

STRUCTURAL TESTS AND INSPECTIONS A GUIDELINE FOR INDIANA PROFESSIONAL ENGINEERS

A JOINT PUBLICATION OF:



TO BE USED WITH THE 2008 INDIANA BUILDING CODE

PREPARED BY

AD HOC STRUCTURAL INSPECTIONS COMMITTEE
INDIANA STRUCTURAL ENGINEERS ASSOCIATION

Document SIC 2012-01
1st EDITION - March 2013

PREFACE

This Joint Guideline document is prepared under an ad hoc committee of the Indiana Structural Engineers Association (ISEA) in cooperation with members of the Indiana Chapter of the American Society of Civil Engineers (ASCE), the American Council of Engineering Companies (ACEC) of Indiana and others. The committee includes the following members:

Kurt Heidenreich, PE, SE – Engineering Resources, Inc.
ISEA 2011-2012 President
ACEC Indiana – Fire and Building Services Liaison Committee

Donald G. Corson, PE - American Structurepoint, Inc.
Indiana Chapter American Concrete Institute (ACI) 2012-2013 President

Brad L. Bobich, PE - Cornerstone Engineering, Inc.
ASCE Metropolitan Indianapolis Branch (ASCE MIB) – Past President 2011-2012
ACEC Indiana – Fire and Building Services Liaison Committee

Steven P. Osborn, PE, SE - CE Solutions, Inc.
ACEC Indiana – Fire and Building Services Liaison Committee

The current Indiana Building Code deletes in its entirety Chapter 17 of the International Building Code (IBC). However, Construction Design Release requirements hold the Design Professional responsible for inspecting at intervals necessary to ensure the construction is in compliance with the plans and specifications. Many practicing structural engineers in Indiana were surveyed by ISEA and ASCE to determine if there was a need for a structural testing and inspection process. The results were overwhelmingly in favor of creating such a process. However, in the absence of a code-prescribed system of implementation, a specification-based approach was determined to be a useful, familiar and easily incorporated format for addressing project-related Structural Testing and Inspections.

A consistent method of ensuring compliance with design intent, for practicing structural engineers in Indiana, was needed. To achieve this in a manner consistent with the nationally recognized provisions outlined in the IBC, several practicing design professionals, representing various organizations, decided to work together to develop a guideline document.

Since significant work had already been completed in other states and by several organizations, the group studied previous examples as a basis for the guideline. The concepts presented in this previous work were adapted to meet specific Indiana requirements. We acknowledge the work completed by the Council of American Structural Engineers (CASE) and the Structural Engineers Association of Kentucky SEAOK, which was beneficial to us in the development of this publication.

DISCLAIMER

The information presented in this publication has been prepared in accordance with recognized engineering principles and is for general information only. While it is believed to be accurate, this information should not be used or relied upon for any specific application without examination and verification of its accuracy, suitability and applicability by a competent licensed engineer practicing in the field of Structural Engineering.

Publication of the material contained herein is not intended as a representation of warranty on the part of any of the organizations, associations, companies or their officers, staff, members, or of any other person named herein, that this information is suitable for any general or particular use or of freedom from infringement of any patent or patents. The person or the entity making use of this information assumes all liability arising from such use.

Caution must be exercised when relying upon specifications and codes developed by other organizations and incorporated by reference since such material may be modified or amended from time to time subsequent to the printing of this edition. Supporting organizations and members of this committee bear no responsibility for such material other than to incorporate it by reference at the time of the publication of this edition, subject to the general comments set forth in the preceding paragraph.

TABLE OF CONTENTS

Table of Contents	3
Glossary of Terms.....	3-5
Guideline Implementation	6-7
Process Flow Chart	8
Frequently Asked Questions.....	9-11
APPENDIX "A" - Base Specification Section 01 45 30.....	01 45 30 : 1 - 27

GLOSSARY OF TERMS

To assist in the implementation of this guideline, the following glossary of terms was developed for quick reference:

Architect - For the purposes of this Guideline, the Architect is the person, when so established by the Owner, to act as the lead design professional for the project. The term “Architect” shall include the Architect’s authorized representative.

Building Official - The governmental agency or representative issuing the permit or assigned to review and approve construction documents for buildings and/or structural projects in the State of Indiana. May include both State and Local agencies.

CASE - Council of American Structural Engineers.

Code - The Indiana Building Code which currently includes the International Building Code with approved amendments.

Construction Design Release – Under the authority of General Administrative Rule 675 IAC 12-6-6, the Indiana Department of Homeland Security, Division of Fire and Building Safety, issues Construction Design Releases for qualifying projects. State Form 37318 is used to apply for Construction Design Release.

Construction Documents - Written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project necessary for obtaining a building permit. Construction Documents include all supplemental instructions, sketches, addenda, and revisions to the drawings and specifications issued by the registered design professional beyond those issued for a building permit.

Contractor - For the purposes of this Guideline, the Contractor is the person or entity identified as such in the Agreement with the Owner to complete the work described in the Construction Documents. The term “Contractor” shall include any subcontractors and/or Contractor’s authorized representative(s).

Design Professional – As defined by 675 IAC 12-6-2(d), Design Professional means a registered architect or professional engineer who is registered under IC 25-4 or IC 25-31.

Designated Inspecting Design Professional, DIDP – As defined on the Application for Construction Design Release, this is the specified Design Professional responsible for inspecting the construction at appropriate intervals to determine general compliance with the released documents and applicable rules of the Commission. Page 2 of the Construction Design Release Application form creates this designated professional which is in accordance with General Administrative Rule 675 IAC 12-6-6(c)(10)(C). This person is typically the person certifying the structural portions of the Construction Documents, but may also be assigned to another Design Professional.

FORM, Compliance Proposal “STI-CP” - (See Specification Section 01 45 30) This form is for use by the Contractor for submitting a certified plan or process, to the DIDP, for correcting a defect for compliance with the Construction Documents.

FORM, Final Report “STI-FR” - (See Specification Section 01 45 30) This form is for use by the Inspection Coordinator to notify the DIDP at substantial completion either of compliance or noncompliance of the project related to the required Structural Testing and Inspection program.

FORM, Interim Report “STI-IR” - (See Specification Section 01 45 30) This form is for use by the Inspection Coordinator for the purposes of communicating with the DIDP or transmitting applicable testing and inspection documentation.

FORM, Noncompliance Response “STI-NR” - (See Specification Section 01 45 30) This form is for use by the DIDP to notify the Inspection Coordinator, Contractor, Owner, Architect, etc. of a noncomplying structural item, provide direction for correction, or request a Compliance Proposal.

FORM, Notification Of Noncompliance “STI-NON” - (See Specification Section 01 45 30) This form is for use by the DIDP to notify the Building Official, Inspection Coordinator, Contractor, Owner, Architect, etc. of project noncompliance with the requirements of the Structural Testing and Inspection program.

IBC - The International Building Code.

Inspector - A qualified person who demonstrates competence to provide testing and/or inspection of the particular type of construction or operation required by the Structural Testing and Inspection program. The inspector shall meet the qualification requirements of Specification Section 01 45 30.

Inspection Coordinator – The Inspection Coordinator is the person assigned to administer the Structural Testing and Inspection program. This person may also act as an Inspector for portions of the project he or she is qualified to complete. The Inspection Coordinator is responsible for submitting test data and inspection documentation for other Inspectors assigned to complete the necessary Structural Testing and Inspection program.

Owner - For the purposes of this Guideline, the Owner is the person or entity identified as such in the Agreement with the Contractor. The Owner is contractually bound to pay for the work specified in the Construction Documents, and ultimately takes ownership of the completed work. The term “Owner” shall also include a duly authorized Owner’s representative.

Shop Drawings / Submittal Data - Written, graphic and pictorial documents prepared and / or assembled by the Contractor based on the Construction Documents.

Structural Observation – Structural observation is the visual review of the structural system by a representative of the Design Professional for general conformance with the approved construction documents. Structural observations are not considered part of the Structural Tests and Inspection program.

Structural Inspection, Continuous - The full-time observation of work requiring structural inspection by an approved Inspector who is present in the area where the work is being performed.

Structural Inspection, Periodic - The part-time or intermittent observation of work requiring structural inspection by an approved Inspector who is present in the area where the work has been or is being performed and at the completion of the work.

Structural Testing - An analysis of materials in accordance with approved standards to determine compliance with the Construction Documents.

Testing Agency – A Testing Agency is a qualified laboratory responsible for measuring, examining, testing, calibrating, or otherwise determining the characteristics or performance of construction materials and verification of compliance with the Construction Documents.

STRUCTURAL TESTS AND INSPECTIONS GUIDELINE IMPLEMENTATION

To implement the Structural Testing and Inspection program, follow the four step process indicated below.

