

# PUBLIC WORKS

# RULES & REGULATIONS

OF THE MANAGER OF THE DEPARTMENT OF PUBLIC WORKS, CITY & COUNTY OF DENVER

Adopted Pursuant to Article II of the  
Charter of the City & County of  
Denver and Section 2-91 et seq.  
of the Revised Municipal Code

## GOVERNING STREET CUTS AND ROADWAY EXCAVATION SPECIFICATIONS

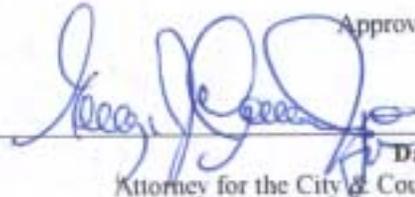
RECEIVED

98 JUL -9 AM 11:53

CITY CLERK  
CITY & COUNTY OF DENVER

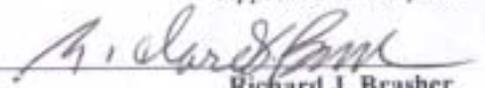
Date Advertised	<u>May 29, 1998; June 1, 1998</u>
In (Publication)	<u>Rocky Mountain News</u>
Public Hearing Date	<u>June 23, 1998</u>

Approved as to form:



**Daniel E. Muse**  
Attorney for the City & County of Denver

Approved & Adopted



**Richard J. Brasher**  
Manager of Public Works

August 1, 1998

Effective Date

**DEPARTMENT OF PUBLIC WORKS  
RULES AND REGULATIONS GOVERNING  
STREET CUTS WITHIN THE CITY AND COUNTY OF DENVER**

The purpose of these Rules and Regulations is to establish standards and procedures to ensure that entities which cut and excavate streets owned by the City and County of Denver ("City") have the knowledge, competence and financial resources needed to perform the type and size of work for which they are licensed. These Rules and Regulations are issued under the authority of the Manager of Public Works as specified in the Revised Municipal Code of the City and County of Denver.

All previously issued policy and procedure bulletins dealing with street cuts are hereby rescinded and replaced by these Department of Public Works' Street Cuts Within the City And County of Denver Specifications effective August 1, 1998.

**I. DEFINITIONS**

**AASHTO** - American Association of State Highway and Transportation officials.

**ACCP** - Asphalt Cement Concrete Pavement - A hot asphalt plant mix comprised of aggregate, filler, hydrated lime, asphalt cement, and recycled asphalt pavement (RAP) Mixes must meet current City "Standard Specifications" for the traffic level of the street cut.

**Approve or Approval** - Approved by the Manager of Public Works or his designee.

**ASTM**- American Society for Testing and Materials.

**Backfill Methods** - Use the following materials:

A: Flowfill or Flowable Backfill Material, meeting requirements of these Rules and Regulations, Section

I and placed according to Sections IX & XI.

B: Uses soil or aggregate (on-site, imported or select) meeting requirements of these Rules and Regulations, Section X and placed according to Section XI.

**Bedding Material** - The material surrounding the pipe which supports the pipe above the trench subgrade. Bedding material is under the backfill material.

**City** - City and County of Denver, and its Manager of Public Works or his Designee.

**Entire Expense** - Total cost of replacing the paving or surfacing material, and the base, sub-base, and backfill including the long term costs of repair directly caused by the street cut.

**Entity** - Permittee, Contractor or Utility Companies.

**Flowable Backfill Material (Flowfill)**

1. Flowable backfill shall consist of a controlled low-strength, self-leveling concrete material composed of various combinations of cement, fly ash, aggregate, water and chemical admixtures. It shall have a design compressive strength between 50 to 150 psi at 28 days when tested in accordance with ASTM D4832. The mix shall result in a product having a slump in the range of 7 to 10 inches at the time of placement. The Contractor shall submit a mix design for approval by the City prior to placement. The mix design shall be supported by laboratory test data verifying compliance with the 28-day compressive strength requirements, to provide a workable backfill material for future access work.
2. Aggregate for flowfill shall conform to the following gradations:

Sieve Size	% Passing
1 inch (25 mm)	100
No. 200	0 to 10

When coarse aggregate is used, 100 percent shall pass the 1 inch sieve, and it shall comprise not more than 40 percent of the total aggregate content. Other aggregate products such as aggregate base, crushed rock, pea gravel, or reject sand which has no more than 20 percent passing the No. 200 sieve and is free of organic material and other deleterious substances, may be accepted by the City if a flowable, workable mix can be produced without segregation of the aggregate.

Mix design must be submitted to the City of Denver Materials Engineering Lab for approval before use. (Lab address: 5440 Roslyn Street, Door E-1, Denver, CO 80216)

- Suggested Proportions for Cement Flowfill:

<u>Ingredients</u>	<u>Specifications</u>	(POUNDS PER CUBIC YARD <u>OF FLOWFILL</u> )
Cement(Type II or 1P)	ASTM C-150, C595	42 lbs. (0.45 sack)Maximum
Sand	ASTM C-33	1845 lbs.
Size #67 (3/4") or #57 Aggregate (1")	ASTM C-33	1700 lbs.
AEA (See note)	ASTM C-260	5.0 oz.
Water	ASTM C-94	325 lbs. (39.0 gal.)

Note: Air entraining agent only needed to increase flowability.

