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## PART II - CONSTRUCTION MATERIALS AND METHODS

### SECTION 5.

#### DEMOLITION, SITE PREPARATION, EXCAVATION AND EMBANKMENT

##### 5.1. GENERAL

The work to be performed shall include the demolition and removal from the site of all designated: buildings, slabs on grade, retaining walls, steps, asphalt, rubbish, stumps, trees, shrubs, fencing, buried tanks, pipe etc.; on site wells shall be sealed; depressed areas are to be filled and graded to drain. These Specifications shall apply to all new construction within the City of Arvada.

In public right-of-ways, wherein the City will assume the maintenance of materials installed, the work to be performed shall also include: top soil removal and replacement, unclassified excavation, placing and compacting embankment, shaping and compacting subgrades, etc.; for drainage ways, parks, concrete slabs on grade, etc.

##### 5.1.1. Local Laws, Ordinances and Code

The Contractor shall be licensed with and bonded to the City of Arvada and shall comply with all current federal, state and local laws, codes and ordinances pertaining to demolition, wrecking, clearing and grubbing operations.

##### 5.1.2. Protection of Public Improvements

The Contractor will be held responsible to insure the protection of all existing public improvements such as fire hydrants, street lights, traffic lights, parking meters, traffic signs, catch basins, manholes, valves, survey monuments, overhead utility lines and poles, and any existing underground sprinkler or utility lines which may be damaged during the execution of the City contract or developer project. It will be the Contractor's responsibility to replace all public improvements so damaged at his own expense. Existing manhole rings and covers, valve boxes and sprinkler heads found defective shall be replaced, as directed by the City Inspector.

The Contractor shall take proper precautions for the protection of and replacement or restoration of driveway culverts, street intersection culverts or aprons, storm drains or inlets, fences, irrigation ditches crossings and diversion boxes, mail boxes, shrubbery, flowers, ornamental trees, driveway approaches and all other public or private installations that may be encountered during the performance of work. He shall provide each property with access at all times during construction. Existing driveways shall be cut, filled and graded as required or as directed by the City Inspector to provide permanent access. Existing driveways shall be resurfaced with the then existing type of surfacing, whenever surfaces are destroyed.

##### 5.1.3. Disconnection of Existing Utilities

Before starting demolition of any structure, the Contractor shall arrange for the disconnection of all utility service connections; such as water, sewer, cable T.V., telephone, gas and electrical power connected thereto. Disconnects shall be made in accordance with the regulations of the utility that controls the supply of service involved.

Underground services are to be cut, capped and marked at point of disconnect to facilitate future location of the line. Caps of underground storm and sanitary sewer shall consist of a plug being placed in the line and the opening then sealed with concrete. Markings of the end of the line shall consist of a 4 x 4 wooden stake or metal fence post driven into the ground and then tagged to note the type of facility.

The county, district, or City Public Works Department will provide a representative to be on site to observe and approve the Contractor's disconnect of the water and sewer services at the main line. It shall also be the responsibility of the Contractor to backfill all holes to finish grade and install concrete or asphalt surfacing when the holes excavated are in streets or paved areas. The Contractor will be given written approval and acceptance for disconnects that are proper. The Contractor shall correct any unsatisfactory disconnects.

5.1.4. Equipment Operated On Streets

The Contractor shall be permitted to operate only pneumatic-tired equipment over any paved surface and shall be responsible for any damage to street surface resulting from his operations.

5.1.5. Protection of Survey Monuments

Prior to start of demolition or construction, any public survey monument or range box that may be disturbed during construction shall be referenced to a minimum of two points outside the limits of construction by a Colorado Professional Land Surveyor. Any public survey monument or range box disturbed as a result of construction shall be replaced by a Colorado Professional Land Surveyor in accordance to the current Colorado Revised Statutes.

5.1.6. Test Results

All subgrade test results including trench compaction, subgrade preparation and stabilization etc. on private developer projects must be submitted to the City Inspector for approval prior to placement of any asphalt or surface concrete. Minimum materials testing frequencies are as outlined in Table 15-1.

**5.2. DEMOLITION, CLEARING AND GRUBBING**

The Contractor shall remove from the site, or within the limits of construction, all obstructions specified in the Special Conditions of City projects or noted on the construction plans of developer projects.

