Guidelines

For

Structural Tests and Inspections

For Compliance with the 6th Edition of the
Massachusetts State Building Code

Boston Association Of Structural Engineers

January 1999

Guidelines

For

Structural Tests and Inspections

For Compliance with the 6th Edition of the
Massachusetts State Building Code

Boston Association Of Structural Engineers

Editors

Richard M. Croswell
Rubin M. Zallen

BASE Committee on the Guidelines

Fred V. Cowen, Chairman
John Born
Richard M. Croswell
David Grandpre
Kit Huettig
Michael Jolliffe
Joseph McDonough
Val Prest
Conrad Roberge
Emile Troup
Rimas Veitas
Mark Webster
Rubin M. Zallen

Users' comments are welcome and encouraged.
Please address all comments and inquiries to:

Boston Association of Structural Engineers
The Engineering Center
One Walnut Street
Boston, MA 02108

Tel: 617-227-5551
Fax: 617-227-6783

Web page: http://www.b-ase.org

BASE Chapter 17 Committee

Fred V. Cowen, Chairman
Craig E. Barnes
David M. Berg
John Born
Stephen K. Crockett
David Gill
Frank J. Heger
Michael Jolliffe
Kenneth Kruger
Mysore Ravindra
Conrad Roberge
Emile Troup
Michele C. Tudor
Rimas Veitas
Jack White
Rubin M. Zallen

The BASE Chapter 17 Committee prepared the BASE recommendations to the Massachusetts Board of Building Regulations and Standards for structural tests and inspections under the 6th Edition of the Massachusetts State Building Code.

Acknowledgments

BASE acknowledges and thanks the following for their assistance in the preparation of the Guidelines for Structural Tests and Inspections

- David J. Hatem, Esquire and the firm of Burns & Levinson LLP for a critical review of the document and the preparation of the recommended contract forms.

- Symmes, Maini & McKee Associates (SMMA) for the graphic design and production of this document.

TABLE OF CONTENTS

GUIDELINES FOR STRUCTURAL TESTS AND INSPECTIONS

For Compliance with the 6th Edition of the Massachusetts State Building Code

1.0 GENERAL INFORMATION

1.1 Overview

The 6th Edition of the Massachusetts State Building Code requires that the structural engineer of record (SER) establish and direct a program of structural tests and inspections for the construction of most engineered structures[1]. The required tests and inspections by the SER are limited to the structural systems and elements which are designed under the aegis of the SER and are part of the permanent and completed project work, or which are designed by other engineers in conformance with the SER's design criteria or performance specifications.

When the design of a structural system is performed independently of the project SER (i.e. not under his aegis and not in conformance with design criteria or a performance specification prepared by him), a special SER must be designated by the owner, architect, or construction contractor, as applicable, to be responsible for that design, and to establish and direct a program of structural tests and inspections for that design. (See Section 1.7).

The Code requires that the SER select the inspectors he will need to implement the program. These inspectors can be from his own staff, from other engineering firms, or from outside testing and inspection agencies, whichever is most beneficial for the operation of the program.

Structural testing and inspection are natural extensions of the SER's design, since the SER is the person who is most qualified to determine if his design has been properly executed. Further, with the SER in charge of the testing and inspection program, there is a continuity of responsibility from the design phase through the construction phase of the project, which is a fundamental Code requirement for the program.

The requirements for the program of structural tests and inspections are contained in Section 1705.0 of the Code (780 CMR 1705.0). A copy of 780 CMR 1705.0 is included in Section 2.0 of these Guidelines, together with recommendations for implementation and explanatory comments for the various subsections.

780 CMR 1705.0 provides specific requirements for structural tests and inspection for the following:

- Steel construction
- Concrete construction (cast-in-place and precast)
- Masonry construction
- Wood construction
- Controlled structural fill (referred to as prepared fill in 780 CMR 1705.0)
- Pile foundations
- Pier Foundations
- Curtain Walls (referred to as wall panels and veneers in 780 CMR 1705.0)
- Light gage metal framing (gravity load bearing, and for curtain walls)
- Special cases (unusual construction, as determined by the building official)

In addition to these items, BASE recommends that in-situ bearing strata for footings be included; this item was an inadvertent omission from 780 CMR 1705.0.

1.2 Basic Elements of a Program of Structural Tests and Inspections

There are three basic elements in a program of structural tests and inspections:

I. Establishment
II. Implementation
III. Reporting

At the end of the design phase, the SER must prepare a program of structural tests and inspections in accordance with the requirements of 780 CMR 1705.0. At the same time, the SER must determine what tests and inspections will be performed by his own staff, and what tests and inspections will be performed by other engineering firms or outside testing and inspection agencies. The SER must then select or retain these other firms or agencies.

[1] See 780 CMR 1705.1, included in Section 2.0 of these Guidelines, for the exceptions.

The SER then prepares a statement of structural tests and inspections, describing the tests and inspections to be performed and listing the firms and agencies who will perform them. This statement must be submitted by the owner with his application for a building permit, and submission and approval of said statement is a condition for the issuance of the building permit.

When construction begins, the SER must organize and direct the testing and inspection work, set up procedures for reporting by the various inspectors, and otherwise administer the program.

All inspection and test reports are made to the SER. The SER provides these reports to the building official when requested by the building official. The SER is required to report willful noncompliance by the construction contractor to the building official for the building official's action. The SER makes a final report on the satisfactory completion of the testing and inspection program to the building official and to the owner prior to the issuance of the certificate of occupancy.

1.3 Additional Responsibilities of the SER

In addition to the responsibilities mentioned above, the SER has implied responsibilities. He is responsible for those he selects for the testing and inspection program, and thus, should review the qualifications of personnel that will be performing tests and inspections. If, during the implementation of the program, he should determine that an individual or agency is not qualified for his tasks or does not perform them in a proper or timely manner, he needs to replace that individual or agency (i.e. deselect him).

The SER should inform the architect and the owner about the Code requirements for structural testing and inspection, when he negotiates the structural design contract, so that the architect and owner will have a clear understanding of these requirements, and so that the costs of the testing and inspection program can be incorporated into the financial planning of the project.

To the extent possible, the SER should develop a good working relationship with the construction contractor, so that the testing and inspection work can be performed in a timely and efficient manor, and so that the contractor's compliance with contract documents may be more readily achieved. Where disputes arise between the SER and the contractor, the SER should use the remedies set forth in the construction contract to obtain the contractor's compliance before reporting any willful non-compliance to the building official.

The SER should notify the building official if there are aspects of the project that fall under the aegis of a special SER.

1.4 Building Official's Responsibilities

The building official is charged with the enforcement of the State Building Code, and through that authority he can and should enforce the program for structural tests and inspections. He should do the following:

- Require that a document prepared by the SER describing the structural test and inspection program for the project be submitted with the application for a building permit, and not issue the building permit until he (the building official) has approved the program.

- Where a special SER designs a structural system independent of the project SER, and 780 CMR 1705.0 requires structural tests and inspections for that system, obtain a document describing the program of structural tests and inspections for that system from the special SER. Where the design of the structural system is under the aegis of the construction contractor, and the special SER is unknown when the application for permit is submitted, the submission of said document, and the drawings and specifications for the design itself, at a particular time, should be made a condition of the building permit.

- Review the program for compliance with 780 CMR 1705.0 in some detail and understand what is required by the SER.

- Arrange reporting requirements with the SER and work out a cooperative arrangement with the SER to help the SER perform his work.

- Visit the job site to determine that the structural inspection and testing program is being performed. (He can also require the construction contractor to notify him of certain critical

structural operations so he may be present to observe the structural inspection and testing at that time).

- Act to enforce the requirements of the design when willful non-compliance is reported by the SER, and shut down the job if the construction contractor does not comply.
- Shut down the job if the required structural inspection and testing is not being performed, or if the SER is terminated without a proper replacement.
- Not issue a Certificate of Occupancy until he has received the Final Report of Structural Tests and Inspections from the project SER and all special SER's.

1.5 Owner's Responsibilities

The owner is obligated to provide and pay for the program of structural tests and inspections. He should treat the costs of the program as a necessary expense, not an optional one, and incorporate said costs into the financial planning of the project.

Prior to the 6th edition of the Code, a certain amount of structural tests and inspections were performed on every project, some mandatory, some optional, with the amount of these tests and inspections varying with the structural engineer, the owner, and the project. Although it is expected that there will be additional cost for structural tests and inspections required under 780 CMR 1705.0, it is not certain how much additional project expense the program will require. A major factor in the cost of the program for a specific project is the quality of the construction contractor and his sub-contractors and their ability and willingness to comply with the requirements of the design and contract documents. A well organized construction contractor who has good internal quality control can significantly decrease the time required for tests and inspections and will thus significantly reduce the cost of the program for structural tests and inspections.

BASE recommends that the owner contract directly with the SER for the SER's testing and inspection services, and that contractual arrangements be in accordance with those given in Section 1.8 of these Guidelines.

1.6 Architect's Responsibilities

When the architect negotiates his contract with the owner, he must insure that the owner is fully aware of the State Building Code requirements for structural tests and inspections, and their potential costs. The architect should also alert the owner that (as just stated above) a well organized construction contractor who has good internal quality control and a willingness and ability to comply with the design and contract documents, will significantly decrease the time required for inspections and will thus significantly reduce the cost of the structural test and inspection program. In addition, there is a potential cost benefit from the required structural testing and inspection program. Over time, as contractors realize that the required structural testing and inspection will lead to fewer time delays and expenses required to fix problems "after the fact", construction cost for the structural work may be reduced.

The architect must assign, or provide for others to assign, special SER's for structural systems that will be designed independently of the project SER and for which 780 CMR 1705.0 requires structural tests and inspections. (See Section 1.7).

There is no reason that the program for structural tests and inspections should interfere with the traditional relationship between architect and structural engineer. The SER must still be responsive to his architect client, the same as before. He must process shop drawings in a timely fashion, respond to requests for clarification and for changes, attend job meetings, and resolve problems in the field, as necessary. See Section 1.8 of these Guidelines for recommendations on the design contract between the SER and the architect.

1.7 Construction not Shown on the Structural Drawings or in the Structural Specifications

Items such as interior non-load bearing partitions, guards (guardrails), steel stairs with concrete filled pans, ordinary ceilings, and mechanical equipment supports are not usually shown or specified in the structural drawings or structural specifications, and thus not usually under the aegis of the SER. It is not intended that they be subject to the structural test and inspection requirements of 780 CMR 1705.0, except when their designs are complex and are included in the drawings and specifications of the SER.

