City of Rockville
Department of Community Planning and Development Services
Inspection Services Division
240-314-8240 / 240-314-8265 (Fax)

Complex Structures Requirements

PROFESSIONAL ARCHITECTURAL AND ENGINEERING SERVICES

1) **Special Professional Services:** Where applications for building permits for structures of unusual design or magnitude of construction are filed or where the 2012 International Building Code Section 1704 require special architectural and engineering inspections, the building official will require special professional services during construction. The professionals providing these services shall keep daily records and submit reports as required by the building official. (IBC Section 1704) These services and reports are stipulated in the Complex Structure Agreement.

2) **Building Permit Requirement:** The special professional services requirements shall be determined before the issuance of the building permit. (IBC Section 110.3.9) Before the permit is issued the parties to the construction must enter into a written agreement (see Attachment A) whereby they agree to comply with the City requirements for complex structures, and in which the owner agrees to implement an inspection plan approved by the City and acknowledges that implementation of the plan is a prerequisite for the issuance of the Occupancy Permit to the extent of the matters covered by the Inspection Plan.

3) **Fees and Costs:** All fees and costs related to the performance of special services shall be borne by the owner.

4) **Engagement of Individuals or Organization:** Any individual or organization engaged to perform inspection services or laboratory-testing services shall be engaged by the owner or his/her representative. No individual or organization engaged to provide the inspection services identified herein shall be engaged by any construction contractor.

CLASSIFICATION OF STRUCTURES OF UNUSUAL DESIGN OR MAGNITUDE OF CONSTRUCTION (COMPLEX STRUCTURES)

1) **Complex Structures:** The following structures shall be considered complex structures:

   a) All buildings three levels or more in height, except one and two family dwellings;
   b) All deep foundations, such as caissons and piles;
   c) All post-tensioned buildings;
   d) Buildings on problem soil conditions;
   e) Other structures determined by the building official to be of unusual design or magnitude, or construction such as malls, large shopping centers, and public parking garages or where code reference standards in the International Building Codes require special architectural or engineering inspections.

2) **Complex Structure Identification:** Upon receipt of an application for a building permit by the Inspection Services Division (ISD), the Plan Review Section of ISD will review the drawings to determine whether or not the application is for a complex structure.

3) **Notification to Applicant:** If the Plan Review Section determines that the application is for a complex structure, the responsible official of the ISD will notify the owner or his/her representative of such determination.

PRE-CONSTRUCTION MEETING (IF REQUIRED BY THE CHIEF OF INSPECTION SERVICES)

1) **Preparation for Pre-Construction Meeting:** After the permits have been issued by the City and it was determined that his building or other structure falls within the purview of these requirements, the owner or his/her representative shall arrange with the City to hold a Pre-Construction Meeting.

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2) **Pre-Construction Meeting:** A Pre-Construction Meeting shall be held for the purpose of:

a) Discussing the City requirements for Complex Structures.
b) Reviewing the proposed Inspection Plan.
c) Discuss the method and who will receive the required reports.

3) **Attendants at the Pre-Construction Meeting:** At least the following should be present at the pre-Construction Meeting.

a) Owner or his/her representative.
b) Structural engineer of record.
c) Professional in charge of architectural inspection if applicable.
d) Professional in charge of mechanical/plumbing/electrical inspections.
e) Professional in charge of geotechnical services.
f) Professional in charge of structural inspections.
g) Professional in charge of materials testing laboratory.
h) General contractor.
i) City representative.

COMPLEX STRUCTURES AGREEMENT (SEE ATTACHMENT A)

1) **Contents of Agreement:** The Agreement shall consist of:

a) A signed declaration by all the principal parties to the construction, inspection and testing processes to the effect that the construction will be carried out in compliance with the City of Rockville requirements for Complex Structures and all City Construction codes and ordinances.
b) Acknowledgement by the owner that implementation of the Inspection Plan is a requisite for the issuance of the Building permit.
c) The Inspection Plan, stating who will perform inspections of each part of the structure.

