



TESTING REQUIREMENTS

SOILS TESTING

Colorado Department of Transportation Standards for Road and Bridge Construction, as amended, and as amended by these Engineering Standards, shall apply to roadway testing requirements.

All tests and inspection results performed by the testing firm in the employment of the owners/developers shall be submitted directly from the testing agency to the Town Engineer or his/her field representative at the time of field tests, and within ten (10) working days after the testing or retesting date of laboratory tests.

Any work performed inside the Town ROW and associated easements shall be tested by an approved materials testing firm. Materials testing firms shall be approved by the Town Engineer and must employ a full-time registered professional engineer who directly supervises work of the firm. The costs of testing and associated reporting will be paid by the owner/developer.

Backfilling of Utility Trenches, Inlets, Manholes and Junction Boxes

All utility trenches within the ROW shall be placed and compacted in accordance with the Details.

Field moisture-density testing shall be performed during backfill operations beginning one foot (1') above the top of the pipe bedding 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 (1) test shall be taken within one foot (1') of all manholes, water valves or other obstacles.

Curb, Gutter, Sidewalk, Crosspans, and Minor Drainage Structures

Subgrade shall be thoroughly compacted to the moisture and 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, proof roll required.

Testing frequency for the subgrade shall be a minimum of each six-inch (6") lift on replacement materials with one (1) test for every two hundred fifty feet (250') or at each structure with more tests taken if necessary for control.

These test results shall be submitted to the field representative of the Town Engineer for compliance review.

Concrete with air entrained, Class A, B, or D shall be used.

Curing methods shall conform to CDOT Standards.

Concrete placement shall include methods which will not reduce the strength or integrity of the final product.

The slump, air content and unit weight tests shall be carried out in the first truck of concrete for the daily placement and thereafter in conformance with the following table:

TESTING FREQUENCY

ITEM	TESTING FREQUENCY
Sidewalks, crosspans, curb returns	1 set of 4 cylinders for every 1,000 square yards or fraction thereof of concrete placed.
Curbing and combination curb, gutter and walk	1 set of 4 cylinders for every 1,000 lineal feet or fraction thereof of curb and gutter placed.
Minor drainage structures	Each structure 1 set of 4

(MINIMUM OF 1 TEST PER DAY OF A POUR)

Note: The testing is 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.

These test results shall be submitted to the field representative of the Town Engineer for compliance review.

At the discretion of the Town Engineer, the contractor will provide core test results of concrete at random intervals, not averaging less than one (1) test in five hundred feet (500'), to verify the specified thickness of concrete was installed. Testing costs shall be paid for by the owner/developer. If the Town Engineer 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 Town Engineer, the contractor will provide additional core tests.

Street Subgrade Preparation (SEE SOILS REPORT)

The subgrade shall be free of organic material and shall be scarified to a depth of twelve inches (12"), moisture treated to within \pm two percent (2.0 \pm %) of optimum moisture content and compacted to ninety-five percent (95%) optimum density, AASHTO T-99.

Field moisture-density tests using acceptable methods will be required at random locations at the rate of one for each two hundred fifty (250) lineal feet of paving for each travel lane.

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 GVW of fifty thousand (50,000) pounds with a loaded single axle weight of at least eighteen thousand (18,000) pounds and a tire pressure of ninety (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 shall be notified at least forty-eight (48) hours before final proof-rolling.

The results of field density tests and proof-rolling shall be submitted and reviewed by the Town Engineer. 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 twenty-four (24) hours. Changes in weather such as freezing or precipitation will require re-approval of the subgrade.

Aggregate Base Course

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

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 reapproved.

Aggregate base materials shall be placed, moisture treated and compacted as outlined in the CDOT Standards.

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 material at random locations at approximate intervals of two hundred fifty feet (250') in each travel lane. Tests shall also be taken within one foot (1') of manholes and valves.

The results of field density tests shall be submitted to and reviewed by the Town Engineer. 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.

ASPHALT

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 for 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 (½) of the daily tonnage to be placed at the discretion of the Town Engineer.

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 the rate of one test for each two hundred fifty (250) lineal feet of travel for each lift.

Backfilling

General

All trenches shall be backfilled after pipe, fittings and appurtenances have been installed, inspected and approved by the Town Engineer. Bedding and "pipe zone" backfill shall be installed in accordance with this Section.

Whenever a compaction requirement value is specified herein, the optimum moisture content and Standard Proctor Density shall be determined in accordance with AASHTO T-99 for ninety-five percent (95%).