Curtain walls are usually shown and specified in the architectural drawings and architectural specifications, however they are subject to structural tests and inspections by 780 CMR 1705.0. Further, curtain walls are usually designed by an engineer under aegis of the construction contractor. Since the SER for the project is not responsible for the design of the curtain walls, he cannot be responsible for the test and inspection program for their installation. There are various ways this dilemma can be handled. The preferred one is for the architect to retain the SER to provide structural design criteria or performance specifications for the curtain wall. In accordance with the requirements of 780 CMR 1705.3, the SER would then be required to review the structural design of the curtain wall (as part of his responsibilities for the testing and inspection program) and to include the curtain wall in the program of testing and inspection. A less practical alternative would be the designation of the structural designer of the curtain wall as a special SER. This special SER would be required to provide the structural testing and inspection program for the curtain wall.

If architectural or mechanical systems have significant structural implications, they can be handled in the same manner as curtain walls, and can be included under “special cases” in the program for structural tests and inspections. Alternatively, the SER can be retained to design them.

1.8 Structural Engineer’s Contractual Relations

The costs of structural tests and inspections must be borne by the owner. BASE recommends that the SER’s contract for these services be directly with the owner. The contractual relationship between the SER and the owner can take two different forms. In the first form, the SER retains and has direct contracts with all outside engineering firms and outside testing and inspection agencies (outside agencies) which he deems necessary to augment his own staff for the testing and inspection program. The owner pays the SER and the SER pays the outside agencies. In the second form, the SER selects these outside agencies but the outside agencies have direct contracts with, and are paid directly by the owner.

For either form of contract, the SER is responsible for directing the testing and inspection program and insuring its success. In the first form, where the SER retains the outside agencies, the SER has direct control over these agencies. In the second form, where the SER only selects the outside agencies, he is still responsible for directing the program, and thus should devise a contract with the owner which will give the SER control over these agencies.

Where the outside agencies have direct contracts with the owner: 1) the SER’s contract with the owner should authorize the SER to act as the owner’s agent in negotiating the owner’s contracts with the outside agencies; and 2) the SER’s contract with the owner and the owner’s contracts with the outside agencies should both require that all bills for services by the outside agencies be sent to the SER for the SER’s approval, and that the SER then forward the approved bills to the owner for payment.

BASE recommends that all testing and inspection contracts be on a time basis or on a measurable "piece" basis, not on a lump sum basis, since the full scope of the program will depend on the construction contractor's organization of the project and quality control.

When negotiating a design services contract with an architect, the SER should come to an agreement with the architect and the owner on what specific construction phase services will be included in the design services contract and on what specific construction phase services will be included in the contract for structural tests and inspections, so that there will be no ambiguity or overlap.

Limiting Liability: BASE recommends that the contract between the SER and the owner contain statements differentiating the Program of Structural Tests and Inspections from the construction contractor's quality control, and contain statements specifying the limitations of the program (see 780 CMR 1705.2 and Subsection R1705.2 in Section 2.0 of these guidelines). BASE also recommends that similar language be written by the SER to be included in either a special section of the construction specifications (under Division 1) or in a special section of the supplementary general conditions of the construction contract. BASE has prepared a standard specification section, included in Section 3.0 of these guidelines, entitled *Program of Structural Tests and Inspections* which can be included in the construction contract specifications.

BASE has prepared sample contract forms for the contract between SER and owner, for the contract between SER and outside agency, and for the contract between owner and outside agency. These forms are included in Section 3.0 of these Guidelines. Contracts between the SER and the outside agencies or between the owner and the outside agencies should require the outside agencies to have professional liability and other liability insurance, with specified coverage and limits, and appropriate indemnification. The topics of insurance and indemnification are further discussed in the instructions for the sample contracts in Section 3.0.

1.9 Limitations to the Guidelines

These Guidelines are not intended to be and should not be interpreted as being a standard of care for the SER. The application of these Guidelines requires professional judgment by the SER on a project by project and system by system basis. The recommendations in these Guidelines do not necessarily represent the only proper procedures or methods for complying with the requirements of 780 CMR 1705, and some of the recommendations may not be applicable to specific projects, structural systems, or structural components.

2.0 STATE BUILDING CODE REQUIREMENTS FOR STRUCTURAL TESTS AND INSPECTIONS WITH COMMENTARY

The sections of the State Building Code which contain the requirements for the program of structural tests and inspections are 780 CMR 1702.0, Definitions, and 780 CMR 1705.0, Requirements for Structural Tests and Inspections. These sections as revised on 9/19/97 are presented below in the left column.

A commentary by BASE is presented in the right column. This commentary contains recommendations for implementation of the Code requirements and explanatory comments opposite the applicable subsections of the Code.

---

780 CMR 1702.0 DEFINITIONS

1702.1 General: The following words and terms shall, for the purposes of 780 CMR 1702.0 and as used elsewhere in 780 CMR, have the meanings shown herein.

*

*

Inspection, structural: Inspection as herein required of the installation, fabrication, erection or placement of components and connections requiring special expertise to ensure adequacy (see 780 CMR 116.0 and 1705.0).

*

*

Structural Engineer of Record (SER): The registered professional engineer whose professional seal of registration and signature appears on the design documents submitted with the building permit application, or the alternate (SER) who succeeds the (SER), as provided in 780 CMR 1705.03.3.

R1702.1: Only the definitions applicable to 780 CMR 1705.0 are presented here.

Structural Engineer of Record (SER): The SER is the professional engineer who is responsible for the structural design of a project, including the development of performance specifications for structural systems and components which are to be designed for the project by other engineers. The SER is not responsible for the design of the means and methods of construction.

In the definition for SER, the term *design documents* should be interpreted to mean *structural design documents*.

Special SER: As used in these Guidelines, a registered professional engineer who designs a specific structural system independent of the project SER (i.e. the design is not performed under the aegis of the project SER or in conformance with a performance specification prepared by him).

780 CMR 1705.0 *REQUIREMENTS FOR STRUCTURAL TESTS AND INSPECTIONS*

1705.1 General: The permit applicant shall provide special inspections where application is made for construction as described in 780 CMR 1705.0.

Exceptions:

1. Structural tests and inspections are not required for building components unless the design involves the practice of professional engineering or

R1705.1: The term special inspections is an error; it should read structural tests and inspections.

The definition of owner in 780 CMR 202.0 includes the owner of a structure, anyone who has care, charge, or custody of a structure, and a lessee of a structure. 780 CMR 110.5 allows the applicant for permit to be the owner or lessee, or an authorized agent of either.

architecture as defined M.G.L. c 112 § 60K and/or M.G.L. c 112 § 81D.
2. Structural tests and inspections are not required for occupancies in use Group R-3.

In these Guidelines, the owner or applicant, as defined above, is referred to generically as the owner.

780 CMR 116.0 requires all structures to be designed by a professional engineer or registered architect, except 1) structures with less than 35,000 cubic feet of volume, 2) one and two family dwellings, 3) buildings used exclusively for farm purposes, and 4) retaining walls less than 10 feet in height.

1705.2 Purpose: The purpose of the structural tests and inspections specified in 780 CMR 1705 is to provide assurance to the owner and the building official that the construction complies with the requirements of the structural design by the SER. These tests and inspections are for quality assurance audits and their implementation does not relieve the contractor or sub-contractors of their responsibility for quality control of the work and any design for which they are responsible.

R1705.2: Implied purposes of the program for structural tests and inspections are to protect the public safety and to assure the SER that the structure is being built in accordance with his design and in accordance with the design of structural components and systems prepared by other engineers in conformance with the SER's performance specifications.

Note that the structural tests and inspections required by 780 CMR 1705 are only for the work designed by the SER. If a structural design is not under the aegis of the SER, he is thus not responsible for, nor can he be made responsible for, the structural tests and inspections for that design. An exception is provided in 780 CMR 1705.3.4 when the SER provides performance specifications for designs to be performed by other engineers.

A special SER must be designated by the owner, architect, or construction contractor, as applicable, for a structural system that is designed independently of the project SER (i.e. not designed under the aegis of the project SER and not in conformance with a performance specification prepared by him). The special SER then takes on all responsibilities assigned to the SER by 780 CMR 1705.0 for the said structural system.

The required structural tests and inspections apply to the project structure(s) being built; they do not apply to any temporary or incidental structure erected under the aegis of the construction contractor in order to build the project structure. The required structural tests and inspections do not apply to means, methods, or procedures of the construction contractor in building the project structure.

1705.3 Program for tests and inspections: The SER shall establish a program of structural tests and inspections which meets the requirements of 780 CMR 17. The SER shall direct the implementation of this program and select any structural inspectors required to undertake the program. All fees and costs related to the implementation of this program shall be borne by the owner.

R1705.3: Structural tests and inspections can be divided into the following three categories: 1) tests and inspections specifically mandated in the State Building Code, 2) tests and inspections required in the standards referenced in the State Building Code, and 3) tests and inspections required by the professional judgment of the SER. All these tests and inspections should be included in the program of structural tests and inspections.

See Section 1.0 of these Guidelines for general recommendations.

1705.3.1 Building permit requirement: The permit applicant shall submit the program of structural tests and inspections prepared by the SER as a condition for permit issuance. This program shall include a complete list of materials and work requiring structural tests and inspections by 780 CMR 1705.1, the inspections to be performed and a list of the individuals, approved agencies and firms intended to be retained for conducting such inspections.

1705.3.2 Report requirement: A final report stating that the program of structural tests and inspections has been satisfactorily completed shall be submitted to the owner and the building official by the SER prior to the issuance of the certificate of occupancy. As construction progresses, inspection reports and records of tests and requirements shall be maintained by the SER. When these records are requested by the building official, they shall be submitted promptly, in accordance with procedures established by the building official prior to the start of construction. When deviations from design requirements are determined during tests or inspections, the SER shall promptly report such to the contractor for correction. If the contractor fails to correct any reported deviation, it shall be reported to the building official by the SER.

R1705.3.2: The SER should not burden the building official with copies of inspection and test reports that are not requested. The SER should meet with the building official to determine what inspection and tests reports the building official desires, and when they should be submitted.

1705.3.3 Alternate SER: If the SER cannot continue with the project, the owner shall retain an alternate qualified registered professional engineer to review the design and assume the full responsibilities of the former SER.

R1705.3.3: This provision ensures a single structural engineering responsibility from design through construction. If the Alternate SER disagrees with any aspect of the original structural design or program of structural tests and inspections, he is obligated to revise that design or program to his satisfaction, since he is assuming the full responsibility for the structural design.

1705.3.4 Performance specifications: The SER shall identify, in the program of structural tests and inspections, submitted with the building permit application, any structural elements or systems that the SER has specified to be designed by another registered professional engineer. The SER shall review the design of these structural elements or systems and shall include them in the program of structural tests and inspections.

