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## SECTION 200 CURB SOCK INLET PROTECTION

### 201 DESCRIPTION

The work to be performed under this section shall consist of furnishing, placing and maintaining curb sock inlet protection.

### 202 MATERIAL

- Sock is to be made of ¼ inch wire mesh (used with gravel only) or geotextile.
- Washed sand or gravel ¾ inch to 4 inches in diameter shall be placed inside the sock.
- Each curb sock inlet protection installed shall consist of 2 socks for each installation.

### 203 CONSTRUCTION METHODS

- Curb sock inlet protection shall be installed in accordance with the detail F – Figure IP-4 on the approved plan set.
- Curb sock inlet protection shall be maintained in accordance with the detail F – Figure IP-4 on the approved plan set.

### 204 QUALITY CONTROL

Contractor shall inspect inlet protection daily and remove any sediment build up immediately following the inspection. Contractor shall provide an inspection log and corrective action list.

### 205 MEASUREMENT AND PAYMENT

Curb Sock inlet protection placed that is accepted by the Engineer will be measured by the each installation. Each installation shall be measured by each and shall consist of a minimum of 2 curb socks for each protected inlet as required by the approved plan and/or as set forth in the Bid Proposal. This payment shall be full compensation for all materials, tools, equipment, and labor necessary to complete the work under this section in accordance with the plans and specifications.

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## SECTION 201 SILT FENCE

### 201.1 DESCRIPTION

The work to be performed under this section shall consist of furnishing, placing and maintaining silt fence.

### 201.2 MATERIAL

- Metal Post shall be “stubbed tee” or “U type” with minimum weight of 1.33 pounds per lineal foot.
- Wood Post shall have a minimum diameter or cross section dimension of 2 inches.

### 201.3 CONSTRUCTION METHODS

- Silt fence shall be installed in accordance with the detail E – Figure SF-2 on the approved plan set.
- Silt fence shall be maintained in accordance with the detail E – Figure SF-2 on the approved plan set.

### 201.4 QUALITY CONTROL

Contractor shall inspect silt fence daily and repair any damaged fence immediately following the inspection. Contractor shall provide an inspection log and corrective action list.

### 201.5 MEASUREMENT AND PAYMENT

Silt Fence placed that is accepted by the Engineer will be measured by the lineal foot installed. Each installation shall be measured by the lineal foot as required by the approved plan and/or as set forth in the Bid Proposal. This payment shall be full compensation for all materials, tools, equipment, and labor necessary to complete the work under this section in accordance with the plans and specifications.

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## **SECTION 220 REMOVAL OF STRUCTURES AND OBSTRUCTIONS**

### **220.1 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.

### **220.2 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.

### **220.3 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.

### **220.4 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.

### **220.5 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.

### **220.6 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.

### **220.7 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:

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

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## **SECTION 230 ADJUST SANITARY SEWER RIM**

### **230.1 DESCRIPTION**

The work to be performed under this section shall consist of furnishing, placing and adjusting sanitary sewer rim.

### **230.2 MATERIAL**

- 2 inch pre-cast concrete adjustment rings shall be used in accordance with the Fountain Sanitation District sanitary sewer manhole detail DWG-04. See detail G on sheet DT01 of the approved plan set.

### **230.3 CONSTRUCTION METHODS**

- Shall be performed in accordance with the latest Fountain Sanitation District standards and specifications. See detail G on sheet DT01 of the approved plan set.

### **230.4 QUALITY CONTROL**

Contractor shall coordinate with the Fountain Sanitation District and the City of Fountain Engineer for inspection of the adjustments of the sanitary sewer manhole rim. Contractor is responsible to ensure the adjusted rim meets the required standards of the Fountain Sanitation District.

### **230.5 MEASUREMENT AND PAYMENT**

Adjust Sanitary Sewer Rim that is accepted by the Engineer will be measured by each unit adjusted as required by the approved plan and/or as set forth in the Bid Proposal. This payment shall be full compensation for all materials, tools, equipment, and labor necessary to complete the work under this section in accordance with the plans and specifications.

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## **SECTION 240 SIDEWALK DRAIN / CHASE**

### **240.1 DESCRIPTION**

The work to be performed under this section shall consist of furnishing, placing and installing sidewalk drain / chase.

### **240.2 MATERIAL**

- All Material shall be provided in accordance with detail B on sheet DT01 of the approved plan set.

### **240.3 CONSTRUCTION METHODS**

- All installation shall be performed in accordance with detail B on sheet DT01 of the approved plan set.

### **240.4 QUALITY CONTROL**

Contractor shall coordinate with City of Fountain Engineer for inspection of the sidewalk drain / chase. Also, all concrete work shall be performed in accordance with section 500.

### **240.5 MEASUREMENT AND PAYMENT**

Sidewalk Drain / Chase that is accepted by the Engineer will be measured by each unit installed as required by the approved plan and/or as set forth in the Bid proposal. Payment will be made as a lump sum payment for this item of work. This payment shall be full compensation for all materials, tools, equipment, and labor necessary to complete the work under this section in accordance with the plans and specifications.

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## SECTION 300 AGGREGATE BASE COURSE

### 301 DESCRIPTION

The work to be performed under this section shall consist of furnishing, placing and compacting one or more courses of base or sub-base material to provide a firm foundation for subsequent construction.

### 302 MATERIAL

The aggregate for the base or sub-base course material shall be composed of crushed stone, crushed slag, crushed gravel, or natural gravel which conforms to the quality requirements of AASHTO M-147 (latest revision). This material shall also conform to the following gradation requirements:

% BY WEIGHT PASSING			
Sieve Size	Sub-base	Base Course	
	Class 2	Class 5	Class 6
4"	100	--	--
3"	95 - 100	--	--
1-1/2"	--	100	--
1"	--	95 - 100	--
3/4"	--	--	100
No. 4	--	30 - 70	30 - 65
No. 8	--	--	25 - 55
*No.200	3-15	3-15	3-12
Liquid Limit AASHTO T-89	35 MAX	30 MAX	30 MAX
Plasticity Index AASHTO T-90	6 MAX	6 MAX	6 MAX
* AASHTO T-11			

The aggregate shall have a Los Angeles Abrasion Test (AASHTO T-96) percentage of wear not exceeding 45% (excluding Class 2). Class 2 material shall have a minimum "R" value of (69), or a minimum CBR of (40), when tested in accordance with AASHTO T-190 or T-193, respectively. Class 5 and 6 material shall have a minimum "R" value of (77), or a minimum CBR of (60).

### **303 CONSTRUCTION METHODS**

#### **303.1 Hauling and Placing**

Care shall be exercised in the hauling and placing of base/sub-base course materials so as to avoid segregation of the coarse and fine materials. The base/sub-base course material shall be placed on the previously prepared subgrade in lifts of sufficient quantity to conform to the thickness specified on the approved plan and profile. If the required compacted depth of the base/sub-base course material exceeds eight (8) inches, it shall be constructed in two (2) or more layers of approximately equal thickness. The maximum compacted thickness of any one layer shall not exceed eight (8) inches.