1. *DETERMINE THE METHOD OF PAYMENT*

There are several methods available to implement the process for the Structural Testing and Inspection program. The DIDP should work with the Owner and/or Architect to determine if the Owner will pay for these services directly (preferred method as outlined in the IBC and recommended in CASE industry guidelines), or if the Contractor will need to include the cost in their bid.

Another method is to have the Contractor include an allowance in the contract for these services. With this method, the DIDP or Architect can authorize payments based on approval of the Inspection Coordinator or Testing Agency's invoices. Regardless of the method used, early communication with the Owner and/or Architect will be beneficial. A properly informed client can eliminate unnecessary misunderstandings.

2. *EDIT THE SPECIFICATION*

A base specification "SECTION 01 45 30," including associated forms, was developed. This specification is available in word processor format. The specification has been developed to accommodate most of the typically required Structural Tests and Inspections. The DIDP must review the project to determine which items are applicable and make appropriate modifications to ensure the program is project specific. In addition, the DIDP must incorporate the method of payment determined in step 1.

The "Schedule of Structural Tests and Inspections," after the main body of the specification, must be edited appropriately for the project. This schedule becomes the requirements for the Structural Testing and Inspection program, and provides the basis for determining compliance.

Once completed, the specification must become a part of the Construction Documents. In essence this assigns responsibility to a qualified Inspection Coordinator, as allowed under item 4 of the Construction Design Release form, "the design professional identified below or a designee will inspect the construction covered by this application. . ."

3. *MONITOR THE INTERIM REPORTS*

The Inspection Coordinator administers the Structural Testing and Inspection program. The Coordinator submits Interim Reports on form “STI-IR” to document the Structural Testing results and Inspection documentation. If noncompliance is reported, the DIDP should respond using form “STI-NR” with an appropriate corrective action to ensure compliance, or provide direction to notify the contractor of a required corrective action. The DIDP can direct the contractor to develop an appropriate modification utilizing a registered professional engineer. The contractor must submit the Compliance Proposal using form “STI-CP.” The DIDP can approve the proposed solution, offer a modification to make it acceptable, or reject the modification using form “STI-NR.”

If inspection reports are not being received in a timely manner as the work is progressing, the DIDP should notify the Architect, Contractor, Inspection Coordinator, Testing Agency, and if appropriate, the Owner using form “STI-NR.” The earlier in the process this notification begins the easier it will be to ensure compliance. Keeping current with report reviews will simplify the final compliance determination.

4. *REVIEW THE FINAL REPORT*

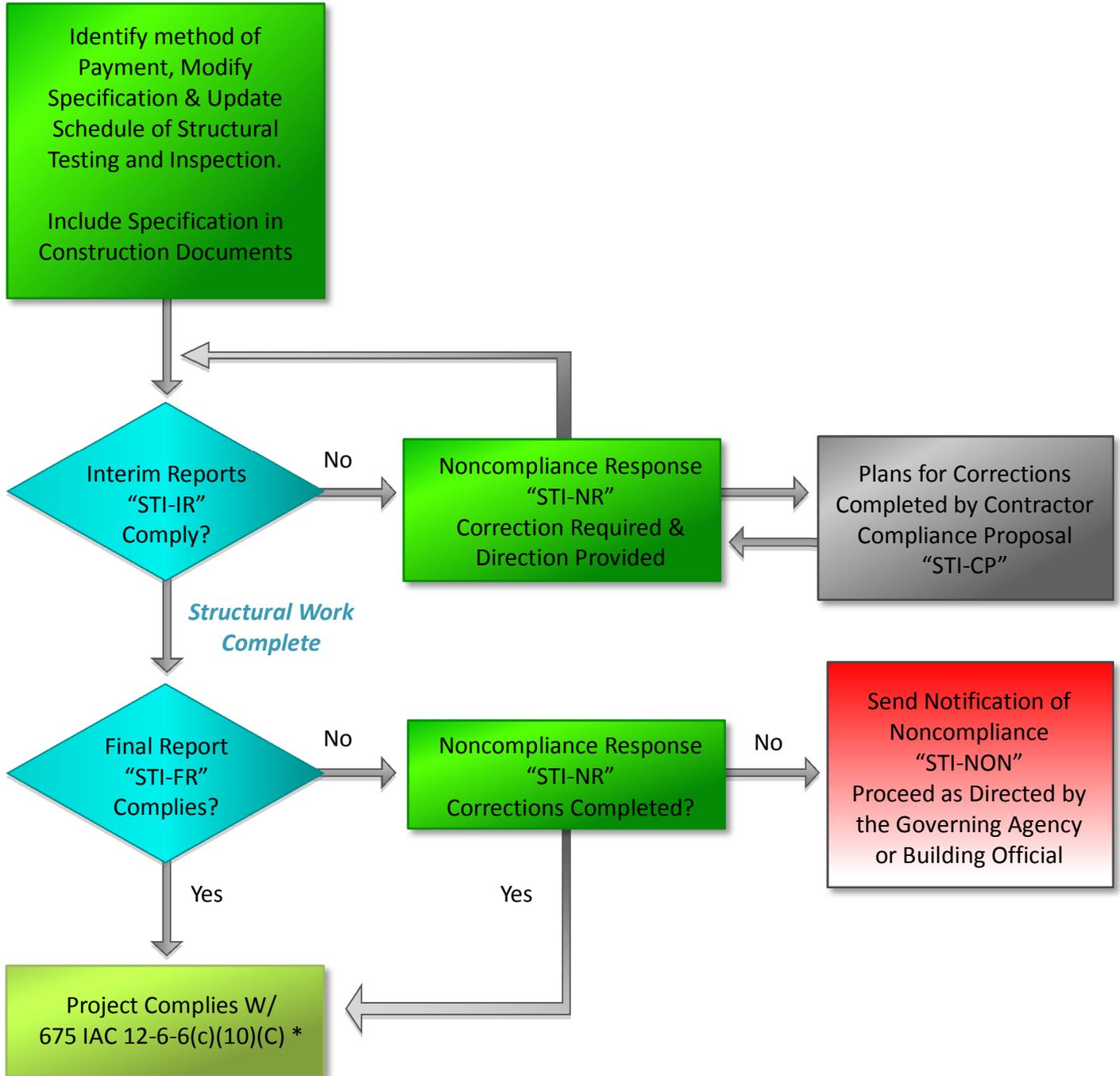
Upon completion of the Structural Testing and Inspection program, the Inspection Coordinator must submit the final report on form “STI-FR.” If all of the Interim Reports were in compliance, or corrective actions were appropriately implemented, and the final report indicates concurrence of compliance, the minimum requirements of General Administrative Rule 675 IAC 12-6-6(c)(10)(C) should be satisfied.

If there are interim reports with uncorrected items or the final report does not indicate compliance, these items must be addressed or you are obligated, under item 4 of the Construction Design Release form, to “Notify the owner and authorities having jurisdiction of all specific deviations and code violations.” Form “STI-NON” can be used to complete the notification of noncompliance. This should occur prior to occupancy of the structure.

Ultimately, the Construction Documents and the Structural Testing and Inspection program work together to ensure compliance with provisions of the Code.

PROCESS FLOWCHART

A flow chart was prepared to graphically explain the implementation process.



* The Design Professional is responsible for developing an appropriate Structural Testing and Inspection Program whereby satisfactory completion will result in compliance.

FREQUENTLY ASKED QUESTIONS

What are Structural Tests and Inspections?

Structural Tests and Inspections involve:

1. Testing - an analysis of materials in accordance with approved standards to determine compliance with the contract documents.
2. Inspection - the evaluation of materials and workmanship based on the application of engineering judgment.

The Inspection process provides greater confidence that the completed work complies with the structural engineer's contract documents thus resulting in enhanced quality and safety of the structure.

Are Structural Tests and Inspections mandatory?

The Indiana Building Code Amendments specifically delete Chapter 17 of the International Building Code; however, Chapter 17 is referenced in many different product and material listings and should be followed. As an example, various post-installed anchor manufacturers require that provisions of Chapter 17 are performed to ensure the installation is performed correctly.

In addition, under item 4 of the design release form, which is based on General Administrative Rule 675 IAC 12-6-6(c)(10)(C), the signing Designated Inspecting Design Professional agrees to provide adequate construction inspection as follows, "the design professional identified below or a designee will inspect the construction covered by this application at appropriate intervals to determine general compliance with the released documents. . ." What this actually requires is subject to interpretation. However, Chapter 17 of the IBC sets a standard of practice considered appropriate by most states and code officials.

Why not just use Chapter 17 of the IBC?

Ideally everyone in the state would follow IBC Chapter 17 requirements. As a Design Professional you are free to implement those requirements subject to approval of the project owner. Unfortunately, the deletion of Chapter 17 from the Indiana Building Code has resulted in the lack of a consistent standard in Indiana.