R1705.3.4 Performance specifications: A performance specification defines the end result to be achieved by a particular design. In addition, the term "performance specification" may be used to describe a situation in which an engineer specifies certain design criteria to be utilized by others in the development of a design.

Common examples of performance specifications in structural design are those for the precast concrete fabricator's designs of precast/ prestressed components, the post-tensioning supplier's final design of post-tensioning tendons and related reinforcing steel, and the structural steel fabricator’s design of steel connections.

The requirements of this section do not apply to "off-the-shelf" components, such as open web steel joists, which are designed and manufactured in accordance with the reference standards listed in 780 CMR

Appendix A, and which are normally specified by the SER using a standard designation and by reference to the appropriate standard. Thus, the structural design of these components need not be ordinarily reviewed, and the strength and stiffness specified in the reference standard can ordinarily be relied upon, the same as would be done for other structural components such as standard structural steel shapes or sawn wood member. "Off-the-shelf" items are subject to structural tests and inspections, the same as are required for other structural components. (At a minimum, these items should be inspected at the job site for the quality of manufacture and their integration into the work.)

Performance specifications can be used for metal buildings which are designed by the metal building manufacturer, and for the design of curtain walls which are designed by the curtain wall manufacturer, if the SER is specifically retained to provide said performance specifications.

Performance specifications can also be used for particular structural aspects of architectural, mechanical and electrical components and systems which are designed by manufacturers, if the SER is specifically retained to provide said performance specifications.

The SER should list in his contract for structural tests and inspections all designs by others that he needs to review for conformance with his performance specifications, the review of which are not ordinarily included in his design services contract.

1705.3.5 Waiver of structural inspection by the SER: Where, in the opinion of the SER, any portion of the contractor's quality control program meets the inspection and test requirements of 780 CMR 1705, the SER may reduce the specified quality assurance structural inspection and test program following approval by the building official. When this is done, the final inspection report shall also include reference to the results of those inspections performed by the contractor. As construction progresses, reports of inspections and measurements shall be submitted to the SER and, if requested, to the building official.

R1705.3.5: When the owner hires a quality contractor who has a good quality control program, the costs of structural tests and inspections can be reduced, to the benefit of the owner. However, the decision to use these test results in place of or in addition to the SER's own results, is the sole decision of the SER.

1705.4 Inspection of Fabricators: Where fabrication of structural load-bearing members and assemblies is being performed on the premises of a fabricator's shop, structural inspection of the fabricated items shall be required. The fabricated items shall be inspected as required by 780 CMR 1705.0 and as required elsewhere in 780 CMR.

1705.4.1 Fabrication Procedures: The special inspector shall verify that the fabricator maintains detailed fabrication and quality control procedures which provide a basis for inspection control of the workmanship and the fabricator's ability to conform to approved drawings, project specifications and referenced standards. The special inspector shall review the procedures for completeness and adequacy relative to the code requirements for the fabricator's scope of work.

R1705.4.1: The term *special inspector* is an error; it should read *inspector*.

1705.4.2 Procedures implementation: The structural inspector shall verify that the fabricator is properly implementing the fabrication and quality control procedures outlined in 780 CMR 1705.4.1.

R1705.4.2: The term *structural inspections* is an error; it should read *structural tests and inspections*.

Exception: Structural inspections as required by 780 CMR 1705.4 may be reduced by the SER where the fabricator maintains an agreement with an approved independent inspection or quality control agency to conduct periodic in-plant inspections at the fabricator's plant, at a frequency that will assure the fabricator's conformance to the requirements of the inspection agency's approved quality control program.

The term *approved* means approved by the building official, the Board of Building Regulations and Standards (BBRS), or the Construction Materials Safety Board. Independent inspectors or quality control agencies that are part of a fabricator's certification or quality control program need to be approved by one of the above.

1705.5 Steel Construction: The structural inspections for steel elements of buildings and structure shall be as required by 780 CMR 1705.5.1 through 1705.5.3.

R1705.5: The term *structural inspections* is an error; it should read *structural tests and inspections*.

1705.5.1 Inspection of Fabricators: The permit applicant shall provide structural inspection of steel fabricated items in accordance with the provisions of 780 CMR 1705.2.

R1705.5.1 In the case of the exception, the SER should review the Fabricator's detailed procedures for material control.

The reference to 780 CMR 1705.2 is an error. It should read 780 CMR 1705.4.

Exception: Structural inspection of the steel fabrication process shall not be required where the fabricator does not perform any welding, thermal cutting or heating operation of any kind as part of the fabrication process. In such cases, the fabricator shall be required to submit a detailed procedure for material control which demonstrates the fabricator's ability to maintain suitable records and procedures such that, at any time during the fabrication process, the material specification, grade and mill test reports for the main stress-carrying elements and bolts are capable of being determined.

Even if the fabricator meets the requirements of this exception, the SER should verify that the specified installation procedures for high-strength bolts in steel connections are being followed, including preparation of faying surfaces.

1705.5.2 Material Receiving: All main stress-carrying elements, welding material and bolting material shall be inspected for conformance to Table 1705.5.2.

R1705.5.2: In the first column of Table 1705.5.2, *Weld filter materials* should read *Weld filler materials*.

Table 1705.5.2
INSPECTION FOR STEEL MATERIALS

Materials	Inspection Required	Reference for Criteria
Bolts, nuts, washers	1. Material identification markings. 2.Conformance to ASTM standards specified by the design engineer. Manufacturer's certificate of compliance is required	Applicable ASTM material specifications; AISC, ASD, Section A3.4; AISC LRFD, Section A3.3.
Structural Steel	1. Material identification markings 2. Conformance to ASTM standards specified in the approved plans and specifications	ASTM A6 or ASTM A568. Provide certified test reports in accordance with ASTM A66 or ASTM A568.
Weld filter materials	1. Conformance to WAS specifications as specified in the approved plans and specifications. Manufacturer's certificate of compliance is required	AISC ASD, Section A3.6; AISC LRFD, Section A3.5.

Note a. The specific standards referenced are those listed in Appendix A.

1705.5.3 Erection: Structural inspections are required for bolts, welding and details as specified in 780 CMR 1705.5.3.1 through 1705.5.3.3.

R1705.5.3: Structural tests and inspections are required of all steel structures during erection to assure conformance to contract documents and shop drawings approved by the SER.

1705.5.3.1 Installation of High-Strength Bolts: Inspection shall be as specified in Section 9 of the RCSC Specification for Structural Joints Using A325 or A490 Bolts listed in Appendix A.

1705.5.3.2 Welding: Weld inspection shall be in compliance with Section 6 of WAS D1.1 listed in Appendix A. Welds inspectors shall be certified in accordance with WAS D1.1 listed in Appendix A.

1705.5.3.2.1 Welding of the Structural Seismic-Resisting System: Welding of the structural seismic-resisting system of buildings, shall be inspected in accordance with 780 CMR 1705.3.2.2 and 1705.5.3.2.3. Each complete penetration groove weld in joints and splices shall be tested for the full length of the weld either by ultrasonic testing or by other approved methods, for special moment frames and eccentrically braced frames.

Exception: The nondestructive testing rate for welds made by an individual welder is permitted to be reduced to 25% of the welds, with the approval of the SER, provided the weld inspection reject rate is 5% or less.

R1705.5.3.2.1: For beam-to-column moment connections and other critical connections using full penetration welds, 780 CMR 2203.2 requires special welding procedures including backing bar removal, backgouging, and installation of reinforcing fillets. These requirements apply to all steel structures in Massachusetts, whether or not seismic forces govern the design for lateral loads. Inspectors should check for certification of the welder(s) as well as for use and proper storage of approved electrodes.

1705.5.3.2.2 Column splice welds: Column splice welds, which are partial penetration groove welds, shall be tested by ultrasonic testing or other approved methods at a percentage rate established by SER. All partial penetration column splice welds designed for axial or flexural tension from seismic forces shall be tested.

1705.5.3.2.3 Base metal testing: Base metal having a thickness more than 1.5 inches (38mm) and subject to through-thickness weld shrinkage strains shall be ultrasonically tested for discontinuities behind and adjacent to the welds after joint welding. Any material discontinuities shall be evaluated based on criteria established in the construction documents by the SER.

1705.5.3.3 Details: The structural inspector shall perform an inspection of the steel frame to verify compliance with the details shown on the approved construction documents, such as bracing, stiffening, member locations and proper application of joint details at each connection.

R1705.5.3.3: The term *approved construction documents* means the documents necessary for obtaining a building permit which have been approved by the building official (780 CMR 109.1 and 202.0). The approved construction documents do not ordinarily include all of the contract documents.

Structural details not shown on the approved construction documents should conform with those shown on shop drawings approved by the SER or addenda issued by the SER.

1705.6 Concrete construction: The structural inspections for concrete structures and concreting operations shall be as required by 780 CMR 1705.6.1 through 1705.6.6.

Exception: Structural Inspections shall not be required for:
1. Concrete footings of buildings three stories or less in height which are fully supported on earth or rock.
2. Nonstructural concrete slabs supported directly on the ground, including prestressed slabs on grade, where the effective prestress in the concrete is less than 150 psi (0.11 kg/mm^2).
3. Plain concrete foundation walls constructed in accordance with Table 1812.3.2.
4. Concrete patios, driveways and sidewalks, on grade.

R1705.6: See 780 CMR R1 and 780 CMR R2 for requirements for concrete testing laboratory licensing and for concrete testing personnel licensing, respectively.

The SER should require tests and inspections of excepted components when he deems it is of critical importance. Note: the exceptions apply only to inspections, not tests.

1705.6.1 Materials: In the absence of sufficient data or documentation providing evidence of conformance to quality standards for materials in Chapter 3 of ACI 318 listed in Appendix A the code official shall require testing of materials in accordance with the appropriate standards for criteria for the material in Chapter 3 of ACI 318 listed in Appendix A. Weldability of reinforcements that conforms to ASTM A706 listed in Appendix A shall be determined in accordance with the requirements of 780 CMR 1906.5.2.

R1705.6.1 Materials: The inspector should review sufficient data or documentation providing evidence of conformance to quality standards for materials in Chapter 3 of ACI 318-95. The inspection should also assure that the materials used meet the product specifications of the Contract Documents.

Test results which have been obtained as part of the Contractor's own Quality Control program may be used in part or in their entirety by the SER, in accordance with 780 CMR 1705.3.5.

1705.6.2 Installation of reinforcing and prestressing steel: The location and installation details of reinforcing and prestressing steel shall be inspected for compliance with the approved construction documents and ACI 318 (such as Section 7.4, 7.5, 7.6 and 7.7) listed in Appendix A. Welding of reinforcing of the structural seismic-resisting system shall be inspected.