For composite asphalt concrete pavement sections, the minimum base course thickness on streets and alleys shall be six (6) inches. Four (4) inches of base course may be specified, but only when overlaid by a minimum of three (3) inches of asphalt concrete. The required thickness of the base course may be reduced by increasing the amount of asphalt concrete pavement thickness at a rate of three and one-half (3-1/2) inches of aggregate base course equals one (1) inch of asphalt concrete pavement. Class 5 and 6 material shall be classified as base course. Class 2 material shall be classified as sub-base course and used only when the base course requirement is greater than six (6) inches.

All base and sub-base course material shall be mechanically compacted to a minimum of 95% of its maximum Modified Proctor dry density (AASHTO T-180, ASTM D-1557), or 100% of its maximum Standard Proctor dry density (AASHTO T-99, ASTM D-698). Water shall be uniformly applied during placement, in an amount necessary to achieve proper compaction.

#### **303.2 Surface and Thickness Tolerances**

The surface of the prepared base course material shall be free from depressions exceeding one-quarter (1/4) inch in ten (10) feet when measured with a straight edge. The surface shall be smooth and true to the established crown and grade. Any areas not complying with these tolerances shall be reworked. Blue top staking shall be required for all crowns as designated by the Engineer. The required compacted thickness shall be as specified on the construction drawings.

**304 QUALITY CONTROL****304.1 Plant Site Testing**

All samples and tests described herein shall be made in accordance with approved ASTM/AASHTO procedures. The owner/developer shall provide for all testing laboratory services in connection with tests verifying conformance of proposed materials with project requirements. The owner/developer shall also provide for testing laboratory services in connection with tests on materials after incorporation into the project, on a first time basis only. The costs of any retesting, as required, shall be borne by the Contractor. Prior to installation of base or sub-base course materials, the Contractor shall provide the Engineer with a copy of the R-value test results, gradation analysis, Atterberg Limits (LL/PI), and moisture/density curve for the proposed base or sub-base course materials. Laboratory testing should be completed on samples taken from the plant site or proposed borrow. Testing should be completed on a monthly basis during the construction season. If, in the opinion of the Engineer, the material being used on the jobsite is not at any time in conformance with approved laboratory mix designs or test reports, conformance tests shall be run. If this material does not meet the specifications, the Contractor shall pay for such testing and remedy the problem at his expense.

**304.2 Minimum Project Testing**

During placement of aggregate base and/or sub-base, testing shall be completed on a regular basis to verify specification compliance. Required laboratory testing shall be completed on samples secured from the jobsite.

1. Gradation Analysis ..... 1/4000 Tons or 1 /project site
2. Atterberg Limits (LL/PI)..... 1/4000 Tons or 1 /project site
3. Moisture/Density Curve ..... 1 /source per month
4. In-place density tests.....1/2000 Tons or 1/500 L.F. of paving  
(AASHTO T-191, 205, 238) Includes thickness measurement

### **305 MEASUREMENT AND PAYMENT**

Base/sub-base course material placed that is accepted by the Engineer will be paid under the item for the work performed and shall be considered incidental to that work. This payment shall be full compensation for all materials, tools, equipment, and labor necessary to complete the work under this section in accordance with the plans and specifications. This work shall be associated with the following pay item.

- 4" Asphalt (HMA) w/ Base Course

Base/sub-base course material placed that is accepted by the Engineer will be paid by the square yard based on 8 inch lifts. This payment shall be full compensation for all materials, tools, equipment, and labor necessary to complete the work under this section in accordance with the plans and specifications. This pay item shall also include the excavation and removal of unsuitable material and shall only be used at the discretion of the Engineer. This work shall be associated with the following pay item.

- Aggregate Base Course (8 Inch lifts).

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## SECTION 400 ASPHALT CONCRETE PAVEMENT

### 401 DESCRIPTION

Asphalt concrete pavement shall consist of asphalt cement uniformly mixed with well graded aggregate and laid upon a prepared surface, along the lines and to the thickness as shown on the approved plans.

### 402 MATERIAL

#### Asphalt Cement

The asphalt cement for the pavement mixture shall be AC-10 or AC-20 and shall conform to the requirements of AASHTO M-226 (latest revision). The asphalt cement shall be homogeneous, free from water, and show no tendency to foam when heated to three hundred forty seven degrees (347°) Fahrenheit. The spot test shall be negative for all grades when conducted with a naphthaxylene solvent containing not more than 10% xylene by volume.

Asphalt cement shall not be heated during the process of its manufacture, storage or during construction, to a temperature so as to cause the formation of carbonized particles. At no time shall the temperature of the asphalt cement be raised above three hundred seventy five degrees (375°) Fahrenheit after loading in a tank for transportation from the refinery to the purchaser.

Written certification of compliance with these specifications shall be given to the Engineer, if requested. The Engineer may, in the absence of written certification, require that samples of the asphalt cement be delivered to an approved testing laboratory to ensure compliance with these specifications.

#### Aggregate

The coarse and fine aggregates for the asphalt concrete mixture shall be graded and combined in such proportions that the resulting composite blend meets the grading requirements of the job mix formula. The following gradation table is for identification of material for bidding purposes only.

Sieve Size	Grading C % Passing	Grading CX % Passing
3/4"	100	--
1/2"	70 - 95	100
3/8"	60 - 88	74 - 95
No. 4	44 - 72	50 - 78
No. 8	30 - 58	32 - 60
No. 30	12 - 34	12 - 34
No. 200	3 - 9	3 - 9

Coarse aggregate (material retained on the No. 8 sieve) shall have a "Los Angeles Abrasion Test" (AASHTO T-96) percentage of wear not exceeding (40%). Fine aggregate (material passing the No. 8 sieve) shall have a maximum loss of 12% at five (5) cycles in a sodium sulfate solution by the "Soundness of Aggregate Test" (AASHTO T-104). The aggregate shall be free from clay balls, organic matter, or other deleterious substances. At least seventy percent of the aggregate retained on the No. 4 sieve shall have at least two (2) fractured faces.

#### **Asphalt-Aggregate Mixture (Job Mix Formula)**

The Contractor shall furnish to the Engineer, a mix design from an approved independent testing laboratory, of the proposed asphalt concrete. This job mix formula shall establish a single percentage of aggregate passing each required sieve size, a single percentage of bituminous material to be added to the aggregate, and a single temperature for the mixture at the discharge point of the plant. The job mix formula shall be determined a minimum of once per year, or when the asphalt supplier or aggregate characteristics change. **After the job mix formula has been established, all mixtures furnished for respective projects shall conform thereto within the following ranges of tolerances:**

Maximum Size.....	±0%
Passing No. 8 and larger sieves.....	±8%
No. 8 to No. 200.....	±6%
Passing No. 200 sieve.....	±3%
Asphalt Content.....	±0.5%
Discharge Mix Temperature.....	±20°F

<b>TESTING FOR STABILITY</b>		
Test	Marshall (50 blows) AASHTO T-245	Hveem AASHTO T-246
Stability/Stabilometer	2000 lbs. min.	37 min.
Swell	--	0.030 in. max.
Flow, 0.01 "	8 min. - 18 max.	--
Air Voids, Total Mix, %	3% min. - 6% max.	
Index of Retained Strength	80% min. (AASHTO T-165, T-167)	
VMA, (Gradings C)	14 min.	
VMA, (Gradings CX)	15 min.	
Minimum Asphalt Content	5.75% by weight of mixture	

When using the Hveem Mix Design Method, the optimum asphalt content (percent by weight of total mix) is determined from stability values, percent air voids, and observations of surface flushing or bleeding of specimens after compaction. The optimum asphalt content for the mix design should not exhibit moderate or heavy surface flushing, and should be the highest percentage the mix will accommodate without reducing stability or void content below minimum values.

