

PART II – CSU FACILITIES PLANNING, DESIGN AND CONSTRUCTION STANDARDS

CHAPTER 09 – CONSTRUCTION TESTING AND CODE COMPLIANCE

900 – TESTING AGENCY REPORTS AND INSPECTIONS

900.1 – General Requirements:

A. Consultant Recommendations for Scope of Work:

1. For most Projects, Colorado State University (CSU) engages professional agencies to provide investigation, testing, analysis and construction inspection services for the Project.
2. Consultants shall assist CSU in determining types, locations and quantities of testing necessary to satisfy data and analysis information required as a basis for complete and accurate design.
 - a. Such studies may include but not be limited to investigations of surface or subsurface conditions, environmental impact, traffic, building performance, concealed component imaging and hazardous materials as required to design the Project.
3. The advised Scope of Work such as surveys, tests and investigations shall be submitted to the Project Representative as soon as possible and no later than the preliminary Written Report.

900.2 – Testing Laboratory:

A. Qualifications:

1. The testing agency laboratory shall be licensed to operate as a commercial testing laboratory and shall have been inspected by the AASHTO Materials Reference Laboratory (AMRL) or the Cement and Concrete Reference Laboratory (CCRL) within the last three years.
2. The Colorado registered Professional Engineer in charge of the laboratory shall be a full-time employee of the laboratory and have a minimum of five years of experience in construction materials testing.
3. Laboratory and field technicians qualified for performing the work as demonstrated through certification by the National Institute for Certification in Engineering Technologies (NICET), American Concrete Institute (ACI), National Ready Mixed Concrete Association (NRMCA), Portland Cement Association (PCA), American Welding Society (AWS), American Society for Nondestructive Testing (ASNT) or a degree in a related engineering field with construction field experience.
4. All laboratory and field equipment to be used for the Project shall be calibrated and certified in conformance to national standards.
5. Records of inspections, documentation showing correction of deficiencies and AMRL or CCRL reference sample program test results shall be provided for review by the Project Representative.

B. Control of Measuring and Test Equipment:

1. The Testing Laboratory shall select measuring and test equipment in such a manner as to provide proper type, range, accuracy, calibration and tolerance for determining compliance with specified requirements.
2. Measuring and test devices shall be calibrated, adjusted, and maintained at prescribed intervals prior to use, based upon equipment stability and other conditions affecting measurement.
3. Provisions shall be made for the proper handling and storage of equipment.

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4. Calibration shall be accomplished using certified standards that have a known traceable relationship to the National Institute of Standards and Technology (NIST).
5. Every calibrated measuring and test device shall show the current status, date of last calibration, and the due date for the next calibration.
6. Calibration records shall be maintained as quality records and shall be made available for inspection upon request by the Project Representative.

C. Surveillance of Inspections:

1. When the laws, ordinances, rules, regulations, or orders of any public agency having jurisdiction, require the University's surveillance of inspections or tests, the Consultant shall notify the Project Representative of the place, date and time 48 hours prior to the inspection/test operation.

D. Retain Tested Materials and Data:

1. The Testing Agency shall be responsible for maintaining tested materials and testing data until Final Completion of the Project or Construction Agreement, or at such time as the Project Representative notifies the Testing Agency in writing.
2. Tests and tested materials shall be available during the Bidding period for review by proposers.

900.3 – Geotechnical Soils Testing Precautions:

A. Unless otherwise directed by the Project Representative, a Colorado Licensed Surveyor shall layout and locate all test pit locations for soils tests prior to sampling.

B. Protection of Property and Work in Progress:

1. The Geotechnical Testing Agency shall take all reasonable precautions for the safety of, and shall provide all reasonable protection to prevent damage, injury, or loss to:
 - a. Property at the Work site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction; and
 - b. The Geotechnical Testing Agency shall give all notices and comply with all applicable laws, ordinances, rules, regulations, and lawful orders of any public authority bearing on the safety of property or its protection from damage, injury, or loss and further, shall cooperate and keep the Project Representative and other Project Teams informed of all of the Geotechnical Testing Agency's precautions for the protection of the Work.
 - c. If any of the Geotechnical Testing Agency's operations destroy or damage any real or personal property, public or private, the Geotechnical Testing Agency shall promptly repair or replace such property before the Project Representative shall accept the Work performed under the Agreement.

