

CHAPTER 9 – TRENCH BACKFILL / COMPACTION

9.1 GENERAL

No pavement cuts will be permitted for any Town roadway granted probationary acceptance or overlaid within the previous five (5) years. Emergency repairs for broken pipes, cables, etc. will be allowed according to the permitting requirements of Chapter 10. If a Contractor makes a cut into new pavement as defined in this paragraph which is not an emergency cut, the Contractor or Owner of the infrastructure shall be liable for additional costs as defined in Chapter 10.

- 9.1.1 Existing pavement shall be cut so the joint line between existing and replacement pavement is straight and neat - i.e. within five (5) degrees of vertical and free from horizontal irregularities. Preferred methods of cutting are saw or blade. The cut depth shall be, sufficient to permit pavement removal without damage to remaining pavement.
- 9.1.2 Removed pavement shall be hauled away and disposed of in a proper manner (recycle or waste facility).
- 9.1.3 Base Course material shall be removed and stockpiled for reuse during backfilling if it meets specifications. If not, it is to be hauled away from the ROW and disposed of in a proper manner.
- 9.1.4 Subbase material is to be stockpiled parallel to the trench alignment, in such a manner that encroachment upon the non-disturbed portion of the roadway and/or pedestrian walkways is kept to a minimum.
- 9.1.5 Safety standards related to the shoring and stabilization of trench sidewalls should be maintained as prescribed by appropriate safety regulatory agencies (OSHA, State of Colorado).
- 9.1.6 The trench for such construction shall not be opened for a distance of more than three hundred (300) feet at any one time, unless specifically authorized by the Director of Public Works or his designated representative.
- 9.1.7 The trench width shall be confined to those minimum dimensions, which will permit proper installation and acceptable pipe loading, as established by current acceptable engineering practices.

- 9.1.8** No trench should be left in an open condition overnight, except for the portion necessary to commence work the following morning. Warning signs, barricades and lights, all in conformance with the Manual of Uniform Traffic Control Devices (MUTCD), shall be used in areas where trenching operations are in public roadways. Any trenching remaining open overnight shall have flashing lights used with warning signs and barricades. All such barricades, signs, and warning devices shall be installed in accordance with an approved Construction Traffic Control Plan.
- 9.1.9** In trenching across the road, no more than one half (1/2) of the traveled way is to be closed to traffic at one time.
- 9.1.10** Closure of any street, road approaches, or other access points will not normally be permitted. Upon trenching across such facilities, steel running plates, planks or other safe methods shall be used to provide for traffic to enter or leave the road or adjacent property. Refer also to Section 10.6.1.
- 9.1.11** Access to private driveways shall be provided at all times except during working hours when construction operations prohibit provision of such access.
- 9.1.12** Free access must be provided at all times to fire hydrants.
- 9.1.13** When, during the progress of work, an excavation is to be made in Town easements through private property, the Contractor shall notify the property owners at least 72 hours in advance of beginning work or in accordance with ROW easements which set forth ingress/egress requirements.
- The Contractor shall take precautions to limit the removal of or damage to existing pavements, sidewalks, curbs, lawns, shrubbery, trees, hedges, walls, fences, buildings or other existing improvements to the least practical amounts and shall replace or restore such improvements to their original location and condition after the excavation has been backfilled and compacted.
- 9.1.14** It shall be the responsibility of the Contractor to appraise himself of all specific conditions contained in private easements. Contractor shall perform all work in accordance with stipulations contained therein.
- 9.1.15** Where trenching excavation occurs within the roadway surface, the minimum allowable remaining pavement sections shall not be less than 4 feet (not including the curb and gutter) unless it is part of a monolithic concrete pavement section.