When using the Marshall Mix Design Method, the optimum asphalt content (percent by weight of total mix) is determined as the numerical average of values which yields the maximum stability, maximum unit weight, and median of limits given for percent air voids.

### **Quality Control**

All samples and tests described herein shall be made in accordance with approved ASTM/AASHTO procedures. The City shall provide for all testing laboratory services in connection with tests verifying conformance of proposed materials with project requirements. The City shall also provide for testing laboratory services in connection with tests on materials after incorporation into the project, on a first time basis only. The costs of any retesting, as required, shall be borne by the Contractor.

#### **Minimum Project Testing:**

1. Gradation ..... 1/1000 Tons or 1/project site.
2. Asphalt Content ..... 1/1000 Tons or 1/project site.
3. In-Place Density..... 1/1000 Tons or min. 1/500 L.F. of paving.  
(including cores & comparative Lab densities)

### **403 MIXING PLANT**

The requirements of this section shall be the same as Section 401.08 "Bituminous Mixing Plant" of the Standard Specifications for Road and Bridge Construction, by the Colorado Department of Transportation, 1991 edition, or as amended. For plant inspection, the Engineer or approved laboratory shall have full right to enter at any time and conduct necessary tests to insure compliance with these specifications.

### **404 CONSTRUCTION METHODS**

#### **Hauling Equipment**

Trucks used for hauling the asphalt concrete mixture shall be equipped with tight, clean, smooth metal beds. When directed by the Engineer, the beds shall be coated with an oil or other approved material to prevent the mixture from adhering to the beds, also each load shall be covered with canvas or other suitable material of sufficient size to protect it from inclement weather conditions.

#### **Rollers**

Rollers shall be steel wheeled and/or pneumatic tire type and be in good condition, capable of reversing without backlash. They shall weigh not less than eight (8) tons. All rollers shall have a water system capable of keeping the wheels properly moistened to prevent adhesion of the mixture to the wheels.

#### **Paving Surface**

After the pavement base has been prepared, it shall be made ready for paving by clearing any loose material off as directed by the Engineer, and applying a prime coat as specified in Section 411 of these specifications. The rate of application of the prime coat shall be 0.3 gallons per square yard, or as directed by the Engineer. Edges of all contact surfaces such as curb and gutter, manholes, cross pans and other structures shall be coated with the prime coat material as described herein before paving. When more than one lift is required, a tack coat shall be used between courses of pavement in accordance with Section 412 of these specifications at the rate of 0.1 gallons per square yard, or as directed by the Engineer.

Asphalt concrete pavement shall be a minimum of two (2) inches compacted thickness and shall be laid in one (1) lift. If a thickness greater than three (3) inches is specified, separate courses shall be laid; each course shall be not less than one (1) inch compacted thickness, nor greater than three (3) inches compacted thickness.

#### 404.5 Spreading, Finishing, and Compaction

The mixture shall be laid upon the approved base surface, spread, and struck off to the grade and elevation required. Pavers shall be used to distribute the mixture over the entire surface except where hand placing is necessary.

The longitudinal and transverse joints shall be made in a careful manner, well bonded and sealed. If directed, the joints shall be coated with tack coat material.

On the areas where the use of mechanical pavers cannot be used, the mixture shall be spread, raked and luted by hand tools. When material is shoveled, it shall be deposited by turning the shovel over above the desired area. No "slinging" of the shovel will be permitted. The hand placed material shall be smoothed and left higher than the machine laid material by about 1/4 inch per inch of depth prior to rolling. If the machine laid mixture has been rolled, then the hand laid mixture shall be smoothed and left higher than the rolled pavement by about 1/4 inch per inch depth. The majority of the raker's work shall be done with a lute rather than a tined rake.

Segregation of materials shall not be permitted. If segregation occurs, the spreading operation shall be immediately suspended until the cause is determined and corrected.

Placing the mixture shall be as continuous as possible. All surface irregularities shall be adjusted by the addition or removal of mixture prior to rolling. After the mixture has been spread, struck off and surface irregularities adjusted, it shall be thoroughly and uniformly compacted by rolling.

The surface shall be rolled at a specified breakdown temperature which shall be determined by the Contractor's foreman and the Engineer at the beginning of the job. The breakdown temperature shall be such that the required density is obtained without displacement, cracking, or shoving of the mixture. The rollers shall operate at a speed slow enough to avoid displacements or "crawl" of the mixture. Any displacement shall be immediately corrected by means suitable to the Engineer.

The number, weight, and type of rollers furnished shall be sufficient to obtain the required compaction while the mixture is in a workable condition. The minimum number of rollers shall be two. Heavy equipment or rollers shall not be allowed to stand on freshly placed pavement.

Unless otherwise directed, rolling shall begin at the sides and proceed longitudinally parallel to the street centerline, each pass overlapping one-half the roller width, gradually progressing to the crown of the street. When paving adjacent to a previously placed lane, the longitudinal joint shall be rolled first followed by the regular rolling procedure.

Rolling shall be continued until all roller marks are eliminated and no further compression is possible. The minimum density of the compacted mixture shall be 95% of the maximum density required to provide laboratory compacted specimen made in the same

proportions as the job mix formula (AASHTO T-209). However, if in the opinion of the Engineer a 95% density would prove to be detrimental to the asphalt cement pavement, then a density of 93% will be allowed. Along forms, curbs, manholes, and other places not accessible to rollers, the mixture shall be thoroughly compacted with hand tampers or with mechanical tampers. The joints between these structures shall be effectively sealed.

Any mixture that becomes loose and broken, mixed with dirt, or is in any way defective shall be removed and replaced with fresh hot mixture, which shall be compacted to conform with the surrounding area.

#### **404.6 Joints**

Transverse joints shall be formed by cutting through the previously laid course to expose the full depth of the course. A coat of tack coat material shall be used on contact surfaces of all joints just before additional mixture is placed.

#### **404.7 Weather Limitations**

The placing and compacting of asphalt surfacing shall be performed only when weather conditions are suitable. Asphalt surfacing shall not be placed on surfaces which are damp or wet nor when the temperature of the surface on which the asphalt pavement is to be placed is less than 40 degrees Fahrenheit and the atmospheric temperature is less than 40 degrees Fahrenheit. The temperature of the mixture delivered to the jobsite shall not be less than 225 degrees Fahrenheit. When the atmospheric temperature is less than 50 degrees Fahrenheit, all loads shall be delivered continuously in covered vehicles.

