



Date: January 31, 2008

To: Engineers, Architects, Contractors, Developers, Homebuilders, Utility Companies, and Other Interested Parties

From: **Cam McNair, P.E., City Engineer**

Subject: Section 200-Street Section Specification Update

In early 2007, a Trenching/ Subgrade Work Group was formed to review and discuss current trench compaction requirements, procedures, and standards to determine what could be done to improve utility trench performance and to reduce premature pavement distress or failures. The group included representatives from the following key stakeholders:

City Engineering
City Streets Division
Colorado Springs Utilities
El Paso County Transportation Department
HBA
Utility Contractors
Asphalt Paving Contractors
Trenching Contractors
Geotechnical Engineers
Association Representatives - CAPA, CCA

Besides improving trench performance and reducing trench settlement problems, another goal of the group was to coordinate efforts for the Pikes Peak Region; so that, to the extent feasible, the requirements for the City of Colorado Springs and El Paso County would be the same or very similar.

As a result of the group's efforts, SECTION 200-STREET SECTION of the City of Colorado Springs Standard Specifications has been updated and is available on City Engineering's web page for review or downloading. The members of the group agreed that the **changes shall become effective April 1, 2008**. A transition period, from the group's last meeting on December 19, 2007 to March 31, 2008, is being provided to allow Springs Utilities, private telecommunication companies, engineers, architects, contractors, developers, and homebuilders sufficient time to include the new requirements and specifications into upcoming projects. Current or new requirements may be used during this transition period; however, after April 1, 2008, testing and compaction of all trenches in City rights-of-way or easements shall be in accordance with the updated SECTION 200-STREET SECTION of the City of Colorado Springs Standard Specifications.

Highlights of the changes in SECTION 200 of the specifications are as follows:

- For Cohesive Soils, Modified Proctor (ASTM 01557) shall no longer be used and **only Standard Proctor (ASTM D698) shall be utilized** to determine the maximum dry density. Minimum compaction requirements of 95% maximum Standard Proctor dry density at $\pm 2\%$ of optimum moisture content did not change. Separate limits for expansive soil was deleted and the following sentence was added, "For highly expansive soils (swell potential $> 2.00\%$ under 200 psf surcharge pressure), paving will not be permitted without a subgrade treatment approved by the Engineer."

- For Cohesionless Soils, minimum compaction requirements were changed from 92% to **95%** maximum Modified Proctor dry density (ASTM 01557) at $\pm 2\%$ of optimum moisture content, and 97% to **100%** maximum Standard Proctor dry density (ASTM 0698) at $\pm 2\%$ of optimum moisture content.
- The specification update clarifies the current requirement that both density and **moisture** limits shall be met throughout entire trench backfill. Geotechnical testing shall be performed during backfilling operations at the specified depths to aid the contractor in determining that the soil moisture is within the specified limits and that their compaction method is obtaining the required results. Geotechnical observation and more frequent testing will help ensure that the **entire trench from the bottom to the top** is being backfilled and compacted in proper lifts to the obtain the required density.
- Vertical Frequency of Density Tests have changed as follows:
 - For trenches less than 30 inches in depth, in lieu of one test at the surface now **at least two** density tests shall be taken. One within 18 inches above the top of pipe or conduit and one at the surface.
 - For trenches greater than 30 inches in depth, in lieu of two tests, one at mid-depth and one at the surface now **density tests shall be taken at 2 foot vertical intervals** with the final test at the surface.
- Horizontal frequency of density tests have also changed as follows:
 - Utility Mains - One set of tests per **250 feet** of linear trench at specified depths (in lieu of every 300 feet).
 - Service Lines - **One test per every service** per utility type at alternate depths (in lieu of every third service).
 - Open Pit - now **one set of tests at 2 foot vertical intervals from the bottom to the top of the trench shall be provided** (in lieu of a minimum of one test). Open pit was also more clearly defined to include, but not be limited to, excavations associated with bore pits, manholes, water valves, storm inlets, vaults, etc. It is hoped that this increased testing will reduce the settlement problem especially around water valves and sewer manholes.
- The **warranty period** was revised from one year to a minimum of **two (2) years**. The starting date for the two (2) year warranty period was also more clearly defined as commencing after the City has receive all the required passing density tests and has conditionally accepted the work.