For Chapter 17 to be mandatory, a change in state law and development of an appropriate process by the state will be required. There are currently several groups working diligently to encourage the state to implement Chapter 17. In the interim, this guideline was developed as a concession, attempting to standardize structural testing and inspections in Indiana.

Who pays for Structural Tests and Inspections?

The IBC states that the owner or architect/engineer of record acting as the owner's agent must employ all Structural Tests and Inspections. However, in the absence of a mandated structural test and inspection policy, other methods may be necessary that involve the contractor directly employing the Inspector.

What are the duties of the Inspection Coordinator?

The Inspection Coordinator administers the Structural Testing and Inspection program. In addition, he/she can perform testing and inspection as qualified, and is responsible for coordinating the effort of other inspectors with the specific qualifications required to meet the project requirements.

During construction, the Inspection Coordinator assembles the test results and inspection documentation and submits the information to the DIDP for review. The Coordinator notifies the DIDP of any discrepancies and items requiring correction.

At the completion of the structural work, the Inspection Coordinator submits a final report stating whether the work requiring testing and inspection complies with the approved construction documents.

What are the duties of the Inspector?

An Inspector implements specific portions of the Structural Testing and Inspection program as directed by the Inspection Coordinator. He/she performs testing and inspections for items with the specific qualifications required to meet the Structural Testing and Inspection program. Although the term "Inspector" is singular, several qualified people may actually participate on a project.

Are these types of Structural Tests and Inspections included with Construction Administration site visits?

No, not typically. The majority of the agreements, whether the contract is with an Architect or Owner, typically provide for periodic site visits by the structural engineer certifying the construction documents to determine general conformance with those documents. These visits are not exhaustive or continuous in nature, and are typically termed Structural Observations. Structural Tests and Inspections are in addition to Structural Observations.

Do Structural Tests and Inspections increase the traditional inspection/testing costs?

Yes. Although various tests and inspections have traditionally been provided during building construction, the International Building Code has expanded these services. After the project scope and structural systems have been defined, usually after the design development phase, the Design Professional can prepare a Structural Testing and Inspection fee estimate for budgeting. Structural Testing and Inspection costs are usually insignificant compared to construction costs, and may in fact result in saving overall project cost, effort and time by identifying noncompliant items before they are fully implemented into the construction.

What are some benefits to the Owner for having these Structural Tests and Inspections?

First and foremost, the Owner will have greater assurance that the project is completed in accordance with contract documents, resulting in safer buildings. Because most structures rarely see loads approaching their design values, critical construction defects may go unnoticed until long after the project is completed. The time to discover and resolve problems is during construction, not after the building is in service. With real-time inspection by qualified personnel, the Owner will receive a higher quality “product”, potentially lower overall project cost and less litigation potential. In addition, consistent testing and inspection practices may also serve to differentiate contractor capabilities and practices so that Owners may make more informed hiring decisions.

Are there any benefits to the Contractor?

The Contractor will likely see faster decisions being made during construction, quicker feedback on items needing correction, potentially less re-work, and less post-construction litigation risk. With market forces driving ever faster schedules, extreme low-price bid competition, and reduced scopes for design professionals’ on-site observation services, the need for consistent, real-time, on-site inspection is obvious.

A well-implemented program of structural tests and inspections will help good contractors identify issues quickly so that adjustments can be made and the project may proceed more efficiently. Also, a project subject to a testing and inspection program will help good contractors by ensuring everyone is subject to the same consistent standard of quality.

APPENDIX "A"

BASE SPECIFICATION SECTION 01 45 30

The base specification is intended to be edited to create project specific requirements for the appropriate Structural Testing and Inspection program.

SECTION 01 45 30 – STRUCTURAL TESTS AND INSPECTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements determined to be necessary by the Designated Inspecting Design Professional for compliance with the Building Code and General Administrative Rules in the State of Indiana.
- B. Provision of Structural Tests and Inspections is included as part of the quality assurance plan for this project. The role of the Inspection Coordinator is to verify the performance and fully document the results of all required tests and inspections for elements and systems identified as requiring inspection and testing.
- C. The <Contractor> <Owner> will engage one or more qualified inspectors and / or testing agencies to conduct structural tests and inspections specified in this section and related sections and as may be specified in other divisions of these specifications and as indicated elsewhere in the contract documents.
- D. Structural testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve contractor of responsibility for compliance with other construction document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the construction document requirements.
- E. Inspections are required for the following items:
 - 1. As indicated on the Drawings.
 - 2. CAST-IN-PLACE CONCRETE.
 - 3. STRUCTURAL STEEL.
 - 4. MASONRY.
 - 5. COLD-FORMED STEEL FRAMING.
 - 6. WOOD CONSTRUCTION.
 - 7. SOILS AND FOUNDATIONS.
 - 8. PRECAST CONCRETE.
 - 9. SPRAY-APPLIED FIREPROOFING.

1.3 DEFINITIONS

- A. **Approved Agency:** An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved by the Registered Design Professional in responsible charge of the work being inspected.
- B. **Construction Documents:** Written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project necessary for obtaining a building permit. Construction Documents include all supplemental instructions, sketches, addenda, and revisions to the drawings and specifications issued by the registered design professional beyond those issued for a building permit.
- C. **Shop Drawings / Submittal Data:** Written, graphic and pictorial documents prepared and / or assembled by the contractor based on the Construction Documents.
- D. **Structural Observation:** Visual observation of the structural system by a representative of the registered design professional's office for general conformance to the approved construction documents. Structural observations are not considered part of the structural tests and inspections and do not replace inspections and testing by the testing agency or inspector.
- E. **Designated Inspecting Design Professional:** A qualified person designated by the Registered Design Professional in responsible charge for administering the required program of Structural Tests and Inspections during construction, reviewing inspection reports and coordinating resolutions of noncompliant items.
 - 1. The Designated Inspecting Design Professional shall be a licensed professional engineer in the State of Indiana.
- F. **Inspection Coordinator:** A qualified person who demonstrates competence, to the satisfaction of the Registered Design Professional in responsible charge, for managing, coordinating, documenting and preparing reports for the inspection and testing program.
 - 1. The Inspection Coordinator shall be a **<licensed professional engineer> <or engineering intern> <or a qualified representative from the testing agency>**.
- G. **Inspector:** A qualified person who demonstrates competence, to the satisfaction of Registered Design Professional in responsible charge, for inspection of the particular type of construction or operation requiring inspection.
 - 1. The inspector shall be a **<licensed professional engineer> <or engineering intern> <or a qualified representative from the testing agency>**.
- H. **Inspection, Continuous:** The full-time observation of work requiring inspection by an approved inspector who is present in the area where the work is being performed.
- I. **Inspection, Periodic:** The part-time or intermittent observation of work requiring inspection by an approved inspector who is present in the area where the work has been or is being performed and at the completion of the work.
- J. **Testing Agency:** A qualified materials testing laboratory under the responsible charge of a licensed professional engineer, approved by the Registered Design Professional in responsible charge, to measure, examine, test, calibrate, or otherwise determine the characteristics or performance of construction materials and verify confirmation with construction documents.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications:

1. Minimum qualifications of inspection and testing agencies and their personnel shall comply with ASTM E329 Standard Specification for Agencies in the Testing and / or Inspection of Materials Used in Construction.
 - a. Inspectors and individuals performing tests shall be certified for the work being performed as outlined in the appendix of the ASTM E329, unless more stringent certification requirements are indicated in the Construction Documents.
 - b. Certification by organizations other than those listed must be submitted to the Designated Inspecting Design Professional for consideration before proceeding with work.
2. In addition to these requirements, local jurisdiction may have additional requirements. It is the responsibility of the testing and inspection agencies to meet local requirements and comply with local procedures.

1.5 CONFLICTING REQUIREMENTS, REPORTS, AND TEST RESULTS

- A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to the registered design professional in responsible charge for a decision before proceeding.
- B. The inspector's reports and testing agencies results shall have precedence over reports and test results provided by the contractor.
- C. Where a conflict exists between the construction documents and approved shop drawings / submittal data, the construction documents shall govern unless the shop drawings / submittal data are more restrictive. All conflicts shall be brought to the attention of the registered design professional in responsible charge.
- D. Where a conflict exists between individual specification sections and this specification, provide testing and inspection to satisfy the more stringent requirements.

1.6 SUBMITTALS BY CONTRACTOR (CONTRACTOR-ENGAGED INSPECTION)

- A. When the Contractor is required to engage the Inspection Coordinator, the Contractor shall submit to the Designated Inspecting Design Professional for review a minimum of 14 days prior to commencement of construction of elements requiring inspection, the following:
 1. Name(s), address(es), telephone number(s), email address(es) and statement(s) of qualifications of all Inspection Coordinators and Inspectors to be engaged on the project.
 2. A listing of all items to receive inspection, designating the name of the individual that will be performing inspection for each item.