C. Protection of University, Municipal and Public Service Utility Systems:

1. Before any Work is started, the Geotechnical Testing Agency shall communicate with all governmental agencies and private entities having jurisdiction over Utility Systems which might be affected by the Work.
2. After Work has begun, the Geotechnical Testing Agency shall perform in a manner designed to reduce the potential for disrupting the operations of utilities to a minimum.

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D. Protection of the Environment:

1. The Geotechnical Testing Agency shall comply with all applicable federal, state and local environmental protection rules, laws and regulations and accept responsibility for compliance with all environmental quality standards, limitations and permit requirements, including but not limited to the University's noise control ordinance, federal and state air quality standards for fugitive dust control, prevention of surface and groundwater contamination and hazardous and other waste disposal practices and procedures.

E. Hazardous Materials:

1. The Geotechnical Testing Agency shall exercise the utmost care if the storage or use of hazardous materials required for the performance of the Work.
2. Activities related to the purchase, storage, use, removal, treatment, and disposal of such hazardous materials shall at all times be the sole responsibility of the Geotechnical Testing Agency and shall be supervised and carried out by personnel properly qualified to perform such activities.
 - a. Any activities requiring the purchase, storage, use, removal, treatment or disposal of hazardous materials shall not be started without first notifying the Project Representative in writing of the proposed activity and receiving the Project Representative's written acceptance of that action.
 - b. The use and storage of explosives is not allowed.

F. Archeological and Historical Discoveries:

1. The Geotechnical Testing Agency shall inform the Project Representative of any evidence which might suggest to a lay person that archaeological, historical materials or human remains may be present in the Work area.
2. Upon making such a discovery, the Geotechnical Testing Agency shall do whatever is necessary to avoid disturbing that Work area.
 - a. This may require the Work be redirected or stopped until the Project Representative determines how to proceed.

900.4 – Geotechnical Report:

- A. To establish the Scope of Work for the Geotechnical Report, the Geotechnical Engineer shall confer with the Project Representative and the Project Team to collect available information regarding the proposed construction, such as:
 1. Building use
 2. Number of levels
 3. Loading
 4. Allowable movement tolerances
 5. Parking and pavement areas
 6. Site grading
 7. Retaining wall locations

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8. Borrow and cut areas

B. Boring and Sampling:

1. The Geotechnical Engineer shall confer with the Project Representative and the Project Team regarding the number and location of borings and the frequency and type of tests necessary for the Project.
2. Minimum Geotechnical Boring:
 - a. One boring for every 2,500 to 5,000 square feet of building footprint
 - b. One boring per level of multi-elevation lower levels
 - c. One boring per 20,000 square feet of pavement or flatwork
 - d. One boring per 250'-0" of roadway
 - e. One boring at each bridge abutment
 - f. One boring every 100'-0" of retaining wall requiring geotechnical design parameters
 - g. Borings at unique features – pools, water features, large signs, monuments
 - h. One boring every five acres of developed space if potential exists for future structures
3. Minimum Geotechnical Boring Depth:
 - a. Paving Areas:
 - i. Shallow (5'-0" – 10'-0")
 - b. Building Areas:
 - i. At least 25'-0" deep or minimum 10'-0" into bedrock, whichever is deeper, with at least one boring 50'-0" deep.
 - ii. Where Deep Foundation Systems shall be used, bedrock penetration shall be at least 20'-0" deep.
4. Frequency of Sampling:
 - a. Initial:
 - i. Every 5'-0" of depth
 - b. If soil conditions are consistent across the site, frequency may be reduced at the discretion of the Geotechnical Engineer.