9.2 BACKFILLING

- 9.2.1 The permittee shall advise the Public Works Department of the trench backfill date at the time the Public Works Department is notified that construction will take place. Normally, backfill will take place on the same day of trenching; if this is not the case, the Engineering or Public Works Department must be given the same prior notice as required for the initial trenching.
- 9.2.2 The bottom of the trench shall be prepared to provide a firm foundation for the pipe or facility in accordance with the bedding conditions specified by the geotechnical engineer or Special District for the type of pipe or facility to be installed. The subgrade of the trench shall be kept free of standing water. Where the trench subgrade material is found to be unsuitable and does not afford a solid foundation, the Contractor shall excavate to such depth as necessary to construct a stable foundation. A stable foundation shall be constructed by placing crushed rock or other approved granular material under the pipe.
- 9.2.3 Backfilling shall be so placed that the pipe will not be displaced or damaged. Backfilling to a depth of one (1) foot maximum over the crown of the pipe shall be made with granular soil or sand as required by the Director of Public Works or his field representative.
- 9.2.4 Immediately after the facility authorized by the permit has been placed in the trench, the trench shall be backfilled with an approved material, which is free of humus, vegetation or other organic matter, frozen material, clods, sticks and debris and contains no stones having a dimension greater than three (3) inches. Said material shall be filled to an elevation which will allow placing the pavement base and wearing surface according to Figure 9.1, found at the end of this chapter.
- When, in the opinion of the Director of Public Works or their representative, the excavated material is unsuitable for backfill, this material shall be hauled away and granular backfill material satisfactory to the Director of Public Works shall be used.
- 9.2.5 The subgrade shall conform to the lines, grades and cross-sections as shown on the approved plans. The backfill materials shall be compacted in successive layers not to exceed eight (8) inches thick and shall be finished and maintained in a smooth compacted condition. The completed surface shall be free from rutting or other objectionable irregularities.
- 9.2.6 Within the roadway area, trench compaction shall be in accordance with AASHTO T 99 or T 180 as required in the latest CDOT standards and specifications.
- 9.2.7 Use of approved, controlled low-slump material (flowfill, shrinkcrete or equivalent) for backfill of trenches may be allowed with prior approval of the Director of Public Works. All controlled low-slump material (CLSM) must have a maximum 28-day strength of 60 psi.

9.3 SUBBASE

Unless more-recent standards are designed and approved by the Town, the following standards apply.

The term "subbase", for the purpose of trench backfill discussion shall refer to CDOT Class 1 or Class 2 material that is part of structural pavement design. There may or may not be a subbase in the pavement section. If there is none, the base course is all CDOT Class 6 aggregate base course.

- 9.3.1** Subbase material shall conform to the lines, grades, cross-sections and thickness shown on the approved plans and shall be finished and maintained in an acceptable condition at least one day's progress in advance of base construction.
- 9.3.2** Subbase material shall be well mixed, free of organic matter and lumps or balls of clay and shall consist of sound aggregate particles and suitable filler or binding materials which when placed and compacted will result in a firm, dense, unyielding foundation. Subbase material need not be crushed but may be of the pit run variety providing it is graded within the following limits:

TABLE 9.1 GRADATION OF SUBBASE MATERIAL	
STANDARD SIZE OF SIEVE	PERCENTAGE OF WEIGHT PASSING SIEVE
2-1/2 Inch	100
2 Inch	95-100
#4	30-60
#200	5-15
Liquid Limit	35 Maximum
Plastic Limit	6 Maximum

- 9.3.3** Deviations from the gradation limits listed above will be permitted on approval by the Director of Public Works, Town Engineer, or their representatives, for unpaved roads where it can be adequately demonstrated that the proposed subbase material can fulfill the intent of these specifications.
- 9.3.4** Subbase shall be deposited and spread, without particle segregation in loose layers not to exceed 6 inches in depth. Each layer shall be thoroughly and individually compacted to 95 percent proctor (AASHTO T 99) density. Wetting or aerating and rolling of the material shall be required when ordered by the Director of Public Works or their representative. Subbase shall not be placed on soft, spongy, or frozen subgrade or other subgrade, the stability of which, in the opinion of the Director of Public Works or their representative, is unsuitable.

9.4 FOUNDATION FOR BASE COURSE

- 9.4.1** Base material shall conform to the lines, grades, cross-sections, and thickness shown on the approved plans and shall be finished and maintained in an acceptable condition at least 1 day's progress in advance of placing prime coat.
- 9.4.2** Base material shall consist of hard, durable particles or fragments of stone or gravel crushed to the required size and an AP-filler of sand or other finely divided mineral matter. When produced from gravel, not less than 60 percent by weight of the aggregate retained on a No. 4 sieve shall consist of particles having at least one fractured face. Base material shall be free from vegetation matter and lumps or ball of clay and which when placed and compacted will result in a firm, dense, unyielding foundation. Base materials shall meet the following grading requirements:

TABLE 9.2 GRADATION LIMITS OF BASE MATERIAL	
STANDARD SIZE OF SIEVE	PERCENTAGE OF WEIGHT PASSING SIEVE
3/4 Inch	100
#4	30-65
#10	25-55
#200	3-12
Liquid Limit	25 Maximum
Plastic Limit	6 Maximum