It was the group's consensus that by implementing the above changes for work in City rights-of-way or easements, along with improving the compaction and testing of service line trenches on each lot by the private sector, trench performance will improve. Working together, we look forward to the 2008 construction season and trust fewer trench settlement problems will occur in new development projects and with cuts made by utility agencies and private contractors in existing streets.

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SECTION 200

STREET SECTION

201 Description

The work to be performed under this section shall consist of excavation, embankment, shaping and compacting the street section, and other sections within the public rights-of-way and public easements as necessary in order to prepare the subgrade for subsequent construction.

202 Excavation

Excavation shall consist of removal of all material necessary for the construction of the roadway section to the subgrade elevation, line, and grade shown on the plans or as specified in the contract documents. Unacceptable material defined as any earthen material containing vegetable or organic silt, topsoil, frozen material, trees, stumps, certain man-made deposits, or industrial waste, sludge or landfill, or other undesirable materials will be categorized as "unclassified excavation" and removed from the site and disposed of in accordance with applicable City, State and Federal requirements. All tree stumps and roots shall be removed to a minimum of two (2) feet below subgrade. Any tree work on a tree over 15 feet tall must be done by a licensed tree service. Unclassified excavation includes any and all earthen materials encountered, including rocks and boulders measuring less than one-half cubic yard in volume, during construction. Rock formations that can be removed by ripping with a D-9 tractor in good repair with single tooth hydraulic ripper is considered "unclassified excavation". Other forms of classified excavation shall be as noted on the plans or called out in the bid proposal.

Excavation shall be performed in a careful and orderly manner with due consideration given to protection of adjoining property, the public and workmen. Any damage to streets, parking lots, utilities, irrigation systems, plants, trees, building or structures on private property, or the bench marks and construction staking due to the negligence of the Contractor, shall be repaired and restored to its original condition by the Contractor at the Contractor's expense. Those areas which are to be saved will be clearly fenced off by the Contractor per the owner's instructions and it will be the Contractor's responsibility to ensure that these areas are not damaged during the construction process. Following completion of construction should any of these trees, shrubs or irrigation facilities etc., require replacement, it shall be done at the Contractor's expense.

All materials determined acceptable by the Engineer acquired from roadway excavations may be used for embankment fill and backfill as needed. The entire area in the vicinity of the construction where excavation and filling has been performed shall be raked clean of all trash, wood forms, and debris, after completion of the work with no additional cost to the Owner. Material removed in excavation and not acceptable or not required for embankment fill or backfill shall be disposed of by the Contractor. It shall not be wasted on private property without written permission of the property owner. Waste banks shall be left with reasonably smooth and regular surfaces. The cost of all work required in the placement of fill material (haul, compaction, water, etc.) or the disposal of materials shall be included in its pay item in the bid schedule. If there is no pay item, then the costs shall be included in the unclassified excavation item and no separate payment will be made for either fill placement or disposal. Payment will be based on plan quantity unless plan quantity changes are otherwise approved by the Engineer.

203 Embankment

Where fill is required, it shall consist of earth, sand, or gravel, free from organic matter or other deleterious material. All fill material shall be approved by the Engineer. The original surface shall be stripped of all organic matter and nonperishable solid objects prior to beginning the embankment operation. The cleared surface shall be completely broken-up by plowing, scarifying or stepping to a minimum depth of six (6) inches. This scarified layer shall be compacted to the compaction specified in Section 205. The fill shall be placed, unless otherwise authorized by the Engineer, in maximum of eight (8) inch horizontal layers (uncompacted thickness) and shall be compacted in accordance with the requirements of Section 205 herein, before the next layer is placed.

Full compensation for the subgrade preparation or any additional work involved in drying embankment material or base of cuts and fills to the required moisture content shall be considered as included in the contract unit price paid for unclassified excavation or furnishing the material and no additional compensation will be allowed.

Borrow is defined as approved import material used for backfill or embankment which must be acquired from designated areas to make up deficient quantities which cannot be completed from excavation within project limits.