C. Testing:

1. Typical Tests:
 - a. The Geotechnical Consultant shall provide a standard unit rate sheet with the costs associated for each test available and confer with the Project Representative and Project Team regarding the type and number of tests necessary.
 - b. Natural moisture content and in-place density:
 - i. Two tests per foundation boring, one test per pavement boring
 - c. Atterberg Limits Test:
 - i. Two tests per foundation boring
 - d. #200 Sieve Analysis (all fine-grained soils):
 - i. Two tests per foundation boring
 - e. Swell Consolidation Testing, one ksf Surcharge:
 - i. One test per foundation boring
 - f. Swell Consolidation Testing, 200 psf Surcharge:
 - i. As needed for pavements
 - g. Sulfate Testing:
 - i. Minimum one per structure
 - h. Unconfined Compressive Strength Test:
 - i. One per structure
 - i. Sulfate/Resistivity/pH Tests:

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- i. Minimum two per Project
 - j. Soil Support Test, R-value or Resilient Modulus:
 - i. Minimum of one sample per Project on a representative subgrade sample
 - 2. Additional Tests as Applicable:
 - a. Full Gradation Sieve Analysis:
 - i. When more than 50% retained on the #200 sieve
 - b. Sulfate/Resistivity/pH Tests:
 - i. For multiple cohesive soils in contact with concrete or steel
 - c. Swell Consolidation:
 - i. For multiple types of soil encountered
 - d. Unconfined Compressive Strength:
 - i. For multiple types of soil encountered
 - e. Suction Test:
 - i. For expansive soil conditions
 - f. Proctor Test
 - g. Direct Shear:
 - i. Retaining walls and slopes
 - h. Triaxial Strength:
 - i. For overburden soft soils supporting heavy structures
 - i. Rock Quality:
 - i. For cemented bedrock that can be cored (not effective for most stone in vicinity of CSU)
 - j. Permeability
- D. The Geotechnical Report should address the following issues:
 - 1. Site, soil and geologic conditions, including bedrock and groundwater
 - 2. Potential geohazards, including faults, radon gas, underground mines
 - 3. Foundation recommendations: bearing capacity of shallow foundations and/or end-bearing capacity and skin friction values for deep foundations. Movement potential of 1" or less.
 - 4. Alternative foundation feasibility
 - 5. Floor slab recommendations: post construction total movement of 1" or less with differential movement potential 1/2 the total value over a given length such as 30'-0".
 - a. Verify with the Structural Engineer or Architect regarding acceptable movement tolerance.
 - 6. Lateral earth pressure recommendations for below grade levels
 - 7. Seismic site classifications
 - 8. Excavation considerations
 - 9. Project earthwork: site grading, backfill recommendations and soil stabilization
 - 10. Soil corrosivity information
 - 11. Underdrain recommendations and waterproofing concerns
 - 12. Utility excavation recommendations

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13. Temporary and permanent slope configurations
14. Exterior flatwork subgrade preparation
15. Pavement thickness and subgrade recommendations
16. Surface drainage recommendations

E. Contents:

1. Cover:
 - a. CSU Project name and number
 - b. Date
 - c. Geotechnical Consultant name, address, phone and email
2. Letter of transmittal and certification with original signature and seal of the Geotechnical Engineer
3. Table of contents
4. Project narrative
5. Purpose of investigation
6. Proposed construction
7. Site and field exploration
8. Laboratory tests
9. Site conditions
10. Subsurface conditions
11. Engineering analysis, conclusions and recommendations
12. Site plan and boring location diagram, including survey coordinates
13. Boring logs
14. Laboratory test results
15. Notes, definitions and terminology

900.5 – Construction Testing and Material Inspections:

- A. All test and inspection records and documents shall be prepared, identified, and maintained by the Testing Agency and copies submitted to the Project Representative.
- B. Records shall be protected from damage, deterioration, or loss.
- C. Retention time for all quality records shall be not less than five years from date of final payment.
- D. Test Results:

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1. Test results shall be submitted to the Project Team and Project Representative after completion of inspections/tests and prior to incorporation of the item(s) into the Work unless the test or inspection must be done after installation.
 2. Field density and moisture tests shall be reported in draft form immediately at the test site with typed final test results given with 48 hours.
 3. Test reports shall include worksheets showing any and all calculations used in obtaining the test results.
 4. All test results must be reviewed and signed by a registered licensed Engineer in the State of Colorado.
 5. The signature represents that the test procedures used are in strict conformance with the applicable testing standard, the calculated data are true and accurate, the tools and equipment used were in calibration, the sample was not contaminated and the persons running the test were qualified.
- E. In addition, the testing laboratory shall prepare and submit to the Project Representative a Monthly Summary Report each month, which summarizes the activities and results for the quality control tests and inspections conducted during that period.
- F. The Monthly Summary Report shall consist of both graphics and text and at a minimum shall identify all test types, test locations, testers, test results, any calculations used, Specifications, whether the test passed or failed, and the material supplier, installer and Consultant.
- G. Material performance trends shall include a statistical evaluation of each type of test, results of which shall be clearly stated in an overview for each Monthly Report.
- H. The Monthly Report shall be submitted per Chapter 02 – Design Administration requirements.
- I. Records:
1. Records or reports of inspection and test activities are quality records and shall be maintained, in a manner that provides integrity of item identification, acceptability, and traceability.
 2. Reports shall identify the following:
 - a. Testing Agency and Engineer's name
 - b. Agreement number and title
 - c. Testing laboratory name
 - d. Name of items inspected/tested including a physical description, model and make
 - e. Quantity of items
 - f. Inspection/test procedure used and any deviation from national standards
 - g. Date the sample(s) was taken and the date the test was made
 - h. Where tests were performed including environmental condition where applicable
 - i. Name of inspector/tester
 - j. Observations/comments
 - k. Specified requirements in the Agreement that the item must meet
 - l. Acceptability
 - m. Deviations/nonconformance
 - n. Corrective action
 - o. Evaluation of results
 - p. Signature of authorized evaluator
 - q. Where the material was installed

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901 – CODES AND COMPLIANCE

901.1 – Agencies:

A. Agencies that have jurisdiction over Projects at CSU include:

1. Building Code:
 - a. All design and construction work is governed by the Colorado Office of the State Architect (OSA), per the Building Code Compliance Policy.
 - b. Facilities Management (FM) has an established Building Department under the OSA delegation. Refer to Building Department website for additional details - https://www.fm.colostate.edu/Code_Compliance_Program
 - c. Refer to OSA website for additional details – <https://www.colorado.gov/pacific/osa/statebuildings>
2. Fire and Life Safety:
 - a. Poudre Fire Authority (PFA) has an MOU with CSU to perform all fire and life safety plan reviews and inspections.
 - i. All testing and inspections shall be conducted with FM Fire Systems and Poudre Fire Authority present.
 - ii. This includes all visual underground, rough-in and hard lid inspections, and hydro tests.
 - b. The Project Representative shall arrange the reviews and conferences with PFA as needed per the International Fire Code (IFC).
 - c. Refer to PFA's website for additional details – <https://www.poudre-fire.org/online-services/contractors-plan-reviews-and-permits>
3. Public Health and Environment:
 - a. CSU is subject to orders, rules and regulations of the Colorado Department of Public Health and Environment (CDPHE). Enforcement of the CDPHE regulations for hazardous chemicals, laboratories, lead and asbestos, radiation sources and biosafety is under the jurisdiction of CSU Environmental Health Services (EHS), and CSU enforcement of the CDPHE regulations for drinking water, stormwater and air emissions is under the jurisdiction of FM.
 - b. All design and construction involving food safety, water quality, sanitation and communicable disease control are subject to review, approval and inspection of the EHS Public Health Officer.
 - i. This includes food preparation and retail areas, child care centers, summer camps, swimming pools, spas, locker rooms and similar facilities.
 - c. Refer to EHS's website for additional details – <http://www.ehs.colostate.edu/>
4. Stormwater Management:
 - a. CSU administers its own Stormwater Management Program in accordance with a State-issued Permit No. COR-070002, Stormwater Discharges Associated with Non-Standard Municipal Separate Storm Sewer Systems (MS4s).
 - b. Refer to Part IV – Regulatory Requirements for information regarding permit and program descriptions stipulating the requirements for stormwater management during construction and for post-construction Stormwater Control Measures (SCMs).
5. Floodplain Management:
 - a. Colorado State University's Main Campus contains a 100-year floodplain administered by FM according to Colorado Department of Natural Resources, Colorado Water Conservation Board (CWCB) Rules and Regulations for Regulatory Floodplains in Colorado.

