CHAPTER 11

TRENCH BACKFILL/COMPACTION

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11.1 GENERAL

This chapter applies to County maintained roads and roads granted probationary acceptance according to Chapter 15 of these Roadway Standards. No hardcover surface cuts (pavement or chip and seal applications) will be permitted for any County maintained roadway or roadway granted probationary acceptance or approval (See Section 15.3) that has been overlayed within the previous 3 years. Exception to this requirement may be made if a request in writing has been made to the Road and Bridge Director by an individual property owner requesting service to their property. Emergency repairs for broken pipes, cables etc. will be allowed according to the requirements of Chapter 10. If a contractor makes a cut into new pavement as defined above which is not an emergency cut, the contractor or owner of the infrastructure shall be liable for additional costs as defined in Chapter 10.

Road cuts will be allowed on roads treated with dust suppressants (i.e. magnesium chloride). If road cut is made within 3 months from last application of dust suppressant, contractor must reapply same dust suppressants as last applied to the entire road width with a 5/10 gallon rate per square foot and per specifications in Section 9.9.3. If road cut is made within 3-6 months from last application, contractor must reapply same dust suppressant as last applied to the entire road width affected with a 3/10 gallon rate per square foot and per specification in Section 9.9.3.

11.1.1 Existing pavement shall be cut so the joint line between existing and replacement pavement is straight and neat – i.e. within 5° of vertical and free from horizontal irregularities. All cuts shall be by saw or blade. The cut depth shall be full depth to permit pavement removal without damage to remaining pavement. In the case of concrete removal, it shall be by full panel only per existing control joints.

11.1.2 Removed pavement shall be hauled away and disposed of in a proper manner (recycle or waste facility).

11.1.3 Base course material should be removed and stockpiled off of the road surface area 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.

11.1.4 Sub-base 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.

11.1.5 Safety standards relating to the shoring and stabilization of trench sidewalls shall be maintained as prescribed by appropriate safety regulatory agencies (OSHA, State of Colorado). Type III barricades will be required if construction area is in or within 10 feet of the roadway.

11.1.6 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 Road and Bridge Director or his designated representative.

11.1.7 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 and all OSHA requirements.

11.1.8 No road cuts 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 MUTCD most recent addition, shall be used in areas where trenching operations are in public roadways. All work shall have flashing lights used with warning signs and barricades. All such barricades, signs and warning devices shall be installed in accordance with the M.U.T.C.D. Type IV barricades will be required in or within 10 feet of the traffic area.

11.1.9 In trenching across the road, no more than one-half (½) of the traveled way is to be closed to traffic at one time, which requires the use of a traffic signal or flaggers. The trenched roadway shall be completely backfilled and a suitable driving surface restored before trenching the other half of the road. Final pavement restoration can be accomplished at one time when the utility installation or repair work is complete within a maximum of five working days for the permanent surface replacement.

11.1.10 Closure of any road (only by approval of the Road and Bridge Director or authorized representative), 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. (See Section 10.6.1 and 10.6.2).

11.1.11 Access to private driveways shall be provided at all times except during working hours when construction operations prohibit provision of such access. Occupants must be notified by the Applicant at least 24 hours in advance of any blockage of access.

11.1.12 Free access must be provided at all times to fire hydrants.

11.1.13 When, during the progress of the work, any excavation is to be made in County easements through private property, the contractor shall notify the property owners at least 24 hours in advance of beginning work or in accordance with right-of-way 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 practicable amounts and shall replace or restore such improvements to their original location and condition after the excavation has been backfilled and compacted.

11.1.14 It shall be the responsibility of the contractor to appraise himself of all specific conditions contained in private easements. He shall perform all of his work in accordance with the stipulations contained therein.

11.1.15 Where trenching excavation occurs within the roadway surface, the minimum allowable remaining pavement sections shall not be less than four feet (4') (not

including the curb and gutter or concrete pavement) unless it is part of a monolithic concrete pavement section which shall be full panel or stone.

11.1.16 All road surface cuts shall be a minimum of two feet (2') in width on all asphalt cuts and full panel (or stone) replacement on all concrete or curb and gutter cuts.

11.2 BACKFILLING

11.2.1 The permittee shall advise the Road and Bridge Department of the trench backfill date at the time the Road and Bridge Department is notified that construction will take place. A minimum of 24 hours advance notification is required. Normally, backfill will take place on the same day of trenching; if this is not the case, the Road and Bridge Department must be given the same prior notice as required for the initial trenching.

11.2.2 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.

11.2.3 Immediately after the facility authorized by the permit has been placed in the trench, the trench shall be backfilled with approved material, which is free of humus, vegetable or other organic matter, frozen material, clods, sticks and debris and contains no stones having a dimension greater than three (3) inches to a depth of one foot maximum over the crown of the pipe. Said material shall be filled to an elevation which will allow placing the pavement base and wearing surface.