2) **The Inspection Plan:** The owner shall prepare an Inspection Plan that identifies specifically the various functions to be performed and those who shall perform them, in accordance with requirements stated herein. In identifying organizations or individuals, the owner shall provide the documentation required to establish their credentials if requested by the City. The Inspection Plan shall provide for the following inspection, testing, and implementation responsibilities as
applicable for the construction project and as included in the Complex Structure Agreement. Inspection requirements contained herein are in addition to inspection by the City's Inspection Services Division personnel.

a) Owner

i) Responsible for implementing the Inspection Plan and for requesting for City approval for any modifications to the plan.
ii) Submit work - time schedule to the City.
iii) Submit to the City copies of contracts with inspection agency and testing laboratory showing scope of work.
iv) Notify City when construction starts.
v) Requesting inspections by City Inspection Services Division personnel 24 hours in advance of need.

b) Structural Engineer of Record (SER)

i) Review shop drawings before steel fabrication and other structural shop drawings.
ii) Approve concrete mix design and send copy to City.
iii) Review and comment on formwork and shoring design and send copy to the City.
iv) Review criteria for removal and re-shoring of formwork and send copy to the City.
v) Approve concrete quality control plan and submit copy to the City.
vi) Review construction observations, inspection and testing records and reports as submitted by Geotechnical Engineering and superstructure inspecting and testing service, for conformance with the structural contract document, (Project Plans and Specifications) and the City of Rockville Building Code. Initiate appropriate

action as required in response to the reports that are reviewed.

vii) Upon completion of foundation and superstructure work provide in writing a professional opinion as to the project's compliance with the structural plans and specifications and the City Rockville Building Codes.

c) Geotechnical Engineering Services

i) Soils

(1) Observe proof rolling and delineate unsuitable materials within areas proposed for support of structural fill, ground slabs and pavement areas.
(2) Conduct laboratory tests on samples of proposed fill materials.
(3) Observe placement of engineered fill and backfill materials.
(4) Conduct field density tests on placed compacted fill.
(5) Provide written statement that fill placement was performed in accordance with approved construction documents.
(6) At least one soil technician shall be present full-time during compaction of structural fill material.

ii) Foundations – Footings

(1) Conduct foundation excavation tests to determine adequate bearing.
(2) The Geotechnical Engineer shall state in writing that in his/her professional opinion the footings are bearing on sub grades capable of supporting the design loads.

iii) Pile Foundations

(1) Observe test pile driving and record data. The data to include type and size of hammer, the rate of penetration, and the type and dimensions of casings.
(2) Observe load tests on test piles and record data to determine if tests were performed in accordance with project specifications.
(3) Analyze load test data and provide driving criteria, including revised estimated pile tip elevations at test boring locations.
(4) Observe pile driving and keep a record of each pile driven containing specifications of pile hammer used, pile dimensions, tip and cut-off elevation of piles, blow count for pile as specified, plumbness of pile(s), and as-built location obtained from contractor's survey, and other pertinent information pertaining to the pile and it's driving.
(5) Ascertain that piles do not exceed driving tolerances as to location, plumbness, and batter angle.
(6) The Geotechnical Engineer shall state in writing that in his/her professional opinion all piles were driven and developed bearing capacity in accordance with specifications.

iv) Caissons

(1) Observe the drilling of the caissons to assure sufficient penetration of transition material to develop design sidewall friction and/or end bearing as required.
(2) Ascertain that caissons are not placed beyond established tolerances for plumbness.
(3) Observe and approve caisson prior to placement of concrete.
(4) Observe concrete placement.
(5) The Geotechnical Engineer shall state in writing that the caissons have been placed in accordance with plans and specifications.

v) Records and Certification

(1) During construction provide the SER, among others, current copies of all field records and reports, laboratory reports, test data, foundation, installation records, etc., for review.
(2) Upon completion of the Geotechnical Engineering Services, the Geotechnical Engineer shall provide a certified document stating that to the best of his/her knowledge and in his/her opinion the construction of soils and foundations has been completed in accordance with the requirements of the Structural Contracts Documents (project plans and specifications) and the City of Rockville Building Code.
(3) The SER shall receive a copy of the final reports and certification documents.

d) S**uper Structure Inspection and Testing Services**

i) Reinforced concrete structures

(1) Formwork and reinforcing

(a) Inspect form-work and reinforcing prior to placing concrete, and authorize pouring.
(b) Authorize in writing the stripping of formwork and shoring prior to removal of these materials.
(c) Inspect all connections between pre-cast concrete and poured-in-place concrete.