R1705.6.2 Installation of reinforcing and prestressing steel: The term *approved construction documents* means the documents necessary for obtaining a building permit which have been approved by the building official (780 CMR 109.1 and 202.0). The approved construction documents do not ordinarily include all of the contract documents.

The applicable details of reinforcing and prestressing steel which are required in ACI 318 are ordinarily shown, specified, or referenced in the structural drawings and specifications.

The inspector should review a sufficient percentage of the reinforcing and prestressing steel installation to assure that the proper material has been installed, that the proper quantity has been placed and that the proper locations and coverage have been maintained.

An inspector who is thoroughly familiar with the particular design is best suited for this work. The reinforcement shop drawings being used by the contractor should be reviewed on site to assure that they are in conformance with the shop drawings approved by the SER. Mill tags attached to steel bundles should be reviewed to assure that the proper grade of reinforcing steel is being used. The effects of cast-in items such as waterstops and steel embedments should be reviewed for their effect on the reinforcement.

1705.6.3 Concrete operations: During placing and curing of concrete, the special inspections listed in Table 1705.6.3 shall be performed.

R1705.6.3 Concrete operations: 780 CMR R1 and 780 CMR R2 give rules and regulations governing the licensing of concrete testing laboratories and concrete testing personnel.

Table 1705.6.3
REQUIRED INSPECTIONS DURING CONCRETING OPERATIONS

Required Inspection	Reference for Criteria
1. Evaluation of concrete strength, except as exempted by 780 CMR 1908.3.1 (3).	1. ACI 318 Section 5.6.
2. Inspection for use of proper mix proportions and proper mix techniques.	2. ACI 318 Chapter 4, Sections 5.2, 5.3, 5.4 and 5.8.
3. Inspection during concrete placement, for proper application techniques.	3. ACI 318 Sections 5.9 and 5.10.
4. Inspection for maintenance of specified curing temperatures and techniques.	4. ACI 318 Section 5.11, 5.12 and 5.13.

Note a. ACI 318 listed in Appendix A

COMMENTS ON TABLE 1705.6.3:

Evaluation of Concrete Strength: The inspector should ensure that an adequate number of cylinders are prepared as determined by the Contract Documents and by ACI 318-95, Section 5.6. It is important to follow the field curing criteria for cylinders in accordance with ASTM C31; failure to do so could result in low cylinder strengths. Proper handling and transportation of cylinders to the designated testing laboratory is also important to prevent damage which may also result in low cylinder strengths.

Mix Proportions and Mix Techniques: Table 1705.6.3 has two errors in the "Reference" column. It should read; "Chapter 5, Sections 5.2, 5.3, 5.4 and 5.8." The mix design and mix proportions should be reviewed

for all classes of concrete used on the project to assure that the mix meets the requirements of both the Contract Documents and ACI 318-95. The addition of water or admixtures on site, if permitted, should be in accordance with procedures acceptable to the SER. The on-site addition of water to redi-mix trucks should be monitored closely to assure that the maximum allowable water amount is not exceeded. Site added admixtures should also be monitored to assure that they are in conformance with the Contract Documents and ACI 318-95.

Concrete Placements: Conveying and depositing of concrete during placement should be inspected to assure compliance with the Contract Documents and with ACI 318-95. Proper consolidation techniques should be monitored to assure that honeycombing, cold joints and other associated deficiencies do not occur. Free fall heights of concrete should also be monitored to assure that segregation does not occur.

Curing: Curing, including hot weather and cold weather conditions, should be monitored in accordance with the Contract Documents and with ACI 318-95. The Contractor's proposed method(s) of curing should be reviewed before actual curing operations begin. It is critical that curing operations begin immediately after concrete has set-up and that curing be maintained for the required duration. Particular attention should be paid to continued curing of formed concrete after form removal. The continued presence of water (in moist curing operations) should be assured for the entire cure period.

1705.6.4 Inspection during prestressing: Inspection during the application of prestressing forces shall be performed to determine compliance with Section 18.18 of ACI 318 listed in Appendix A.

.

1705.6.4.1 Inspection during grouting: Inspection during the grouting of bonded prestressing tendons in the structural seismic-resisting system shall be performed.

1705.6.5 Manufacturing of precast concrete: The manufacture of precast concrete, as required by 780 CMR 1705.4, shall be subject to a quality control program administered by an approved agency.

R1705.6.5 Manufacturing of precast concrete: See responsibilities of the SER for inspections of fabricators in 780 CMR 1705.4. See R1705.4.2 for commentary on *approved agency*.

1705.6.6 Erection of precast concrete: Erection of precast concrete shall be inspected for compliance with the approved plans and erection drawings.

1705.7 Masonry construction: The structural inspections listed in Table 1705.7 shall be required for masonry construction.

Table 1705.7
SPECIAL INSPECTIONS FOR MASONRY CONSTRUCTION

Inspection or Test	Referenced[a] Criteria	
	ACI 530/ ASCE 5/ TMS 402	ACUI 530.1 ASCE 6/ TMS 602
1. Material		Sec. 2.2
2. Masonry Strength		Sec. 1.6
3. Construction operations:		Sec 2.3.2.5
a. Proportioning, mixing consistency of mortar and grout.		Sec 4.2.2
b. Application of mortar grout and masonry units.		Sec 2.3.3.3 Sec 4.3.3
c. Condition, size, location and spacing of reinforcement.	Chapter 8	
d. Protection of masonry during cold weather (temp. below 40°) or hot weather (temp. above 100°)		Sec 2.3.2.2 Sec 2.3.2.3
e. Anchorage	Sec 4.2 Sec 5.14	
4. Inspection of welding of reinforcement, grouting, consolidation and reconsolidation for buildings assigned to Seismic Performance Category C or D in accordance with 780 CMR 1612.2.7.	Note b.	Note b.

Note a. The specific standards referenced are those listed in Appendix A.
Note b. Referenced criteria not applicable.

1705.8 Wood Construction: Structural inspections of the fabrication process of wood structural elements and assemblies shall be in accordance with 780 CMR 1705.4. Structural inspection is required for nailing, bolting, structural gluing or other fastening of the structural seismic-resisting system.

R1705.7: The term *structural inspections* is an error; it should read *structural tests and inspections*.

COMMENTS ON TABLE 1705.7:
The term *Special Inspections* in the title is an error; it should read *Structural Tests and Inspections*.

ACUI in the third column heading should read *ACI*.

Masonry units should be verified for conformance with the specifications prior to their installation in the work. Approved material literature and samples for all types of reinforcing and ties required for the project should be on site for verification and comparison to actual components used for construction. Materials requiring inspection include masonry units, mortar, grout, metal reinforcement and accessories, prefabricated elements, movement joints, and joint fillers.

When the prism test method is used, samples for laboratory testing should be made and inspected in the field. When the unit strength method is used, material submittals should be reviewed to verify conformance with the contract documents.

The reinforcement should be inspected and approved before grouting operations begin. Prior to grouting, check that the cells are free and clear of debris and that the reinforcing steel is secured in place. Maximum lift heights should be checked as well as the methods of vibration of grout between lifts.

Protection of masonry during cold or hot temperatures should be inspected. In cold weather, ensure that methods of heating and covering masonry are followed in accordance with specifications. In hot weather, methods should be reviewed to ensure masonry is protected from improper curing.

Anchorage of the masonry and spacing of ties as required should be checked. Connections between masonry walls and other structural members, particularly at floor and roof levels, should be inspected for conformance with the Contract Documents.

R1705.8: If prefabricated wood members and assemblies are used for the project, the inspector should perform fabrication inspections as described in 780 CMR Sect. 1705.4. This would apply in particular to wood trusses or laminated elements such as glulam or joint assemblies. Quality control certification programs such as those by APA-EWS or AITC may be considered for the Exception under 780 CMR 1705.4.2.

Connections should be inspected in the seismic load-resisting system to verify conformance with the contract documents. Particular attention should be given to inspection of nailing of sheathing in shear walls and horizontal diaphragms, hold downs at ends of shear walls, and sill bolting.

1705.* In-Situ Bearing Strata for Footings: (This section is not part of 780 CMR 1705.0; the title is placed here for convenience).

R1705.*: Requirements for in-situ bearing strata for footings were inadvertently omitted from 780 CMR 1705.0; however BASE recommends that it be part of the program of structural tests and inspections.

The bearing surfaces of footings should be observed to confirm that the bearing strata is that specified by the contract documents, that the density of the bearing strata is suitable for the assumed or specified design bearing strength, and that the bearing surfaces are prepared as specified. For thin bearing strata underlain with less suitable soil, the thickness of the strata at each footing location should be verified by auguring or by other suitable methods.

If footings are to be placed on rock, the soundness of the rock should be verified to determine if the rock is suitable for the assumed or specified design bearing strength, and the slope and shape of the bearing surfaces should be observed to determine if they are as specified. If cushion pads are used between footings and rock, the thickness of the pads and the cushioning material should be observed to determine if they are as specified.

If foundations are anchored to rock, the installation of the anchors and the testing of the anchors should be observed for conformance with the contract documents.

1705.9 Prepared Fill: The structural inspections for prepared fill shall be as required by 780 CMR 1705.9.1 through 1705.9.3. The approved report, required by 780 CMR 1804.1, shall be used to determine compliance.

R1705.9 (Controlled structural fill): In these Guidelines, the term prepared fill is referred to by the more common term: controlled structural fill.

The requirements of this section apply to fill designed to support the gravity load of structures, to slabs on grade, and to backfill of foundations and retaining walls.

780 CMR 1705.9 and its subsections refer to the approved report required by 780 CMR 1804.1. Said report is required to be prepared by a registered design professional and to describe the load bearing strata of the foundations (in this case, the controlled structural fill). The report must be submitted with the construction documents and the application for permit, for the approval of the Building Official. Since the report is required to be used as the basis of compliance, it should refer to the project specifications for detailed requirements for the controlled structural fill.

There are additional inspection requirements in 780 CMR 1804.3.3 for controlled structural fill designed to support the gravity load of structures.

The characteristics of the fill material should be checked for conformance with the specifications. Tests should be made to determine optimum moisture content.

1705.9.1 Site preparation: Prior to placement of the prepared fill, the structural inspector shall determine that the site has been prepared in accordance with the approved report.

R1705.9.1: The nature and condition of the subgrade should be checked before compaction procedures begin. If unsuitable soil is discovered, it should be removed and replaced.

1705.9.2 During fill placement: During the placement and compaction of the fill material, the structural inspector shall determine that the material used and the maximum lift thickness comply with the approved report.

R1705.9.2: Compaction procedures should be observed, and they should be correlated with field tests for density. If the contractor changes his procedures, a new correlation needs to be established.

1705.9.3 Evaluation of in-place density: The structural inspector shall determine, at the approved frequency, that the in-place dry density of the compacted fill complies with the approved report.