- 9.4.3** Base material shall be deposited and spread without particle segregation in loose layers not to exceed six (6) inches in depth. Each layer shall be thoroughly and individually compacted to ninety-five (95) percent proctor (AASHTO T 180) density. Wetting and aerating and rolling of the material shall be required as ordered by the Director of Public Works or their representative following review of all field test results. No base course shall be placed on a soft, spongy or frozen subgrade or subbase or other subgrade, the stability of which, in the opinion of the Director of Public Works, is unsuitable.
- 9.4.4** Deviations from the gradation limits may be permitted by the Director of Public Works on unpaved roads provided it can be unequivocally demonstrated that the subbase material is not conducive to rutting, raveling or forming a soft yielding surface in the presence of moisture. Compaction equipment must be on the job site before excavation is started. Compaction equipment must be capable of compacting within the trench width limits to avoid bridging the ditch.

- 9.4.5** If the existing base course is untreated, it shall normally be replaced with CDOT Class 6 aggregate base material and compacted in layers not to exceed 6 inches. The resulting total compacted base thickness shall be 8 inches or to the thickness of the removed base plus 2 inches. If the existing base material is asphalt treated aggregate it shall be replaced by a minimum of 3 inches of acceptable asphalt base or the existing base thickness plus 1 inch, whichever is greater. A replacement 2 inch thick asphalt surface wearing course shall also be used when replacing asphalt treated aggregate.

Note: For the purpose of replacing a full depth asphalt pavement section, the top 2 inch mat be considered the wearing course, with the remainder being the base course.

9.5 TRENCH COVER-SUBGRADE

- 9.5.1** After the backfill has been made and compacted as specified, it shall be cut and trimmed to the required depth and cross-section. Trench cover subgrade shall be free of all rock over two and one-half (2-1/2) inches in size. It shall have a compaction of ninety-five (95) percent or more by standard tests (see Chapter 8) at the time of constructing curb, gutters, sidewalk, pavement and/or other permanent trench cover structure.
- 9.5.2** All excess excavated material shall be removed and disposed of outside the legal limits of the ROW as the work progresses, unless the approval of the Director of Public Works is obtained for disposal of the material within the legal limits of the ROW. All parts of the roadway and various structures disturbed shall be restored to a condition equal to that which existed before starting the work.

9.6 TRENCH COVER-ASPHALT

9.6.1 Temporary

9.6.1.1 Temporary Trench Cover

All trenches across traffic lanes, where it becomes necessary to remove any existing surface or pavement, shall be provided with temporary trench cover.

- 9.6.1.2** A temporary patch of cold mix shall be placed on all pavement surface cuts immediately after backfilling has been completed and shall be removed at the time a permanent patch is made.

- 9.6.1.3** Minimum requirements for temporary trench covers shall be well compacted surfacing material conforming to "Road Mixed Asphalt Surfacing Material" of the CDOT Standard Specifications and shall match the existing asphalt or concrete thickness but shall not be less than 4 inches thick. The mineral aggregate shall, with a tolerance of 5 percent, conform to the grading specified for three-eighth (3/8) inch maximum aggregate. Bituminous binder to be mixed with the mineral aggregate shall be liquid asphalt, Grade MC-3000 and shall be between 5-1/2 percent and 6 percent by weight of the dry mineral aggregate.
- 9.6.1.4** Temporary trench cover surfacing material shall be stockpiled on the job site and shall be placed within 6 hours after completion of trench backfill and compaction.
- 9.6.1.5** Temporary trench cover shall be properly maintained until permanent trench cover is placed.
- 9.6.1.6** Trench covered with temporary surfacing will be considered as open to traffic.
- 9.6.1.7** The surface of the temporary repaving shall be smooth and at the same level as the adjacent undisturbed paved area.

9.6.2 Permanent

Unless otherwise specified, the replacement of pavement shall be as follows:

- 9.6.2.1** In the areas where the wearing surface is asphalt concrete, replace the pavement with a Full Depth asphalt paving of a minimum thickness of 4 inches but in all cases to a thickness of the old surface plus base course plus 1 inch.
- 9.6.2.2** In areas where the wearing surface is Portland cement concrete, replace the pavement with concrete pavement conforming to the requirements of the governing authority. Said concrete pavement replacement shall be of the same depth as the original pavement, but not less than 6 inches thick on alleys or residential streets, nor less than 8 inches on major or secondary streets and highways.

9.7 PERMANENT ALTERNATIVES

- 9.7.1** Where original surface was Portland cement concrete; Portland cement concrete shall be placed to a thickness of 6 inches or the thickness of the removed pavement, whichever is greater.