Compaction test reports shall be required daily.

When, in the opinion of the Road and Bridge Director or his field representative, the excavated material is unsuitable for backfill, this material shall be hauled away.

11.2.4 The subgrade shall conform to the lines, grades and cross-sections as shown on the approved plans. The backfill material 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.

11.2.5 Within the roadway area, trench compaction shall be in accordance with AASHTO T99 or T180 as required in CDOT Standard Specifications. See Table 9.2. Compaction tests must be performed by a competent soils and materials testing laboratory that has a professional engineer employed, and shall be a minimum of every 250 feet along the trench and every one foot in elevation for paved roadways. Testing intervals may be increased at the discretion of the Road and Bridge Inspector. Testing frequency for gravel surfaced roads shall be at the discretion of the Road and Bridge Inspector, but shall not exceed the above requirements for paved roadways.

11.2.6 Use of an approved controlled low slump material (flowfill, shrinkcrete, flashfill or equivalent) for backfill of trenches shall be required on all trenches less than 12" in width on any hard surfaced road (pavement, chip and seal) and may be allowed with prior approval of the Road and Bridge Director or his field representative on other roads. All controlled low slump material (CLSM) must have a 28-day strength of 60 - 100 psi, and a maximum slump of three and one-half inches (3.5").

11.3 SUBBASE

The term "subbase", for the purpose of trench backfill discussion, shall refer to the CDOT Class 1 or Class 2 material that is part of a 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.

11.3.1 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.

11.3.2 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 11.1
GRADATION OF SUBBASE MATERIAL

Standard Size of Sieve	Percentage of Weight Passing Sieve
2 ½ inch	100
2 inch	95 - 100
#4	30 - 60
#200	5 - 15
Liquid Limit	35 maximum
Plastic Limit	6 maximum

11.3.3 Deviations from the gradation limits above will be permitted on approval by the Road and Bridge Director or his representative for unpaved roads where it can be adequately demonstrated that the proposed subbase material can fulfill the intent of these specifications.

11.3.4 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% proctor (AASHTO T 99) density. Subbase shall not be placed on soft, spongy, or frozen subgrade or other subgrade, the stability of which, in the opinion of the Road and Bridge Director or his representative, is unsuitable.

11.4 FOUNDATION FOR BASE COURSE

11.4.1 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 one day's progress in advance of placing prime coat.

11.4.2 Base material shall consist of hard, durable particles or fragments of stone or gravel crushed to the required size and a AP-filler of sand or other finely divided mineral matter. When produced from gravel, not less than 60% 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 vegetable matter and lumps or balls of clay and which when placed and compacted will result in a firm, dense, unyielding foundation. Base material shall meet the grading requirements of Table 11.2:

TABLE 11.2
GRADATION OF LIMITS OF BASE MATERIAL

Standard Size of Sieve	Percentage of Weight Passing Sieve
3/4 inch	100
#4	30 - 65
#18	25 - 55
#200	3 - 12
Liquid Limit	30 maximum
Plasticity Index	6 maximum

11.4.3 Base material shall be deposited and spread without particle segregation in loose layers not to exceed six inches in depth. Each layer shall be thoroughly and individually compacted to 95% proctor (AASHTO T 180) density. No base course shall be placed upon a soft, spongy or frozen subgrade or subbase or other subgrade, the stability of which, in the opinion of the Road and Bridge Director or his representative, is unsuitable.

11.4.4 Deviation from the gradation limits may be permitted by the Road and Bridge Director or his representative 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.

11.4.5 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 six inches. The resulting total compacted base thickness shall be eight inches or to the thickness of the removed base plus two inches. If the existing base material is asphalt treated aggregate it shall be replaced by a minimum of 3" of acceptable asphalt base or the existing base thickness plus 1", whichever is greater. A

replacement 2" 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" may be considered the wearing course, with the remainder being the base course.

11.5 TRENCH COVER -- SUBGRADE

11.5.1 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 2 ½ inches in size. It shall have a compaction of 95 percent or more, by standard tests, see Table 9.2, at the time of constructing curb, gutter, sidewalk, pavement and/or other permanent trench cover structure.

11.5.2 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 Road and Bridge Director or his representative 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 or better than that which existed before starting the work.

11.6 TRENCH COVER -- ASPHALT

11.6.1 Temporary

11.6.1.1 **Temporary Trench Cover**
All trenches across traffic lanes, where it becomes necessary to remove any existing surfacing or pavement, shall be provided with temporary trench cover.

11.6.1.2 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.