1705.10 Pile foundations: Structural inspections of pile foundations are required as provided for in 780 CMR 1816.13.

R1705.10: 780 CMR 1816.14 contains requirements for identification of piling materials. 780 CMR 1820.2.7 and 1820.6.7 contain additional inspection requirements for augured uncased piles and for small diameter grouted piles, respectively. 780 CMR 1817.3.3 provides a criteria for load testing of jacked piles during their installation.

780 CMR 1816.13 requires a qualified registered design professional to perform pile inspection. This registered design professional is selected by the SER in accordance with 780 CMR 1705.3. Said registered design professional or his representative must be present at all times during the driving of piles.

1705.11 Pier foundations: Structural inspection is required for pier foundations.

R1705.11: 780 CMR 1815.11 contains requirements for inspection of pier foundations. 780 CMR 1815.11 requires a qualified registered design professional to perform pier inspection. This registered design professional is selected by the SER in accordance with 780 CMR 1705.3. Said registered design professional or his representative must be present at all times during the installation of the piers.

The required depth of piers, the bearing strata, and the condition of the bearing strata should be verified after excavation. For thin bearing strata over weaker strata, the minimum design depth of the strata below the bearing surface should be verified by auguring. The required diameter of both the shaft and bell of piers should be verified. Placement of reinforcing steel and concrete should be inspected.

1705.12 Wall panels and veneers: Structural inspection is required for exterior wall panels and their attachment to the building structure.

R1705.12 (Curtain walls): In these Guidelines, wall panels, veneers, structural members supporting them, and their attachment to the building structure are referred to by the common and inclusive term: curtain walls.

Structural systems, components, and connections for factory fabricated and site fabricated wall panels, veneers, and curtain wall assemblies should be inspected for conformance with the contract documents. This includes load resisting elements in curtain walls such as commonly used "non-structural" items such as sealants, adhesives, mortars, plastics, and glass, as well as common structural materials such as structural steel, aluminum, reinforced concrete, and reinforced masonry.

1705.13 Light gauge metal framing: Structural inspection is required for light gauge metal framing systems for roofs, floors and load bearing walls and for light gauge metal framing in exterior curtain walls that have a story height greater than ten feet.

R1705.13: BASE recommends that the exclusion for curtain walls 10 feet or less in height be ignored, and that light gage metal framing for curtain walls of all heights be considered as part of 780 CMR 1705.12. Framing for exterior curtain walls of ten feet or less in height is not necessarily safer than higher walls.

The structural inspection for light gauge metal framing should be similar to inspections for structural steel including review of the material for compliance with the specifications, and inspecting erection and installation of the structural members and their connections. Erection and installation of structural members should be inspected to verify that type, size, quantity, location, and connections in plan and elevation are in conformance with the contract documents and approved shop drawings. Visual examination of all welds should be performed. Fastener (self-drilling screws, bolts, PAF's, etc.) installations should be observed to determine if the installation procedures and the installation of the fasteners are in accordance with manufacturer's installation requirements approved by the SER. Prefabricated assemblies, like roof trusses, should be inspected according to 780 CMR 1705.4.

1705.14 Special Cases: Structural inspections shall be required for proposed work which is, in the opinion of the code official, unusual in its nature, such as:

1. Construction of materials and systems which are alternatives to materials and systems prescribed by 780 CMR.
2. Unusual design applications of materials described in 780 CMR.
3. Materials and systems required to be installed in accordance with additional manufacturer's instructions that prescribe requirements not contained in 780 CMR or in standards referenced by 780 CMR.

R1705.14: The SER should also use the Special Cases classification to specify necessary structural tests and inspections for structural elements or systems which are not classified under 780 CMR 1705.0. Examples are:

- Underpinning. The design of underpinning may be performed by an underpinning contractor in accordance with a performance specification developed by the SER, in which case, the SER would review the design and include the underpinning in the program of structural tests and inspections. (See 780 CMR 1705.3.4 and R1705.3.4.)

- Metal buildings. Although the components of metal buildings could be distributed to the various construction categories, such as structural steel and light gage metal framing, it may be more efficient to deal with metal buildings under *Special Cases*.

- Passive seismic damper system, which is also an example of a system requiring additional manufacturer's instructions for installation. Normally, the SER would specify that the additional manufacturer's instructions for installation be followed, and would incorporate the inspection of the installation into the program for structural tests and inspections.

Structural tests and inspections of aluminum structural members and systems are not required by 780 CMR 1705. However, BASE recommends that structural aluminum shown on the SER's structural drawings or specified in the SER's specifications be included in the program of structural tests and inspections under the category, *Special Cases*.

Examples of unusual design applications are structurally complex architectural or mechanical systems, or their supports. The structural design of these components may not be under the aegis of the SER or in conformance with a performance specification prepared by him. In such cases, special SER's, appointed by the owner, architect, or contractor, as applicable, must be responsible for their respective structural designs and the respective program of structural tests and inspections.

3.0 RECOMMENDED FORMS

BASE recommends that SER's use standard forms when specifying the Program of Structural Tests and Inspections that will be submitted with the application for a building permit, and when writing contracts for services with the owner, other engineering firms, or with testing and inspection agencies. The following listed forms are recommended by BASE and are included in this section of the Guidelines.

1. Program of Structural Tests and Inspections.[1]
   - Instructions.
   - Forms (to be submitted to the building official with the application for building permit).
2. Final Report of Structural Tests and Inspections[1] (to be submitted by the SER to the building official and to the owner).
3. Standard Construction Specification Section for Program of Structural Tests and Inspections.
   - Instructions.
   - Section 01---: Structural Tests and Inspections.
4. Sample Contracts.
   - Instructions.
   - Owner - SER Contract (where Owner contracts with Inspection Agencies).
   - Owner - SER Contract (where SER is responsible for testing and inspection services).
   - Owner-Inspection Agency Contract.
   - SER-Inspection Agency Contract.

[1] Portions of these forms are adapted with permission from Connecticut Engineers in Private Practice, Structural Engineers Coalition, Form 101 - Statement of Special Inspections, Copyright 1993.

Program of Structural Tests and Inspections

INSTRUCTIONS

1. The form *Program for Structural Tests and Inspections* has two parts: 1) the front two pages which summarize what will be tested and inspected, and who will be doing the tests and inspections; and 2) the pages following the first two, which list the details of the required tests and inspections, with an individual page for each construction category.

2. Each firm, agency, or individual, who is selected by the Structural Engineer of Record (SER) to perform tests and inspections should be listed as an agent on page 1, together with an appropriate abbreviation identifying said agent.

3. The category listing on page 2 encompasses all the construction categories listed in Section 1.1 of these Guidelines. Check all that apply to the specific program of structural tests and inspections. Do not check curtain walls unless they have been designed by the SER, or will be designed by other engineers in accordance with a performance specification prepared by the SER.

4. Following the category listing is a listing of all items which are specified by the SER on a performance basis. Add items to the listing, as applicable. Check all that apply.

5. At the end of the form, list items or systems that are to be excluded from the Program of Structural Tests and Inspections required by the Code. The exclusions apply when the SER has not been retained to design an item or system or has not been retained to provide a performance specification for an item or system.

6. The tests and inspections listed under each category of construction have been given in as much detail as is feasible. The SER should delete all the items that do not apply, add items as he sees fit, and edit the other listed items to suit the project. The abbreviation for the agent who will be performing the tests or inspections should be given for each item on the final listing.

7. There are three levels of structural tests and inspections: 1) those specifically mandated in the State Building Code, 2) those which are required by standards referenced by the State Building Code, and 3) those required by the professional judgment of the SER. All three levels of structural tests and inspections should be included under each category of construction.

8. The user may find it convenient to develop his own form for the Program of Structural Tests and Inspections, to suit his own practice. However, the basic features of the BASE form should be included. Electronic copies of this form are available from BASE.

Boston Association of Structural Engineers

Program of Structural Tests and Inspections

For compliance with the 6th Edition of the Massachusetts State Building Code

Project: _____

Location: _____

Owner: _____

Owner's Address: _____

Architect of Record: _____

Structural Engineer of Record (SER): _____

This program of structural tests and inspections is submitted as a condition for issuance of the building permit in accordance with 780 CMR 1705.0 of the 6th edition of the Massachusetts State Building Code.

The following firms, agencies, or individuals (hereinafter referred to collectively as *agents*) will perform the tests and inspections under the direction of the SER:

Abbreviation	Agent
SER	Structural Engineer of Record listed above
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

The abbreviations will be used on the attached pages to identify which agent is performing the particular tests or inspections.

The following categories of structural tests and inspections, if checked, are included in the program for structural tests and inspections for this project. The specific tests and inspections required for each checked category are listed on the page noted opposite the category.

Category	Page	Category	Page
☐ Steel Construction	____	☐ In-situ bearing strata for footings	_____
☐ Cast-in-place concrete construction	____	☐ Pile foundations	_____
☐ Precast concrete construction	____	☐ Pier foundations	_____
☐ Masonry construction	____	☐ Curtain Walls (wall panels and veneers)	_____
☐ Wood construction	____	☐ Light gage metal framing	_____
☐ Controlled structural fill (prepared fill)	____	☐ Special cases	_____

The following items of construction, if checked, are specified in the structural plans or specifications on a performance basis. In accordance with 780 CMR 1705.3.4. their structural design will be reviewed by the SER and their construction is included in the program for tests and inspections on the attached sheets:

☐ Curtain Walls	☐ Metal Buildings
☐ Precast concrete components	☐ _____
☐ Post-tensioning steel	☐ _____
☐ Structural steel connections	☐ _____

The following items are excluded from this program of structural tests and inspections, since they are designed by other structural engineers not under the aegis of the SER and the SER was not retained to provide performance specifications for their design. These other structural engineers must be assigned by the owner, architect, or construction contractor, as applicable, to be special SER's for their respective designs and to provide a program of structural tests and inspections for their respective designs.

_____

_____

Prepared by the Structural Engineer of Record:

Name:_____
Please type or print

Signature:_____

Firm:_____

Date:_____ Registration Seal

Schedule of Structural Tests and Inspections Page _____ of _____

Project: _____

Steel Construction

Item	Agent	Scope
1. Fabricator Certification/ Quality Control Procedures.		Review each Fabricator's quality control procedures.
2. Fabricator Inspection. (1705.4.2 and R1705.4.2)		Inspect in-plant fabrication, or review Fabricator's approved Independent Inspection Agency's reports.
3. Material Certification.		Review for conformance to the specifications.
4. Bolting.		Test and inspect bolted connections in accordance with specifications. Verify bolt size and grade.
5. Welding.		Check welder qualifications. Visually inspect fillet welds and test full-penetration field welds in accordance with specifications.
6. Shear Connectors.		Inspect for size and placement. Test for proper weld attachment.
7. Structural framing, Details and Assemblies.		Inspect for size, grade of steel, camber, installation and connection details. Check against approved construction documents and shop drawings.
8. Open Web Steel Joists.		Inspect for size, placement, bridging, bearing and connection to structure. Visually inspect all welds of a minimum of 5% of the joists, randomly selected.
9. Metal Decking.		Verify gage, width, and type. Inspect placement, laps, welds, sidelap attachment and screws or other mechanical fasteners. Check welder qualifications.
10. Other.		
11.		