(2) Sampling

(a) Take samples of concrete in accordance with ASTM specifications for "Sampling fresh concrete."

(3) Batching

(a) Inspect batching, mixing, and delivery operations for compliance with the specifications.

(4) Compression Tests

(a) Label each compression cylinder identifying the truckload of concrete from which sample was taken and the exact location in construction where deposited.
(b) Test specimens in accordance with ASTM standard "Method of Test for Compressive Strength of Molded cylinders."

(5) Slump Tests

(a) Conduct slump tests in accordance with specifications.
(b) Conduct slump tests at a minimum at the same frequency and same truckload as compression tests.

(6) Air Content tests

(a) Conduct air content tests in conformance with ASTM C231.
(b) Determine air content at same frequency and from same truckload as for compression tests.

Copies of all testing reports must be sent to the City of Rockville within 5 business days from the date of testing.

ii) Post-Tension Structures

(1) Inspect formwork, tendons and reinforcing prior to placing of concrete.
(2) Observe all placing of concrete.
(3) Observe all tensioning and keep tensioning records.
(4) Grant permission to contractor prior to all burning, cutting or capping of pre-stressing anchorage.
(5) Perform testing of concrete as for cast-in-place concrete except as modified in the specifications for post-tensioning structure.

iii) Structural Steel Structures

(1) Observe shop fabrication facilities and verify shop welders qualifications by examining their certifications.
(2) Check setting of anchor bolts and base plates.
(3) Structural Steel Structures continued;
(4) Determine that members are properly located and that member sizes are in accordance with approved plans.
(5) Check field welder's qualifications by examining their certificates.
(6) Observe erected members for proper workmanship and to determine that members are plumb and level.
(7) Observe shop and field connections for proper workmanship.

(8) Test any shop weld that visually appears questionable.
(9) Test each full penetration butt or groove weld by ultrasonic method. The radiographic method shall be used to clarify ultrasonic results where necessary.
(10) Test high strength bolting in accordance with generally accepted engineering practice and as specified herein.
(11) Inspect sprayed on fireresistive materials (SFRM) A copy of the inspection report must be available on the jobsite prior to the City close in inspection.
(12) Test shear studs in accordance with generally accepted engineering practice.
(13) Observe steel deck placement.
(14) Observe steel joist placement.

iv) Structural Masonry Structures

(1) Observe sampling and placing of masonry units.
(2) Observe placement of reinforcing.
(3) Conduct mortar and grout tests per contract documents.
(4) Conduct prism test per contract documents.
(5) Inspect the framing system as required.

v) Records and Certification

(1) During construction provide the SER current copies of all construction inspection records and reports, laboratory reports, tests, etc., for review.
(2) Upon completion of the structural phase of the building, the inspection agency shall provide a certified document stating that to the best of his/her knowledge and in his/her opinion the construction of the super structure has been completed in accordance with the requirements of the Structural Contract Documents (project plans and specifications) and the City of Rockville Building Code. Report is required prior to close in by City inspectors. Keep a copy of report on jobsite available for City inspectors review.
(3) The SER shall receive a copy of the final reports and certification documents.

e) Mechanical/Plumbing/Electrical Systems Inspection Services

i) Provide periodic inspections of the systems installation.
ii) Upon completion of the work, the professional providing mechanical/plumbing/electrical inspection service shall certify in writing that to the best of his/her knowledge, information and belief, the construction of the mechanical/plumbing/electrical systems have been completed in accordance with the approved construction documents and the Mechanical, Plumbing and Electrical Code(s) of the City of Rockville.

f) Architectural Observation Services

i) Provide observation of the construction work at intervals appropriate with the work to establish compliance with approved construction drawings for the following areas:

(1) Means of egress.
(2) Fire resistive construction requirements.
(3) Maryland Accessibility Code
(4) Conduct close-in inspections and authorize proceeding with the work in conjunction with close-in inspection and approval by the Inspection Services Division.
(5) Fire resistive Construction: Visual observation of fire-resistant construction and fire stopping shall be made at intervals appropriate to the progress of the work to establish conformance with the fire resistance rating of the structure as required by the approved construction drawings and specifications and the City Building Code.
(6) Upon completion of the work, the architect shall provide written certification that to the best of his/her knowledge, information and belief, the work that he/she was responsible to observe was constructed in accordance with the approved construction drawings and specifications, the City Building and Life Safety Codes and the Maryland Accessibility Code

g) Fire Protection Engineering (FPE).

i) If required, Provide observations and inspections of the construction work at intervals appropriate with the work to establish compliance with approved construction drawings as specified in the City Code Amendments for the FPE

OTHER GENERAL REQUIREMENTS

1) **Subsurface Investigation Report:** Prior to commencement of construction the owner shall provide a copy of a subsurface investigation report of the project site prepared by a geotechnical engineering firm and signed by a geotechnical engineer duly registered in the State of Maryland.

2) **Direction of Professional Services:** All inspections performed by an inspection agency and tests performed by a laboratory shall be conducted under the guidance and responsibility of a professional architect/engineer registered in the State of Maryland.

3) **Identification of Organizations and Individuals:** The owner shall identify all organizations and individuals who have been engaged to perform inspection, except that it shall be unnecessary to identify individuals who are employees of engaged organizations which shall assign specific individuals later, providing such organizations state, in writing, that any such individuals they assign will be in compliance with the various competency verification requirements stated herein.

4) **Competence of Inspecting Personnel:** Except for individuals who are architects or professional engineers duly licensed by the State of Maryland, all persons engaged for purposes of inspection shall provide evidence of their competence to perform the inspections for which they have been engaged. Such evidence shall include as a minimum appropriate certification by the Washington Area Council of Engineering Laboratories (WACEL), the National Institute for Certification in Engineering Technologies (NICET), or some other organization whose programs are recognized by the City. In the event there is no program applicable to a specific function, the individual involved shall furnish to the City personal background information bearing upon his/her competency.

5) **Qualifications of Testing Laboratories:** Any engineering testing laboratory engaged to perform services relative to materials testing shall meet requirements of ASTM E329 and shall be accredited by the Washington Area Council of Engineering Laboratories (WACEL), the American Association for Laboratory Accreditation (AALA), the National Voluntary Laboratory Accreditation Program (NVLAP) or some other organization whose laboratory accreditation program is recognized by the City.

6) **Inspection and Testing Reports:** All inspection and testing reports shall be sent within five business days of the inspection or testing activity involved to the owner or his designee, the Chief of Inspection Services and to such others as the owner may direct. Each such report shall identify the individual who performed the inspection or test and shall highlight or otherwise call special attention to any conditions which were unanticipated, or which were not in conformance with plans, specification, applicable standards or regulations or the City Building Code. Reports of corrective measures taken and the adequacy of such measures shall bear the seal and signature of the architect or engineer in responsible charge of testing or inspection. All reports must state the building address, project name and related permit number.

7) **Soil Testing and Compaction:** Soil testing and compaction shall be undertaken under the observation of a geotechnical soils engineer duly registered in the State of Maryland or by qualified personnel under his/her guidance.

8) **Laboratory Tests of Fill and Backfill Materials:** Classification tests consisting of gradation analysis and Atterburg limits shall be performed to evaluate suitability for use. Proctor test to determine moisture/density curves for the soils to be used as fill and backfill shall be performed in accordance with the project specification.

9) **Soils Compaction Tests:** Field density tests shall be performed in accordance with ASTM D1556 (sand cone method), ASTM D2922 (nuclear method), ASTM D2167 (rubber balloon method), or ASTM D2937 to verify that specified degree of compaction is achieved.

10) **Minimum Compaction:** All fills supporting the foundation of any structure shall be compacted to at least a density as required by the project specifications.