#### **404.8 Surface and Thickness Tolerances**

The surface of the finished pavement shall be free from depressions exceeding 3/16 inch in 10 feet, when tested with a straight-edge. All depressions exceeding the specified tolerances shall be corrected by removing defective work and replacing it with new material as directed. The surface shall be smooth and true to the established crown and grade. The required compacted thickness shall be as specified on the construction drawings.

### **405 RESTRICTION OF TRAFFIC**

The Contractor shall arrange the work in such a manner as to cause a minimum of inconvenience to the traveling public and the abutting property owners. The Contractor shall submit to the Engineer a plan of this operation. In general, the Contractor shall be allowed to proceed as he proposes. However, the Engineer retains the authority to order the Contractor to schedule the proposed operation in another manner if such a change in schedule is to the benefit of the owner and beneficial to the interests of a good project. The Contractor shall provide all necessary Traffic Control in conformity with these

provisions and specifications and with the ordinances and regulations of the City of Colorado Springs, in particular to Section 22-1-315 of the City Code, "Work Zone Traffic Control". Traffic Control shall be paid for as specified in the contract documents.

#### **406 PATCHING**

Remove the backfill material to the depth and extent required in accordance with drawing nos. D-3, D-4, or D-5, whichever applies. Prepare the subsurface with the required base course and/or Portland Cement concrete subsurface in accordance with the above referenced drawings and as specified in Section 200 and 300 of the City of Colorado Springs Standard Specifications. Depths and/or thickness of base course, Portland Cement concrete and/or asphalt pavement shall be as indicated on the drawings. The asphalt pavement shall be a minimum of four (4) inches or equal to the existing pavement thickness, whichever is greater. The backfill and base coarse material shall be thoroughly compacted to the densities specified in Section 205 and 303 with a roller for large areas and smaller hand operated compactor for small patches.

Existing pavement may be rough cut initially in conjunction with trenching; however, a square even vertical cut shall be made in the existing asphalt cement pavement after placement of backfill and prior to pavement replacement. The square vertical cut shall be made at a minimum of six (6) inches back from the trench line into good pavement. Before placement of the new pavement, the cut edges shall be thoroughly cleaned and a tack coat shall be uniformly and evenly applied to vertical faces in accordance with Section 412. The patch shall be made with placement of a hot asphalt cement and aggregate mixture as described in Section 401 of the Standard Specifications for Road and Bridge Construction, latest edition, by the Colorado Department of Transportation.

In large patches or whenever possible, a self-propelled paving machine shall be used to place the mixture. In small patches, the material shall be hand placed or placed with a spreader box without separation of the mixture. The material shall be placed to the grade and thickness required to allow for compaction after rolling. The hot mix material shall be compacted using the number, weight and type of rollers required to provide 95% of the maximum density of a laboratory compacted specimen made in the same proportions as the job mix formula (AASHTO T-209). Rolling shall continue until all roller marks are eliminated and no further compression is possible in the pavement. After rolling the surface, a straight-edge or a stringline shall be used to check grade and riding quality of the patch.

## 407 RECYCLED PLANT MIX BITUMINOUS PAVEMENTS

Plant mixed bituminous pavements shall not contain more than 20% reclaimed asphalt pavement. The reclaimed asphalt pavement shall meet all the requirements for hot bituminous pavement, as contained herein.

- A. Reclaimed Asphalt Pavement (RAP) Material: The Engineer may require the contractor to maintain separate stockpiles for each type of RAP material. All processed material shall be free of foreign materials and segregation shall be minimized. The RAP material shall be processed, if needed, so that at least 95% passes through a 5/8 inch sieve. Any RAP material that cannot be readily broken down in the mixing process and/or affects the paving operation, shall be processed prior to mixing with the virgin material.
  
- B. Composition of Mixtures: Tests for cleanliness, abrasion loss, and percent of fractured faces will be made on representative samples of aggregate taken during production or from the stockpiles. Proportions of the reclaimed and virgin material shall be determined and proposed by the Contractor to meet the mix composition requirements of this Section No. 400 of the Standard Specifications. The maximum aggregate size contained in the combination of reclaimed asphalt pavement and new aggregate shall not exceed the maximum specified in the gradations presented in Section 402 of these specifications.
  1. Job-Mix Formula: See Section 402.03 of these specifications for approval of mix design. Cost for this testing shall be the responsibility of the Contractor.
  2. Uniformity: After the job-mix formula has been approved, the owner shall implement an acceptable quality control plan as detailed in Section 406 of these specifications. Deviations from the final approved design for bitumen content and gradation of aggregates shall not be greater than the tolerances listed in Section 402 of these specifications and shall be based on the extraction test.
  3. Bituminous Mixing Plant:
    - a. Batch Plant - The batch plant shall be modified to allow weighing the reclaimed asphalt pavement (RAP) material prior to incorporation into the pugmill. The cold feed bin, conveyor system and the special bin adjacent to the weigh box, if used, shall be designed to avoid segregation and stocking of the RAP material. The virgin aggregates shall be dried and heated to a suitable temperature so that on combining with the RAP material at ambient temperature the resulting mix temperature

of successive loads may be a cause for a rejection of the mix by the Engineer. The virgin aggregates shall be free of unburned fuel oil when delivered to the pugmill.

- b. Drum Mixer Plant - The drum mixer plant shall be modified to prevent direct contact of the RAP material with the burner flame and/or overheating of the RAP material in the process.

#### 408 MEASUREMENT AND PAYMENT

Asphalt concrete pavement courses measured by the square yard, will be paid for at the contract unit price per square yard. This payment shall be full compensation for all materials, tools, equipment, and labor necessary to complete the work under this section in accordance with the plans and these specifications. This pay item shall also include the excavation and the base course. The payment shall be full compensation for prime and/or tack coats applied in accordance with these specifications.

If there is no pay item for asphalt concrete pavement of the type specified it will not be measured and paid for separately but shall be included in the pay item most closely associated with the work. Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Asphalt Concrete Pavement (Grading) (Asphalt)	S.Y.
Asphalt Concrete Pavement (RAP) (Asphalt)	S.Y.
Asphalt Concrete Pavement (Patching) (Asphalt)	S.Y.

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## SECTION 410 ASPHALTIC PRIME COAT AND TACK COAT

### 411 PRIME COAT

#### Description

When indicated in Bid Proposal or the plans, all prepared or existing surfaces ready for asphaltic surfacing shall be primed with a cut-back asphaltic oil in accordance with these specifications, or as directed by the Engineer.

#### Surface Preparation

Before applying the prime coat, all loose material shall be removed from the surface as directed by the Engineer. That portion of the surface prepared for treatment shall be dry and in satisfactory condition.

#### Liquid Asphalt

The cut-back liquid asphalt shall be MC-70 and shall satisfy the requirements of ASTM 2027. MC-250 may be used under certain conditions with written permission from the Engineer.