RULES & REGULATIONS GOVERNING STREET CUTS

Page 3 of 23

- Suggested mix proportions for fly ash Flowfill - Flowable fly ash backfill may be used to backfill culvert pipes, storm sewer pipes, and utility cuts. It shall not be used to backfill abutments.

<u>Ingredients</u>	<u>Specifications</u>	<u>Pounds -per cubic yard of Flowfill</u>
Class C Fly Ash	ASTM C 618	200 to 400 lbs.
Class F Fly Ash	ASTM C 618	1600 to 1800 lbs.
Water	Potable	(96 gallons) 800 lbs. (or as needed for proper consistency)

Compaction of either flowable backfill material will not be required.

**Geosynthetic Material** Shall be a woven or non-woven fabric resistant to chemical attack, mildew and rot and shall meet the following physical requirements:

<u>Property</u>	<u>Criteria</u>	<u>Specifications</u>
Grab tensile strength	220 lb. Minimum	per ASTM D-4632
Water flow rate	4.0 gpm/sf minimum	per ASTM D-4491
Permeability	0.008 cm/sec minimum	per ASTM D-4491

Width of the applied material shall be trench width plus a minimum 6 inches on each trench side, with overlaps to be 3 feet minimum. Handling and placing shall be per manufacturer's requirements.

Data sheet information shall be submitted for approval, prior to use.

**Manager** - Manager of Public Works or his Designee.

**PCCP - Portland Cement Concrete Pavement** - Concrete composed of Portland cement (with or without fly ash) , fine and coarse aggregates, admixtures and water. Mixes must meet current City "Standard Specifications".

**Pavement Thickness Design** - Shall meet current City Standards for test hole placement, soil testing, traffic analysis, thickness determination, treatment of problem soils and report submittal.

**Range Point, Range Point Monument, or Range Point Box** - A reference point set within streets to establish street alignment which may be physically represented by a solid steel rod set within a cast iron cylinder.

**Select Backfill Material**

1. Select backfill material, also called select backfill or structural fill, may be required if import or on-site soil material is not suitable. It shall be a well graded mixture of sound mineral aggregate particles free of organic, trash or large debris materials and shall contain a sufficient quantity of a proper quality binding material to be firm and stable when placed and compacted. The material shall meet the following gradation requirements:

Sieve Size	% Passing
2 inch	100
No. 4	30-100
No. 200	3-35 (by washing)

Stabilometer tests (R value, AASHTO T 190) may be required to properly evaluate the quality of the material.

2. All select backfill material shall be of such quality that the material shall have a liquid limit of not greater than 35 and a plasticity index of not greater than 10 when tested by AASHTO T-89 and T-90 respectively.
3. Colorado Department of Transportation ("CDOT") approved class 4, 5 or 6 base course material meet the above specifications.  
A report showing the gradation analysis and T-89 and T-90 test results for the materials proposed for select backfill material shall be submitted and approved prior to placement.

**Standard Specifications** - The Department of Public Works' Standard Construction Specifications and Drawings.

**Street Cut** - A cut made in the ground or pavement of any City street, alley or other right-of-way, including excavation, backfill and paving.

**Subgrade** - Layers of soil or granular material below the asphalt or concrete surface of the street or road.

**Subsoil Investigations** - Shall consist of the following:

- A test hole drilled for each City block, or minimum 600 linear foot of Class 2 or 3 Trench Cut to the depth of street cut proposed.
- Tests on each layer proposed to be used in the backfill, to determine its suitability under Section X.
- Proctor curves for material(s) to be actually used during backfill, according to Section XI.

Report signed and sealed by a Professional Engineer registered in Colorado.

**Test Hole** - A hole, not exceeding 12 inches in diameter, bored for the purpose of subsoil investigation or pavement thickness design.

**Test Pit** - A hole or excavation larger than 12" in diameter for the purpose of subsoil investigation or pavement thickness design.

**Trench** - Any hole or rectangular excavation caused by the removal of subgrade from a street cut including what is commonly called a cut.

**Trench Cut Classes -**

**Class 1:** Less than 150 square feet in surface area or within 4 feet of a manhole or vault.

**Class 2:** 150 to 1,000 square feet in surface area.

**Class 3:** Greater than 1,000 square feet in surface area.

Meeting the requirements of these Rules & Regulations, Section IX.

**Trenchless Technology** - Refers to the numerous underground construction methods that eliminate or minimize surface disruption. Trenchless methods include directional drilling, pipe relining, pipe inspection and cleaning systems, microtunneling, pipe ramming, pipe jacking, auger boring, utility tunneling, pipe bursting, and robotic sewer repair methods. Any method, as approved, is encouraged to avoid disturbing the existing pavement and traffic flow.

**II. GENERAL**

Requests for a permit for the installations of utility facilities along and/or across City roadways may be granted subject to the following terms and conditions:

- A. All expenses of the installation and repair of the street or public way shall be borne by the permittee.
- B. The permittee shall be responsible for repairing all damage to the street resulting from cutting the pavement and/or excavation of or boring under a street. The repairs shall be in compliance with these Rules & Regulations, and with the City's "Standard Specifications." Any traffic control devices which are affected by any work done in the roadway shall be repaired or replaced in conformance with criteria set forth in the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD) and the Colorado Supplement thereto, herein

## RULES & REGULATIONS GOVERNING STREET CUTS

Page 6 of 23

called the "Traffic Specifications". These Rules and Regulations shall supersede any conflicting provisions of the Standard Specifications and Traffic Specifications.