1.7 SUBMITTALS BY INSPECTION COORDINATOR (OWNER-ENGAGED INSPECTION)

- A. When the Owner engages the Inspection Coordinator, the Inspection Coordinator shall submit to the Designated Inspecting Design Professional for review a minimum of 14 days prior to commencement of construction of elements requiring inspection, the following:
 - 1. Name(s), address(es), telephone number(s), email address(es) and statement(s) of qualifications of all Inspection Coordinators and Inspectors to be engaged on the project.
 - 2. A listing of all items to receive inspection, designating the name of the individual that will be performing inspection for each item.

1.8 SUBMITTALS BY INSPECTION COORDINATOR

- A. A minimum of 14 days prior to construction, for all materials and systems specified and/or referenced in this Section, the Inspection Coordinator shall prepare and submit to the **<Owner,>
<Registered Design Professional in responsible charge,>** Designated Inspecting Design Professional and Contractor for review a complete and detailed schedule of required tests and inspections.
- B. The Inspection Coordinator shall review, keep and distribute records of required tests and inspections. The Inspection Coordinator shall furnish interim reports to the **<Owner,>
<Registered Design Professional in responsible charge,>** Designated Inspecting Design Professional and Contractor. Interim reports shall indicate whether work inspected was done in compliance with approved construction documents. The Inspection Coordinator shall bring noncompliant items to the immediate attention of the contractor for correction. If the noncompliant items are not corrected, the noncompliant items shall be brought to the attention of the Designated Inspecting Design Professional prior to the completion of that element of the work.
 - 1. Interim Reports and test results shall include, but not be limited to, the following:
 - a. Date of inspection and/or test.
 - b. Description of inspections or tests performed including location (reference grid lines, floors, elevations, etc.).
 - c. Results of inspections or tests performed including data, descriptions, photographs, etc., as evidence of compliance or noncompliance.
 - d. Statement noting that the work, material, and / or product complies or does not comply with the construction document requirements.
 - 1) Name and signature of contractor's representative who was notified of work, material, and/or products that do not meet the construction document requirements.
 - 2. Interim reports shall be submitted within one week of inspection or test.
- C. Final Report of Inspections. Submitted by the Inspection Coordinator at completion of construction for each element requiring inspection confirming that all work has been completed in compliance with approved construction documents. Final Report shall document all noncompliant items (if any) that remain uncorrected at completion of construction.
 - 1. Final report shall be submitted at a point in time agreed upon by the **<Owner,>
<Registered Design Professional in responsible charge,>** Designated Inspecting Design Professional, Inspection Coordinator, and Contractor prior to the start of work, but not later than 14 days after completion of construction of all elements requiring inspection and/or testing.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION

3.1 DESIGN PROFESSIONAL'S RESPONSIBILITY

- A. The Registered Design Professional in Responsible Charge shall coordinate with the Designated Inspecting Design Professional as necessary to respond to valid requests for clarification of structural testing and inspection requirements and as necessary to resolve reported noncompliant items.

3.2 CONTRACTOR'S RESPONSIBILITY

- A. The contractor shall provide sufficient notice to the Inspection Coordinator to allow proper scheduling of all personnel and the contractor shall provide safe access for performing inspection and on site testing.
- B. The contractor shall submit schedules to the **<Owner,> <Registered Design Professional,>** Designated Inspecting Design Professional, Inspection Coordinator and testing and inspecting agencies. Schedules will note milestones and durations of time for materials requiring structural tests and inspections.
- C. The contractor shall repair and/or replace work that does not meet the requirements of the construction documents.
 - 1. If directed by the Designated Inspecting Design Professional, contractor shall engage a qualified design professional to prepare repair and / or replacement procedures.
 - 2. Contractor's design professional shall be registered in the State of Indiana. The contractor's design professional shall be acceptable to the registered design professional in responsible charge, code enforcement official, and owner.
 - 3. Procedures shall be submitted for review and acceptance by the Designated Inspecting Design Professional before proceeding with corrective action.
- D. The contractor shall be responsible for costs of:
 - 1. Re-testing and re-inspection of materials, work, and products that do not meet the requirements of the construction documents and shop drawings / submittal data.
 - 2. Review of proposed repair and / or replacement procedures by the Designated Inspecting Design Professional, Registered Design Professional in responsible charge and the inspectors and testing agencies.
 - 3. Repair or replacement of work that does not meet the requirements of the construction documents.

3.3 DESIGNATED INSPECTING DESIGN PROFESSIONAL RESPONSIBILITIES

- A. The Designated Inspecting Design Professional shall review reports provided by the Inspection Coordinator and coordinate resolution of reported noncompliant items with the Contractor, Inspection Coordinator and Registered Design Professional in responsible charge.

3.4 INSPECTION COORDINATOR RESPONSIBILITIES

- A. The Inspection Coordinator for each element requiring testing and inspection is responsible to confirm that all specified tests and inspections are performed and documented.
- B. The Inspection Coordinator for each element requiring testing and inspection may engage and coordinate additional approved qualified Inspector(s) as required to perform the required tests and inspections.
- C. Prior to commencement of construction of an element requiring inspection, the Inspection Coordinator shall review the testing and inspection requirements and the construction documents to determine the necessary tests and inspections and shall coordinate these requirements with the Contractor.
- D. As the construction progresses, the Inspection Coordinator shall coordinate with the Contractor to ensure performance of the required inspections and shall confirm that all required testing and inspection is satisfactorily completed.
- E. The Inspection Coordinator shall alert the Contractor immediately of any observed noncompliant items so that the Contractor may make corrections to the work. The Inspection Coordinator shall document all noncompliant items and related corrective work.
- F. The Inspection Coordinator shall keep and maintain detailed records of all tests and inspections performed and shall include copies of test and inspection reports with interim reports.
- G. The Inspection Coordinator shall submit interim and final reports in accordance with the provisions of this specification.

3.5 INSPECTOR RESPONSIBILITIES

- A. Inspector(s) shall perform tests and inspections as directed by the Inspection Coordinator.

3.6 STRUCTURAL OBSERVATIONS

- A. Structural observations may be made periodically as determined by the registered design professional in responsible charge.

3.7 TESTING AND INSPECTION

- A. Testing and inspection shall be in accordance with the provisions of this specification and as outlined elsewhere in the Construction Documents.
- B. Reference related specifications for the minimum level of inspections and testing. Provide additional inspections and testing as necessary to determine compliance with the construction drawings.

PART 4 - SCHEDULES AND FORMS (ATTACHED)

4.1 SCHEDULE OF INSPECTORS AND TESTING AGENCIES.

- A. To be submitted by the Inspection Coordinator prior to commencement of construction in accordance with the provisions of this specification along with Inspector and Testing Agency qualifications. Indicate the specific individual(s) responsible for inspecting each material/system.

4.2 REPORTING FORMS

- A. Form STI-IR: Interim Report.
 - 1. Inspectors shall utilize this form to document items tested and inspected, indicate whether or not each item complies with the stated requirements and describe any successful or unsuccessful attempts by the Contractor to correct noncompliant items.
- B. Form STI-NR: Noncompliance Response
 - 1. Designated Inspecting Design Professional shall utilize this form to alert **<Owner>**, Contractor and Inspection Coordinator of actions required on the part of the Contractor to correct non-compliant items.
- C. Form STI-CP: Compliance Proposal
 - 1. Contractors shall utilize this form to submit proposed resolution(s) to noncompliant item(s) to the **<Owner>**, Designated Inspecting Design Professional, and Inspection Coordinator.
- D. Form STI-FR: Final Report
 - 1. After completion of all items requiring structural tests and inspections, the Inspection Coordinator shall utilize this form to report to the Designated Inspecting Design Professional the overall final compliance status. Final Report shall document all noncompliant items (if any) that remain uncorrected at completion of construction.
- E. Form STI-NON: Notification of Noncompliance
 - 1. Designated Inspecting Design Professional shall utilize this form to notify the building official of any noncompliant items at completion of construction.

4.3 SCHEDULE OF TESTS

- A. **<The scope of testing shall be in accordance with this section.> <The scope of testing shall be in accordance with this section. Where other testing requirements are indicated elsewhere in the contract documents they shall be in addition to the requirements in this section. Where conflicting provisions occur, the more stringent requirements shall apply.> <The scope of testing shall be as indicated <in the material specifications> <elsewhere in the contract documents>>.**

1. SOILS AND EARTHWORK

- a. Footing Subgrade: At footing subgrades, perform at least one test of each soil stratum to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Structural Engineer.
- b. Test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 - 1) Prior to backfill placement perform proof rolling test of exposed subgrades.