5.2.1. Fences

Where existing fence or corner markers are to be removed, site corners shall be marked by 1/2" rebar, 18" long, firmly implanted at ground level by the Contractor.

5.2.2. Trees and Shrubs

Trees not impeding demolition of structures or performance of the work will not be removed except as designated. Trees and shrubbery designated for removal will include stumps and roots to a minimum depth of three (3) feet below existing or finished grade, whichever is lower. Downed trees, brush and rubble shall be removed from the site. A tree shall be defined as having a trunk that is greater than twelve (12) inches in diameter when measured four (4) feet above the existing ground surface.

Trees scheduled to remain shall be carefully protected from damage during performance of the work. Any damage due to the Contractor's operations shall be repaired by suitable tree surgery methods. Damaged trees shall be replaced, as approved by the City at the Contractor's expense.

5.2.3. Cesspools, Privies, Buried Fuel and Septic Tanks

Tanks that may exist on project sites shall be completely removed and contaminated soils remediated. The void created shall be filled by the Contractor to finished grade.

Underground motor fuel storage tanks shall be excavated and removed under the direction and in the presence of a representative from the Arvada Fire Protection District. The Contractor shall notify the fire district twenty-four (24) hours in advance of the time he proposes to start excavation in the vicinity of the tanks.

5.2.4. Wells

On site wells and well casings shall be sealed to prevent contamination of ground water aquifers in accordance with Section 5; Abandonment Regulations, State Board of Examiners, Rules and Regulations and Water Well and Pump Installation Contractors Law, State of Colorado Division of Water Resources. All abandonment activities shall be approved by the utility that services the location, and the State Engineer. There may be instances where the well will not be plugged, but merely capped with a steel, lockable cover plate.

5.2.5. Buildings

The demolition of buildings shall include the removal from the site of all roofs, walls, chimneys, basement walls, supporting walls, footings, footing post, caissons, basement floors; including all pipes, conduits and similar appurtenances lying therein or beneath for a depth of two (2) feet below grade.

5.2.6. Slabs on Grade

All concrete and asphalt slabs on grade shall be removed from the site. This shall include, but is not limited to, floor slabs, driveway and garage slabs, sidewalks, curbs, crosspans, gutters, etc.

5.2.7. Walls

Retaining walls and their footing shall be removed in their entirety, from the site.

5.2.8. Salvage

Unless otherwise specified in the Special Conditions on City projects; all materials, salvageable or otherwise, to be removed from the site is considered as being the property of the Contractor performing the work.

5.2.9. Filling and Grading

Depressions resulting from the removal of structures, basement walls, footings, buried tanks etc., shall be filled and compacted with clean fill materials so as to eliminate hazards of cave-in, accumulation and ponding of water. Under no circumstances shall organic building material, broken concrete over 1 foot in diameter or asphalt be considered as approved fill material.

Immediately following demolition and removal of rubbish from the site, the Contractor shall grade the entire contract area by filling, compacting, and leveling the site to existing adjacent grades. Grading and cleanup of the site must be complete and acceptable before any consideration will be given to making final payment for the work on City projects.

5.2.10. Topsoil

The Contractor shall salvage within the project limits, or acquire when needed, loose friable loam reasonably free of admixtures of subsoil, refuse, stumps, rocks, roots, brush, weeds or other material which would be detrimental to the proper development of vegetative growth for use as topsoil.

Topsoil shall be placed and spread at locations and to the thickness shown on the plans, after the areas to be covered have been properly prepared and grading operations in the area have been completed and accepted. Soil so placed shall be keyed to the underlying subgrade by the use of harrows, rollers or other equipment suitable for the purpose, followed by applying water in a fine spray by nozzles or spray bars in such a manner and extent that wash or eroding will not occur.

**5.3. EXCAVATION**

Excavation will be unclassified and shall consist of the excavation of all material of whatever character encountered within the limits of the project, including but not limited to surface boulders, muck, rock, concrete foundations, slabs, stripping, excavation for ditches or channels, borrow, etc.