- 9.7.2** Where original surface was asphalt concrete, bituminous treatment or mix, or oil mat; asphalt concrete shall be compacted in layers not to exceed 3 inches to a total compacted thickness of 4 inches or the thickness of the removed pavement plus 1 inch whichever is greater. On oil mat surfaces or substandard asphalt surfaces, an overlay of Class "EX" asphalt pavement 1-1/2 inches thick shall be placed across the entire traffic lane disturbed by the trench and shall be finished as set forth below.
- 9.7.2.1** Immediately prior to placing the wearing surface, the abutting pavement edges shall be neatly cut (See Section 8.11).
- 9.7.2.2** The existing pavement shall be cleaned, removing all loose material and coated with hot liquid asphalt (Grade AC-10) or asphalt emulsion applied cold (Grade CSS-1h) to insure a bond with new asphalt surfacing.
- 9.7.2.3** The restored pavement shall be finished to a smooth riding surface and to the grade of the surrounding undisturbed pavement.
- 9.7.2.4** Pavement replacement shall commence not more than 7 working days after backfilling, unless the Director of Public Works permits otherwise.
- 9.7.3** In the event the trench edges fall in the wheel traveling portion of a traffic lane, existing or proposed, the applicant shall extend the finish surface paving to a point deemed satisfactory by the Director of Public Works. Finish surface paving shall be performed in such a manner as to provide a crown slope equal to that existing prior to excavation, with no ponding of runoff surface water either over the trench or the joints between new and original surfaces.
- 9.7.4** When road surface damage involves more than one traffic lane, a full width paving lift may be required.
- 9.7.5** See Figure 9.1 at the end of this chapter for details of trench backfill and asphalt surface repair.

9.8 REPAIR TO RURAL ROADWAYS

9.8.1 Restoration of Unpaved Areas

- 9.8.1.1** Where the original surface was crushed rock or gravel for the wearing surface and foundation material, Class 6 aggregate base course shall be used as replacement material. It shall be placed to a compacted thickness minimum of 8 inches or the thickness of the removed material plus 2 inches, whichever is greater. See Chapter 8 for compaction requirements.

9.8.1.2 Compaction

In the area from the ROW line (fence line/property line) to a point 5 feet outside of the roadside ditch flowline, all trenches shall be backfilled with excavated material and compacted to 95 percent standard compaction, or to the density of the existing ground whichever is greater.

9.8.1.3 In all other areas not referred to in Section 9.8.1.2 above, including the gravel road, the shoulders and the roadside ditch to a point 5 feet outside of the flowline; all trench compaction shall be in conformance with Figure 9.1 of these standards.

9.8.1.4 Erosion Control

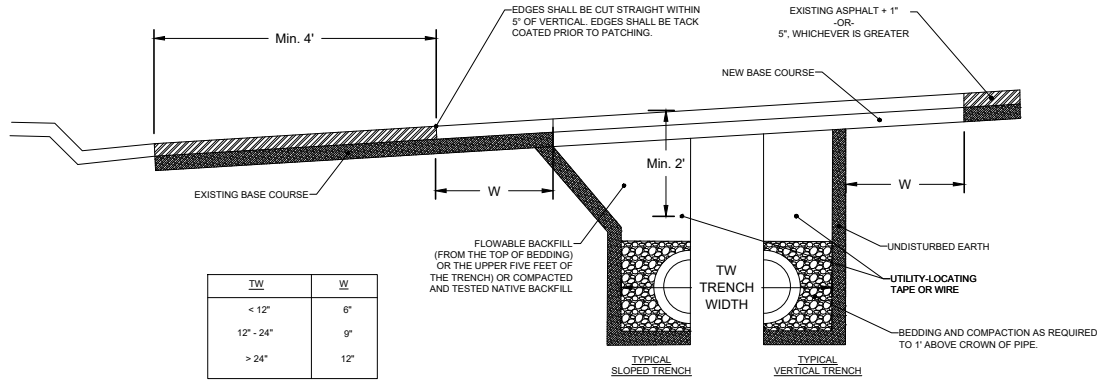
During construction and after the trench is backfilled and compacted, erosion protection shall be provided per the Town of Bennett's Storm Drainage Design and Technical Criteria Manual.