#### Placing

The prime coat shall be placed by means of an approved pressure distributor capable of applying the prime coat uniformly to the surface to be treated in the required quantity and maintain the specified rate of the entire load regardless of changes in grade. Before application, the liquid asphalt shall be heated to the proper viscosity for spraying, however, the temperature shall not exceed 130 degrees Fahrenheit. The rate of application shall be 0.3 gallons per square yard or as directed by the Engineer. The prime coat shall not be applied when the surface is wet or when the atmospheric temperature is less than 40 degrees Fahrenheit, or when precipitation is imminent.

The prime coat shall be carefully applied. If excessive amounts of curb, sidewalks, or other structures are sprayed with liquid asphalt, they shall be cleaned as directed by the Engineer at the Contractor's expense. The prime coat shall be allowed to cure for a minimum of 24 hours prior to the paving operation. If after the curing period, the prime coat has not penetrated the base materials, and the surface must be used by traffic, a suitable blotter material shall be applied in amounts needed to absorb excess liquid asphalt. The blotter material shall be a dry, gritty sand.

## 412 TACK COAT

### Description

Existing asphalt surfaces receiving an asphalt overlay, existing vertical concrete surfaces such as curb and gutter, crosspans and manholes, or the first course of multi-course asphaltic pavement structure, shall receive a tack coat consisting of an emulsified asphalt in accordance with these specifications at the locations shown on the plans, or as directed by the Engineer.

### Surface Preparation

Before applying the tack coat, surfaces shall be thoroughly cleaned of all dirt and other debris to insure adequate bond between tack surface and asphaltic mat.

### Liquid Asphalt

The liquid asphalt used for tack coat shall be an emulsified asphalt grade CSS-1h or SS-1h and shall satisfy the requirements of ASTM 977. Other emulsified asphalts may be used upon written permission of the Engineer.

### Placing

Refer to Section 411.04. The rate of applications shall be 0.1 gallons per square yard and provide a uniform and even coating of the surface. The surface shall be allowed to cure to permit drying and setting of the tack coat prior to the paving operation.

## 413 MEASUREMENT AND PAYMENT

Payment for prime coat and/or tack coat shall be included in the unit price bid for asphaltic concrete pavement, Section 400, and shall include all materials, tools, equipment, and labor necessary to complete the work in accordance with the plans and specifications, and as directed by the Engineer.

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## SECTION 500 CONCRETE

**SCOPE:** The work under this Section includes the furnishing of all labor and materials necessary for the construction of nonreinforced concrete according to the plans and these specifications.

### 501 DESCRIPTION

Concrete shall be composed of Portland Cement, fine and coarse aggregates and water, together with any specified additives or admixtures proportioned and mixed in conformity with the following specifications.

### 502 MATERIALS

#### 502.1 Cement

Portland Cement shall conform to the specifications for Portland Cement (ASTM C-150) and specifications for air-entrained Portland Cement (ASTM C-175 or C-595) and shall be Type IIA (Air-Entraining) cement, unless sulfate conditions allow otherwise. Table 2.2.3 in Chapter 2.2 of ACI 201 presents cement recommendations for sulfate resistances. In addition to the standard chemical requirements for Portland cement in ASTM C-150, the maximum percent of alkalis shall be as specified in Table 2 of ASTM C-150 for low alkali cement. Other types of cement or admixtures are only to be used upon approval by the Engineer.

#### 502.02 Aggregate

The amounts and proportions of fine and coarse aggregates shall be such as to produce a plastic, workable mix which can be readily placed into the corners and angles of the forms and around reinforcement and other embedded fixtures without undue accumulation of water or laitance on the surface, and such that there will be no honeycombing in the structure.

Proportions of fine and coarse aggregates shall be such that the ratio of the coarse to the fine aggregate shall not be less than one (1) nor more than two (2).

If, in the judgment of the Engineer, based on laboratory tests, concrete aggregates from a given source are detrimentally reactive with alkalis in Portland Cement, they shall be used in concrete in combination with low-alkali cement only.

Concrete aggregates shall consist of sand-gravel, gravel, crushed stone, or limestone; the particles shall be clean, hard, tough, durable, of uniform quality, free of any soft, thin, or elongated pieces, disintegrated stone, dirt, organic or other injurious materials occurring either free or as a coating. All aggregate must be supplied from a source approved by the City Engineering Division. Aggregate shall be made of the following sub sections:

- A. Fine Aggregate. Fine aggregate shall conform to ASTM C-33. Fine aggregate shall consist of sand or other inert materials, or combinations thereof approved by the Engineer, and having hard, strong, durable particles, free from adherent coating. Fine aggregate shall be thoroughly washed to remove shale, coal, mica, clay, loam, alkali, organic matter or other deleterious matter.

1. Deleterious Substances. The amount of deleterious substances in the washed aggregate shall not exceed the following values:

Clay lumps & Friable Particles, % by weight	.0 MAX.
Coal & Lignite, % by weight	.0 MAX.
Friable Particles, % by weight	.0 MAX.
Sand Equivalent	5 MIN.
Fineness Modulus	.3-3.1
Sodium Sulfate Soundness, % by weight	0 MAX.

- Grading. Fine aggregate shall be regularly graded from coarse to fine in two (2) sizes and when tested by means of the U.S. Standard, sieves shall conform to the following requirements expressed as percentages by weight:

Sieve Size or Test Procedure	Percent Passing or Test Requirement *(Concrete Sand)
3/8"	100
No. 4	95-00
No. 8	80-00
No. 16	50-85
No. 30	25-60
No. 50	5-30
No. 100	0-10
No. 200	** 0-3

\*The fine aggregate shall have not more than 45% passing any sieve and retained on the next consecutive sieve.

- B. Coarse Aggregate. Gravel and crushed stone shall conform to ASTM C-33. Coarse aggregate shall consist of gravel, crushed stone, or other inert

material or combinations thereof approved by the Engineer, and having hard, strong, durable pieces free from adherent coating. Coarse aggregate shall be thoroughly washed of clay, loam, bark, sticks, alkali, organic matter, shale, coal, mica, or other deleterious material.

1. Deleterious Substances. The amount of deleterious substances shall not exceed the following values:

Clay lumps & Friable Particles, % by weight	.0 MAX
Coal & Lignites, % by weight	.5 MAX
Sum of Clay Lumps, Friable Particles and Chert, % by weight	.0 MAX
Abrasion, % by weight	0 MAX
Sodium Sulfate Soundness, % by weight	2 MAX

Wood waste is defined as all material which, after drying to constant weight, has a specific gravity less than 1.0.

2. Grading. Coarse aggregate, when tested in conformity with ASTM C-136, shall conform to one or more of the following gradings as called for elsewhere in the specifications, special provisions or on the plans.

Sieve size or Test Procedure	Percent Passing or Test Requirement		
	No. 357	No. 467	No. 57
2 1/2"	100	--	--
2"	95-100	100	--
1 1/2"	-	95-100	100
1"	35-70	--	95-100
3/4"	--	35-70	--
1/2"	10-30	--	25-60
3/8"	--	10-30	--
No. 4	0-5	0-5	0-10
No. 8	--	--	0-5
No. 200	*1.0 MAX.	*1.0 MAX.	*1.0 MAX.