204 Slopes

The street section behind the curb to the back of the sidewalk shall be graded at 2% draining to the top of the curb. Side slopes of all permanent excavations and embankments within the street section behind the sidewalk shall not exceed the ratio three to one (3:1, horizontal to vertical), unless shown otherwise on approved drawings.

205 Subgrade

The subgrade for the pavement structure shall be graded to conform to the cross sections and profile required by the construction plans. Prior to the placement of aggregate base course or sub-base course, the subgrade shall be properly prepared. The subgrade shall be scarified to a minimum depth of six (6) inches, moisture adjusted as necessary, and recompacted to not less than:

- A. For Cohesive Soils, 95% maximum Standard Proctor dry density (ASTM D698) at $\pm 2\%$ of optimum moisture content. For highly expansive soils (swell potential $>2.00\%$ under 200 psf surcharge pressure), paving will not be permitted without a subgrade treatment approved by the Engineer.
- B. For Cohesionless Soils, 95% maximum Modified Proctor dry density (ASTM D1557) at $\pm 2\%$ of optimum moisture content, or 100% maximum Standard Proctor dry density (ASTM D698) at $\pm 2\%$ of optimum moisture content.

The subgrade shall also be thoroughly proof-rolled using a heavily loaded vehicle having a single axle weight of at least 18,000 lbs. and a minimum tire pressure of 70 psi. Particular attention shall be directed to the utility main and service trenches, specifically around valves, manholes, inlets, and other similar surface features. Proof-rolling shall be done after specified compaction has been obtained. Areas found to be weak, and those areas which fail, shall be ripped, scarified, wetted or dried, as necessary, or replaced with suitable material, and recompacted to the requirements for density and moisture, at the Contractor's expense.

The proof-rolling procedure shall be observed by the Engineer, or his representative, prior to paving. Acceptable field moisture density tests using approved methods will be required at random locations on the subgrade at a minimum rate of one for each 500 linear feet of paving.

206 Compaction of Utility Trenches

Prior to approval to place the base, sub-base course, or full depth asphalt, all utility main and service trenches shall be compacted to not less than the above referenced density (Section 205) required for the given soil classification. This density requirement also applies to all utility trenches within the public right-of-way or public easement regardless of the location of the pavement structure.

The density tests shall be performed during backfilling at specified depths in the trench to ensure that the required density and moisture is obtained throughout. For trenches less than 30 inches in depth, density tests shall be taken within 18 inches above the top of pipe

or conduit and at the surface as a minimum. For trenches greater than 30 inches in depth, density tests shall be taken within 18 inches of the top of the pipe or conduit, and at 2' vertical intervals to the top of the trench with the final test at the surface.

Horizontal and Vertical Frequency of Density Tests

1. Utility Mains - One set of tests per 250 feet of linear trench at specified depths
2. Service Lines - One test per every service per utility type at alternate depths
3. Open Pit - minimum of one set of tests at 2' vertical intervals from the bottom to the top of the trench. (Open pit shall include, but not be limited to, excavations associated with bore pits, manholes, water valves, storm inlets, vaults, etc.)

The number of density tests required may be increased if directed by the Engineer. For City CIP Contracts, the City shall provide for all testing laboratory services, and pay for all tests on a first time basis only. The costs of any retesting, as required, shall be borne by the Contractor. For subdivision development/private projects or utility projects, the subdivider, utility company, or contractor shall provide, at their expense, the required tests and retests to the City.

In existing pavement, all excavations within 18" of a concrete surface (gutter, drainway, curb) shall remove and replace existing asphalt to the edge of concrete.

At the City's option, utility trench backfill meeting the following requirements (flowable-fill) may be used in lieu of native backfilling in any excavation regardless of width or depth. Concrete slurry type full depth backfill will not be allowed within the public right-of-way. Compaction and testing of utility trench backfill will not be required if material meeting the flowable-fill specification below is used.

INGREDIENTS

LBS./C.Y.

Cement	42(0.47 sack)
Water	325 (39 gallons or as needed)
Coarse Aggregate (Size No. 57)	1700
Sand (ASTM C-33)	1845

The maximum desired 28 day strength is 60 psi (not a specification requirement). The above combination of material, or an equivalent, may be used to obtain the desired "flowable-fill".

