multiplied by four (i.e., for a 16,986 ft2 building, lineal feet of footing is equal to (16,986^.5) \*4 = 521). Two lifts were used to create the table.
13. The TA is to inspect placement procedures while taking tests.
14. Before placing paving, determine if the elevation of the base is correct.
15. Wood and wood assemblies do not require testing or inspections.
16. Welds and deck attachments require only visual inspections.
17. Testing of materials for masonry (units, grout, masonry, and prisms) is performed for every 5,000 ft2 of wall surface.
18. Inspections of concrete in footings and foundation walls are assumed to occur every 150 lineal feet of footing or foundation wall.
19. Inspections of steel welding are assumed to occur once for every 5,000 ft2 of building area.
20. Inspections of masonry are assumed to occur once for every 1,000 ft2 of wall surface area.
21. Use three tests for projects under 9,000 ft2 and six tests for projects over 9,000 ft2. This would be reviewed by the design team.
22. Based upon using one test (4 cylinders) for every 50 yd3 of concrete using a concrete paving thickness of 5 inches.