- C. The permittee shall protect the traveling public by proper warning signs and/or signals both day and night until the street is fully repaired. Warning signs and signals shall be installed by and at the expense of the permittee and in accordance with the Traffic specifications, the MUTCD and the Barricade Manual of the City and County of Denver. All traffic control devices and plans are subject to the orders of the City Traffic Engineer or his assignee.

Any materials and/or equipment used as the result of utility installation will be removed from through lanes between the hours of 3:30 p.m. and 8:00 a.m. each day, unless otherwise specified by a Street Occupancy Permit issued by the Transportation Division of the Department of Public Works or their Representatives.

- D. Any roadway surface will only be cut and/or excavated as described in the permit.
- E. Street Occupancy Permits issued by the Transportation Division at 200 West 14th Avenue, or their representatives are required when parking or traffic conditions, including pedestrian movements, are affected by the permitted work. Parking meter sacking may also be required. State permits are required on state highways.
- F. The permittee shall provide a Subsoil Investigation by a licensed professional engineer prior to the backfill of any Trench Cut Class 2 or Class 3 cut, as defined in Section IX, using excavated soil as backfill.
- G. The permittee shall maintain the area of the street cut for three years after final acceptance in accordance with the statement in Paragraph H, Section II, and shall hold the City, the agencies thereof, and their officers and employees harmless from any and all loss and damage which may arise out of or be connected with the work performed under any permit issued hereunder.
- H. The Contractor shall guarantee to repair or replace any defective work. This guarantee is part of the Contractor's promise of performance. Under special circumstances the City may require, and such requirement will appear in the Special Permit Conditions, the Contractor, subcontractor, or materialman to provide a performance bond issued by an acceptable surety company. The Contractor's guarantee and bond shall continue for a period of three years after the work has been finally accepted by the City. Special needs and circumstances may require that the guarantee period extend for more than three years, and should this occur, the Special Permit conditions or Detail Specifications will note that difference.

## RULES & REGULATIONS GOVERNING STREET CUTS

Page 7 of 23

- I. For street cuts in contaminated streets, the Manager's Rules and Regulations for Street Cuts must be complied with. It is the responsibility of the permittee to inquire as to the presence of contaminants in the requested permit area.
  
- J. Protection of the Municipal Storm Sewer
  1. The permittee shall protect all storm sewer and storm drainage appurtenances located adjacent to the construction site. The protection measures used shall be designed to prevent the discharge of pollutants to any portion of the storm sewer system.
  2. The permittee shall be responsible for the removal of all construction debris, dirt, trash, rock, sediment, sand or other pollutants that may accumulate in the storm sewer conveyance system and storm water appurtenances as a result of construction activities associated with a permit.
  3. No person shall cause the impediment of stormwater flow in the flow line of the curb and gutter.
  4. The Contractor shall prevent sediment, debris, and all other pollutants from entering the storm sewer system during all phases of construction.
  5. Unless confined in a predefined, bermed containment area, the cleaning of cement truck delivery chutes is **prohibited** at the job site. The discharge of water containing waste cement to the storm sewer system is **prohibited** (Sec.56-102a,c; Revised Code).
  6. The permittee shall protect all storm sewer facilities adjacent to any location where pavement cutting operations involving wheel cutting, saw cutting or abrasive water jet cutting are to take place. The permittee shall remove and properly dispose of all waste products generated by said cutting operations on a daily basis. The discharge of any water contaminated by waste products from cutting operations to the storm sewer system is **prohibited**.
  7. The discharge to the storm sewer system of water used for flushing off paved surfaces is **prohibited**, unless measures have been taken to remove pollutants from the discharge.
  8. The use of rebar, steel stakes, or steel fence posts to stake down straw or haybales, or to support silt fencing used as a sediment control measure, is **prohibited**.

### **III. SURFACE REMOVAL**

- A. All surfaces not, included in the construction must be protected and kept clean by the contractor and if damaged, replaced to the satisfaction of the Manager or Designee.
- B. Cleated equipment shall not work on or move over asphalt surfaces without mats.
- C. All disturbed portions of the right-of-way which are not paved with concrete or asphalt shall be restored to their original condition. Established grassed areas will be replaced with sod. Shrubs and trees shall be repaired, restored or replaced, to an equal quality, which existed prior to the work. All sidewalks, affected streets, bikeways, and handicap ramps must be kept clean and free of debris. Closure of bikeways may not exceed 15 minutes without an approved detour plan. Where it is necessary to close traffic lanes for over one day, a traffic plan providing for both detours and signing, in order to insure traffic routing is maintained, shall be submitted for the approval of the Manager.
- D. Where 100 lineal feet or more of curb and/or gutter are to be replaced plans and profiles shall be submitted and approved before work is begun.
- E. The Manager or Designee must be notified 24 hours in advance of surface removal.

### **IV. REMOVAL REQUIREMENTS**

- A. All pavement removals shall be in straight lines. Irregular shaped cuts with more than four sides or cuts within existing patches will not be allowed.
- B. In order to provide straight edges, all pavement must be cut by wheel cutting, saw cutting, abrasive water jet, rotomilling or an approved method which assures a straight edge for the required depth of the cut.
- C. All pavement removals shall be sized in accordance with the current Standard Specifications. Surface material shall be removed on each side of the trench to provide support of the new pavement surface on existing undisturbed subgrade a minimum of 1 foot for concrete surfaces and 0.5 foot for asphalt surfaces. When the trench backfill is flowable backfill material, the additional asphalt pavement removal specified above can be eliminated by filling the trench to the bottom of existing pavement to ensure all voids are filled.