Density Requirements in Trench – The contractor shall obtain a Standard Proctor Density of ninety-five (95%) for the total depth of all trenches in open fields and in dedicated ROWs. Backfilling shall be done with good sound earth, sand or gravel, and no oil cake, bituminous pavement, concrete, rock or other lumpy material shall be used in the backfill unless these materials are scattered and do not exceed six inches (6") in any dimension and are not placed within one foot of the 2-1/2' limit. Material of perishable, spongy or otherwise improper nature shall not be used in backfilling and no material greater than four inches (4") in any dimension shall be placed within one foot (1') of any pipe, manhole or structure. Backfilling shall be accomplished in the zone in layers not to exceed three feet (3'). All backfill material shall be subject to the approval of the Town Engineer.

Compacted Fill – Compaction shall be done by use of vibratory equipment, tamping rollers, pneumatic tire rollers or other mechanical tampers of the type and size approved by the Town Engineer. Hand tampers shall be used around all manholes, valve boxes, and any surface structure. The backfill shall be placed in horizontal layers of such depths as are considered proper for the type of compacting equipment being used in relation to the backfill material being placed. Each layer shall be evenly spread, properly moistened and compacted to the specified density. Any damage to the pipe as a result of contractor's operation shall be repaired and/or replaced.

Procedure at Street Zone – The top two and one-half-foot (2 ½') from finish street grade or ground surface, as the case may be, shall be compacted in horizontal layers not exceeding eight inches (8") in thickness, using approved hand pneumatic or mechanical type tampers to obtain a Standard Proctor Density of ninety-five percent (95%). Flooding and jetting are not permitted. From existing street grade to two and one-half-foot (2 ½') below street grade, the material for backfill may contain stones up to two inches (2") in diameter, in quantity not exceeding twenty percent (20%) of the volume where said coarse materials are well distributed throughout the finer material and the specified compaction can be obtained.

Compaction Tests For Water, Sewer and Storm Lines

Compaction tests will be taken by an approved testing laboratory at locations designated by the Town Engineer. All expenses involved in these tests will be borne by the developer/owner. Results of the tests will be made available to the Town Engineer immediately and copies of test results will be supplied to the Town Engineer once per week. A final typed bound copy of final test results must be submitted to the Town Engineer at the end of the project. In all cases where the tests indicate compaction less than that required, additional compaction and tests will be required until these specifications are met. Probationary Acceptance of the lines by the Town will be contingent upon satisfactory compaction results. No hydrostatic testing of the water main will be allowed until satisfactory compaction is obtained. Frequency of testing will be as follows:

One (1) test at every above ground appurtenance (i.e. valve box, manhole) at two-foot (2') increments.

One (1) test every two hundred (200) LF of mainline trench at two-foot (2') increments beginning one foot (1') above pipe bedding to final grade and one test at final grade.

Two (2) tests at every service. One (1) test three feet (3') from proposed gutter and one (1) test behind proposed walk all at two-foot (2') increments.

These requirements are for all utilities installed within public ROW and in dedicated easements.

Pipeline Testing After Installation

Chlorination – All mains, extensions and private pipe shall be chlorinated accordance with AWWA C-651, "Disinfecting Water Mains" and the local health authority having jurisdiction prior to the lines being accepted.

The chlorination of the finished pipelines shall be done in the presence of the Town Engineer. Prior to the hydrostatic testing the Town must receive documentation which indicates all Bacteriological test have passed.

Material – Chlorine tablets may be used for disinfection in twelve-inch (12") and smaller. For pipes having a larger diameter, a chlorine slurry is fed into the water filling the pipe. If chlorine tablets are used, they shall be attached to the inside top of the pipe with red permatex just prior to the pipe installation. Hypochlorite may be used and shall conform to Federal specification O-C-114, Type II, Grade B.

Method – Flushing and sterilization of lines shall be accomplished in accordance with the requirements of the Colorado State Board of Health. Chlorine dosage shall be at least fifty (50) parts per million, and shall be retained in the line at least twenty-four (24) hours, after which time the residual at the end of the line and at other representative points in the line shall be at least ten (10) parts per million. If the residual at the end of twenty-four (24) hours is less than ten (10) parts per million, the entire operation shall be repeated.

All valves in the lines being sterilized shall be opened and closed several times during the contact period. After completion of sterilization, the system shall be flushed with clean water

until the residual chlorine content is not greater than 1 part per million, or the existing systems normal residual. A Town representative will take all chlorine test. De-chlorination will be required on all flushing of lines with chlorine levels greater than system norm.

The contractor will be required to supply test bottles and pull clear water samples in the presence of a Town representative. A sample will be taken at every fire hydrant and blow off. The contractor will submit the samples to Colorado Analytical Laboratory 240 South Main Street Brighton Colorado 80601 for testing, or a state-certified laboratory.