Schedule of Structural Tests and Inspections Page _____ of _____

Project: _____

Cast-in-Place Concrete Construction

Item	Agent	Scope
1. Mix Design.		Review mix designs.
2. Materials Certification		Review for conformance to specifications.
3. Batching Plant		Review Plant quality control procedures and batching and mixing methods.
4. Reinforcement Installation		Inspect reinforcing for size, quantity, condition and placement.
5. Post-Tensioning Operations. (1705.6.4)		Inspect tensioning and anchorage of tendons. Inspect grouting of bonded tendons.
6. Formwork Geometry		Inspect form sizes.
7. Concrete Placement		Observe concrete placement operations. Verify conformance to specifications including cold-weather and hot-weather placement procedures. Perform slump, density and air content tests at point of discharge.
8. Evaluation of Concrete Strength		Test and evaluate in accordance with the specifications.
9. Curing and Protection		Observe procedures for conformance to the specifications.
10. Other		
11.		

Schedule of Structural Tests and Inspections Page _____ of _____

Project: _____

Precast Concrete Construction

Item	Agent	Scope
1. Plant Certification/Quality Control Procedures. (1705.6.5)		Review Plant quality control procedures. Inspect plant storage and handling procedures. Confirm that approved submittals are in the plant and are being used for fabrication. Review welder's certifications. Monitor finished product for structural defects (cracks).
2. Material Certification. (1705.6.1)		Review for conformance to ACI 318, Chapter 3.
3. Formwork Geometry.		Inspect form sizes.
4. Reinforcement Installation. (1705.6.2)		Inspect reinforcing and prestressing strands for size, quantity, condition and placement for conformance with Contract Documents, SER approved submittals, and ACI 318, Sections 7.4, 7.5, 7.6 and 7.7. Inspect welding.
5. Mix Design. (1705.6.3)		Review for conformance to ACI 318 and Contract Documents. Inspect for proper mix proportions and mix technique per ACI 318 Chapter 4 and Sections 5.2, 5.3, 5.4 and 5.8.
6. Concrete Placement. (1705.6.3)		Inspect concrete placement procedures for conformance to ACI 318, Sections 5.9 and 5.10, and Contract Documents.
7. Curing and Protection. (1705.6.3)		Inspect for maintenance of specified curing temperatures and techniques per ACI 318 Sections 5.11, 5.12 and 5.13, and Contract Documents.
8. Evaluation of Concrete Strength. (1705.6.3 and 1908.3.1)		Test for conformance to specifications in accordance with ACI 318, Section 5.6, and 780 CMR, Paragraph 1908.3.1.
9. Prestress Operation. (1705.6.4)		Inspect application of prestressing forces per ACI 318, Section 18.18. Inspect grouting of bonded, post-tensioned, prestressing tendons.
10. Assembled/Erected Precast Elements. (1705.6.6)		Inspect for compliance with SER approved submittals and Contract Documents. Review site storage and handling procedures for consistency with design of precast elements. Verify that SER approved erection drawings are on site and are being used for erection. Verify that SER approved erection procedures are being followed. Observe grouting for all bonded, post-tensioned, pre-stressing tendons. Review welder's certifications.
11. Connections/Embedded Items.		Inspect interface connections including end and edge doweling. Inspect embedments for proper location. Inspect shimming, bearing, bolting and welding of connections.
12. Other		
13.		

Schedule of Structural Tests and Inspections Page _____ of _____

Project: _____

Masonry Construction

Item	Agent	Scope
1. Material Certification		Review for conformance to specifications.
2. Evaluation of Masonry Strength		Verify strength in accordance with the specifications.
3. Proportioning, Mixing and Consistency of Mortar and Grout		Inspect field-mixing procedures for conformance to the specifications.
4. Installation of Masonry		Inspect placement for conformance to the specifications.
5. Reinforcement Installation		Inspect reinforcing steel for size, quantity, condition and placement for conformance to SER approved submittals and Contract Documents. Inspect welding of reinforcement and review welder's certifications.
6. Grouting Operations		Inspect grouting procedures for conformance with the specifications. Inspect cells prior to grouting.
7. Weather Protection		Inspect protection for cold and hot weather for conformance with the specifications.
8. Anchorage		Inspect anchorage of masonry to other construction for conformance to the Contract Documents.
9. Other		
10.		

Schedule of Structural Tests and Inspections Page _____ of _____

Project: _____

Wood Construction

Item	Agent	Scope
1. Fabricator Certification/ Quality Control Procedures for prefabricated wood components.		Review Fabricator's quality control procedures.
2. Material Grading.		Inspect Lumber for conformance to the Contract Documents. Check moisture content.
3. Framing, Details and Connections.		Inspect members for size, placement and connection details. Inspect blocking between floors and at posts. Verify connection hardware and its installation. Inspect bearing, nailing and completed connections for conformance to the SER approved submittals and Contract Documents.
4. Shear Walls and Diaphragms.		Inspect thickness and grade of plywood, blocking, hold-down anchors and the edge and field nailing of the plywood to the framing for conformance to the SER approved submittals and Contract Documents.
5. Wood Trusses.		Inspect size and location of nail plates, split rings, bolts, or other connection devices for conformance to SER approved submittals and the Contract Documents. Verify that nails, bolts, hold-down anchors or clips or other devices are tight and otherwise properly installed.
6. Laminated Lumber.		Inspect nailing, end bearing and end attachment for conformance to SER approved submittals and the Contract Documents.
7. Other		
8.		

Schedule of Structural Tests and Inspections Page _____ of _____

Project: _____

In-Situ Bearing Strata for Footings

Item	Agent	Scope
1. Bearing strata for footings		Inspect strata for conformance to the structural drawings, specifications, and/or geotechnical report.
2. Bearing surfaces of footings		Inspect bearing surfaces for conformance to the requirements of the structural drawings, specifications, and/or geotechnical report.
3. Other		
4.		

Schedule of Structural Tests and Inspections Page _____ of _____

Project: _____

Controlled Structural Fill (Prepared Fill)

Item	Agent	Scope
1. Fill Material		Test material for conformance to specifications or geotechnical report. Perform laboratory compaction tests in accordance with the specifications to determine optimum water content and maximum dry density.
2. Installation of controlled structural fill (780 CMR 1705.9.1 and .2)		Provide full-time inspection of the installation, in accordance with the specifications and 780 CMR 1705.9.1 and .2.
3. Density of fill (780 CMR 1705.9.3)		Perform field density tests of the in-place fill in accordance with the specifications and 780 CMR 1705.9.3.
4. Other		
5.		

Schedule of Structural Tests and Inspections Page _____ of _____

Project: _____

Pile Foundations

Item	Agent	Scope
1. Pile material (780 CMR 1816.14)		Inspect documents identifying pile material and certifying grade of material for conformance to the Contract Documents, and that the identification is maintained from the point of manufacture to the point of delivery to the site.
2. Pile material tests (780 CMR 1816.14		If Item 1 is unsatisfactory, test material for conformance to the Contract Documents.
3. Precast concrete piles.		Perform structural tests and inspections as listed under category *Precast Concrete Construction.*
4. Pile installation (780 CMR 1816.13)		Perform full time inspection of installation. Maintain accurate records for each pile as required in 780 CMR 1816.13. Record final location of each pile in plan.
5. Cast-in-place concrete and reinforcing steel components of piles.		Perform structural tests and inspections as listed under category *Cast-in-Place Concrete Construction.*
6. Other		
7.		

Schedule of Structural Tests and Inspections Page _____ of _____

Project: _____

Pier Foundations

Item	Agent	Scope
1. Load-bearing steel components.		Inspect documents identifying material and certifying grade of material for conformance to the Contract Documents, and that the identification is maintained from the point of manufacture to the point of delivery to the site.
2. Cast-in-place concrete and reinforcing steel components of piles.		Perform structural tests and inspections as listed under category *Cast-in-Place Concrete Construction.*
3. Pier installation (780 CMR 1815.11).		Perform full time inspection of installation in accordance with 780 CMR 1815.11. Maintain accurate records for each pier, documenting observations required by 780 CMR 1815.11.
4. Other		
5.		

Schedule of Structural Tests and Inspections Page _____ of _____

Project: _____

Curtain Walls (Wall Panels and Veneers)

Item	Agent	Scope
1. Precast Concrete Panels.		Perform structural tests and inspections as listed under category *Precast Concrete Construction*.
2. Light Gage Metal Framing for Panels.		Perform structural tests and inspections as listed under category *Light Gage Metal Framing*.
3. Proprietary Light Weight Curtain Walls Systems.		Review manufacturer's fabrication methods and quality control procedures. Review material certification, and inspect fabrication of structural framing, details, connections, and fasteners for conformance to SER approved submittals and the contract documents.
4. Masonry Veneers.		Perform structural tests and inspections as listed under category *Masonry Construction*. Verify that relieving angles, ties to the backup structure, and other structural supports are installed in conformance with the contract documents and SER approved submittals.
5. Aluminum Welding.		Review welding procedures and welding qualifications in accordance with AWS D1.2. Observe performance testing of welds required by AWS D1.2.
6. Other		
7.		

Schedule of Structural Tests and Inspections Page _____ of _____

Project: _____

Light Gauge Metal Framing

Item	Agent	Scope
1. Fabricator's Quality Control Procedures.		Review fabricator's quality control procedures.
2. Material Certification.		Review for conformance to contract documents.
3. Fabrication Inspection.		Inspect in-plant fabrication or on-site fabrication.
4. Installation.		Verify that type, size, quantity, location, details, and connections of framing members conform to SER approved submittals, and the contract documents..
5. Welding.		Check welders' qualifications. Verify that welding conforms to AWS specifications, SER approved submittals, and the contract documents. Visually inspect welds.
6. Other Fasteners.		Verify fastener type and installation procedures. Verify that fasteners conform to SER approved submittals and the contract documents. Verify that fasteners are installed tight.
7. Other		
8.		

Schedule of Structural Tests and Inspections Page _____ of _____

Project: _____

Special Cases

Item	Agent	Scope
1.		
2.		
3.		
4.		
5.		
6.		