## RULES & REGULATIONS GOVERNING STREET CUTS

Page 9 of 23

- D. The minimum size of a street cut shall be 2 feet by 2 feet in asphalt pavement; 5 feet by 5 feet in concrete sidewalks and concrete alleys, except for utility pole locations which shall be 2 feet by 2 feet; and 6 feet by 6 feet in concrete roadways. Trenches shall be large enough to accommodate OSHA (Occupational Safety and Health Act) required trench bracing and the sloping of trench walls. Test holes and range points are exempt from these minimum requirements.
- E. The edge of a street cut shall not be in a wheel path. Local residential streets may be exempted by the Manager from this requirement.
- F. Where a street cut edge would be in a wheel path, jointing pattern, or where site conditions make it necessary, the Manager may require removal of additional street surface.
- G. If the street cut is made to repair a void caused by a water, wastewater, or other utility break, the full extent of roadway undermining or other damage shall be determined. Special test borings or other studies may be required by the Manager.

The Manager or Designee will determine if the undermined area needs to be exposed, excavated, filled and compacted by conventional methods, or if they can be filled and compacted using special techniques. All utility breakage will be repaired and approved before backfilling. Temporary backfilling with subsequent re-excavation and properly controlled backfill may be approved in emergency situations.

### **V. CONCRETE REMOVAL**

- A. Engineering drawings, showing the existing concrete joints, existing joint details, limits of concrete removals, new concrete joints, new concrete joint details, new expansion joint details, design thickness of concrete patch and such other information as required for the specific design shall be submitted to Manager or Designee for approval.
- B. The sides of an interior cut shall be at least 4 feet from either a transverse joint or a longitudinal joint. If either dimension is less than 4 feet, the pavement shall be removed to the respective joint. When removal extends through a joint, a minimum of 3 feet shall be removed on the side of the joint away from the excavation.
- C. Where the removal is to the longitudinal joint, tie bars should be left in place to extend into the patch. If any of the bars are removed or destroyed, deformed bars of the same dimension and essentially the same interval shall be used.

- D. All concrete spalls and chips shall be removed from the subgrade.

**VI. ASPHALT REMOVAL**

- A. Where the cut is 2 feet or less from a curb, gutter or the edge of the roadway, the remaining street surface shall be removed and replaced to the curb, gutter, or edge of the roadway as part of the patch.
- B. All street surfaces shall be neatly cut, rectangular or trapezoidal in shape, and edges shall be parallel and perpendicular or skewed up to 45' from perpendicular to the traffic flow.

**VII. TRENCHING AND EXCAVATION FOR UTILITIES, WHERE TUNNEL BORING IS NOT USED**

- A. Trench excavation shall be in accordance with current accepted practices of the City. All trench excavation shall be made by open cut to the depth required to construct the facility and adequately braced. Permission for tunnel work may be granted for crossing under crosswalks, driveways, or existing utility lines.
- B. The length of trench permitted to be open may be limited when, in the opinion of the Manager, such limitation is necessary for the safety and convenience of the public. However, in no case shall the length of the open trench exceed 400 feet unless approved in a Street Occupancy Permit.
- C. All excavation, trenching, shoring and stockpiling of excavated materials shall be in strict compliance with the applicable NOSHA rules and regulations, State Health Department rules and regulations, and all zoning and other ordinances and regulations of the City.
- D. All underground installations shall have a minimum 3 feet of cover below the roadway surface of the right-of-way. Where conflicts occur with other utilities, the Manager may approve a lesser minimum depth for short distances. Manhole covers, water and gas valve boxes and other normal utility equipment that are required for traffic operation and access, are exempted from this regulation. Signal conduits shall have a minimum of 30" of cover from the roadway surface.
- E. Dewatering shall be in accordance with the Standard Specifications, Wastewater Specifications, and current State health regulations.

## RULES & REGULATIONS GOVERNING STREET CUTS

Page 11 of 23

- F. Before installation of the utility and bedding in the trench, the trench shall be inspected to insure the trench conforms with Removal Requirements, Section IV.
- G. All non-granular material in the street removed from the trench and not meeting the subgrade material specifications shall be removed from the site. After the utility is installed, the trench shall be backfilled to bring the trenched area up to grade in accordance with appropriate backfill method.

### **VIII. USE OF TRENCHLESS TECHNOLOGY METHODS**

- A. Trenchless technology methods may be used where applicable and as approved by the Manager. A Subsoil Investigation shall be performed to properly determine the subsoil conditions and to choose a desirable trenchless method that will not disrupt the integrity or surface elevation in the Right of Way. The Manager or Designee may require other information or justification on the methods proposed or the Contractor's ability in order to make final approval.
- B. Any and all surface heave or settlement, or related problems caused by the trenchless method, shall be corrected by the Contractor at his expense, to the satisfaction of the Manager or Designee. The methods of concerns include, but are not limited to, pushing conduit or reaming and backpulling conduit through pilot bore holes of any size. Any annular region or other cavity remaining between the subgrade and the conduit or utility shall be pressure grouted to the satisfaction of the Manager or Designee, prior to backfilling the bore pits.
- C. All drilling fluids shall be removed and disposed of properly. All entrance and exit bore pits and other areas used shall be cleaned of all objectionable material and properly backfilled according to Section XI. All such reclaimed areas shall be restored to original contour, shape and use.