- 2) Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every [2000 sq. ft. (186 sq. m)] <Insert area> or less of building slab, but in no case fewer than three tests.
 - 3) Foundation Wall Backfill: At each compacted backfill layer, at least one test for every [100 feet (30 m)] <Insert dimension> or less of wall length, but no fewer than two tests.
- c. Controlled Structural Fill:
- 1) Perform sieve tests (ASTM D422 & D1140), Atterberg limits (D4318) and <modified Proctor tests (ASTM D1557)> <standard Proctor tests (ASTM D698)> of each source of fill material.
 - 2) Verify proposed fill material meets project specification.
 - 3) Test density of each lift of fill by nuclear methods (ASTM D2922) for conformance to compaction requirements.
2. DRIVEN PILES
- a. Perform tests of driven piles as follows:
 - 1) Dynamic Pile Testing: Perform high-strain dynamic monitoring and report according to ASTM D 4945 during initial driving and during restriking on [five single] [3 percent of] <Insert number or percent of> piles.
 - 2) <Insert testing requirements>
3. AUGER-CAST PILES
- a. Perform tests of auger-cast piling as follows:
 - 1) <Insert testing requirements>
4. CAST-IN-PLACE CONCRETE
- a. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 - 1) [Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.]
 - 2) [Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mixture placed each day.]
 - 3) Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 - 4) Air Content: ASTM C 231, pressure method, for normal-weight concrete; [ASTM C 173/C 173M, volumetric method, for structural lightweight concrete;] one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - 5) Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
 - 6) Lightweight Concrete Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - 7) Compression Test Specimens: ASTM C 31/C 31M.
 - a) Cast and laboratory cure [one] <Insert number> set of four standard cylinder specimens for each composite sample.
 - 8) Compressive-Strength Tests: ASTM C 39/C 39M.
 - a) Test one laboratory-cured specimen at 7 days and two specimens at 28 days. Reserve fourth specimen as a spare for testing at the discretion of the Structural Engineer as needed.

- b) A compressive-strength test shall be the average compressive strength of two specimens obtained from same composite sample and tested at age indicated.
 - 9) [Field-Cured Compression Test Specimens: ASTM C 31/C 31M.]
 - a) [Cast and field cure **[one]** **<Insert number>** set of four standard cylinder specimens for each composite sample.]
 - b) [When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.]
 - 10) Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
 - 11) Test results shall be reported in writing to Structural Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- 5. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Structural Engineer but will not be used as sole basis for approval or rejection of concrete.
- 6. Additional Tests: Testing agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Structural Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Structural Engineer.
- 7. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- 8. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- 9. SLABS-ON-GRADE
 - a. Perform flatness and levelness measurements as follows:
 - 1) Measure slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within **[24]** **[48]** **<Insert number>** hours of finishing.
- 10. STRUCTURAL PRECAST CONCRETE
 - a. Testing of precast concrete is the responsibility of the precast concrete manufacturer. Testing of precast structural concrete shall be according to PCI MNL 116 requirements and ASTM C 1610/C 1610M, ASTM C 1611/C 1611M, ASTM C 1621/C 1621M, and ASTM C 1712/C 1712M.
 - b. Perform the following tests in the field:
 - 1) Visually inspect **<100%>** of field welds and test according to ASTM E 165 or to ASTM E 709 and ASTM E 1444.
- 11. CONCRETE MASONRY
 - 1) Prior to start of construction, perform the following tests:
 - a) Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
 - b) Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
 - c) Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for **[mortar air content]** **[and]** **[compressive strength]**.

- d) Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.
 - e) Prism Test: For each type of construction provided, according to ASTM C 1314 at [7 days and at] 28 days.
- 2) During the course of construction perform the following tests at a frequency of one set of tests per [5,000] square feet of constructed area:
- a) Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
 - b) Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
 - c) Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for [mortar air content] [and] [compressive strength].
 - d) Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.
 - e) Prism Test: For each type of construction provided, according to ASTM C 1314 at [7 days and at] 28 days.
12. COLD-FORMED STEEL FRAMING
- a. Perform tests of cold-formed steel framing as follows:
 - 1) <Insert testing requirements>
13. STRUCTURAL STEEL FRAMING
- a. Perform testing of structural steel as follows:
 - 1) <Insert testing requirements>
14. STRUCTURAL STEEL TRUSSES
- a. Perform tests of structural steel trusses as follows:
 - 1) < Insert testing requirements>
15. STEEL JOISTS
- a. Perform tests of steel joists as follows:
 - 1) < Insert testing requirements>
16. FLOOR SLABS ON STEEL DECK
- a. Perform flatness measurements as follows:
 - 1) Measure slab flatness according to ASTM E 1155 (ASTM E 1155M) within [24] [48] <Insert number> hours of finishing.
17. POST-INSTALLED ANCHORS AND DOWELS
- a. Proof test mechanical anchors as follows:
 - 1) Anchor type: <insert anchor type>
 - 2) Anchor location(s): <insert anchor locations>
 - 3) Percentage of anchors to be tested: <insert percentage>
 - 4) Proof test tension load: <#,### lbs> <<100%> of allowable tension load capacity>.
 - b. Proof test adhesive anchors as follows:
 - 1) Anchor type: <insert anchor type>
 - 2) Anchor location(s): <insert anchor locations>
 - 3) Percentage of anchors to be tested: <insert percentage>
 - 4) Proof test tension load: <#,### lbs> <<100%> of allowable tension load capacity>.
18. SPRAY-APPLIED FIREPROOFING

- a. Test thickness of fireproofing (ASTM E605). Perform a set of thickness measurements for every 1,000 SF of floor and roof assemblies and on not less than 25% of rated beams and columns.
- b. Test the density of fireproofing material (ASTM E605).
- c. Test the cohesive/adhesive bond strength of fireproofing ASTM E736). Perform not less than one test for each 1,000 SF.

4.4 SCHEDULE OF INSPECTIONS

A. The scope of inspections shall be in accordance with this section.

1. SOILS AND EARTHWORK

- a. Inspect soils below foundations and slabs for adequate compaction and bearing capacity prior to placement of concrete.
- b. Verify performance of required quality control testing.
- c. Inspect all earthwork operations affecting the building foundations, slabs, envelope and related structural items.
- d. Inspect removal of unsuitable material and preparation of subgrade prior to placement of controlled fill. Document extents of necessary removal.
- e. Controlled Structural Fill:
 - 1) Inspect placement, lift thickness and compaction of controlled fill.
 - 2) Verify extent and slope of fill placement.

2. DRIVEN PILES

- a. The inspector must be present during all pile driving operations.
- b. Inspect and log pile driving operations. Record pile driving resistance and verify compliance with driving criteria.
- c. Inspect piles for damage from driving and plumbness.
- d. Verify pile size, length and accessories.
- e. Verify required pile load testing is performed and reported in accordance with the project requirements.

3. DRILLED PIERS

- a. The inspector must be present during all drilled pier operations.
- b. Inspect installation of drilled pier foundations. Verify pier diameter, bell diameter, lengths, embedment into bedrock and suitability of end bearing strata.
- c. Verify required drilled pier load testing is performed and reported in accordance with the project requirements.

4. AUGER-CAST PILES

- a. The inspector must be present during all auger-cast pile installations.
- b. Verify installation to design depth at required grout ratios.
- c. Verify auger-cast pile diameter.
- d. Verify proper size, length and quantity of pile reinforcement is used.
- e. Verify dowels projecting from the pile are installed with the proper development lengths and hooks.
- f. Verify required pile load testing is performed and reported in accordance with the project requirements.
- g. Verify pile integrity testing.

5. PILE CAPS

- a. The inspector must be present full time during the entire placement of the first <2> pile cap concrete pours and then must be present at the start of <100%> of all other concrete pours.

- b. Verify cap dimensions.
 - c. Verify cap reinforcement prior to placement of cap concrete.
 - d. Verify anchor rods and/or dowels are installed with the proper embedment and projection lengths.
 - e. Verify proper engagement of piles into pile cap prior to placement of cap concrete.
6. SHALLOW FOUNDATIONS
- a. The inspector must be present full time during the entire placement of the first <2> shallow foundation concrete pours and then must be present at the start of <100%> of other concrete pours.
 - b. Verify approval of the footing subgrade prior to placement of foundation concrete.
 - c. Verify that forms are plumb and straight, braced against movement, and lubricated for removal.
 - d. For earth-formed foundations, verify that earth forms are sufficiently uniform to allow for proper dimensions and required concrete cover over reinforcement.
 - e. Verify foundation dimensions.
 - f. Verify anchor rods and/or dowels are installed with the embedment and projected lengths and in accordance with the contract documents.
 - g. Verify foundation reinforcement prior to placement of concrete.
 - h. Verify concrete placement as outlined in this inspection plan.
7. GRADE BEAMS
- a. The inspector must be present full time during the entire placement of the first <2> grade beam concrete pours and then must be present at the start of <100%> of other concrete pours.
 - b. Verify approval of the subgrade prior to placement of grade beam concrete.
 - c. Verify that forms are plumb and straight, braced against movement, and lubricated for removal.
 - d. For earth-formed grade beams, verify that earth forms are sufficiently uniform to allow for proper dimensions and required concrete cover over reinforcement.
 - e. Verify grade beam dimensions.
 - f. Verify anchor rods and/or dowels are installed with the embedment and projected lengths and in accordance with the contract documents.
 - g. Verify grade beam reinforcement prior to placement of concrete.
 - h. Verify concrete placement as outlined in this inspection plan.
8. FOUNDATION WALLS AND PITS
- a. The inspector must be present full time during the entire placement of the first <2> concrete pours and then must be present at the start of <100%> of other concrete pours.
 - b. Verify that forms are plumb and straight, braced against movement, and lubricated for removal.
 - c. Verify wall/pit dimensions.
 - d. Verify anchor rods and/or dowels are installed with the embedment and projected lengths and in accordance with the contract documents.
 - e. Verify pit/wall reinforcement prior to placement of concrete.
 - f. Verify water stops are properly installed and anchored into position prior to placement of concrete.
 - g. Verify that foundation and pit walls with uneven backfill conditions are not backfilled until floor construction at top of wall is complete or temporary bracing is provided in accordance with the contract documents.
 - h. Verify concrete placement as outlined in this inspection plan.
9. CONCRETE COLUMNS, WALLS, AND SHEAR WALLS