Excavation operations shall be conducted, so that material outside the limits of slopes will not be disturbed, and to provide adequate drainage at all times. Insofar as practicable, all suitable materials shall be used in the formation of embankments and backfilling. Materials that are considered unsuitable or surplus by the Engineer shall be disposed of by the Contractor at his expense.

All excavations shall be made to subgrade elevations and shall be true to grade. Material below subgrade elevation in cuts shall not be loosened by plowing or other methods during the progress of the work except with the approval of the Engineer. No excavation shall be made below subgrade elevation except to remove spongy material, vegetable matter or other undesirable materials. In the event the Contractor over excavates an area, he shall replace the excavated material with satisfactory material and thoroughly compact same at his own expense.

Whenever excavation greater than twelve (12) inches below subgrade elevation is required to remove spongy material, vegetable matter, or other material and is ordered by the Engineer, the Contractor shall remove the same to the satisfaction of the Engineer and shall replace it with satisfactory material in layers not to exceed six (6) inches in thickness and thoroughly compact and moisture treat each layer before the next layer is placed. The volume of material ordered to be removed shall be paid for at the unit price for excavation. When such excavations are backfilled with suitable material from other excavations in the project, no separate payment will be made. In the event the Engineer orders such excavations to be filled with material from borrow, the Contractor will be paid at the unit price for "Select Subgrade Material" when called for in the proposal.

The Contractors shall not deposit surplus or undesirable materials on private property without first securing the written consent of the property Owner and filing a copy of said consent with the City representative. When approved, disposal of surplus material on City property shall

be kept below the grade designated by the Engineer.

**5.4. EMBANKMENT**

Areas to receive embankment and/or structural backfill material and the top of cut areas shall first be stripped of all vegetation, organic material, asphalt, concrete and materials unsuitable for use in embankments. Topsoil shall be stockpiled for reuse and unsuitable material disposed of.

Under no circumstances shall organic building material, broken concrete (greater than 1 ft. diameter) or asphalt be considered as approved embankment material.

Within the limits of the embankment area the subgrade shall be winrowed or deep plowed to a depth of twelve (12) inches and the moisture content increased or reduced as necessary to bring the moisture within +/- 3% of optimum. This winrowed or deep plowed layer shall then be rolled and compacted to the relative compaction specified for the type of soil. The remainder of the embankment volume shall then be constructed in six (6) inch lifts of suitable material, containing +/- 3% of optimum moisture content for sandy soils and compacted to the relative compaction specified for the soil classification. Rollers shall be of a tamping type conforming to CDOT standards. In-place density tests of embankment material shall be taken every 250 lineal feet along the roadway or per every 200 yd<sup>3</sup> of embankment, whichever is less. Results shall report densities (maximum dry and relative) to nearest 0.1 lb/cu. ft., moisture content (optimum and in place) to nearest 0.1%, and compaction (relative and required) to nearest 1%. Gradation in accordance with ASTM D 422 and Atterberg Limits in accordance with ASTM D 423 and D 424 shall be taken for each type of embankment soil placed. A moisture density curve determination for each embankment soil type placed in accordance with ASTM D 1557/AASHTO T-180 (A-1, A-3, A-2-4 and A-2-5 soils only) or ASTM D 698/AASHTO T-99 (all other soils) shall also be submitted to the Engineer.

In connection with normal grading operations, the Contractor shall use trucks, tractors, bulldozers and other pieces of equipment in the most effective manner by routing the equipment over the entire embankment or roadway width.

**5.4.1. Compaction**

Maximum dry densities of all soil types encountered or to be used will be determined in accordance with AASHTO T-99 or T-180. The percent of relative compaction required will be equal to or greater than minimum values as hereinafter shown for the various classes of soil and type of compactions.

Soil Classification (AASHTO M-145)	AASHTO T-99 Minimum Relative Compaction	AASHTO T-180 Minimum Relative Compaction
A-1	100	95
A-3	100	95
A-2-4	100	95
A-2-5	100	95
All Others	95	n/a

Compacted subgrade ready to receive subbase material shall conform to the lines, grades and cross-section called for on the plans. Subgrade is to be established by survey.