### **IX. BACKFILL METHODS**

- A. Backfilling shall not be performed without the approval of the Manager or Designee.
- B. Test holes and range point excavations shall be backfilled with flowable backfill material or select backfill material, properly compacted with tamper and patched in accordance with these Rules & Regulations.

## RULES & REGULATIONS GOVERNING STREET CUTS

Page 12 of 23

- C. **CLASS 1 TRENCH CUTS** - For small trenches of less than 150 square feet or trenches 2 feet in width or less, regardless of length: or those areas within 4 feet of the outside of a manhole or vault.
1. **Backfill Method A** using Flowable Backfill Material (Flowfill) is required for **Class 1 Trench Cuts**.
  2. The permittee shall provide support to prevent the utility line from floating during flowfill operations.
  3. The permittee may install flowable backfill material to the pavement surface as a temporary patch. Flowable Fly ash shall not be used as a wearing surface.
- D. **CLASS 2 TRENCH CUTS** - For trenches in excess of 150 square feet in surface area and a width greater than 2 feet:
1. **Class 2 Trench Cuts** shall use **Backfill Method A or B**.  
Backfill Method B may be used provided the purposed materials (on-site, imported or select; soil or aggregate) meets requirements of Section X. The contractor shall use Method A if the City does not approve material for method B. Requirements for Method B are outlined in Section XI.
  2. For those cuts less than 10 ft. in depth and between 150 sq. ft. and 1000 sq. ft. in surface area; Trench Backfill Method B shall require one (1) layer of GEOSYNTHETIC MATERIAL meeting the specifications to be placed immediately above the pipe bedding and two (2) additional layers at 1 ft. spacing directly above, to be placed in conjunction with the compacted lifts in accordance with these specifications.  
  
Width of the applied GEOSYNTHETIC MATERIAL shall be trench width plus 6 inches, with overlaps to be 3 f t minimum; and handling and placing shall be per manufacturers requirements.
- E. **CLASS 3 TRENCH CUTS**  
Class 3 Trench Cuts shall also use **Backfill Method A or B**.  
Backfill Method B may be used provided the proposed materials (on-site, imported or select; soil or aggregate) meets requirements of Section X. The contractor shall use Method A if the City does not approve materials for Method B. Requirements for Method B are outlined in Section XI. Only (1) layer of GEOSYNTHETIC MATERIAL required
- F. **DEEP TRENCHES MORE THAN 10 FEET DEEP**  
When any Class 2 or Class 3 Trench Cut is deeper than 10 feet, a GEOSYNTHETIC MATERIAL, with higher possible strength characteristics than specified above, shall be required to meet field conditions. The permittee shall consult with the Manager or Designee, to select a suitable

GEOSYNTHETIC MATERIAL meeting the field conditions as stated by the Manager or Designee.

The selected GEOSYNTHETIC MATERIAL shall be placed according to the applicable Section D or E, above.

**X. SOIL AND AGGREGATE BACKFILL MATERIAL REQUIREMENTS - IMPORT & ON-SITE SOIL**

- A. Excavated material may only be used for backfill with the approval of the Manager or Designee. In general, excavated material will be considered satisfactory for backfill purposes, provided its use results in a well compacted, stable condition and it meets the following.
- B. All such backfill material shall be free from rubbish, organic material, frozen material, broken pavement, other debris, stones larger than 3 inches in diameter, or other materials considered deleterious by the Manager or Designee. The backfill material shall have a plasticity index not greater than 20 and a liquid limit of not greater than 40.
- C. It may be necessary for the contractor to dry, wet or otherwise rework excavated material, in order to meet the compaction specifications. All conditioning, handling, placing and compaction of reworked material shall be in conformance with the Manager's recommendations. When, in the opinion of the Manager or Designee, the excavated material is not satisfactory for use as backfill, or whenever there is a shortage of satisfactory backfill material within the project limits, the contractor shall locate and furnish all necessary suitable backfill material and shall dispose of unused excavated material.
- D. Unless specified otherwise, any excess backfill or excavated material shall be disposed of off the rights-of-way and public property by the contractor.
- E. The use of squeegee sand material or pea gravel will not be allowed as backfill material for sewers due to their free flowing nature if undermined. These materials may be used in pipe bedding for other utilities, and if so approved, then shall be consolidated by vibration.

**XI. TRENCH BACKFILL CONSTRUCTION REQUIREMENTS**

- A. Backfill shall start at the top of pipe bedding material. Flowfill for cast-in place or precast structures such as, but not limited to, manholes, transition structures, junction structures, vaults, inlets and reinforced concrete box culverts, shall start at the subgrade for the structure.

The permittee shall comply with the minimum backfill and compaction requirement described below.