Hydrostatic Pressure Test

The hydrostatic test pressure for any type of pipe shall be one hundred fifty (150) pounds per square inch based on the elevation of the lowest point in the line of section under test and carried to the elevation of the test gauge. All sections of newly laid pipe, subsequent to backfilling, shall be subjected to the hydrostatic pressure test.

The duration of the hydrostatic pressure test shall be at least one (1) hour.

Air Removal Before Test – Before applying the specified test pressure, all air shall be expelled from the pipe. If permanent air vents are not located at all high points, the contractor shall install corporation cocks at such points as the air can be expelled as the line is filling with water. After all the air has been expelled, the corporation cocks shall be closed and test pressure applied. Any cracked or defective pipe, fittings, valves or hydrants discovered in sequence of this pressure test shall be removed and replaced by the contractor with sound materials, and the test shall be repeated until results satisfactory to the Town Engineer are obtained.

Procedure – Each valved section of pipe shall be slowly filled with water and the specified test pressure shall be applied by means of a pump connected to the pipe in manner satisfactory to the Town Engineer. The pump, pipe connection, gauges and all other necessary equipment and personnel to complete the test, shall be furnished by the contractor and shall be approved by the Town Engineer. All corporation cocks and taps to the main line and all connection piping and valves that may be required to make the test, whether or not specified or shown on the construction drawings, shall be installed by the contractor. The Town will furnish only the calibrated meter.

While the test pressure is maintained, the new pipe will be inspected and any leaks will be repaired. After all leakage has stopped, the pressure of one hundred fifty (150) psi shall be maintained for one (1) hour. Allowable leakage for each section between the line valves shall not exceed the following values:

**ALLOWABLE LEAKAGE PER 1000 FT/PIPE
GALLONS/HR.**

INSIDE DIAMETER	D.I.	PVC
4	0.37	0.33
6	0.55	0.50
8	0.74	0.66
12	1.10	1.00
16	1.47	----
20	1.84	----

Should the leakage rate be greater than the above set rates, the pipeline shall not be accepted. The pipeline shall be repaired, re-chlorinated as previously described and retested.

The contractor shall ensure that a satisfactory test is completed and shall employ all methods necessary to pass the test, including disconnection from existing water mains and use of a temporary plug, if necessary.

Test Results – The contractor will be responsible for presenting certified test results to the Town Engineer prior to acceptance of the lines.

Sanitary Sewer Pipeline and Manhole Testing After Installation

Clean and Video all sanitary sewer lines, provide videos to Town Engineer

Sewer Mainline Pressure Test: Maintain pressure between 3.5 psi and 4.5 psi for 10 minutes for each section between manholes.

Manhole Vacuum Test: Vacuum of 10" mercury for 60 seconds must maintain at least 9" mercury.

Town of Lochbuie As-Built Submittal Procedure

Prior to **Probationary Acceptance**, the Developer shall deliver to the Town Engineer and Public Works Director one (1) signed and sealed set of as-builts and electronics

As-builts shall verify the location, size, type, class and elevation of all pipes (water, sanitary and storm) manholes, fire lines, curb stop boxes, meter pits, valves, fire hydrants, inlets, riprap, headwalls and other storm drainage infrastructure shown on the construction plans. This will include those improvements outside of public ROW and off-site improvements specified in the SIA.

Detention Ponds volumes, elevations of outlet structure and pipe, grade of trickle channels will need to be surveyed and certified. This information will be reviewed and approved by the Town Engineer.

The drawings and electronics will be revised to show all As-Built horizontal locations to within one foot (1') and all vertical elevations to within 0.1'

Certification Block for As-Built Drawings:

The responsible professional engineer, registered in the State of Colorado, for the project shall state:

"I hereby affirm that the public improvements (name of subdivision or project) have been constructed in compliance with the construction plans approved by the Town and revised as noted to reflect the "As-Built" conditions."

Name, P.E. Date

This block shall appear on the cover sheet of each set of drawings

If the improvements for a project are constructed in phases, as-built drawings will be submitted at the completion of each phase.

Provide Northing, Easting and elevation for two (2) section corners adjacent to the site. If available, provide Weld County GIS coordinates/elevations.

Hard copies

Prior to submittal of as-builts, submit one (1) paper copy to the Town Engineer and one (1) to the Town for review.

After addressing redline comments and prior to Probationary Acceptance, provide to the Town:

- >Three (3) full-size paper and three (3) half-size paper, sealed and signed sets for the Town.
- >Two (2) full size paper, two (2) half size paper sealed and signed sets for Public Works.
- >One (1) full size paper, one (1) half size paper sealed and signed sets for the Town Engineer
Electronics as identified below.

