

CHAPTER 8 - ROADWAY CONSTRUCTION INSPECTION, SAFETY REQUIREMENTS AND MATERIALS TESTING

8.1 GENERAL

8.1.1 Protection of Work and Property

The Developer shall be responsible for all violations of Town ordinances and state laws involved in the performance of their work; and for obstruction of streets, sidewalks, alleys, and pavements, and shall in all cases make good any damage to any streets, sidewalks, alleys and pavements. They shall use every precaution to brace and otherwise support and secure the structural members and trench walls during the construction of the work; and shall provide, during the progress of their work, every and all safeguards and protection against accidents, injury and damage to persons and property, including adjoining property. The Developer shall be responsible for their work and every part thereof: all materials, tools, appliances and property of every description used in connection to their project.

Accident Prevention - Precaution shall be exercised at all times for the protection of persons and property. The safety provisions of applicable laws, ordinances, building, and construction codes shall be observed. Hazards shall be guarded against or eliminated in accordance with the safety provisions or the Manual of Accident Prevention in Construction, published by the Associated General Contractors of America, to the extent that such provisions are not in contravention with applicable laws and OSHA

8.1.2 Project Management Coordination

The Developer shall provide attentive personal supervision to their work and shall keep a competent Foreman and necessary assistants constantly on the job site. The Foreman shall be the personal representative of the Developer and all directions given by them shall be binding, as if given by the Developer.

8.2 QUALITY ASSURANCE

(Procedures to assure quality of construction)

8.2.1 General

These Regulations state the minimum requirements for materials sampling, testing, and inspection. All tests shall be made and certified by an approved testing laboratory. The Developer shall be responsible for retaining a qualified Engineer for material testing. All costs required and pertaining to testing the work performed and materials supplied, to verify compliance with these Regulations, shall be the

responsibility of the Developer. All re-testing shall be at the Developer's expense. Where certified test reports are required to be furnished by the Manufacturer, the Developer shall furnish duplicate copies of the reports to the Inspector before the material will be approved for use.

The use of a Testing Agency's services does not relieve the Developer of the responsibility to furnish the required materials and to perform the required construction in full compliance with the Specifications. Passing test results do not constitute acceptance of the work or materials represented by the test. The Developer is responsible for quality control of his/her work.

In various sections of these Regulations, specific testing or other data is required to be provided by the Developer to ensure that the intent of these Regulations is fulfilled. The costs of such tests or other specific data, where required by these Regulations or on the approved plans, shall be borne by the Developer. Whenever, at the sole discretion of the Engineer, additional tests or data is required beyond that identified as required in these Regulations or on the approved plans, the costs of such tests shall be borne by the Developer. Should such tests or additional data show a failure to meet these Regulations or the approved plans, the Developer shall be responsible for the cost of such testing and data along with all costs associated with repair or replacement of said failure.

8.2.2 Use of Non-approved Material

In the event any material or equipment proposed to be used by the Developer is disapproved by the Town Engineer or Director of Public Works for not meeting the requirements of these Regulations, said materials or equipment shall not be used on the project. If, after approval of the plans, the Developer desires to change any materials or equipment from that previously approved by the Town Engineer or Director of Public Works, said change shall be accomplished only by a written request to the Town Engineer or Director of Public Works.

8.2.3 Pavement Design Report

The Pavement Design Report shall be completed by a qualified Registered Professional Engineer in the State of Colorado. This report is required to be submitted to the Town after the overlot grading process and prior to paving of any roadway.

8.2.4 Testing Agency Access and Assistance

The Developer shall allow the testing agency access to the job site at all times; furnish any labor required to assist the Testing Agency in obtaining and handling samples at the source of material and at the project; provide and maintain, for the sole use of the Testing Agency, adequate facilities for safe storage and proper curing of concrete test specimens on the project site as required by AASHTO T23.

8.2.5 Mix Designs

The Developers shall furnish asphalt mix designs or concrete mix designs that meet the requirements of these Specifications. A separate mix design shall be provided if pumped concrete is used.

8.2.6 Reports

Reports shall bear the seal and signature of a Professional Engineer registered in the State of Colorado and competent in the required testing practice. All test reports shall show the location where the test was performed or at which the work or batch represented by the test was placed. Test reports shall include all information as specified in the applicable AASHTO or ASTM test procedures. Improperly completed reports will not be accepted. Certificates of Final Acceptance will not be issued until all final reports indicating compliance with these Specifications are reviewed and placed on file by the Town of Bennett. The Testing Agency personnel are not authorized to revoke, alter, relax, enlarge, or release any requirements of the Specifications, nor to approve, accept, or reject any portion of the work on behalf of the Town. The Testing Agency personnel are authorized to stop work in the event of witnessed deficiencies with immediate contact of the Town Engineer or the Director of Public Works.