11) **Bearing Piles:** Bearing piles of all types shall be inspected in accordance with accepted engineering practice. Upon completion of pile installation, a report of such inspection shall be submitted to the City within ten days of its installation and shall include findings based upon inspection.

12) **Load Testing of Piles:** Load tests shall be performed on test piles in accordance with ASTM D1143 or per project specifications.

13) **Production of Precast Piles:** The production of precast piles shall take place at a fabricating plant engaged primarily in the manufacturing of similar units. Quality control shall comply with PCI MNC-116 "Manual for Quality Control" for production of pre-cast concrete units.

14) **Caisson Foundations:** Caissons shall be inspected in accordance with accepted engineering practice. No concrete shall be placed without the approval of a geotechnical engineer registered in the State of Maryland or of a technician under his/her guidance. Concrete and reinforcing shall be in compliance with the requirements stated herein for the testing, placing and inspecting of those materials. Upon completion of the caisson installation, the geotechnical engineer shall provide a report to the City of the caisson installation and a professional opinion that the caissons have been installed and are bearing on subsurface per project specifications. Such report shall bear the seal and signature of the geotechnical engineer in charge.

15) **Excavation Bearing Test for Footings:** Excavation bearing tests under the guidance of a geotechnical engineer registered in the State of Maryland shall be conducted to ascertain that footings will bear on sub grades capable of supporting the design loads. No concrete shall be placed without the approval of the engineer or the technician. Upon completion of foundation work the geotechnical engineer in charge shall provide a report to the City related to the footing construction and a written professional opinion that the sub grades meet the requirement of the project plans and specifications.

16) **Cast-in Place Concrete Construction:** Concrete construction shall comply with building code requirements for reinforced concrete (ACI Standards 318, 301, 305, and 306), and concrete inspections shall be performed in accordance with recommended practices (ACI Standard 311). Quality control procedures shall comply with ACI Standard 311 (Chapter 4, "Concrete Quality") and any additional requirements, which may be directed, by the architect or engineer of record and/or the City.

    a) Full-time inspection shall be provided during concreting operations related to the structural elements of the building. A copy of all inspection reports shall be submitted to the City and to the SER. At a minimum, the following number of test cylinders shall be cast for each 150 cubic yards of concrete poured or each 5,000 square feet covered, or, in the event such is not poured in a day, for that day's work:

For elevated slabs (Including beams)	**For walls & columns**	**For footings & all structural concrete**
2 @ 28 days, lab-cured	2 @ 28 days, lab-cured	2 @ 28 days, lab-cured
2 @ 28 days, field-cured	2 @ 7 days, field-cured	2 @ 7 days, lab-cured
2 @ 7 days, lab-cured	2 @ 7 days, lab-cured	
2 @ 7 days, field cured		

    The structural engineer of record may request the casting of additional test specimens, with two specimens being required for each test. (Two cylinders must be broken and averaged to establish break data.)

17) **Formwork and Shoring:** A structural engineer duly registered in the State of Maryland shall design all formwork and shoring, and plans for such formwork, bearing the seal and signature of such engineer, shall be submitted to the structural engineer of record for review and comment. Results of such review and any comments shall be forwarded to the City on plans submitted to the structural engineer of record by the contractor.

18) **Removal and Re-shoring of Formwork:** The designing formwork engineer shall establish criteria for removal and re-shoring of formwork, with such criteria being based on the project's specifications and minimum ACI standards. All formwork removal and re-shoring shall be approved in writing by the inspecting agency or the engineer of record prior

to such removal or re-shoring. The criteria for removal and re-shoring of formwork shall be reviewed by the SER.

19) **Precast Concrete:** When precast concrete units are to be employed, the manufacturer shall submit shop drawings, which provide complete information for making and installing the units. Such drawings shall include, as a minimum:

    a) Erection plan with all pieces marked, showing the necessary bracing and shoring required during construction;
    b) All dimensions of units, including tolerances and, when units are pre-stressed, the allowance for elastic shortening;
    c) Details and locations of connections showing size, amount and location of reinforcement and methods of adjusting;
    d) Locations and details of erection devices; and
    e) Location and type of inserts and lift points. The above signed by a structural engineer registered in the State of Maryland.