- a. The inspector must be present full time during the entire placement of the first <2> concrete pours and then must be present at the start of <100%> of other concrete pours.
- b. Verify all reinforcement before vertical forms are placed.
- c. Verify that forms are plumb and straight, braced against movement, lubricated for removal, and conform to approved shop drawings.
- d. Verify proper dimensions and orientation.
- e. For flat slab construction, verify that top of column or wall elevation is set 1/2 inch below the future slab soffit, or as shown on the contract documents.
- f. Verify wall openings and sleeves as follows:
 - 1) Correct size and location as shown on the contract documents.
 - 2) Check placement of additional reinforcement around openings.
 - 3) Report all wall openings larger than 12" that are not shown on the contract documents.
 - 4) Verify that all debris is removed from within the forms prior to concrete placement.

10. CONCRETE RETAINING WALLS

- a. The inspector must be present full time during the entire placement of the first <2> retaining wall concrete pours and then must be present at the start of <100%> of all other concrete pours.
- b. Verify that the project geotechnical engineer has approved the footing subgrade prior to placement of foundation concrete.
- c. Verify foundation toe, heel, overall and thickness dimensions prior to placement of foundation concrete.
- d. Verify foundation reinforcement prior to placement of foundation concrete.
- e. Verify wall dowels are installed with the embedment and projected lengths.
- f. Verify wall reinforcement prior to placement of wall concrete.
- g. Verify that forms are plumb and straight, braced against movement, and lubricated for removal.
- h. Verify that form ties are of the proper type.
- i. Verify weep holes are of proper size, type and spacing.
- j. Verify foundation drains are properly sized and bedded in drainage fill and filter fabric.
- k. Verify control and construction joints are properly spaced and installed in conformance with the contract documents.
- l. Verify that backfill, including drainage fill where required, is properly installed.
- m. Verify concrete placement as outlined in this inspection plan.

11. SLABS-ON-GRADE

- a. The inspector must be present full time during the entire placement of the first <2> slab-on-grade concrete pours and then must be present at the start of <100%> of all other concrete pours.
- b. Observe subgrade preparation including backfilling, compaction, and performance of compaction tests by the testing laboratory prior to concrete placement.
- c. Note any alteration and subsequent replacement of subgrade materials required by other trades.
- d. Verify that required moisture retarder or vapor barrier is lapped properly, and is not torn or punctured.
- e. Observe that formwork at turndowns and slab edges is plumb and straight, braced against movement and lubricated for removal.
- f. Observe placement of screeds to obtain proper level and thickness of slabs. observe location of slab depressions and steps in slab while maintaining required slab thickness.
- g. Verify the pour area is free of standing water and other debris.
- h. Verify placement of reinforcement and observe concreting operations as outlined in this inspection plan.
- i. Check that the location and type of slab control joints and construction joints conform to the contract documents.

- j. Verify that sawcut control joints on slab-on-grades are cut within 12 hours of placement.
- k. Verify that flatness and levelness measurements are performed as required.

12. REINFORCING STEEL

- a. This section applies to all elements of construction identified in this inspection plan that contain reinforcing steel.
- b. Verify that reinforcement surfaces are free of excess rust or other coatings that may adversely affect bonding capacity. If oiling of forms is required, verify that it is applied before reinforcing is placed.
- c. Verify all reinforcing bars for compliance with contract documents and approved shop drawings as follows:
 - 1) Material Grade,
 - 2) Reinforcement size,
 - 3) Quantity, spacing, and layering,
 - 4) Proper hook type and location.
 - 5) Splice locations and required length of lap.
 - 6) Proper clearance and cover requirements from concrete surfaces.
 - 7) Sufficient spacing between reinforcement for concrete placement.
 - 8) Verify that unscheduled/additional reinforcing bars shown on plan, in details, or specified in notes are provided and are in compliance with contract documents and approved shop drawings.
 - 9) Mechanical splices:
 - a) Provide visual inspection of 100% of the mechanical splices (tension and/or compression) on the project.
 - b) Verify compliance with specifications and conformance with the manufacturer's recommendations for installation.
 - c) Verify that the manufacturer is present for the first installation of each type of splice on the project.
 - 10) Verify that welded wire reinforcement is composed of flat sheets, has proper wire gage and spacing, is properly supported, and is properly lapped.
 - 11) Inspect headed stud shear reinforcement to ensure that it conforms to the project requirements:
 - a) Review type and spacing.
 - b) Verify that reinforcing is adequately supported to resist displacement or shifting during concrete placement.
 - c) Verify welding of reinforcement is performed according to AWS requirements and that it is inspected by the testing laboratory.

13. CONCRETE PLACEMENT

- a. This section applies to all cast-in-place concrete elements identified in this inspection plan.
- b. Verify that debris and foreign materials have been removed before concrete is placed.
- c. Verify that quality control testing is provided in accordance with the project requirements.
- d. Verify the following with regard to the testing laboratory:
 - 1) Verify contractor is coordinating with testing agency to allow testing technician to be available to make tests as required.
 - 2) Verify slump is measured at the point of discharge.
 - 3) Verify concrete test cylinders are taken in accordance with the contract documents.
- e. Periodically inspect concrete upon arrival to verify the following:
 - 1) Proper concrete mix number, type of concrete, and concrete strength for the placement location.
 - 2) Verify that the concrete is not over 90 minutes old at the time of placement.
- f. Verify that hot-weather or cold-weather techniques are being applied as required.

- g. Verify that concrete being deposited is uniform, that the vertical drop does not exceed six feet, and that concrete is not permitted to drop freely over reinforcement causing segregation.
- h. Verify that the concrete is properly vibrated.
- i. Verify that embedded items and reinforcing steel are not adversely altered during placement. Note if anything was displaced or otherwise altered during placement.
- j. Verify that there are no cold joints within the area of the pour.
- k. Verify that the curing process is as specified in the contract documents and that any curing compound used is applied in accordance with manufacturer's printed application instructions.

14. CONSTRUCTION JOINTS

- a. Verify the location of vertical and horizontal construction joints for compliance with the construction joint location plan submitted by the contractor to engineer of record.
- b. Verify that reinforcement, dowels, keys, and bulkheads at construction joints are in conformance with the contract documents.
- c. Embedded items:
 - 1) Verify that conduits placed in the concrete are reasonably spaced to ensure structural integrity and comply with the requirements of the contract documents. Verify conduit placement allows for proper concrete cover of the reinforcement.
 - 2) Review load carrying embedded items as placed for compliance with the contract documents. Relocation of embedded items in conflict with reinforcing shall not be permitted without the prior approval of the engineer of record.

15. STRUCTURAL PRECAST CONCRETE

- a. **<Perform the following inspections at the precast fabrication facility for the purpose of evaluating fabricator's ability to produce precast concrete of acceptable quality:**
 - 1) **Evaluate precast manufacturer's quality control and testing methods for conformance to PCI MNL 116 requirements and ASTM C 1610/C 1610M, ASTM C 1611/C 1611M, ASTM C 1621/C 1621M, and ASTM C 1712/C 1712M.**
 - 2) **Review plant operations and quality control procedures.**
 - 3) **Inspect procedures for placement of reinforcement, prestressing tendons, embedded items, reveals, form liners, chamfers, etc.**
 - 4) **Inspect placement of concrete. Verify that concrete conveyance and depositing avoids segregation or contamination. Verify that concrete is properly consolidated.**
 - 5) **Inspect curing, cold weather protection and hot weather protection procedures.>**
- b. Perform the following inspections at the project site:
 - 1) Inspect erection of precast concrete including member configuration, alignment, connections, welding and grouting.
 - 2) Visually inspect **<100%>** of field welds and test suspect welds according to ASTM E 165 or to ASTM E 709 and ASTM E 1444.
 - 3) Visually inspect all high-strength bolted connections. For slip-critical bolted connections, verify installation is performed in accordance with one of the following methods:
 - a) Turn-of-Nut: According to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - b) Calibrated Wrench: According to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - c) Twist-off Tension Control Bolt: ASTM F 1852.
 - d) Direct-Tension Control Bolt: ASTM F 1852.