9.9 MAINTENANCE PERIOD

9.9.1 For a period of 2 years following the backfilling of any trench in the Town ROW and/or permanent patching of the paved surface, the applicant shall be responsible for the condition of said trench backfill and pavement patches. During that time the applicant shall, at his own cost, upon request from the Director of Public Works, repair cracked, broken, or otherwise faulty constructions. Settlement of replaced road surface of 1/2 inch or more within a 6 foot straight edge shall constitute evidence of improperly compacted backfill material. If test results do not meet the standards for compaction as set forth in Sections 8.2 thru 8.5, the contractor shall be responsible for repairs or replacement to meet these standards. Settlement of 3/8 inch or greater with a 6 foot straight edge will be cause for repair in the case of settlement, or replacement in the case of unsatisfactory workmanship.

9.9.2 All inspection costs shall be borne by permittee.

9.9.3 The permittee shall notify the Director of Public Works in writing upon completion of work accomplished under provisions of the permit.



NOTES:

1. This Trench Patching Detail specifies requirements in addition to those specified in the latest version of MGPEC and Colorado standards.
2. Any utility installed within the ROW or Easements shall have utility locating tape or wire over the top of the utility located a minimum of 2'-0" below final grade, or located on utility if minimum depth cannot be achieved.
3. A construction Traffic Control Plan shall be submitted to and approved by the Director of Public Works or his representative prior to issuance of construction permits in the ROW.
4. Trenches shall be braced or sheeted as necessary for the safety of the workmen and protection of the other utilities or structures in accordance with applicable local, State, and Federal safety regulations.
5. The trench width shall be confined to those minimum dimensions, which will permit proper installation and acceptable pipe loading, as established by current acceptable engineering practices.
6. Existing asphalt of pavement shall be cut back a minimum of "W" (See chart above) beyond the trench limits or to sound pavement, whichever is greater. If encroachment into the outside 4-foot zone or if an island is located inside the f-Foot zone, the 4-foot zone shall be included in the required patch.
7. Backfill shall meet MGPEC standards - Item 18, Sections 18.1, 18.2, 18.2.1, 18.2.2, 18.2.3, and 18.2.4 , except where these standards dictate otherwise.
8. Full depth asphalt can be used as an alternative to base course. A ration of 3 inches of base course to 1 inch of asphalt shall be used in the substitution.
9. A temporary cold-mix patch, 4 inches in depth, shall be required for all street cuts if a permanent hot-mix asphalt patch cannot be applied immediately following construction.
10. The temporary patch shall be maintained until the permanent hot-mix asphalt patch is applied within a maximum of 7 calendar days.
11. Compaction testing results shall be a minimum of 95% compaction within the limits of the roadway, and 90% compaction when outside the limits of the roadway.



ROADWAY DESIGN & CONSTRUCTION STANDARDS

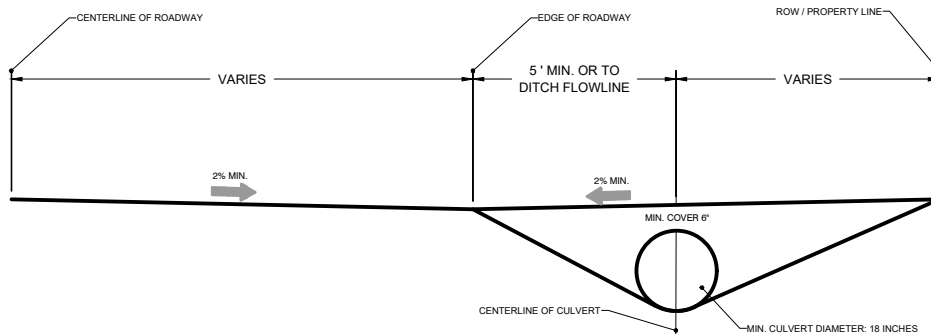
TRENCHING DETAIL

Scale: N.T.S

Issued: 12/31/18

Revised: _____

Figure No. 9.1



NOTES:

1. A construction permit is required from the Department of Public Works and the Rural Driveway Culvert shall be installed in accordance with the latest Town standards.
2. Unless otherwise noted, cover shall be a minimum of 6 inches of road base.
3. The driveway slope shall be either +2% or -2% for a minimum of 5 feet from the existing edge of roadway.
4. Culverts shall be a minimum of 18-inch diameter Corrugated Metal Pipe, 16 Gauge, with flared sections on each end.
5. Culverts shall have a minimum 2% longitudinal grade to convey the ditch flows.
6. The minimum length of the culvert shall be 24 feet.
7. Driveways shall be crowned in the center with a minimum cross slope of 2% to each edge.



ROADWAY DESIGN & CONSTRUCTION STANDARDS

DRIVEWAY CULVERT DETAIL FOR RURAL AREAS

Scale: N.T.S
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 Figure No. 9.2