Electronics

All submittals must be on CD.

Refer to disk/case labeling requirements, see below. Contact RG for electronics of CD Case Label and RGA Job Number.

Provide two (2) copies of each CD.

All CDs must be submitted in a hard plastic CD case.

No projects will be accepted without the proper labeling.

All drawings are to be in AutoCAD; for version, contact the Town Engineer.

PDF's

Provide PDF's of the entire plan set. Each PDF will be 24"x36". PDF each sheet individually. Name the PDF by using the drawing name and inserting the sheet number at the beginning.

All drawings must be to scale.

Contents of the Disk

All information must be contained in two (2) folders; labeled "DRAWINGS" and "PDF's."

The "DRAWINGS" folder shall include all AutoCAD drawings for the project.

No permits will be issued until the hard copies and electronics are received by the Town.

Example of CD Case

Project Name: Subdivision & Filing or Site Plan Name Type: Final Plat or Site Plan	
<u>Section Corner #1:</u> Corner Description: Northing: Easting: Elevation:	<u>Section Corner #2:</u> Corner Description: Northing: Easting: Elevation:
Developer:	Name Address Town, CO, Zip phone#/email
Design Engineer:	Name, PE # Firm Name & Address Town, CO, Zip phone#/email

Example of CD



ACCEPTANCE OF WORK

Probationary Acceptance.

No later than thirty (30) days after Public Improvements are completed for the Site Plan or Development, the applicant shall request inspection by the Town. If the applicant does not request this inspection within thirty (30) days of completion of improvements, the Town may conduct the inspection without the approval of the applicant. The applicant shall provide "as-built" drawings and a certified statement of construction costs no later than forty-five (45) days after Public Improvements are completed. If the Public Improvements completed by the applicant are satisfactory, the Town shall grant "Probationary Acceptance," which shall be subject to "Final Acceptance" as set forth below. If Public Improvements completed by the applicant are unsatisfactory, the Town shall provide written notice to the applicant of the repairs, replacements, construction or other work required to receive Probationary Acceptance. The applicant shall complete all needed repairs, replacements, construction or other work within thirty (30) days of said notice, weather permitting. After the applicant completes the repairs, replacements, construction, or other work required, the applicant shall request of the Town a re-inspection of such work to determine if Probationary Acceptance can be granted, and the Town shall provide written notice to the applicant of the acceptability or unacceptability of such work prior to proceeding to complete any such work at the applicant's expense. If the applicant does not complete the repairs, replacements, construction or other work required within thirty (30) days of said notice, the Town may exercise its rights to secure performance. The Town reserves the right to schedule re-inspections, depending upon scope of deficiencies.

No building permit for the construction of any structure shall be issued by the Town until all the water lines, fire hydrants, sanitary sewer lines and all but the final lift of pavement for the streets (including curb, gutter, and sidewalk pavement with at least the base course completed and the storm drainage facilities within the streets) serving such structure have been completed and granted Probationary Acceptance by the Town or an equivalent confirmation of completion by another entity, as is appropriate.

For a two (2) year period from the date of Probationary Acceptance of the Public Improvements related to the Site Plan or Development Plans, the applicant shall warrant all said Public Improvements and, at its own expense, make all needed repairs or replacements that, in the reasonable opinion of the Town, shall become necessary. If within forty-five (45) days after the applicant's receipt of written notice from the Town requesting such repairs or replacements, the applicant has not completed such repairs, the Town may exercise its rights to secure performance.

Final Acceptance.

At least forty-five (45) days before two (2) years have elapsed from the issuance of Probationary Acceptance, or as soon thereafter as weather permits, applicant shall request a "Final Acceptance" inspection, the process of which is defined as follows:

The Town shall inspect the Public Improvements and shall notify the applicant in writing of all deficiencies and necessary repairs, if any. If there are no deficiencies, or after the applicant has corrected all deficiencies and made all necessary repairs identified in said written notice, the Town Council shall by resolution grant Final Acceptance. If the applicant does not correct all deficiencies and make repairs identified in said inspection to the Town's satisfaction within thirty (30) days after receipt of said notice, weather permitting, the Town may exercise its rights to secure performance. If any mechanic's liens have been filed with respect to the Public

Improvements, the Town may retain all or a portion of the Improvement Guarantee up to the amount of such liens. If the applicant fails to have the Public Improvements finally accepted within two (2) years of the date of the issuance of Probationary Acceptance, or any Public Improvements are found not to conform to this Agreement or to applicable Town standards and specifications, then the applicant shall be in default of the Agreement and the Town may exercise its rights.