16. CONCRETE MASONRY

- a. The inspector must be present at the site **<for a minimum of 2 hours per day>** **<continuously>** while concrete masonry construction is in progress.
- b. Verify that materials are stored properly before placement in the structure.
- c. Verify wall locations and thicknesses.
- d. Verify the proper installation of horizontal joint reinforcement.
- e. Verify the proper installation of control joints, type and location.
- f. Verify the proper installation of lintels, sills, and door or window jambs.
- g. Verify that the masonry is properly connected to the supporting structure(s).
- h. Mortar and grout:
 - 1) Verify that mortar and grout materials comply with the contract documents and approved submittals.
 - 2) Site-mixed mortar: Verify the mortar is mixed in accordance with specified proportions.
 - 3) Bag-mix mortar: Verify the mortar is mixed according to the manufacturer's instructions.
 - 4) Verify proper mortar placement.
 - 5) Grout bag mix: Verify that the grout is mixed according to the manufacturer's instructions.
 - 6) Ready-mix grout: Verify the mix number and grout strength.
 - 7) Prior to any grouting procedure, inspect the grout space to verify that it is clean and that cleanouts, if required, are in place and conform to requirements of the contract documents.
 - 8) Verify the proper grout placement and consolidation.
 - 9) Verify that grout testing is performed in accordance with the contract documents.
- i. Reinforcing steel:
 - 1) Verify that the size, spacing, location, hooks, and lap splice lengths of vertical and horizontal reinforcement are installed in accordance with the contract documents.
 - 2) Notify the engineer of record when placement of conduit, piping or other items interferes with cell grouting and/or vertical reinforcing steel.

17. COLD-FORMED STEEL FRAMING

- a. Visually inspect elements as follows:
 - 1) 10% of stick-framed bearing wall construction and assemblies
 - 2) 100% of all strap bracing, hold-down anchors and related connections
 - 3) 100% of all shear walls, hold-down anchors and related connections
 - 4) 100% of all cold-formed steel truss anchorage connections
- b. Inspect framing member sizes, configuration and spacing.
- c. Verify material gauges meet indicated requirements.
- d. Verify proper material yield strengths.
- e. Verify proper connection materials are used (clips, brackets, etc.). Visually observe size, type, configuration and installation of fasteners. Verify proper engagement into connected materials.
- f. Visually inspect welding for size, quantity and quality.
- g. Verify framing assemblies are constructed to the configurations required and that all materials are provided for a complete assembly. Review installation of all permanent bridging and bracing.
- h. Inspect the installation of cold-formed metal trusses for proper location and fastening to supports.
- i. Verify proper alignment of supported elements on load-bearing walls, including assemblies requiring supported elements to be installed directly above supporting studs.

18. WOOD CONSTRUCTION

- a. Visually inspect elements as follows:
 - 1) **<10%>** of stick-framed bearing wall construction and assemblies

- 2) <100%> of all shear walls, hold-down anchors and related connections
- 3) <100%> of all wood truss anchorage connections
- b. Inspect sill anchorages for wall construction. Inspect connections and connection hardware for proper size, type, configuration and quantity of fasteners.
- c. Verify materials are in accordance with specification requirements including: type, grade, moisture content, material properties, etc.
- d. Inspect framing sizes and configurations.
- e. Verify treated lumber is used where required.
- f. Inspect size, configuration, blocking and fastening of shear walls and diaphragms. Verify sheathing panel grade and thickness. Inspect hold-down anchors and fasteners into chord members.
- g. Prefabricated Wood Trusses;
 - 1) Inspect shop fabrication and quality control procedures for wood truss plant.
 - 2) Inspect the installation of wood trusses for proper location and fastening to supports.
 - 3) Verify bracing is installed in accordance with project plans and/or erection drawings.

19. STRUCTURAL STEEL FRAMING

- a. Visually inspect structural steel elements as follows:
 - 1) Inspect <100%> of beam and girder construction and assemblies
 - 2) Inspect <100%> of all braced frames and moment frames
- b. Visually inspect steel as it is received for possible damage in shipping, workmanship, and piece marking.
- c. Review certified mill test reports and identification markings on wide-flange shapes, high-strength bolts, nuts and welding electrodes.
- d. Verify that steel member sizes and steel grade conform to the contract documents and approved shop drawings.
- e. Check the installation of base plates for proper leveling.
- f. Verify the proper grout type and installation procedures are followed.
- g. Inspect field welded connections as follows:
 - 1) Inspect <100%> of complete joint penetration field welds.
 - 2) Inspect <100%> of partial joint penetration field welds.
 - 3) Inspect <100%> of fillet field welds in lateral-load-resisting braced frames and moment frames.
 - 4) Inspect <10%> of other fillet field welds.
 - 5) Perform pre-welding inspections to verify that materials (i.e. structural steel, weld filler material, etc.), welding procedures, and welding personnel qualifications are appropriate.
 - 6) Visually inspect field welds according to AWS D1.1/D1.1M.
 - 7) Verify welding procedures are in accordance with AWS requirements.
 - 8) Inspect pre-heat, post-heat and surface preparation between passes.
 - 9) Verify size and length of fillet welds.
 - 10) Verify that welds are clean; welder identification is legible; size, length and location of welds; verify that welds meet acceptance criteria; placement of reinforcement fillets; removal of backing bars and weld tabs as required; and repair activities.
 - 11) Provide continuous inspection for full-penetration and partial-penetration groove welds and multi-pass fillet welds.
- h. Inspect bolted connections as follows:
 - 1) Inspect <100%> of all pre-tensioned and slip-critical bolted connections.
 - 2) Inspect <100%> of bolted connections in lateral-load-resisting braced frames and moment frames
 - 3) Inspect <20%> of all other bolted connections.
 - 4) For slip-critical bolted connections, verify installation is performed in accordance with one of the following methods:

- a) Turn-of-Nut: According to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - b) Calibrated Wrench: According to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - c) Twist-off Tension Control Bolt: ASTM F 1852.
 - d) Direct-Tension Control Bolt: ASTM F 1852.
- 5) For all bolted connections, verify quantity, size and grade of bolts, required surface preparation and proper fit-up of connected elements.
- i. Inspect **<100%>** of the column splices and base joints for verification that gaps in contact bearing do not exceed 1/16 inch.
 - 1) Gaps greater than 1/16 inch shall be reported to the engineer of record for assessment.
 - j. Inspect steel frame for compliance with structural drawings, including bracing, member configuration and connection details.
 - k. Composite steel beams:
 - 1) Observe the welding of shear connectors. Inspect studs for full 360 degree flash.
 - 2) Inspect size, number, positioning and welding of shear connectors.
 - 3) Ring test **<100%>** of shear connectors with a 3 lb hammer.
 - 4) Bend test all questionable studs to 15 degrees.
 - l. Steel grating:
 - 1) Visually inspect the grating for damage during shipping.
 - 2) Verify that the grating depth, type or properties, and finish comply with the contract documents and/or approved shop drawings.
 - 3) Verify all grating attachment to the supporting concrete, steel, and/or masonry as specified in the contract documents and/or approved shop drawings.

20. STRUCTURAL STEEL TRUSSES

- a. Visually inspect field splices to ensure that trusses are properly connected before removal of temporary bracing.
- b. Verify that trusses are picked up by the crane at the specified and approved points.
- c. Verify that erection proceeds in the sequence and method as shown on the approved erection plan. Report any discrepancies to the engineer of record.
- d. Welded Connections:
 - 1) Visually inspect all field-welded connections are for conformance with the contract documents and the approved shop drawings.
 - 2) Verify that proper welding procedures are being implemented.
- e. Bolted connections:
 - 1) Verify bolt and washer sizes and types.
 - 2) Verify the tightening method for high strength bolts and that impact wrenches are being properly calibrated.
 - 3) Visually check that bolts are being tightened properly.
- f. Erection Procedures:
 - 1) Obtain a copy of the approved erection plan.
 - 2) Verify that steel is erected in accordance with the approved erection plan.
 - 3) Verify that temporary bracing is installed and is in conformance with the approved erection drawings.
 - 4) Verify that surveys are occurring as required by the contract documents to check plumbness and frame alignment as erection progresses.
 - 5) Review the submitted survey report.

21. STEEL JOISTS

- a. Visually inspect all joists for damage.
- b. Verify that the size and spacing of the joists being installed comply with the contract documents and approved shop drawings.
- c. Verify that proper joist bridging is being installed.