\*1.5 MAX. for crusher fines

**NOTE:** Size No. 67 may also be used on a case-by-case basis when approved by the Engineer.

The above values are in percentages by weight from AASHTO M-80 No. 357 and 467.

Other gradations may be used when specified by the Engineer.

- C. Concrete Strength. Concrete made from the coarse aggregate, graded to comply with the requirements of these specifications,

combined with the specified proportions of cement and the fine aggregate proposed for use with the coarse aggregate shall develop a compressive strength at the age of 28 days of not less than 4000 psi.

- D. Water. Water used in concrete shall be potable, clean, and free from deleterious amounts of acids, alkalis, or any organic materials.

### 503 STORAGE OF MATERIALS

Cement and aggregates shall be stored in such a manner as to prevent deterioration or the intrusion of foreign material.

### 504 AIR-ENTRAINING ADMIXTURES

All air-entraining admixtures shall contain an air entraining agent conforming to ASTM C-260. The entrained air content of all concrete shall be controlled at 6% (-1+2).

### 505 CONCRETE ADMIXTURES

Calcium Chloride shall not be used as an antifreeze agent. Calcium Chloride as an accelerating agent in amounts not to exceed 1.5% by weight of cement may be used upon the approval of the Engineer.

### 506 QUALITY OF CONCRETE

<b>Specified Compressive Strength at 28 Days</b> 4000 PSI	<b>Maximum Water/Cement Ratio by Weight</b> 0.45
<b>Minimum Cement Content per Cubic Yard of Concrete</b> 564 lbs	

The proportioning of aggregate to cement shall be such as to produce a good workable mix and the slump shall be a maximum of four inches (4") as per ASTM C-143. The equipment for batching of the aggregates, cement, water, and air-entraining agent shall be such that accurate control can be held over the various constituents.

Ready-mixed concrete shall comply with ASTM C-94 for ready-mixed concrete and the following specifications:

Time of Haul: Concrete transportation in truck mixers or truck agitators shall be delivered to the site of work and completely discharged within a period of ninety

(90) minutes after the cement comes in contact with the mixing water or with the combined aggregates when the combined aggregates contain free moisture in excess of 2% by weight. If hot weather exists causing the temperature of the concrete to rise above 90 degrees Fahrenheit, then the time of haul shall be within a period of sixty (60) minutes.

**Production and Delivery:** The production and the delivery of ready-mixed concrete shall be such that placing and finishing shall be continuous in so far as the operations require.

**Testing of Concrete:** Samples for test cylinders should be taken not less than once each day or not less than each 50 cubic yards of concrete placed. This requirement applies to both reinforced and unreinforced concrete work unless otherwise directed by the Engineer. For structural elements, the Engineer may call for additional samples for strength testing.

A minimum of four cylinders shall be prepared for each sample of concrete. One cylinder shall be strength tested after 7 days of curing time. Two cylinders shall be strength tested after 28 days of curing time.

In the event, the initial 28 day cylinder should fail, the remaining two cylinders should be strength tested after 45 days of curing time.

Samples for slump and air-content testing should be taken for each truck delivery or not less than each 12 cubic yards where site batching is performed. The Engineer may vary the frequency of sampling and testing depending on site conditions.

The preparation, handling, storage and testing procedures of all samples shall be in conformance with the applicable ASTM and AASHTO standards.

## **507 MIXING AND PLACING**

### **507.1 Preparation of Equipment and Placing of Deposit**

Before any concrete is placed, all equipment for mixing and transporting the concrete shall be cleaned. All debris and ice shall be removed from the places to be occupied by the concrete. Forms shall be thoroughly oiled. Water shall be removed from the place of deposit before concrete is placed. Newly placed concrete shall be protected from any water damage. The top six (6) inches of the bedding or subgrade shall be graded and compacted to a minimum density of 90% ASTM D-1557 prior to placement of the concrete.

When concrete placed on earth surfaces is necessary, the surfaces shall be free from frost, ice, mud and water.

### **507.2 Conveying**

Concrete shall be conveyed from the mixer to the place of final deposit by methods which will prevent the separation or loss of materials. Concrete shall not be free dropped from more than four (4) feet.

Equipment for tremming, chuting, pumping, and pneumatically conveying concrete shall be of such size and design as to insure a practically continuous flow of concrete at the delivery end without separation of materials.

### **507.3 Placing**

Concrete shall be deposited as practicable in its final position to avoid segregation due to rehandling or flowing. Concrete shall be placed at such a rate that it is at all times plastic. The practice of moving concrete from one point another by the use of vibrators is expressly forbidden. Vibrators shall be used to consolidate the concrete, not to transport it. No concrete that has partially hardened or been contaminated by foreign materials shall be deposited on the job site nor shall retempered concrete be used. All concrete shall be thoroughly consolidated during placement. It shall be thoroughly worked around reinforcement and embedded fixtures and into the corners of forms.

## **508 CURING AND PROTECTING**

All concrete shall be cured for a period of seven (7) days. Concrete shall be kept moist for at least five (5) days after placement. The curing medium used shall be applied so as to prevent checking and cracking of the finish surface of the concrete immediately after the finishing operation is completed, and it shall be maintained so as to prevent loss of water from the surface and edges of the concrete for the entire duration of the curing period. The contractor shall use one of the following methods:

### **508.1 Burlap or Mat Curing**

Cotton mats or burlap shall be kept continuously (not periodically) moist for the duration of the curing period. After the forms are removed, the cotton mats or burlap shall be folded down over the back of the curb to subgrade. All mats or burlap covering material shall be approved by the City Engineering Division.

### **508.2 Wetted Earth Curing**

The entire surface of the concrete will be covered with earth not less than one and one-half inches (1-1/2") in depth. The earth covering shall be thoroughly

wetted while it is being placed on and against the sides of the placed concrete and kept completely and continuously saturated for three (3) days and left saturated at the beginning of the fourth day. If the earth covering becomes displaced during the curing period, it shall be replaced to the original depth and saturated. Clean, loose straw or hay at the rate of three (3) pounds to the square yard may be substituted for the earth material saturated under the same requirements.

### **508.3 Curing Compounds**

If curing compounds are used, they shall be thoroughly agitated during use and shall be uniformly sprayed in a single coat. Application shall be on all concrete surfaces at a rate not to exceed 150 square feet per gallon in place. Application shall be made as soon as all surface water sheen has disappeared from the concrete surface. If concrete surfaces become partially dry, they shall be thoroughly moistened with water immediately prior to the application of the compound. If in the opinion of the Engineer pinholes exist, a second coat shall be immediately applied at right angles to the first in the affected area. Under no circumstances shall curing compound be used on surfaces to which new concrete is to be bonded. All curing compounds shall conform to ASTM C-309.

If, at any time during the curing period any of the forms are removed, a coat of curing compound shall be applied immediately to the exposed surface.