8.3 QUALITY CONTROL

(Procedures to measure and report quality)

8.3.1 General

8.3.1.1 All testing methods and procedures performed by testing agency personnel shall be in accordance with the applicable AASHTO and ASTM requirements and procedures. Test reports shall include the AASHTO and ASTM test designations of all tests taken. All testing and retesting services shall be at the expense of the Developer.

8.3.1.2 The testing and construction of all materials shall be in conformance with the appropriate AASHTO, ASTM, or CDOT specifications. In case of conflicting information between these standards, the order of precedence is CDOT standards followed by AASHTO & ASTM standards, or as directed by the Town Engineer or Director of Public Works.

- 8.3.1.3** When changes in materials or proportions are encountered during construction; or when work fails to pass test or fails to meet the Specifications, additional tests shall be taken as directed by the Town Engineer or Director of Public Works. Failure of the Developer to furnish satisfactory test data shall be sufficient cause for rejection of the work in question.

8.4 ANCILLARY STRUCTURE TESTING

8.4.1 Utility Trenches, Inlets, Manholes and Junction Boxes Backfilling

8.4.1.1 Materials, Placement, and Compactions

All utility trenches within the ROW shall be placed and compacted in accordance with Section 9.2.6 of these Standards.

8.4.1.2 Testing

Field moisture-density testing shall be performed during backfill operations beginning one (1) foot above the top of the pipe and extending to the finished subgrade elevation. A sufficient number of tests shall be taken at various depths to confirm backfill compaction and moisture content specifications are met. As a minimum, one test shall be taken within one (1) foot of manholes, water valves or other obstacles. Testing shall be done in accordance with Chapter 9 of this manual.

A Letter of Responsibility may preclude the testing requirements as stated herein. Refer to the Town Engineer or Director of Public Works for more information.

8.4.1.3 Acceptance

The results of field density tests shall be submitted to and reviewed by the Town Engineer or Director of Public Works. Provided all tests are acceptable, the two (2) year probationary period may begin. If no failures of the trenches are evident after two (2) years, the Town will assume maintenance obligations. Any failures must be corrected in accordance with the provisions of Chapter 9.

8.4.2 Curb, Gutter, Sidewalk, Crosspans, and Major Drainage Structures

8.4.2.1 Subgrade Preparation

- A. Subgrades shall be thoroughly compacted to the moisture-density specifications required for the material tested. The surface shall be smooth with no humps or depressions and to the final grade on which the concrete will be placed.
- B. Testing frequency for the subgrade shall be a minimum of each six (6) inch lift on replacement materials with one test for every two-hundred and fifty (250) feet of structure with more tests taken if necessary for control.
- C. These test results shall be submitted to the field representative of the Town Engineer or Director of Public Works for compliance review.

8.4.2.2 Concrete

- A. Air entrained Class B, P, or D concrete shall be used.
- B. Curing methods shall conform to CDOT standard specifications.
- C. Concrete placement shall utilize methods which will not reduce the strength or integrity of the final product.
- D. *Testing and Inspection of Concrete* - The slump, air content and unit weight tests shall be carried out on the first truck of concrete for the daily placement and thereafter in conformance with the following table:

TABLE 8.1 TESTING FREQUENCY	
ITEM	TESTING FREQUENCY
SIDEWALKS, CROSSPANS, CURB RETURNS	1 SET OF 4 CYLINDERS FOR EVERY 200 SQUARE YARDS OR FRACTION THEROF OF CONCRETE PLACED
CURBING AND COMBINATION CURB, GUTTER AND WALK	1 SET OF 4 CYLINDERS FOR EVERY 400 LINEAL FEET OR FRACTION THEROF OF CURB AND GUTTER PLACED

NOTE: The testing to include the *Slump* (T 119), *Air Entrainment* (T 152), *Temperature of Concrete at Placement*, *Yield and Compressive Strength of the Cylinders* (T 22).

All work done by hand (non-extrusion) shall require a minimum of two (2) sets of tests per day.

- E. Test results shall be submitted to the field representative of the Town Engineer or Director of Public Works for compliance review.

8.4.2.3 Inspection and Testing at Acceptance

At the discretion of the Director of Public Works, the Contractor will provide core test results of concrete at random intervals not averaging less than one test in five-hundred (500) feet, to verify that specified thickness of concrete was installed.

Testing costs shall be paid for by the Owner/Developer. If the Director of Public Works has not been given the opportunity to inspect the subgrade and/or concrete forms prior to placement of the concrete, and at the discretion of the Director of Public Works, the Contractor will provide core tests.