**B. Flowable Backfill Method A for CLASS 1 TRENCH CUTS, optional for CLASS 2 or CLASS 3.**

1. Flowable Backfill should be discharged directly from the truck into the space to be filled, or by other methods approved by the Agency. The mix may be placed part depth or full depth of trench as conditions at the site dictate. When used as backfill above any pipe, care should be taken to prevent flotation or misalignment of the pipe by means of straps, soil anchors or other approved means of restraint. Material may be placed in stages with initially lesser flowability, to prevent movement or flotation of pipe.
2. Compaction of flowable backfill will not be required. The maximum layer thickness shall be 3 feet. Additional layers shall not be placed until the backfill has lost sufficient moisture to be walked on without indenting more than 2 inches. Any damage resulting from placing flow fill in layers that are too thick or from not allowing sufficient time between placement of layers shall be repaired in a method approved by the City at the Contractor's expense.
3. Warnings on fly ash flowfill:
  - Shall not be placed if the temperature falls below 20 degrees Fahrenheit.
  - Shall not be placed on or into frozen ground.
  - Does not require any internal vibrations and any other method of consolidations is strictly prohibited.

**C. Backfill Method B for CLASS 2 or CLASS 3 TRENCH CUTS**

1. Free draining granular material, if approved, shall be compacted by vibration or impact type equipment.
2. As a guideline, material near its optimum moisture content shall be placed in loose lifts (layers) which, prior to compaction, shall not exceed the thickness listed below for the various types of compaction equipment. These maximum thicknesses shall be reduced if compaction is not met.
  - a. A maximum loose lift thickness of 2 feet when using heavy impact, free-fall, or stomping equipment;

RULES & REGULATIONS GOVERNING STREET CUTS

Page 15 of 23

- b. A maximum loose lift thickness of 1 foot when using vibratory equipment, including vibratory smooth-wheel rollers, and vibratory pneumatic-tired roller;
  - c. A maximum loose lift thickness of 8 inches when using rolling equipment, including sheeps foot (both vibratory and non-vibratory), grid, smooth-wheel (non-vibratory), pneumatic-tired (non-vibratory), and segmented wheels; and
  - d. A maximum loose lift thickness of 6 inches when handdirected mechanical tampers, including vibratory plates, jumping jacks, and pogo sticks
3. Each layer shall be thoroughly and completely compacted by hand held pneumatic or mechanical tampers to the required percent of maximum dry density listed below and tested for this layer prior to adding material for the next layer.
4. Thinner loose lifts shall be used if the specified compaction cannot be obtained.
5. The Manager or Designee may approve the use of specific compaction equipment. Such approval shall not be construed as guaranteeing or implying that the use of such equipment will not result in damage to adjacent ground, existing improvements, or improvements installed under this permit. Any such damage will be repaired by the permittee at his cost.
6. Compaction and Moisture Requirements -  
 Each layer shall be compacted to the required density by any method, type and size of equipment which will give the required compaction. The depth of layers, prior to compaction, shall be as previously described. Prior to and in conjunction with the rolling operation, each layer shall be brought to the required moisture content and shall be kept level with suitable equipment to ensure uniform compaction over the entire layer.

This density and moisture shall be obtained for each layer in trenches up to the pavement subgrade, even when small rigid conduits are in the trench.

AASHTO Classification	Compaction Percent of Maximum	Moisture Content Deviation from Optimum
Clay Soils A-6, A-7	95% Min. of AASHTO T 99- (Standard Proctor Method)	0% to +2%
Sands Gravels, silts A-1, A-2, A-3, A-4, A-5	95% Min. of AASHTO T 180 (Modified Proctor Method)	-2% to +2%

When clay pipe, large (greater than 12" diameter) plastic, concrete or flexible steel pipe is in the trench, then less density is allowed over the pipe. A minimum 85% compaction, by applicable proctor method, should be maintained at 1 foot over these pipes, and linearly increase to the specified 95% compaction for the top 5 feet below pavement subgrade.

7. Backfill Testing and Proof Roll. After each layer of backfill is complete, tests may be made and approved by the City. If the material fails to meet the moisture or density requirements or should the material lose the required stability, density, moisture or finish before the next course is placed or the project is accepted, the layer shall be reworked as necessary to obtain the specified compaction and moisture content, and the compaction method shall be altered on subsequent work to obtain specified density and moisture content. Such procedure shall be subject to the approval of the Agency.

The Contractor may be required to excavate an area of the layer in order to facilitate the taking of density tests. Replacement and compaction of the removed material in the area shall be at the Contractor's expense.

The Contractor shall proof roll the completed backfill to determine if any soft, yielding or otherwise unacceptable areas exist. These areas shall be removed and replaced without additional payment. The proof roller shall be a pneumatic tired vehicle (100 psi tire pressure) provided by the Contractor, capable of applying ground loads of not less than 18,000 pounds per axle.

Complete coverage of the proof roller will be required. Rollers shall be operated at between 2 and 6 miles per hour.

8. Each lift shall be tested at least every 200 linear feet for a typical 12 foot wide trench, at least once for every 25 cubic yards of backfill, or at least once per day. Projects involving less than 200 feet of trench or less than 25 cubic yards of backfill will require at least one compaction and moisture test per lift. The Manager may alter the testing frequency required to suit the soil conditions.
9. A moisture density relationship curve (Proctor curve) , the applicable type determined by soil classification, shall be provided to the Manager or Designee for each soil material type. A relative density relationship will be used when testing clean (non-cohesive) sands and gravels.
10. All field tests for compaction and moisture will be performed using nuclear methods described by AASHTO T-238 and T-239, respectively, unless the trench widths are too narrow to test backfill density and moisture by nuclear methods, in which case the density determinations shall be made by the sand-cone method or the rubber balloon method, AASHTO designations T-191 or T-205, respectively.