For street maintenance purposes, "flowable-fill" shall be prohibited as a permanent street surface within the top 4 inches of any utility trench (See Standard Drawing No. D-5A). The permanent top 4 inches (minimum) of all utility trenches shall be properly compacted asphalt, or 6 inches (minimum) concrete pavement or gravel (for existing concrete or gravel alleys or streets).

Flowable-fill will be required as utility trench backfill for all trenches less than 1 foot in width. This requirement applies to all pavement and gravel locations. If approved by the inspector, flowable-fill may be used as utility trench backfill around water valves or sewer manholes. For trench excavations greater than 1 foot in width in newly overlaid, or newly constructed streets, a 6" thick concrete cap will be required in accordance with Standard Drawing Nos. D-4 and D-5.

The methods of compaction are the responsibility of the contractor/utility and shall be sufficient to attain the required density in accordance with these specifications. The method of testing the compacted material shall be the responsibility of the professional engineer certifying the results. Said engineer shall be responsible for the validity of all test results.

207 Warranty

Performance of the compacted trench shall be the responsibility of the contractor/utility for a minimum of two (2) years from the start of the warranty period. The starting date for the (2) two year warranty period shall be established by the City and will commence after the City has receive all the required passing density tests and has conditionally accepted the work. Any failure, as determined by the City, that occurs within the two (2) year warranty period shall be corrected, as stipulated by the City, by said contractor/utility at no additional cost to the City.

208 Measurement and Payment

Payment for preparation of the roadway section shall be included in the costs of unclassified excavation/embankment, compaction of utility trenches, pipe line and appurtenant structures, or as otherwise indicated in its pay item in the bid schedule or applicable project/utility specifications.

SECTION 220

REMOVAL OF STRUCTURES AND OBSTRUCTIONS

220.01 Description

This work shall consist of the removal, wholly or in part, and satisfactory disposal of all buildings and foundations, fences, signs, structures, old pavements, traffic signal materials, abandoned pipelines, and any other obstructions which are not designated or permitted to remain, except for the obstructions to be removed and disposed of under other items in the contract. It shall also include the salvaging of designated materials and backfilling the resulting trenches, holes and pits.

This work shall include saw cutting in reasonably close conformity with the dimensions and details on the plans or as directed, to create planes of weakness in order to facilitate controlled breaking for removal.

This work shall include removing pavement markings in accordance with these specifications and in reasonably close conformity with details shown on the plans, or as directed.

220.02 Construction Requirements

The Contractor shall raze, remove and dispose of all buildings and foundations, signs, structures, fences, old pavements, abandoned pipelines, conduits, cables, encasements, traffic signal materials and other obstructions, any portions of which are on the right-of-way, except utilities and those for which other provisions have been made for removal. All salvageable material shown on the plans shall be removed, without damage, in sections or pieces which may be readily transported, and shall be stored by the Contractor as directed within the project limits. The Contractor shall be held responsible for the safekeeping of all material designated to be salvaged during the period of the contract. The Contractor shall make good or replace at his own expense any such materials damaged, stolen or otherwise lost prior to receipt by the City.

Basements or cavities left by structure removal shall be filled with suitable material acceptable to the Engineer to the level of the surrounding ground and if within the prism of construction, shall be compacted as designated.

Concrete adhering to sign posts shall be removed.

Sign island shall be considered part of the removal item and shall be removed to the level of the surrounding terrain. Pedestals shall be removed to one foot below the surrounding ground.

Where portions of structures are to be removed, the remaining portions shall be prepared to fit new construction. The work shall be done in accordance with plan details, and in such manner that materials to be left in place shall be protected from damage. All damage to portions of structure to remain in place shall be repaired by the Contractor at his expense. Reinforcing steel projecting from the remaining structure shall be cleaned and aligned to provide bond with new extension. Dowels, as required by the plans, are to be securely grouted with approved grout.

Where culverts or sewers are to be left in place and plugged, the ends of concrete culverts shall be filled with concrete or a concrete plug, a minimum length of 1/2 diameter or 12 inches. All other pipes shall be removed or completely filled or specified in the contract documents. Culvert and sewer pipe shall be sufficiently filled to prevent future settlement of embankments. Plugging of culverts shall include removal of headwalls and other appurtenances where necessary to accommodate the work.