## 5.5. SUBGRADE FOR SLABS ON GRADE AND PAVING

### 5.5.1. General

Subgrade areas to be occupied by concrete curbs, gutters and sidewalks, base course or asphaltic concrete shall, at a minimum, be stripped of all top soil and excavated to a depth of twelve (12) inches below final subgrade level, be backfilled in two (2) six inch lifts and compacted to establish final subgrade level. This work shall be done with particular care in accordance with all requirements herein.

### 5.5.2. Preparation

Subgrade soils shall be free of organic material, roots, sod, weeds, wood, ice, snow, or other deleterious matter and all rocks greater than six (6) inches in diameter. Subgrade soil shall be winrowed, tilled in place using a Bomag type rototiller or otherwise completely removed to a minimum depth of twelve (12) inches below final subgrade level, moisture treated to within 2 percent of optimum moisture content (-1% to +3% optimum for A-6 or A-7-6 soils), and replaced and compacted in 6 inch lifts to densities as shown for the soil type in Section 5.4.1. Scarifying in place soils by means of discing or ripping is not acceptable. Minimum removal depth must be verified by City Inspector prior to replacing soil in excavated area. A moisture density curve determination in accordance with ASTM D 1557/AASHTO T-180 (A-1, A-3, A-2-4 and A-2-5 soils only) or ASTM D 698/AASHTO T-99 (all other soils), Atterberg Limits and gradation test of each soil type removed and replaced shall be submitted to the Engineer. In place compaction testing frequency for the subgrade shall be a minimum of each six inch lift on replacement materials with one test for every 250 feet alternating each lane with more tests taken if necessary to establish that compaction requirements are being met. Results shall report densities (maximum dry and relative) to nearest 0.1 lb/cu. ft., moisture content (optimum and in place) to nearest 0.1%, and compaction (relative and required) to nearest 1%. Soft and yielding material and other portions of the subgrade which will not compact when rolled or tamped shall be removed as directed by the Engineer and replaced with suitable material. Additional or alternate subgrade preparation may be required as recommended by the geotechnical and/or pavement design report submitted by the Geotechnical Engineer on developer projects or as called out on the construction plans or in the Special Conditions on City projects. No paving, subbase, or base shall be placed on soft, spongy, frozen or otherwise unstable subgrade that is considered unsuitable by the Engineer.

### 5.5.3. Proof Rolling

Proof rolling will be required on all prepared subgrade including subgrade under proposed concrete flatwork areas to determine whether the subgrade meets compaction requirements. Proof roll all areas of subgrade with a heavy rubber-tired roller having a minimum GVW of 50,000 pounds, or single axle water truck loaded to provide a single axle weight of 18,000 pounds with a tire pressure of 90 psi or equivalent wheel loading. Areas found to be pumping or deforming shall be re-worked, dried or wetted if necessary, replaced or otherwise modified to provide a smooth, stable, non-yielding base for subsequent base and/or paving courses. The Engineering Division shall be notified at least 24 hours before final proof-rolling. Approval of proof rolling is valid for 24 hours. Changes in weather such as freezing or precipitation will require reapproval of the subgrade prior to asphalt placement.

Surface of ground between concrete curb or sidewalk line and property line shall be sloped as staked or as directed by the Engineer and rounded into existing lawn or ground surface after concrete is placed.

#### 5.5.4. Wetting and Compacting

Embankments, bases of cuts, natural foundations, base courses and surface courses shall be wetted and rolled to obtain the densities required by the Specifications. The Contractor shall use his equipment to consolidate each layer of embankment in the most effective manner. Each layer shall be compacted by routing the loaded hauling equipment over the entire width, and spreading equipment shall be operated so as to produce a dense, stable fill. Successive layers of material shall not be placed until the layer under construction has been thoroughly compacted. Where methods in use do not consolidate materials to required densities, rollers or mechanical tamping units of the type ordered by the Engineer shall be used.

Concurrently with the rolling or tamping operations, the materials shall be wetted by uniformly sprinkling each layer or course of material being placed, to within 2% of optimum moisture content (-1% to +3% optimum for A-6 or A-7-6 soils). Sprinkling shall be done in such a manner that areas of dry material alternated with areas of saturated material and pools of water will be avoided.

Where mechanical tampers are used as ordered by the Engineer, they shall be operated at all times with an air pressure not less than eighty (80) p.s.i. at the tamper. Successive blows with the tamper shall overlap at least one-fourth the width of the tamper foot.