    The Structural Engineer of Record shall review all shop drawings.

20) **Structural Steel Construction:** Fabrication, erection, quality control and inspection of steel construction shall be in accordance with AISC "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" (latest adoption), and AISI "Specification for the Design of Cold-formed Steel Structural Member" (latest adoption). The structural engineer of record shall review erection plans and shop drawings. All revisions to the structural contract documents shall bear the seal and signature of the Structural Engineer of Record.

21) **High Strength Bolting:** High-strength bolting shall be inspected in accordance with AISC Standard 85, specification for "Structural Joints using A3525 or A490 Bolts", as well as standards for ASTM. When it is planned to use alternate fasteners, and the installation and/or inspection of such fasteners will differ from that specified above, the installation procedure and/or inspection method shall be detailed in a supplemental specification applying to the alternate fastener. Such supplemental specification shall not be employed until the Structural Engineer of Record has approved it in writing.

22) **Welding:** Welds shall be made only by welders, tackers and welding operators whose competence has been demonstrated by successfully passing tests prescribed by the AWS "Code for Welding in Building Construction" (latest adoption). The inspecting agency shall implement a thorough system of preventive inspections designed to visually detect and prevent occurrences that may result in a substandard welds or may otherwise compromise product quality. Such system shall entail systematic observation of welding practices both before and during welding. Inspections shall be performed after welding as well, in accordance with AWS "Code for Welding in Building Construction" (latest adoption).

23) **Structural Masonry:** Inspection of structural masonry shall be in accordance with ANSI requirements for masonry (ACI 531 and ASTM C780).

24) **Certification by the Structural Engineer of Record:** Upon completion of all structural work, the SER shall submit a Letter of Certification to the City stating that to the best of his/her knowledge and his/her opinion the structural phase of the building is constructed in accordance with the Structural Contract of Documents (Project Plans and Specifications) and the City of Rockville Building Code.

25) **Mechanical/Plumbing/Electrical System:** The installation of the mechanical/plumbing/electrical systems shall be inspected in accordance with accepted engineering practice. Upon completion of the work, the mechanical/plumbing/electrical engineer shall state in writing that in his/her professional opinion the systems were constructed in accordance with the mechanical and plumbing construction drawings and specifications and the Mechanical, Plumbing and Electrical Code(s) of the City of Rockville.

26) **Contractors' Certifications:** Subsequent to completion of construction, each contractor of record shall submit to the City a signed certification indicating that, to the best of his/her knowledge and belief, work was performed in accordance with approved construction documents and all applicable codes.

27) **Detection of Critical Problems:** Any individual involved in the inspection function who detects a condition which in his/her opinion justifies a stop-work proceeding or other immediate remedial measure, shall immediately so notify the

supervisor and the City of the function in question. If the supervisor is not present, or the supervisor is unable or unwilling to take what is deemed to be appropriate corrective measures, the person detecting the condition in question shall immediately notify the City's Inspection Services Division.

28) **Changes in Critical Services:** In the event that the observing architect, engineer(s) of record, the organizations or individuals contracted for inspection services or the engineering testing laboratory is changed during the course of the work, the City shall be so notified immediately by the owner. The owner shall provide to the City a written explanation for such change; shall identify the replacement organization or individual with whom he has contracted; shall furnish the documentation necessary to show such organization or individual is qualified for the work as required herein, and shall provide a revised inspection plan. The City shall stop work if, in the City's opinion, work otherwise would proceed without adequate inspection, and shall authorize a recommencement of work only at such time at it is satisfied that the integrity of inspection can be assured.

29) **Relevant Codes and Standards:** The requirements set forth herein are the requirements that shall apply throughout the project. These requirements shall not be modified without the City's knowledge and consent. The applicability to this project of revisions to any technical codes or standards referenced in these requirements shall be determined by the provision of the relevant code or standard in effect as of the date of submission of the permit application. Any waiver granted by appropriate authorities to the requirements of the Maryland Accessibility Code or other governmental regulations shall supersede any requirement to the contrary in the "Complex Structures Requirements."