The saw cutting of concrete shall be done carefully, and all damages to concrete to remain in place, due to Contractor's operations, shall be repaired by the Contractor at his expense.

The minimum depth of saw cut in concrete shall be full depth unless the reinforcing steel is to be salvaged and connected to new improvements in which case the depth to reinforcing steel.

Pavement markings shall be removed from the pavement by grinding unless otherwise approved by the Engineer. The pavement markings shall be removed to the extent that they will not be visible under day or night conditions.

Pavement markings shall be removed before any change is made in the traffic pattern.

Materials deposited on the pavement as a result of removing pavement markings shall be removed as the work progresses and shall not interfere with roadway drainage.

Operations that may damage or constitute a hazard to the traveling public will not be permitted.

220.03 Removal of Bridges, Culverts, and Other Drainage Structures

Bridges, culverts and other drainage structures in use by traffic shall not be removed until satisfactory arrangements have been made to accommodate traffic.

Unless otherwise directed, the substructures of existing structures shall be removed down to the natural stream bottom and those parts outside of the stream shall be removed down two foot below natural ground surface. Where such portions of existing structures lie wholly or in part within the limits of new structure, they shall be removed as necessary to accommodate the construction of the proposed structure.

Steel bridges and wood bridges as specified, shall be carefully dismantled without damage. Steel members to be salvaged shall be match marked with waterproof paint. All salvaged material shall be stored as specified in Section 220.02.

220.04 Removal of Pipe

Unless otherwise provided, all pipe which is removed shall be hauled from the site and properly disposed of. All pipe to be salvaged, as noted on the plans, shall be carefully removed, cleaned and every precaution taken to avoid breaking or damaging the pipe. Removal of pipe shall include headwalls, wingwalls, slope paving, end sections and all other appurtenances. Pipes to be relayed shall be removed and stored when necessary so that there will be no loss or damage before relaying. The Contractor will be required to replace sections lost from storage, or damaged by negligence, or by use of improper methods at no additional cost to the City. The Engineer shall make the determination whether the salvaged materials are reusable prior to installation.

In removing manholes, catch basins and inlets, any live sewers connected with these shall be properly reconnected and satisfactory bypass service shall be maintained during such operations. Any excavation resulting from removal of manholes, catch basins and inlets shall be backfilled and compacted per the project specifications.

220.05 Removal of Pavements, Sidewalks, Curbs, etc.

All concrete pavement, sidewalks, curbs, gutters, etc., designated for removal, shall be broken into pieces and disposed of.

Where old pavement construction abuts new pavement construction, edges of pavement, sidewalks, curbs, etc., to be left in place shall be sawn to a true line with a vertical face.

220.06 Method of Measurement

When the contract stipulates that payment will be made for removal of obstructions on a lump sum basis, the pay item, removal of obstructions, will include all stipulated structures and obstructions encountered within the right-of-way in accordance with the provisions of this section. Where the proposal stipulates that payment will be made for the removal of specific items on a unit basis, measurement will be made by the unit stipulated in the contract. Items to be removed which do not have specific pay items are considered incidental to the work and the cost included in the pay item must be closely associated with the work.

Removal of pavement markings will be measured by area in square feet, completed and accepted.

220.07 Basis of Payment

The accepted quantities will be paid for at the contract unit price for each of the pay items listed below that appear in the bid schedule. Payment shall be full compensation for sawing, removing, hauling and disposal of such items, excavation and subsequent backfill. The price shall also include salvage of materials removed, their custody, preservation, storage and disposal as provided herein.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Removal of Structures and Obstructions	Lump Sum, Each, Linear Foot, Square Yard, Square Foot
Removal of Plug	Each

SECTION 240

RESET STRUCTURES

240.01 Description

This item shall consist of removing, relaying, resetting, or adjusting structures and related materials. All designated items shall be carefully removed and every precaution taken to avoid damage. Items shall be removed and stored when necessary so that there will be no loss or damage. The Contractor will be required to replace or repair any material damaged due to his operations at his own expense. The Engineer shall determine the suitability of salvaged materials or structures prior to installation.