### **508.4 Protection in Cold and Freezing Weather**

In cold weather concrete shall be mixed and placed only when the ambient temperature is at least forty degrees (40) Fahrenheit, in the shade and rising. For ambient temperatures below 40 degrees, permission from the City Engineering Division must be obtained prior to placing of concrete.

In freezing weather, suitable means shall be provided for mixing and maintaining concrete at a temperature of at least fifty degrees (50) Fahrenheit, for seven (7) days after placing. Adequate equipment shall be provided for heating the concrete materials and protecting the concrete during freezing or near freezing weather. Under no circumstances shall frozen materials or materials containing ice be used for the preparation of concrete. Salt, chemicals or other foreign materials shall not be mixed with the concrete for the purpose of preventing freezing. All materials, reinforcement, forms, fillers, and ground with which the concrete is to come in contact shall be free from frost.

The housing, covering, or other protection used in connection with curing shall remain in place and intact for at least forty-eight (48) hours after the artificial heating is discontinued.

### **508.5 Protection in Hot Weather**

In hot weather the Contractor may use shaved ice in the mixing water to reduce the temperature of the concrete at the mixer, but there shall be no ice in the concrete when it is discharged from the mixer. Concrete temperature shall be placed at 50 degrees - 90 degrees Fahrenheit. All concrete deposited in hot weather shall have the proper temperature control so that there will be no difficulty from loss of slump, flash set, or cold joints.

## **509 CONCRETE CONSTRUCTION FLATWORK: SEE DETAILS**

### **509.1 General**

This section of the specification provides for the operations and construction of concrete combination curbs and gutters, valley gutters, crossspans, driveway approaches, and sidewalks to be constructed within street right-of-way except for patterned concrete median, refer to detail D-24.

No concrete shall be placed adjacent to concrete that has taken its initial set unless the specified expansion joint is provided.

The contractor shall mark in every fifty (50) lineal feet of sidewalk and curb & gutter, and in every crossspan, valley gutter and driveway, by stamping his name and the year of construction. The stamped letters shall be one (1) inch high and one-fourth (1/4) inch deep.

### **509.2 Combination Curbs and Gutters**

Maximum slump 4", minimum 6 sacks cement, 4000 psi at 28 days compressive strength.

- A. Materials. Concrete for construction of combination curbs and gutters shall be as specified previously in Sections 502 through 507.
- B. Expansion Joint Materials. Expansion joints a maximum of every 50 feet shall be constructed with preformed expansion joint filler, conforming to Federal Specifications MR-F-341 or wood board conforming to AASHTO Designation M-90 and placed at curb returns, against fixed objects, at points of sharp radius and between adjacent sidewalk and curb at all curb returns.
- C. Joint Sealing. Materials for sealing and for filling all joints and for filling premolded expansion joints shall be rubber asphalt type joint seal. Sealing material shall be applied in strict accordance with the manufacturer's directions. All expansion joints shall be sealed.

- D. Contraction Joints. Contraction joints shall be installed every ten feet (10') and shall be made by insertion of a one-eighth inch (1/8") thick steel template at right angles to the curb and 1-1/2" deep into the concrete.
- E. Forms. Forms may be of metal or seasoned shiplap lumber of a depth equivalent to that of the work prescribed.

Forms for concrete shall be used for all vertical surfaces, mortar type, true to required lines and grades, and of sufficient strength to maintain shape during the placing of the concrete and the mechanical finishing without springing or settling. Wood forms shall be two inch (2") (nominal) surfaced plant; metal forms shall be approved section and shall have a flat surface on the top of not less than one and three-quarter inches (1-3/4"). Forms shall be thoroughly cleaned of all dirt, mortar, and foreign matter before being used. Unit lengths of forms shall be jointed in advance of the point of placing concrete. Flexible, curved, or wood forms of the proper radii shall be used for curbs having a radius of less than two hundred feet (200'). All forms shall have dimensions of the City of Colorado Springs specified curb and gutter sections.

Forms shall be equipped with not less than three (3) staking points per each ten feet (10') of length with means for securely locking the form to each stake. Flange braces and staking pockets shall extend outward on the base not less than two-thirds (2/3) of the height of the form.

Forms that are bent, twisted, warped, broken, or forms that have battered or splintered top faces shall be removed from the job. Repaired forms shall not be used until they have been inspected and approved by the Engineer. The top and face of a form shall not vary from a true plane by more than one-fourth inch (1/4") in ten feet (10').

The building of pedestals of earth or other materials upon which to rest the forms in order to bring them to the grade will not be permitted. Sufficient forms shall be provided so that they may remain in place 12 hours or more after the concrete has been placed before it is necessary to move and reuse them. Forms shall be cleaned and oiled before concrete is placed against them. The alignment and grade of forms shall be checked and approved immediately before placing the concrete.

Forms which show a variation exceeding the surface test required shall be reset or removed as directed.

- F. Removal of Forms. Forms shall be removed within twenty-four (24) hours after the placement of concrete. After the forms have been removed, no honeycomb or minor defects will be acceptable by the Engineer, unless acceptable repairs are made.

- G. Preparation of Subgrade. Where soils are encountered with R less than 32, CBR less than 15, the soils engineer will make a determination of the requirement for base course under curb and gutter based upon recommendations contained in the soils report. Select base course material and/or subgrade shall be compacted to not less than:
1. For cohesive soils, 90% of Modified Proctor at  $\pm 2\%$ , of optimum moisture content or 95% Standard Proctor at  $\pm 2\%$ , of optimum moisture content.
  2. For noncohesive soils, 92% Modified Proctor at  $\pm 2\%$  of optimum moisture content or 97% Standard Proctor at  $\pm 2\%$  of optimum moisture content.
  3. For expansive soils, 88% Modified Proctor at 3% above optimum moisture content or 93% Standard Proctor at 1% above optimum moisture content.

- H. Placement and Finish. After placement in the forms, the concrete shall be thoroughly spaded or mechanically vibrated so that there will be no air spaces in the mass. The combination curb and gutter shall be brought to proper surface by running a straight-edge over the steel templates with a sawing motion, so as to fill all holes and depressions. Immediately after using the straight-edge, the surface shall be floated with a wood float, trowel led with a steel trowel, and edged with an approved edger. Finishing with a steel trowel shall be accomplished without adding water to the surface. Excessive water, laitance or other inert material shall be floated from the surface.

Just before the concrete takes its initial set, the surface shall be brushed with a soft bristle brush so as to remove all trowel marks and leave a uniform appearance. Brushing shall be at right angles to the curb line. No more concrete shall be poured in one day than can be finished before dark, the same day. No concrete that has begun to set shall be deposited in the forms.

No concrete shall be placed if there is not enough to completely fill one complete ten foot (10') curb and gutter section. No concrete shall be deposited adjacent to concrete that has already taken its initial set (90 minutes or older), unless the specified expansion joint is provided.

- I. Finished Work. The work shall be performed in a manner which results in a curb and gutter constructed to specified line and grade and uniform in appearance and structurally sound. Curbs found with unsightly bulges, ridges, low spots in the gutter or other defects shall be removed and replaced at the Contractor's expense. When checked with a ten foot (10') straightedge, grade shall not deviate more than one fourth ( $1/4$ " ) inch and alignment shall not vary more than three eighths ( $3/8$ " ) inch.