Boston Association of Structural Engineers

Final Report of Structural Tests and Inspections

For compliance with the 6th Edition of the Massachusetts State Building Code

Project: _____

Location: _____

Owner: _____

Owner's Address: _____

_____

Architect of Record: _____

Structural Engineer of Record: _____

To the best of my information, knowledge and belief, the structural tests and inspections itemized in the Program of Structural Tests and Inspections submitted for permit have been satisfactorily completed and all discovered defects have been corrected.

Comments: _____

_____

_____

_____

_____

_____

_____

_____

The Program of Structural Tests and Inspections does not relieve the Contractor or its subcontractors of their responsibilities and obligations for quality control of the work, for any design work which is included in their scope of services, and for full compliance with the requirements of the Construction Documents. Furthermore, the detection of, or the failure to detect, deficiencies or defects in the work during testing and inspection conducted pursuant to the Program does not relieve the Contractor or its subcontractors of their responsibility to correct all deficiencies or defects, whether detected or undetected, in all parts of the work, and to otherwise comply with all requirements of the Construction Documents.

Respectfully Submitted,
Structural Engineer of Record

_____
Type or print name

_____
Signature Date

Registration Seal

Standard Construction Specification Section for Program of Structural Tests and Inspections

INSTRUCTIONS

1. This specification section should be inserted into Division 1 of the project specifications. When an architect is the prime professional, the SER should give the architect a copy of this section and request that it be included in the project specifications. The criteria of this section protects the owner, the architect, and the structural engineer.

2. Alternatively, this section can be included as an article in the general or supplementary general conditions.

3. The terms *Contract Documents* and *Work* are as defined in AIA Document 201, General Conditions of the Contract for Construction. If other terms are used in lieu of these terms in the contract, conditions of the contract, or specifications, they should be defined in an appropriate contract document.

4. Paragraph 1.02.A covers the situation where 780 CMR 1705 requires structural tests and inspections for a component or a system, for which the SER has provided neither a structural design nor a performance specification. If this situation does not apply to the project, then this paragraph should be deleted.

SECTION 01---
STRUCTURAL TESTS AND INSPECTIONS

1.01 GENERAL

A. The 6th Edition of the Massachusetts State Building Code, 780 CMR, under which this project is designed and will be built, requires the structural engineer of record (SER) to provide a program of structural tests and inspections for this project in accordance with 780 CMR 1705. The SER is the structural engineer (an individual) who is in responsible charge of the preparation of the structural drawings and structural specifications for this project and whose Massachusetts professional engineering seal appears on said structural drawings.

B. The SER has prepared a document entitled *Program of Structural Tests and Inspections*, which has been or will be submitted to the building official who has jurisdiction over this project, with the application for a building permit.

C. The program of structural tests and inspections shall not relieve the Contractor or its subcontractors of their responsibilities and obligations for quality control of the Work, their other obligations for supervising the work, for any design work which is included in their scope of services, and for full compliance with the requirements of the Contract Documents. Furthermore, the detection of, or failure to detect, deficiencies or defects in the Work during the testing and inspection conducted pursuant to the program shall not relieve the Contractor or its subcontractors of their responsibility to correct all deficiencies or defects, whether detected or undetected, in all parts of the Work, and to otherwise comply with all requirements of the Contract Documents.

D. The program of structural tests and inspection does not apply to the Contractor's equipment, temporary structures used by the Contractor to construct the project, the Contractor's means, methods, and procedures, and job site safety.

1.02 CONTRACTOR'S RESPONSIBILITIES

A. Where the document *Program of Structural Tests and Inspections* indicates that a structural component or system is subject to structural tests and inspections by 780 CMR 1705 and that the SER for the project has not been retained to design said component or system or to prepare a performance specification for said component or system, and the Architect has not otherwise provided for the structural design of said component or system, the Contractor shall retain, or require others under his aegis to retain, a professional engineer registered in Massachusetts to design said component or system and to provide the required program of structural tests and inspections for said component or system.

B. The Contractor shall provide free and safe access to the Work for the SER and all other individuals who are observing the Work or performing structural tests or inspections. The Contractor shall provide all ladders, scaffolding, staging, and up-to-date safety equipment, all in good and safe working order, and qualified personnel to handle and erect them, as may be required for safe access.

C. The Contractor shall give reasonable notice to the SER, or to those performing inspections and tests under the SER's direction, of when the various parts of the Work will be ready for inspection. The Contractor shall obtain instructions from the SER as to what is reasonable notice for the various aspects of the work, and who is to be notified.

D. The Owner reserves the right to back charge the Contractor for additional expense incurred by the Owner for the services of the SER or those under his direction when work is not reasonably ready for inspection in accordance with the notice provided by the Contractor.

Sample Contracts

INSTRUCTIONS

1. There are four sample contracts which follow these instructions and to which these instructions apply. The contracts are designed to be used in pairs, as follows:

   - When the owner directly hires the outside inspection agencies selected by the SER:

     A. Owner - Structural Engineer of Record Contract (where Owner contracts with Inspection Agencies)

     B. Owner - Inspection Agency Contract

   - When the SER selects and retains the outside inspection agencies:

     C. Owner - Structural Engineer of Record Contract (where the SER is responsible for testing and inspection services)

     D. Structural Engineer of Record - Inspection Agency Contract

2. For the purposes of these contracts (only), the Structural Engineer of Record (SER) is the firm (single proprietorship, partnership, or corporation) which employs the individual structural engineer whose professional engineering seal appears on the structural design documents submitted with the building permit application. For the purposes of 780 CMR 1705.0, the SER is the said individual structural engineer.

3. The structural engineering firm should review the sample contracts with its attorney and insurance advisor, and adapt the sample contracts to the needs of the firm and the particular project. The structural engineering firm should insure that there is no conflict between the firm's contract with the architect for structural design services and the contract with the owner for structural tests and inspections.

4. **Contracts with inspection agencies:** The SER should develop a detailed scope of structural testing and inspection services that will be performed by each particular inspection agency, and specify same in Exhibit A of that agency's contract. The SER should also negotiate the rates for payment with that inspection agency and specify them in Exhibit B. Where the owner hires the inspection agencies directly, the SER (the firm) will be acting as the owner's agent in these regards.

5. **Indemnity:** The contracts with the inspection agencies require that the inspection agency indemnify the SER, owner, and architect for the inspection agency's negligence. The purpose of this indemnity is to provide an equitable distribution of risk considering that the SER has less control over the actions of the inspection agencies than the actions of its own personnel. These indemnities must be backed-up with adequate insurance; the recommended minimum coverage and other requirements are given in the contracts. The indemnity provisions exclude defense costs since professional liability insurance does not include coverage for defense costs.

   Most owner-architect, owner-engineer, or architect-engineer design contracts do not include provisions for indemnification of the owner (e.g. AIA B141 and EJCDC 1910-1), since most architects and engineers do not consider providing indemnification of the owner to be equitable. The Owner-SER contracts herein also do not include indemnification of the owner for the same reason. However, some owners may request indemnification from the SER firm. If this is agreeable to the SER firm, the firm should make sure that the requested indemnification is negligence based and does not include defense costs. Further, the firm should consult with its attorney and obtain approval of the indemnification clause from its insurance carrier.

OWNER-STRUCTURAL ENGINEER OF RECORD CONTRACT

(where Owner contracts with Inspection Agencies)

The following constitutes the terms of the Agreement between _____ ("Owner") and _____ ("Structural Engineer of Record" or "SER") with respect to the performance of its services for the _____("the Project").

1. SCOPE OF SERVICES

The SER shall establish and direct a program of structural tests and inspections in accordance with the Massachusetts State Building Code, 780 CMR 1705.0.

As required by 780 CMR 1705.3, the SER shall select all personnel who will perform structural tests and inspections. Said personnel may be from the SER's firm, other engineering firms, individuals, inspection agencies, or testing firms. The SER shall direct and coordinate the activities of said personnel.

As required by 780 CMR 1705.3.4, the SER shall review the following designs for which it provided a performance specification and for which said review is not included in the scope of services of the architect-structural engineer contract for this project: _____

_____

For testing and inspection services which will not be performed by the SER's firm, the SER shall, as an agent of the Owner, assist in the negotiation of agreements between the Owner and the inspection agencies selected by the SER. The inspection agencies shall be solely responsible for the performance of its structural testing and inspection services, and the SER shall be entitled to rely upon such performance. Nothing herein shall be construed so as to establish a contractual relationship between the SER and the inspection agencies.

The SER shall, as an agent of the Owner, review invoices submitted by the inspection agencies in connection with the performance of the testing and inspection services. In connection with such review, the SER will either approve an invoice for payment or return it to the inspection agency for further information. The SER shall not, however, be responsible for the payment of such invoices.

2. INDEMNIFICATION

The Owner shall require the inspection agencies to indemnify and hold harmless the SER and the Architect from and against all claims, costs and liability arising out of or resulting from the performance of the testing and inspection services.

3. INSURANCE

The Owner shall require that the inspection agencies obtain at their own expense, to have in force before commencing any services, and for a six-year period beyond the date of substantial completion of the project, the following insurance:

A. Comprehensive General Liability Insurance providing for a combined single limit of One Million Dollars ($1,000,000.00) for bodily injury, death and property damage; and

B. Professional Liability Insurance with a limit of One Million Dollars ($1,000,000.00) per claim and in the aggregate.

Insurance certificates evidencing the above coverage shall be issued to the Owner and the SER prior to commencement of the testing and inspection services and shall specify that the Owner and the SER must be given, in writing, thirty (30) days notice of cancellation, termination, or alteration of the policies evidenced by the certificate.

4. LIMITATIONS TO SERVICES

Structural tests and inspections are for quality assurance audits and their implementation is not intended to relieve the construction contractor or its subcontractors of their responsibility for quality control of the work and for any design for which they are responsible. The Owner shall include a statement to this effect in the construction contract.

5. TERMS OF PAYMENT

The Owner shall pay the SER for the scope of services set forth herein, in accordance with the rates listed in Exhibit A attached hereto, based upon invoices submitted by the SER.

The period covered by each invoice shall be one calendar month ending on the last day of the month.

The Owner shall review all invoices within seven days of receipt. If said invoices are appropriate, the Owner shall pay the invoiced amount within ___ days of receipt; if the invoices are not appropriate, he shall send them back to the SER for correction.

EXECUTED:

As of this ____ day of _____, 19___.

OWNER:	STRUCTURAL ENGINEER OF RECORD:

OWNER-STRUCTURAL ENGINEER OF RECORD CONTRACT

(where SER is responsible for testing and inspection services)

The following constitutes the terms of the Agreement between _____ ("Owner") and _____ ("Structural Engineer of Record" or "SER") with respect to the performance of its services for the _____("the Project").