11.6.1.3 Minimum requirements for temporary trench cover 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 four inches (4") thick. The mineral aggregate shall, with a tolerance of 5 percent, conform to the grading specified for 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 ½ percent and 6 percent by weight of the dry mineral aggregate.

11.6.1.4 Temporary trench cover surfacing material shall be stockpiled on the job site and shall be placed immediately after completion of trench backfill and compaction.

11.6.1.5 Temporary trench cover shall be properly maintained until permanent trench cover is placed.

11.6.1.5 Trench covered with temporary surfacing will be considered as open to traffic.

11.6.1.7 The surface of the temporary repaving shall be smooth and at the same level as the adjacent undisturbed paved area.

11.6.2 Permanent

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

11.6.2.1 In the areas where the wearing surface is asphalt concrete, replace the pavement with a full depth asphalt paving of a minimum thickness of four (4") inches but in all cases to a thickness of the old surface plus base course plus one (1") inch. Four inch (4") full depth asphalt must be accomplished with 2 lifts. Each lift must not be less than one inch (1") thick or greater than three inches (3") thick compacted.

11.6.2.2 In areas where the wearing surface is Portland cement concrete, replace the pavement with concrete pavement conforming to the requirements of the Roadway Standards. Said concrete pavement replacement shall be of the same depth as the original pavement, but not less than six inches thick on residential roads, nor less than eight inches on all other roads.

11.6.2.3 In areas where the wearing surface is other than asphalt concrete or Portland cement concrete, replace the pavement and base in kind. Said surface replacement shall be of materials and thickness conforming to the requirements of the Roadway Standards.

11.6.2.4 Pavement replacement shall commence not more than seven (7) working days after backfilling, unless the Road and Bridge Director permits otherwise.

11.7 PERMANENT ALTERNATIVE

11.7.1 Where original surface was Portland cement concrete, Portland cement concrete shall be placed to a thickness of six inches or the thickness of the removed pavement, whichever is greater.

11.7.2 Where original surface was asphalt concrete, bituminous treatment or mix, or oil mat, asphalt concrete shall be compacted in layers not to exceed three (3") inches to a total compacted thickness of four (4") inches or the thickness of the removed pavement plus 1", whichever is greater. On oil mat surfaces or substandard asphalt surfaces, an overlay of Class "CX" asphalt pavement 1 ½ inches thick shall be placed across the entire traffic lane disturbed by the trench and shall be finished as set forth below.

11.7.2.1 Immediately prior to placing the wearing surface, the abutting pavement edges shall be neatly cut (See Section 11.1.1).

11.7.2.2 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 ensure a bond with the new asphalt surfacing.

11.7.2.3 The restored pavement shall be finished to a smooth riding surface and to the grade of the surrounding undisturbed pavement.

11.7.2.4 Pavement replacement shall commence not more than seven (7) working days after backfilling, unless the Road and Bridge Director or his representative permits otherwise.

11.7.3 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 Road and Bridge Director, or his field representative. 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 run-off surface water either over the trench or at the joints between the new and original surfaces.

11.7.4 When road surface damage involves more than one traffic lane, a full width paving lift may be required. Individual jobs may require negotiations with the Road and Bridge Director for partial participation in the cost of a full width overlay.

11.8 REPAIR TO GRAVEL ROADS AND SHOULDERS

11.8.1 Restoration of Unpaved Areas

11.8.1.1 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 eight (8) inches or the thickness of the removed material plus two (2) inches, whichever is greater. See Table 11.2.

11.8.1.2 Compaction
In the area from the ROW line (fence line/property line) to a point five (5) feet outside of the roadside ditch flowline, all trenches shall be backfilled with excavated material and compacted to 90% standard compaction, or to the density of the existing ground, whichever is greater.

11.8.1.3 In all other areas not referred to in Section 11.8.1.2 above, including the gravel road, the shoulders and the roadside ditch to a point five (5) feet outside of the flowline, all trench compaction shall be in conformance with Section 11.5 of these Roadway Standards.

11.8.1.4 Erosion Control
During construction and after the trench is backfilled and compacted, erosion protection shall be provided according to the Drainage Criteria (Appendix G).

11.9 MAINTENANCE PERIOD

11.9.1 For a period of two years following the backfilling of any trench in the County ROW and/or the 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 Road and Bridge Department, repair to the Road and Bridge Director's satisfaction, any of the said patches which become settled, cracked, broken, or otherwise faulty. Settlement of the replaced road surface of one-half (½") inch or more within a six (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 9.2 thru 9.5, the contractor shall be responsible for repairs or replacement to meet these Roadway Standards.

11.9.2 All inspection costs shall be borne by the permittee. (Appendix H for fee schedule.)

11.9.3 The permittee shall notify the Road and Bridge Department in writing upon completion of work accomplished under the provisions of any permit requiring hard surface repair (asphalt or chip and seal).