11. All testing shall be performed by a materials testing lab with persons qualified in soils testing and under the direct supervision of a Colorado licensed Professional Engineer, who shall certify the test results in writing to the Manager or Designee.
  12. Any work that has not been tested and approved shall be uncovered in order that testing may be performed.
  13. The permittee shall provide safe means of egress to and from the trench bottom and will provide trench bracing or a trench box when required by OSHA Standards or the City.
- D. Other backfill methods. Prior written approval of the Manager or Designee must be obtained to use other methods of backfill placement and compaction. Density testing, as specified in this Section, shall be performed where other methods of backfill are approved.
- E. The permittee shall exercise the utmost care during backfilling or compaction by any method to assure that no damage will occur to the facility, its appurtenances or other existing utilities.  
Any damage resulting from the compaction shall be repaired or replaced by the permittee.
- F. Documentation. Records of compaction test results shall be maintained and be available for review. Upon completion, the records of the results of compaction tests shall be submitted to the Manager or Designee in an acceptable form.

## **XII. ROADWAY REPLACEMENT**

### Compaction of Subgrade.

1. Except for undisturbed and approved surfaces using Flowable Backfill, the pavement subgrade excavation or backfill at the approximate grade shall be scarified to a depth of 6 inches, wetted or aerated as needed, and re-compacted to meet at least 95% of density as determined by the proctor method applicable to the soil type, within the prescribed moisture limits of Section XI D6.
2. Valves and manhole coverings shall be set 1/4 inch to 1/2 inch below the compacted finished street surface.

### **XIII. PATCHING (RESURFACING) STREETS**

The patch will be the same type of material as the existing street, and shall be at least as thick as existing roadway while meeting the specific requirements listed under B. ACCP Streets or C. PCCP Streets, below. Variations to these requirements may be accepted based on a Pavement Thickness Design report submitted to and approved by the Manager or Designee.

- A. Gravel Streets: Gravel streets shall be patched with materials in accordance with Crushed Gravel Base course of the Standard Specifications. The crushed gravel base course shall not be contaminated with any excavated material.
  
- B. ACCP Streets
  - 1. The exposed edge of the excavated pavement shall be painted with a SS-1h or CSS-1H Emulsified Asphalt Tack Coat to ensure a good bond between existing and new pavement.
  
  - 2. ACCP streets shall be patched with ACCP material in accordance with the Standard Specifications. The Manager or Designee shall designate which mix grading, asphalt cement type and traffic level is to be used in the mix design. An ACCP mix design shall be submitted and approved by the Manager or Designee, prior to use. A cold mix asphaltic material may only be used as a temporary patch and the cold mix material shall be approved by the Manager or Designee. The final hot patch, at the discretion of the Manager or Designee, may be made by City forces.
  
  - 3. All ACCP lifts shall be compacted to between 92% and 96% of maximum theoretical (voidless) density (rice value) as determined by AASHTO Method T-209. At the average of all compaction tests for each street shall be at least 93% of T-209.
  
  - 4. ACCP hot mix including aggregate gradation for base and top lifts shall be in accordance with current City Standard Specifications. Where the current surface lift is a polymer modified asphalt, the upper 3 inch lift of the patch shall be done with an approved polymer modified asphalt mix. Other mix gradings may be used only upon approval of the Manager.
  
  - 5. A permanent patch of material meeting the above material requirements and the following thickness requirements, shall be made within 14 calendar days after the temporary patch is open to traffic (major arterials within two days, weather permitting).

## RULES & REGULATIONS GOVERNING STREET CUTS

Page 19 of 23

6. Temporary patching time allowed before permanent patch material is required, during winter months (November 1 through March 31st) may be extended to 28 days if Unique Paving Materials (UPM) High Performance Mix (HPM) or equivalent is used. If final patching is not completed within the specified time, no non-emergency permits will be granted to the permittee under any circumstances until outstanding work is completed.
  7. Patching construction method required:
    - a. When any patch is less than 8 feet wide and less than 50 feet in length, patching shall be in maximum 3 inch lifts, which shall be constructed level and smooth.  
Handwork and racking should be minimized to limit mix segregation.
    - b. When any patch is over 8 feet but less than 12 feet in width and over 50 ft in length, a box type paver shall be required to replace the asphalt pavement on all lower and final lifts.
    - c. When a patch is over 12 ft in width and over 50 ft in length, the bottom lifts shall be placed with a box type paver or a self propelled paving machine. The top lift shall be placed with a self propelled paver.
  8. Patching thickness requires:
    - a. The thickness shall be minimum of 9" in depth or match existing pavement up to 12", whichever is greater and ACCP mix design shall be approved by the Manager or Designee.
    - b. A Pavement Thickness Design must be submitted, and approved by the Manager or Designee if lesser thicknesses are proposed.
- C. PCCP Streets
1. Concrete streets will be patched in accordance with Concrete Pavement, of the Standard Specifications. The patch shall contain the same steel reinforcement as the existing pavement which shall be placed in the patch area and shall overlap the existing steel and/or deformed tie bars and shall be essentially flush with the edge of the patch.
  2. Joint load transfer bars are required for all full depth cuts and the existing reinforcing steel should be preserved and used where possible.