240.02 Construction Requirements

Pipe to be relayed and structures to be reset shall be thoroughly cleaned.

Removal site shall be neatly backfilled as part of this item. Methods to be used shall conform to those required in the specifications for the various types of construction involved.

Reset Light Standard shall consist of all bases, pull boxes, base grounding and 1-1/2 inch P.V.C. Schedule 40 conduit with a nylon "Jetline" pull rope in accordance with the City of Colorado Springs, Department of Utilities, Electric Transmission/ Distribution, Service Standards Manual, at locations indicated on the plans. It will be the Contractor's responsibility to supply and install any new materials needed to restore the Light Standard to service at the new locations in conformance with the specifications.

Where fences (except snow fence) are to be rebuilt, it will be the Contractor's responsibility to supply and install any new materials required to restore the fence to acceptable condition. Gates designated or noted on the plans to be reset shall be removed and restored for service at the new locations indicated.

Reset fence shall be constructed approximately six inches inside the boundary of the right-of-way line or as shown on the plans. Anchorages, footings or fence appurtenances shall not extend beyond the limits of the right-of-way without the consent of the abutting property owner.

Unserviceable material from structures shall be replaced with new material of dimensions similar to those used in building the original structure. Replacement parts and new materials, including concrete footings, necessary to restore these structures to service at new locations shall be provided and installed by the Contractor as part of this item.

All new materials and replacement parts shall conform to the requirements of these specifications for the appropriate items.

Where guard rail or snow fence is to be rebuilt, it will be the Contractor's responsibility to supply and install any new materials needed to restore the rail or fence to acceptable condition.

New materials needed to restore guard rail to acceptable condition shall include: replacement posts, blocks, rail and hardware for that deemed not feasible to reset, together with additional posts, blocks and hardware needed to complete the intermediate post installations as shown on the plans. Posts with similar tops shall be installed in groups as directed. Installation of flat-top posts alternately with other top shapes will not be permitted. Posts may be either cut, rotated or turned upside down to eliminate unacceptable tops of posts. If posts are cut, Contractor will be required to treat the exposed surface with hot material the same as or similar to that used in the treated posts.

Mailboxes complete with supporting structures are to be removed and temporarily reset at points near their original location to be easily accessible for mail delivery service. Upon completion of surfacing operations, the boxes shall again be reset to a height of 36" to 42" at locations designated. A supporting structure may contain one or more mailboxes. Refer to Standard Detail Drawing No. D-18, "Mailbox Placement with Sidewalk Taper".

Adjusting structures in pavement sections shall refer to, but not be limited to, manhole rings and covers, inlet gratings and frames, water valve boxes, water meters, gate posts and other structures and facilities. Construction operations shall include any raising, lowering, moving, removing masonry or concrete, adding brickwork, masonry or concrete, and resetting grates, frames or rings and covers to fit the new construction. Work on water mains or services shall be in accordance with Water Division Specifications. Damage to any fire hydrant or any part of the system due to Contractor's operations shall be repaired at the Contractor's expense.

240.03 Method of Measurement

The quantity to be measured where items are reset or adjusted on an "each" basis shall be the actual number of those items restored for service at new location, completed and accepted.

The quantity to be measured where items are reset or adjusted on a "linear foot" basis shall be the actual number of linear feet of the items completed and accepted, measured end to end except guard rail. Guard rail shall be measured as the actual number of linear feet completed and accepted, measured as shown on the plans.

The quantity to be measured for "relay pipe" shall be the number of linear feet of relayed pipe and end sections measured end to end, in place, completed and accepted.

Resetting of structures, fences and related materials shall include all work necessary to remove the items from their existing location to the new location, and shall include all mounting hardware, footings, and all other work necessary to complete the reset item.

240.04 Basis of Payment

The accepted quantities, measured as provided in the forgoing, will be paid for at the contract price for each of the pay items listed below that appear in the bid schedule.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Reset	Each, Linear Foot, Square Yard
Relay Pipe	Linear Foot
Adjust	Each

Excavation installation and backfill required for "Relay Pipe" will not be measured and paid for separately but shall be included in the contract unit cost.

Except as otherwise indicated on the plans or in the special provisions, collars and connecting devices will not be measured and paid for separately but shall be included in the work.