#### 5.5.5. Stabilized Subgrade Preparation

The subgrade to be stabilized shall be free of roots, sod, weeds, wood, ice, snow, or other deleterious matter and stones greater than six (6) inches in diameter. Material in the stabilized zone shall have a soluble sulfate content less than 0.5 percent. If the subgrade soils have a soluble sulfate content greater than 0.5 percent, the mix design for the stabilized subgrade shall be addressed to prevent adverse sulfate reactions. The subgrade shall not be treated when the ambient air temperature falls below freezing or the subgrade material is below 40 degrees F.

### 5.6. **HOUSEKEEPING, RESTORATION AND CLEANUP**

#### 5.6.1. Surplus Excavation

All surplus excavated material shall be removed from the job site by and to locations provided by the Contractor. Written permission shall be obtained by the Contractor, before disposal of excess material on private property, and a copy of said permission shall be furnished to the Engineer. The City relinquishes all right and title to the surplus material unless otherwise specified in the Special Conditions.

Excess material shall not be wasted on any public ROW without written permission from the Engineer.

#### 5.6.2. Concrete Curb, Gutter, Valley Gutter and Sidewalk

The Contractor shall replace in like kind all curb and gutter and valley gutter that are damaged during construction. The replacement shall be of equal or better quality than found at a minimum concrete thickness of 6". Separate payment will be made for replacing curb and gutter and valley gutter removed for the installation of a pipeline on City projects. Minimum removal length shall be five (5) feet from an existing control joint. If, after removal of the minimum five (5) feet, less than five (5) feet of concrete remains to the next control joint, then the entire length to the next control joint shall be removed and replaced.

5.6.3. Repair of Tree Damage

Any trees along the alignment of conduits that are damaged by the Contractor shall be repaired and treated accordingly. All broken limbs shall be sawed off evenly and cut faces painted with an approved compound. All repairs and treatments shall be done in accordance with the forestry regulations of the authority having jurisdiction and at Contractor's expense.

5.6.4. Surface Restoration

The Contractor must secure and pay for all street cut and ROW permits required from the Engineering Division for the prosecution of work. Permits are granted at no charge on City projects. The Contractor shall assume full responsibility for the consequences of such cutting or damaging and shall comply with all requirements contained therein.

The replacement of excavated base course, permanent paving and damaged curb and gutter shall be done in accordance with the "Engineering Code of Standard and Specifications for the Design and Construction of Public Improvements" and requirements contained in the permits.

Damaged driveways shall be replaced in like kind by the Contractor to an equal or better condition than existed prior to construction. All cuts necessary for the replacement of damaged concrete shall be made using a concrete saw. Drainage and ditch facilities shall be maintained in operating condition, at all times during construction.

- A. **Unsurfaced Areas:** The general grade and condition of all unsurfaced areas shall be restored to nearly as practicable to the grade and condition immediately prior to construction. Topsoil shall be removed, saved and replaced in cultivated and agricultural areas; and any excess earth shall be removed from the ROW at no additional expense to the City. If topsoil is not saved, Contractor must import additional topsoil to match existing prior to resurfacing. All grassed areas shall be reseeded or resodded, and the Contractor shall be responsible for caring for the grass until its growth is established.
- B. **Surfaced Areas:** Roadway surface cuts shall be made in a vertical plane and in a straight line. All roadway surfacing between the surface cuts on each side of the excavations shall be removed and replaced with base course material and/or hot mix bituminous or concrete surfacing. In the event that the trench must be paved before hot mix bituminous material can be acquired, the Contractor, at the discretion of the Engineer, shall install and maintain temporary cold mix bituminous paving. When hot mix bituminous material becomes available, the Contractor shall remove the temporary cold mix material, add the compact base course material, if necessary, and install the permanent hot mix bituminous surfacing.
- C. **Cleanup:** Upon completion of the work, the Contractor shall remove from the job site all rubbish, unused materials, concrete forms and other like material. Also, at all times during construction, the Contractor shall maintain the site, partially finished structures, material stockpiles and other like areas in a reasonable state of order and cleanliness.

In the event of the Contractor's failure to perform the above work in a timely manner, the Work may be performed by the City at the expense of the Contractor.