## RULES & REGULATIONS GOVERNING STREET CUTS

Page 20 of 23

3. The Manager or Designee shall determine whether the existing reinforcing at the joint for load transfer and slab integrity shall be used.
4. If the existing bars are to be used, they shall be straightened or, if deformed tiebars are to be used, 1 inch holes shall be drilled for deformed tie bars which shall be set in a quick setting non-shrink grout.
5. Steel reinforcing extending into the patch shall be maintained at the proper height by approved supports resting on the subgrade.
6. The aggregate base and edges of the concrete shall be dampened without leaving puddles of water on the base.
7. The concrete shall be placed using a concrete mixture as specified by the Standard Specifications, or an approved Class D or P Colorado Department of Transportation or City Class AX mix. The following requirements shall be met:
  - a. Field compressive strength of 3000 psi minimum shall be obtained prior to opening the street to early traffic and 4000 psi at 28 days. A high early strength mix may be required. If deemed necessary, the Manager or Designee may require control cylinders be cast and broken to determine that the concrete has reached the required strength.
  - b. Curing blankets or heated tenting shall be used in cold weather to insure this strength gain and protection from freezing.
  - c. An approved laboratory mix which is designed to obtain field strength of 4000 psi at 28 days shall be used. ACI procedures should be followed.
    1. The minimum cement content (ASTM C-150) shall be 564 pounds per cubic yard. A maximum of 25% substitute of Class C fly ash for cement will be allowed, as long as opening strength is obtained.
    2. The allowable air content range shall be 5.0% to 7.0%.
    3. The allowable slump range shall be 3 to 5 inches.
  - d. The concrete surface shall be finished to match the existing surface grade lying outside of the patch.

## RULES & REGULATIONS GOVERNING STREET CUTS

Page 21 of 23

8. There shall be no surface deviation at the joint or within the patch of more than 1/8 inch in any 10 feet
9. The concrete shall be placed and vibrated in accordance with good construction practices.
10. The surface shall be broom finished or matched to the existing finish already in place.
11. Curing will be done in accordance with the Standard Specifications and good construction practices.
12. Joints.
  - a. The regular longitudinal and transverse joints shall be constructed to match the existing joints and shall be sawed 1/8 inch wide and 3 inches deep. The top 1 inch of the joint shall be sawed to a width for a backer rod and sealant (generally to 3/8 inches or as recommended by the sealant supplier.)
  - b. All expansion joints shall be provided with expansion joint material of the same width as the original and shall be sealed with a jointing detail that is approved by the Manager or Designee.
  - c. All other joints shall be sawed to a 2 inch depth and a 3/8 inch width.
  - d. The joint filler shall be a CDOT approved hot poured sealant or a silicone joint sealant such as Dow Corning 888 or equal, and shall be installed in accordance with the manufacturer's recommendations.
  - e. The sealant shall be left 1/4 inch low to prevent tracking.
13. All work shall be performed in workman-like manner to the satisfaction of the Manager or Designee and shall conform to industry standards.
14. Street Plates - The use of street plates on concrete pavements is **not allowed** from **September through April**. Use is allowed only with the written permission of the Manager or Designee. When used on concrete pavements, cold mixed asphalt shall be ramped a minimum of two (2) feet in the travel direction and the design engineer for the applicant shall certify in writing the suitability for use and specify additional methods to be used to secure the plates from movement.

## RULES & REGULATIONS GOVERNING STREET CUTS

Page 22 of 23

The use of street plates on flexible pavements is allowed only with the written permission of the Manager or Designee. The Design Engineer for the applicant shall certify in writing, the suitability for use and allow and require a minimum one foot six inch overhang of the trench width on both sides of trench, and require a minimum one and a half inch deep milling area transverse to the travel direction to secure the plates from movement. In no case may the Street Plates extend above the present street elevation.

The permittee shall have suitable equipment available on one hour notice in the event that the street plates fail or move to the extent that replacement becomes necessary. A responsible party shall be named as 24 hour contact at the time the permit is granted.

### **XIV. EXPLANATION OF FEES SECTION 49-197**

- A. As detailed in Section 49-197 (a) of the Revised Municipal Code, the administrative and inspection fee for a permit shall be \$.35 per square foot, but not less than \$50.00.
- B. An additional administrative fee for excavation and improvement permits in a radium street shall be \$2,470.00 for each street cut that will disturb 200 cubic feet or more of radium contaminated material; provided, however that no fee shall be required if the person performing the street cut lawfully disposes of all radium contaminated material disturbed at a properly sited and lawfully permitted radioactive waste disposal facility located outside a major metropolitan area.
- C. Payment of all fees shall be due prior to the issuance of a permit unless other arrangements have previously been approved by the Manager.
- D. The Manager of Public Works may accept work performed in the public right-of-way in exchange for fees due; or accept payment of fees due in an alternate manner in accordance with the ordinance.

### **XV. CRITERIA FOR DETERMINING COMPETENCE**

Section 49-200 (a) of the Denver Revised Municipal code requires proof to the Manager of the competence of the applicant for a license to perform excavation work in a street. Competence can be demonstrated by meeting or exceeding any one of the following criteria:

- A. Proof of experience in other municipalities, states, etc. including evidence establishing the ability to satisfactorily perform excavation work.
- B. Letters of reference, which can be verified, establishing the applicant's ability and skill in performing excavation work.

RULES & REGULATIONS GOVERNING STREET CUTS

Page 23 of 23

- C. Evidence establishing experience performing excavation work under the supervision of a skilled excavator.
- D. The Application for Denver Contractors License, specifically the Statement of Experience section, properly completed, will provide all necessary information for the Manager's determination of competency.