- d. Verify that the proper bearing at joist supports is provided.
 - e. Visually inspect connections of joists to supports.
22. FLOOR SLABS ON STEEL DECK
- a. Inspect all concrete placements exceeding <500> sft in area.
 - b. Inspect a minimum of <25%> of the concrete placement as it occurs.
 - c. Visually inspect the deck for damage during shipping.
 - d. Verify that the deck depth, gauge, type, properties and finish comply with the contract documents.
 - e. Verify that the deck attachment to the supporting steel is as indicated in the contract documents.
 - f. Inspect reinforcement (welded wire or mild steel bars) for size, lap length and cover as specified in the contract documents support before all concrete pours.
 - g. Verify the concrete thickness and slope, if any, for conformance with the contract documents.
 - h. Verify that the proper concrete type and strength is being placed.
23. ROOF DECK
- a. Visually inspect the deck for damage.
 - b. Verify that the deck depth, gauge, type, properties and finish comply with the contract documents.
 - c. Verify that the deck attachment to the supporting steel is as specified in the contract documents.
 - d. Verify that the proper deck support is used around openings.
 - e. Verify that deck accessories are being installed according to the contract documents and approved shop drawings.
24. POST-INSTALLED ANCHORS AND DOWELS
- a. Inspect post-installed anchor installation at the following frequencies:
 - 1) Mechanical Anchors:
 - a) Inspect installation of first <10> post-installed mechanical anchors for each individual installer with each individual anchor product.
 - b) Inspect <10%> of remaining anchor installations after the initial verification.
 - 2) Adhesive Anchors and Reinforcing Dowels:
 - a) Inspect installation of first <10> post-installed adhesive anchors for each individual installer with each individual anchor product.
 - b) Inspect <10%> of remaining anchor installations after the initial verification.
 - 3) Verify that each inspected anchor and dowel is installed in accordance with manufacturer's printed installation instructions as well as the following requirements:
 - a) Anchor/product type, manufacturer and material grade
 - b) Anchor diameter, length and installed embedment depth
 - c) Hole diameter and depth
 - d) Hole preparation (cleaning procedure and cleanliness)
 - e) Edge distances and spacing
 - f) Inspect expansion bolt installations for proper torque.
 - 4) The following additional requirements apply to adhesive anchors and reinforcing dowels:
 - a) Verify the proper adhesive product is used for each application.
 - b) Verify the adhesive product being installed has not exceeded its expiration date.
 - c) Verify proper mixing and installation of the adhesive
25. EXPANSION JOINTS
- a. Check the joint manufacturer, type, and width for compliance with the contract documents and approved shop drawings.

26. EXISTING STRUCTURES

- a. Verify that storage of materials on existing floors has been approved by the engineer of record.
- b. Verify that the demolition and installation limitations defined on the contract documents are not exceeded.
- c. Verify that all demolition and installation procedures are in conformance with the contract documents.
- d. Verify that all hoisting and demolition equipment used on site has been approved or is as specified in the contract documents.
- e. Verify that all new openings in the existing structure have been reviewed by the engineer of record before the commencement of core drilling or demolition.

27. SPRAY-APPLIED FIREPROOFING

- a. Review fireproofing products for compliance prior to installation.
- b. Review UL fire resistive design for each rated beam, column, or assembly.
- c. Review approved thickness schedule.
- d. Inspect surface preparation of steel prior to application of fireproofing.
- e. Inspect application of fireproofing.
- f. Verify ambient air temperature and ventilation is suitable for application and curing of fireproofing.
- g. Verify that testing of fireproofing materials is performed as required.

Schedule of Inspectors and Testing Agencies

PROJECT: _____

The Structural Tests and Inspections Program for this project includes the following materials/systems:

- | | |
|--|---|
| <input type="checkbox"/> Cast-in-Place Concrete | <input type="checkbox"/> Soils and Foundations |
| <input type="checkbox"/> Structural Steel | <input type="checkbox"/> Precast Concrete |
| <input type="checkbox"/> Masonry | <input type="checkbox"/> Spray-Applied Fireproofing |
| <input type="checkbox"/> Wood Construction | <input type="checkbox"/> Other: _____ |
| <input type="checkbox"/> Cold-Formed Steel Framing | <input type="checkbox"/> Other: _____ |

Inspector/Agency Name	Material/System Responsibility	Firm, Address, Telephone, e-mail
1. Inspection Coordinator		
2. Inspector		
3. Inspector		
4. Inspector		
5. Testing Agency		
6. Other		

Note: Provide names of individual inspectors and the material/system each is responsible to inspect. Provide agency names for firms providing material testing services. Provide additional copies of this form as necessary.

INTERIM REPORT

STI-IR #:

PROJECT: _____

Attach supporting documents to this form and reference each attachment in the description section.

MATERIAL/SYSTEM:	<input type="text"/>	ITEM #:	<input type="text"/>	DATE:	<input type="text"/>
DESCRIPTION OF LOCATION, TESTING AND INSPECTION					COMPLIES?
					<input type="checkbox"/> YES
					<input type="checkbox"/> NO
DESCRIBE ANY CORRECTIVE ACTIONS THAT WERE ATTEMPTED OR IMPLEMENTED					
<input type="text"/>					

MATERIAL/SYSTEM:	<input type="text"/>	ITEM #:	<input type="text"/>	DATE:	<input type="text"/>
DESCRIPTION OF LOCATION, TESTING AND INSPECTION					COMPLIES?
					<input type="checkbox"/> YES
					<input type="checkbox"/> NO
DESCRIBE ANY CORRECTIVE ACTIONS THAT WERE ATTEMPTED OR IMPLEMENTED					
<input type="text"/>					

ADDITIONAL COMMENTS:
<input type="text"/>

SIGNED: _____
Inspection Coordinator

DATE: _____

PRINTED NAME: _____

NONCOMPLIANCE RESPONSE

STI-NR #:

PROJECT: _____

Attach supporting documents to this form and reference each attachment in the description section.

RESPONSE REFERENCE (Check One):	<input type="checkbox"/> STI-IR #: _____	<input type="checkbox"/> STI-CP #: _____	<input type="checkbox"/> STI-FR
MATERIAL/SYSTEM:			ITEM: _____
<input type="checkbox"/> PROPOSAL OR CORRECTIVE ACTION ACCEPTED	<input type="checkbox"/> CONDITIONAL APPROVAL WITH CORRECTIONS DESCRIBED BELOW	<input type="checkbox"/> PROPOSAL REJECTED, REVISE & RESUBMIT	
DESCRIPTION OF REQUIRED ACTION			

SIGNED: _____
Designated Inspecting Design Professional

DATE: _____

PRINTED NAME: _____

COMPLIANCE PROPOSAL

STI-CP #:

PROJECT: _____

Attach supporting documents to this form and reference each attachment in the description section.

STI-IR #:	MATERIAL/SYSTEM:	ITEM #:
DESCRIPTION OF PROPOSED CORRECTIVE ACTION		

SIGNED: _____
Contractor Representative

DATE: _____

PRINTED NAME: _____

PROJECT: _____

All of the requirements of the Structural Testing and Inspection Program, as described in Specification Section 01 45 30, have been satisfactorily completed or appropriately corrected as documented on the Interim Reports.

The requirements of the Structural Testing and Inspection Program, as described in Specification Section 01 45 30, have NOT been satisfactorily completed or noted discrepancies have NOT been appropriately corrected (Described noncomplying items below).

DESCRIPTION OF NONCOMPLIANT ITEMS

(Attach continuation sheets if required to complete the description of non-complying items.)
Interim reports submitted prior to this final report form a basis for, and are to be considered an integral part of, this final report.

**ADDITIONAL
COMMENTS:**

To the best of my knowledge and belief, the information provided on this form is accurate and complete.

SIGNED: _____

Inspection Coordinator

DATE: _____

PRINTED NAME: _____

NOTIFICATION OF NONCOMPLIANCE

STI-NON

TO:

PROJECT: _____

AGENCY PERMIT #: _____

A Structural Testing and Inspection Program was implemented for the above referenced project. The requirements of the program were defined in the project Specification Section 01 45 30. The requirements of this process were NOT properly satisfied.

In accordance with item 4 of the Design Professional Certificate Section of the Application for Construction Design Release, it is the duty of the Designated Inspecting Design Professional to "Notify the owner and authorities having jurisdiction of all specific deviations and code violations." The deficiencies in the Structural Testing and Inspection program are therefore noted below:

Attach supporting documents to this form and reference each attachment in the description section.

DESCRIPTION OF NONCOMPLIANT ITEMS

SIGNED: _____

Designated Inspecting Design Professional

DATE: _____

PRINTED NAME: _____

COPIES TO:

Electronic versions of the forms used in this specification are available for download from the Indiana Structural Engineers Association website (www.seain.org)

END OF SECTION 01 45 30