1. SCOPE OF SERVICES

The SER shall provide and be responsible for the performance of the structural tests and inspections as required by 780 CMR 1705.0.

As required by 780 CMR 1705.3.4, the SER shall review the following designs for which it provided a performance specification and for which said review is not included in the scope of services of the architect-structural engineer contract for this project: _____

_____

2. LIMITATIONS TO SERVICES

Structural tests and inspections are for quality assurance audits and their implementation is not intended to relieve the construction contractor or its subcontractors of their responsibility for quality control of the work and for any design for which they are responsible. The Owner shall include a statement to this effect in the construction contract.

3. TERMS OF PAYMENT

The Owner shall pay the SER for the scope of services set forth herein in accordance with the rates listed in Exhibit A attached hereto, based upon invoices submitted by the SER.

The period covered by each invoice shall be one calendar month ending on the last day of the month.

The Owner shall review all invoices within seven days of receipt. If said invoices are appropriate, the Owner shall pay the invoiced amount within ___ days of receipt; if the invoices are not appropriate, he shall send them back to the SER for correction.

EXECUTED:

As of this ____ day of _____, 19___.

OWNER:	STRUCTURAL ENGINEER OF RECORD:

OWNER-INSPECTION AGENCY CONTRACT

The following constitutes the terms of the Agreement between _____ ("Owner") and _____ ("Inspection Agency" or "the Agency") with respect to the performance of its services for the _____("the Project").

1. SCOPE OF SERVICES

The Agency shall perform the Structural Testing & Inspection Services listed in Exhibit A attached hereto, as directed by the Structural Engineer of Record ("SER").

It is understood and agreed that in the performance of the Structural Testing & Inspection Services required by this Agreement, the Agency is acting in the capacity of an independent contractor, as currently defined at law, and that the relationship of employer and employee shall not exist between the Owner and the Agency.

2. RELIANCE ON SERVICES AND RESPONSIBILITY FOR DATA

It is understood and agreed that the Owner and the SER shall be entitled to rely upon, and the Agency shall be fully responsible for, the accuracy and completeness of the Agency's performance of the services, including any data, test results, evaluative material, tests, reports or studies developed or prepared by the Agency.

3. QUALIFICATIONS OF PERSONNEL

The Agency shall provide personnel who are qualified by education, training, and experience to perform the testing and inspection services listed in Exhibit A. The Agency shall submit the qualifications of said personnel to the SER for the SER's approval. Only personnel approved by the SER may be used. Where a statute or the State Building Code requires a license or certification for a particular task, all personnel performing said tasks shall be so licensed or certified.

4. INDEMNIFICATION

The Agency hereby agrees to indemnity and hold harmless the Owner, SER, and Architect from and against all claims, costs and liability arising out of the Agency's services hereunder, to the extent that such claims, costs and liability are the result of negligent acts, errors or omissions of the Agency, or breach by the Agency of its obligations hereunder.

5. INSURANCE

The Agency agrees to obtain at its own expense, and to have in force before commencing any services, and for a six-year period beyond the date of substantial completion of the project, the following insurance:

A. Comprehensive General Liability Insurance providing for a combined single limit of One Million Dollars ($1,000,000.00) for bodily injury, death and property damage; and

B. Professional Liability Insurance with a limit of One Million Dollars ($1,000,000.00) per claim and in the aggregate.

All insurance coverage shall be through a company or companies acceptable to the Owner. Insurance certificates evidencing the above coverage shall be issued to the Owner and the SER prior to commencement of the Structural Testing & Inspection Services and shall specify that the Owner and the SER must be given, in writing, thirty (30) days notice of cancellation, termination, or alteration of the policies evidenced by the certificate.

6. LIMITATIONS TO SERVICES

Structural tests and inspections are for quality assurance audits and their implementation is not intended to relieve the construction contractor or its subcontractors of their responsibility for quality control of the work and of any design for which they are responsible. The owner shall include a statement to this effect in the construction contract.

7. TERMS OF PAYMENT

The Owner shall pay the Agency for the testing and inspection services listed in Exhibit A, in accordance with the rates listed in Exhibit B attached hereto, based upon invoices submitted to and approved by the SER.

The period covered by each invoice shall be one calendar month ending on the last day of the month.

The SER shall review the invoices submitted by the Agency within seven days of receipt. If said invoices are appropriate, the SER shall approve and forward the invoices to the Owner for payment; if the invoices are not appropriate, the SER shall send them back to the Agency for correction.

Invoices approved by the SER shall be paid by the Owner within ___ days of receipt by the SER.

EXECUTED:

As of this ____ day of _____, 19___.

OWNER:	INSPECTION AGENCY:

STRUCTURAL ENGINEER OF RECORD-INSPECTION AGENCY CONTRACT

The following constitutes the terms of the Agreement between _____ ("Structural Engineer of Record" or "SER") and _____ ("Inspection Agency" or "the Agency") with respect to the performance of its services for the _____("the Project").

1. SCOPE OF SERVICES

The Agency shall perform the Structural Testing & Inspection Services listed in Exhibit A attached hereto, as directed by the Structural Engineer of Record ("SER").

It is understood and agreed that in the performance of the Structural Testing & Inspection Services required by this Agreement, the Agency is acting in the capacity of an independent contractor, as currently defined at law, and that the relationship of employer and employee shall not exist between the SER and the Agency.

2. RELIANCE ON SERVICES AND RESPONSIBILITY FOR DATA

It is understood and agreed that the SER, Owner and Architect shall be entitled to rely upon, and the Agency shall be fully responsible for, the accuracy and completeness of the Agency's performance of the services, including any data, test results, evaluative material, tests, reports or studies developed or prepared by the Agency.

3. QUALIFICATIONS OF PERSONNEL

The Agency shall provide personnel who are qualified by education, training, and experience to perform the testing and inspection services listed in Exhibit A. The Agency shall submit the qualifications of said personnel to the SER for the SER's approval. Only personnel approved by the SER may be used. Where a statute or the State Building Code requires a license or certification for a particular task, all personnel performing said tasks shall be so licensed or certified.

4. INDEMNIFICATION

The Agency hereby agrees to indemnity and hold harmless the SER, Owner and Architect from and against all claims, costs and liability arising out of the Agency's services hereunder, to the extent that such claims, costs and liability are the result of negligent acts, errors or omissions of the Agency, or breach by the Agency of its obligations hereunder.

5. INSURANCE

The Agency agrees to obtain at its own expense, to have in force before commencing any services, and for a six-year period beyond the date of substantial completion of the project, the following insurance:

A. Comprehensive General Liability Insurance providing for a combined single limit of One Million Dollars ($1,000,000.00) for bodily injury, death and property damage; and

B. Professional Liability Insurance with a limit of One Million Dollars ($1,000,000.00) per claim and in the aggregate.

All insurance coverage shall be through a company or companies acceptable to the SER. Insurance certificates evidencing the above coverage shall be issued to the SER prior to commencement of the Structural Testing & Inspection Services and shall specify that the SER must be given, in writing, thirty (30) days notice of cancellation, termination, or alteration of the policies evidenced by the certificate.

6. TERMS OF PAYMENT

The SER shall pay the Agency for the testing and inspection services listed in Exhibit A, in accordance with the rates listed in Exhibit B attached hereto, based upon invoices submitted by the Agency to the SER and as set forth herein.

The period covered by each invoice shall be one calendar month ending on the last day of the month.

The SER shall review the invoices submitted by the Agency within seven days of receipt. If said invoices are appropriate, the SER shall approve and forward the invoices to the Owner for payment. The SER shall pay the invoices within ___ day of receipt of payment by the Owner. If the invoices are not appropriate, the SER shall send them back to the Agency for correction.

EXECUTED:

As of this ____ day of _____, 19___.

STRUCTURAL ENGINEER OF RECORD:	INSPECTION AGENCY:

4.0 QUALIFICATION OF INSPECTORS

4.1 Overview

The Code requires that the SER select the inspectors he will need to implement the program. These inspectors can be from his own staff, from other engineering firms, or from outside testing and inspection agencies, whichever is most beneficial for the operation of the program.

The SER is responsible for those he selects for the testing and inspection program, and thus, should review the qualifications of personnel that will be performing tests and inspections. When a testing agency is under consideration as an agent for the testing and inspection program, the SER should review the resumes and qualifications of individual personnel in the agency and indicate which individuals are to perform specific tests and inspections. The SER should require that inspection reports contain the names of the individual performing the inspections.

The criteria for the qualification of inspectors and testing agencies is not well defined. As a minimum, BASE recommends that any inspection and testing agency be under the direct full-time supervision of a Professional Engineer registered in the Commonwealth of Massachusetts. In addition, 780 CMR R1 and 780 CMR R2 give requirements for concrete testing laboratory licensing and for concrete testing personnel licensing, respectively.

When reviewing the qualifications of an individual agent, the SER should consider certifications and registrations, relevant education and experience. Several professional organizations have certification programs. In addition there are standards for the evaluation of testing and inspection agencies. See Section 4.2.

4.2 Reference Standards for Testing and Inspection

The following listed standards are for information only, and are given herein to assist the SER in establishing the required qualifications for testing and inspection agencies and their personnel. The SER should decide to what extent the listed standards may be applicable to the determination of qualifications.

American Council of Independent Laboratories:

- Recommended Requirements for Independent Laboratory Qualification

American Society for Testing Materials (ASTM):

- ASTM E329 - Standard practice for use in the evaluation of testing and inspection agencies as used in construction.
- ASTM E543 - Practice for Determining the Qualification of Non-destructive Testing Agencies.
- ASTM E548 - Practice for preparation of Criteria for use in the Evaluation of Testing Laboratories and Inspection Bodies.
- ASTM A880 - Standard practice for use in evaluation of testing laboratories and organizations for examination and inspection of steel, stainless steel, and related alloys.
- ASTM C1077 - Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory.
- ASTM C1093 - Practice for the Accreditation of Testing Agencies for Unit Masonry.
- ASTM D3740 - Standard Recommended Practice for Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

International Conference of Building Officials (ICBO) Model Program for Special Inspection (excerpts):

- ICBO Reinforced Concrete certification
- ICBO Prestressed Concrete certification
- ICBO Structural Steel and Welding certificate
- ICBO Structural Masonry certificate

American Concrete Institute (ACI):

- ACI Grade I certification
- ACI Concrete Construction Inspector Level II certificate

National Institute for Certification in Engineering Technologies (NICET):

- NICET Level II certification in geotechnical engineering technology (construction/generalist) or construction materials testing (soils).

American Welding Society (AWS):

- AWS Certified Welding Inspector (CWI) certification in accordance with AWS QC1 - Standard and Guide for Qualification and Certification of Welding Inspectors.

- AWS D1.1-96, Section 6.1.3: Inspector Qualification Requirements.