8.5 ROADWAY SUBGRADE PREPARATION

8.5.1 Compaction

The subgrade shall be free of organic material and shall be scarified to a depth of 12 inches, moisture treated to within two (2) percent (optimum to + 1% for A-6 or A-7-6) of optimum moisture content and compacted. Refer to the latest CDOT standards and specifications to determine compaction requirements.

8.5.2 Testing

Field moisture-density tests using acceptable methods will be required at random locations at the rate of not less than one (1) for each five-hundred (500) lineal feet of paving for each travel lane.

8.5.3 Final Proof Rolling

After the subgrade has been compacted, tested and found to meet Specifications, the entire subgrade shall be proof-rolled with a heavily loaded vehicle to ensure uniformity of the subgrade. The vehicle must have a loaded Gross Vehicle Weight of 50,000 pounds with a loaded single axle weight of at least 18,000 pounds and a tire pressure of 90 psi. Subgrade which is pumping or deforming must be reworked, replaced or otherwise modified to form a smooth, stable, non-yielding base for subsequent paving courses. The Town Engineer or Director of Public Works shall be notified at least 48 hours before final proof-rolling.

8.5.4 Acceptance

The results of field density and proof-rolling shall be submitted and reviewed by the Town Engineer or Director of Public Works. Provided all tests are acceptable, compaction will be approved for the placement of the next paving course. Should testing indicate unsatisfactory work, the necessary reworking; compaction, or replacement will be required prior to continuation of the paving process. The approval is valid for 24 hours. Changes in weather such as freezing or precipitation will require approval of the subgrade.

8.6 LIME-TREATED SUBGRADE

8.6.1 Materials

Lime treated subgrade shall be used only where a mix design has been previously submitted and approved by the Town Engineer or Director of Public Works. The requirements of Section 5.5.5.5 shall apply.

8.6.2 Construction

Construction of lime treated subgrade shall be in accordance with the requirements of Section 307 of the CDOT Standard Specifications, except that the curing period shall be a minimum of 48 hours.

8.6.3 Testing

Lime-treated subgrade shall be observed and tested on a full-time basis and paid for by the owner/developer. Field moisture-density tests shall be taken at the rate of one for each 500 linear feet of travel lane for each lift. Compaction curves (AASHTO T 220) will be required for each soil type and field density shall be compared to the appropriate curve for percentage compaction determinations. Field compacted seven (7) day strength and lime content (AASHTO T 232) determinations shall be required for each five hundred (500) tons of treated subgrade, with a minimum of one (1) per project.

8.6.4 Acceptance

The results of field density, lime content, and strength tests shall be submitted and reviewed by the Town Engineer or Director of Public Works. Provided all tests are acceptable, the subgrade will be approved and the next paving course can be placed. Should these tests fail to meet the project specifications, the strength reduction will be used to calculate increased pavement layer or overlay thickness required for the design section.

8.7 AGGREGATE BASE COURSE

8.7.1 Materials

Aggregate Base Course materials must be from a currently approved source and conform to the requirements of Section 5. The owner/developer shall, upon request, provide verification of material properties.

8.7.2 Placement and Compaction

Materials shall be placed on an approved subgrade which has been proof-rolled within the past twenty-four (24) hours and found to be stable and non-yielding. Should weather conditions change such as freezing, precipitation, etc., aggregate base materials shall not be placed until the subgrade is approved.

Aggregate materials shall be placed, moisture treated, and compacted as outlined in Section 304 of the CDOT *Standard Specifications for Road and Bridge Construction*.

8.7.3 Testing

At least one (1) sample of aggregate base course for each one thousand (1,000) tons of materials placed shall be tested to determine gradation and Atterberg Limits. Should these tests indicate the material does not meet specifications, the material shall be removed and replaced.

During placement and compaction, Compaction Curves will be required for each material used. Field moisture-density tests shall be taken of each lift of materials at random locations at approximate intervals of five hundred (500) feet in each travel lane. At least twenty (20) percent of the tests shall be taken within one (1) foot of manholes, valves, and curbs.

8.7.4 Acceptance

The results of field density tests shall be submitted to and reviewed by the Town Engineer or Director of Public Works. Provided all tests are acceptable, the aggregate base course materials, placement, and compaction will be approved and the next paving course can be placed. Should testing indicate unsatisfactory work, the necessary reworking, compaction or replacement will be required prior to continuation of the paving process.

8.8 CEMENT-TREATED AGGREGATE BASE COURSE

8.8.1 Materials

Aggregate and cement materials must be from a currently approved source and the mix design shall conform to the requirements of Section 5. The Owner/Developer shall provide verification of material properties and an approved mix design.