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- b. Refer to Part IV – Regulatory Requirements for information regarding the floodplain boundaries and applicable requirements for new construction or redevelopment of existing structures.
6. Local Zoning Administration:
 - a. Review and acceptance of plans for compliance with the Fort Collins Zoning Ordinance and Larimer County Land Use regulations as they apply to CSU shall be coordinated by the Project Representative.
 - b. Refer to City of Fort Collins SPAR process.

901.2 – Compliance:

A. Code Review Agent Responsibility:

1. The Code Review Agent shall comply with the current Code Compliance Plan Review Procedures, per OSA.
2. Design and construction shall be based on the latest edition of the adopted codes as of the date of Procurement, including additions and revisions by OSA.
3. Refer to OSA's website for current Approved State Building Codes - https://drive.google.com/file/d/1rZY7Edt_IRxkNn34U4I20nQROp1TSU5P/view

B. Plan Review:

1. The Project Representative shall submit documents in a timely manner to all required review agencies in order to ensure that permits and notice of compliance are available at time of Advertisement for Bid.
 - a. This shall include intergovernmental agreements and easements.
2. The State Buildings Program provides a list of approved Code Review Agents on an annual basis.
 - a. Approved Code Review Agents perform Plan Reviews and provide Inspection Services.
 - b. Project Representatives are responsible for contracting with an approved Code Review Agent, per OSA's Building Code Compliance Policy.
 - c. Inspections required by the issued Compliance Notice must be performed and signed by qualified inspectors certified by the International Code Council or the State of Colorado Department of Regulatory Agencies and/or the Colorado Department of Labor and Employment.

C. Modifications:

1. All requests for Code Modifications must be accepted by the Project Representative prior to requesting a formal Code Modification from the CSU Building Department and OSA.

D. Construction Inspections:

1. The Project Representative is responsible for contracting for inspection services on a per Project basis.
2. Capital Construction:
 - a. Projects with a total development value of \$2,000,000.00 and above shall employ a State Building's Program Approved Code Review Agent.

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- b. Inspections for Projects with a total development value of less than \$2,000,000.00 are coordinated by the CSU Building Department.
 3. Remodel and Construction Services:
 - a. Inspections for Projects with a total development value of less than \$2,000,000.00 are coordinated by the CSU Building Department.
 - b. Inspections for Projects with a total development value of \$2,000,000.00 and above shall employ a State Building's Program Approved Code Review Agent.
 4. Third-Party Professional Engineers (PE) registered in Colorado may be acceptable for special inspections with prior approval of the State Buildings Program through the Project Representative and CSU Building Department.
- E. Building Inspection Record:
 1. All inspections, whether interim or final, shall be noted on all Building Inspection Record(s) (BIR, State Form SBP-BIR) issued for the Project.
 - a. Phased projects shall include individual BIR(s) per phase in alignment with the Project-specific Agreement and Notice(s) to Proceed.
 2. The Approved Code Review Agency's Inspector shall be responsible for asking the Project Team to make the BIR(s) available for annotation and signature at the time of inspection on site.
 3. The Approved Code Review Agency's Inspector shall sign the BIR(s) and include their ICC certification or State of Colorado PE registration number.

END OF CHAPTER