8.8.2 Placement and Compaction

Materials shall be placed on an approved subgrade which has been proof-rolled within the past twenty four (24) hours and found to be stable and non-yielding. Should weather conditions change such as freezing, precipitation etc., materials shall not be placed until the subgrade is re-approved. Cement treated aggregate base shall be prepared per the mix design, and placed, moisture treated and compacted as outlined in Section 307 of the CDOT *Standard Specifications for Road and Bridge Construction*.

8.8.3 Testing

At least one sample of cement-treated aggregate base course for each one thousand (1,000) tons of material placed shall be tested to determine cement content, gradation and Atterberg Limits. Six (6) field-prepared proctor mold samples shall be taken for each five hundred (500) tons placed and tested at seven (7) and twenty-eight (28) days to determine unconfined compressive strength.

During placement and compaction, Compaction Curves will be required for each material used in accordance with AASHTO T 134. Field moisture-density tests shall be taken of each lift of material at random locations at approximate intervals of five hundred (500) feet in each travel lane. At least twenty (20) percent of the tests shall be taken within one (1) foot of manholes, valves and curbs.

8.8.4 Acceptance

The results of laboratory tests and field density tests shall be submitted to and reviewed by the Town Engineer or Director of Public Works. Provided all tests are acceptable, the cement treated aggregate base course materials, placement and compaction will be approved and the next paving course can be placed. Should testing indicate unsatisfactory work, necessary

adjustments will be made to the pavement section to comply with original design strength requirements.

8.9 PLANT MIX HOT BITUMINOUS PAVEMENT (HBP)

8.9.1 Materials

All asphalt, aggregate fillers, and additives shall be combined to form a mix design in accordance with Section 5. The mix design must be submitted to and approved by the Town Engineer or Director of Public Works.

8.9.2 Placement and Compaction

Materials shall be placed upon an approved subgrade base course or previous paving course in accordance with Division 400 of the CDOT *Standard Specifications for Road and Bridge Construction*. Prime or tack coats shall be applied in accordance with Section 8.11.1 of this Chapter.

When more than one (1) lift of pavement is required, where possible, the joints or seams between lifts shall be staggered so that joints are separated by at least two (2) feet in the horizontal direction.

The bituminous paving mix shall be compacted to at least ninety-five (95) percent of the mix determined Marshall density or specified density from Hveem testing to achieve design strength.

8.9.3 Testing

During placement and compaction of plant mix bituminous pavement, observation and testing shall be on a full-time basis. For each one thousand (1,000) tons of material placed or at least one (1) or each day of production, a field sample shall be taken and subjected

to Marshall or Hveem testing, extraction and gradation analysis. Testing intervals may be increased to approximately one half (1/2) of the daily tonnage to be placed at the discretion of the Town Inspector.

Mix temperatures will be checked on each truck and, where the temperature does not meet specifications, the load shall not be placed.

During compaction the density of the pavement will be checked randomly at a rate of one (1) test for each five hundred (500) lineal feet of travel for each lift.

Either during or after completion of the paving the final pavement thickness shall be determined for the plant mix bituminous pavement using coring, rings or other acceptable methods. Thickness determinations shall be made at random locations at intervals of approximately five hundred (500) feet in each travel lane.

8.9.4 For collector and arterial streets, a profil-o-graph test shall be submitted to, and accepted by, the Town Engineer or Director of Public Works prior to the beginning of the two (2) year warranty period.

8.9.5 Acceptance

The result of Field Density and Laboratory Tests shall be submitted and reviewed by the Town Engineer or Director of Public Works. Provided all tests are acceptable, the asphalt concrete materials, placement and compaction will be approved. Acceptable results shall be in compliance with tolerances for gradation and extraction found in Tables in Section 5. Marshall stability test results shall average fifteen hundred (1,500) lbs. or more. Should testing indicate unsatisfactory work, removal and replacement or overlay work will be required.

Criteria used to determine satisfactory work shall be all for the following:

- A. Ninety (90) percent of core test must meet or exceed design HBP thickness;
- B. Average of all core test must meet or exceed design HBP thickness;

C. All core test thicknesses must exceed design HBP thickness minus one-quarter (1/4) inch.

If all these criteria are not met, additional core tests or approved non-destructive testing at the expense of the owner/developer may be required to further delineate the area(s) of unsatisfactory work which will require correction prior to acceptance.

8.10 PORTLAND CEMENT CONCRETE

Portland Cement Concrete pavement is only permitted under special circumstances and with prior approval from the Town Engineer or Director of Public Works.

8.11 OTHER MATERIALS

8.11.1 Asphalt Prime and Tack Coats

Asphalt Prime and Tack Coats shall comply with the CDOT *Standard Specifications for Road and Bridge Construction*.