- J. Curing and Protection. The concrete shall be protected and cured as specified previously in Section 508.
- K. Backfill. Immediately after the curb and gutter have been properly cured, backfill shall be placed and compacted against the back of the curb to the satisfaction of the Engineer, to prevent any movement of the curb and/or gutter during the placing of the street pavement. Placement of asphalt paving shall be no sooner than seven (7) days after placing of concrete except when the threat of erosive rains exists.
- L. Measurement and Payment. Shall be paid for at the contract unit price. This item includes all materials such as concrete, forming and form removal, finishing and curing of concrete, grading, compaction and any other work items required by the plans and specifications.

### **509.3 Sidewalk and Pedestrian Ramps**

- A. General. Sidewalks shall be four inches (4") in thickness and a minimum four feet (4') in width. Pedestrian ramps shall be six inches (6") in thickness. Sidewalks shall have a minimum thickness of six inches (6") residential and eight inches (8") commercial for the full width of all driveway approaches. Sidewalks shall have a minimum slope of one quarter inch (1/4") per foot toward the top of the curb. Maximum slump 4", minimum 6 sacks cement, 4000 psi at 28 days compressive strength.

Concrete for construction of sidewalks and pedestrian ramps shall be as specified previously in Sections 502 through 507, with the exception that the maximum size for aggregate shall be three-quarter inch (3/4") rock. (ASTM C-33, Size No. 67)

- B. Preparation of Sub Grade. Before the placement of concrete, the area under the section shall be graded and compacted to not less than:
  - 1. For cohesive soils, 90% of Modified Proctor at  $\pm 2\%$ , of optimum moisture content or 95% Standard Proctor at  $\pm 2\%$ , of optimum moisture content.
  - 2. For noncohesive soils, 92% Modified Proctor at  $\pm 2\%$  of optimum moisture content or 97% Standard Proctor at  $\pm 2\%$  of optimum moisture content.
  - 3. For expansive soils, 88% Modified Proctor at 3% above optimum moisture content or 93% Standard Proctor at 1% above optimum moisture content.

Sub grade shall be compacted to not less than as stated in (2) above.

The sub grade and/or base course shall be lightly moistened immediately before the placement of concrete.

- C. Expansion Joints. Expansion joints shall be one-half (1/2") inch premolded and joints shall be placed where sidewalks end at curb returns, against fixed objects, at points of sharp radius, and between sidewalk and all driveway slabs. Expansion joints shall be placed a maximum of every fifty (50) feet.
- D. Contraction Joints. Contraction joints shall be installed at intervals not to exceed five feet (5') and shall be at least one and one-half (1-1/2") inch in depth.
- E. Placement and Finish. In depositing concrete against the forms, care shall be taken to work the fine portions of the aggregate surface so as to leave the surface in a uniform and smooth condition. The concrete shall be worked sufficiently to produce a dense mass. The surface shall be struck off with a straight-edge. When the concrete has set sufficiently, the surface shall first be trowelled, then broomed with a fine hair push broom at right angles to the centerline of the sidewalk. Pedestrian ramps shall be broomed with a coarse hair push broom, parallel with the scoring.
- F. Tolerance. The top face of the slab shall not vary from the true grade and alignment by more than one-fourth inch (1/4") in ten feet (10') when checked with a straight-edge. Slope of the grass portion of the parkway shall be 1/4" to 1-1/2" per foot above the top of curb. Slope of sidewalk shall be 1/4" to 1" per foot.
- G. Curing and Protection. The concrete shall be protected and cured as specified previously in Section 508.
- H. Measurement and Payment. All sidewalk and pedestrian ramps shall be measured in square feet. Payment will be based on the number of square feet constructed in place at the contract unit price per square foot, unless otherwise noted in the bid proposal.

#### **509.4 Crosspans**

- A. General. Minimum crossspan bases shall be per plan. The crossspan shall be sloped from each edge to the middle. The depth of concrete shall be eight inches (8") using 6x6-4, 4 wire welded fabric or #4 @ 18" E.W. Concrete for construction of crosspans shall be as specified previously in Sections 502 through 507. One inch (1") smooth steel dowels with sleeves or caps shall be installed at expansion joints, and when pouring half pans, spacing shall be at one foot (1') center.
- B. Preparation of Subgrade. Subgrade shall be compacted to not less than:

1. For cohesive soils, 90% of Modified Proctor at  $\pm 2\%$ , of optimum moisture content or 95% Standard Proctor at  $\pm 2\%$ , of optimum moisture content.
  2. For noncohesive soils, 92% Modified Proctor at  $\pm 2\%$  of optimum moisture content or 97% Standard Proctor at  $\pm 2\%$  of optimum moisture content.
  3. For expansive soils, 88% Modified Proctor at 3% above optimum moisture content or 93% Standard Proctor at 1% above optimum moisture content.
  4. When the temperature of the surrounding atmosphere is fifty degrees (50) Fahrenheit or above, the sub grade and/or base course shall be lightly moistened immediately before the placement of the concrete.
- C. Expansion joints Expansion joints. Expansion joints shall be one-half inch (1/2") premolded and placed completely through the section at fifty foot (50') intervals and at curb returns. One inch (1") smooth steel dowels with sleeves or caps at two (2') foot centers shall be placed in the joint.
- D. Placement and Finish. The concrete shall be placed in the forms and thoroughly spaded or mechanically tamped so that there will be no air spaces in the mass. Crossspans shall be brought to proper surface by wood floating so as to fill all holes and depressions. Just before the concrete takes its initial set, the surface shall be brushed with a soft bristle brush, so as to remove all trowel marks and to leave a uniform appearance. Brushing shall be parallel to the center line of the crossspan.
- E. Curing and Protection. The concrete shall be protected and cured as specified previously in Section 508.
- F. Measurement and Payment. Shall be paid for at the contract unit price for each lineal foot actually installed. Each gutter apron with monolithic curb radius shall be paid for separately. This item includes forming and form removal, purchase and placement of concrete, finishing and curing of concrete, grading, compaction, and any other work items required by the plans and specifications.

### **509.5 Driveway Approaches**

- A. General. Driveway approaches shall be of two (2) types:
1. Type D-16A. Type A shall be constructed from cuts in eight inch (8") vertical curb. The curb head shall be transitioned from eight inches (8") to one and a half inches (1-1/2") at a distance of four feet (4'). The sidewalk is attached and four feet (4') wide. (See Details)
  2. Type D-16B. Type B is the same as Type A, except the sidewalk is detached and four feet (4') wide. (See Details)

Concrete for construction of drive approaches shall be as specified previously in Sections 502 through 507. Depth of concrete shall be six (6") inches, except for commercial driveways in which case the depth shall be eight inches (8") minimum.

- B. Expansion Joints. Shall be one-half inch (1/2") premolded and joints shall be placed between drive approaches and either existing sidewalk or driveway beyond the property line. P
- C. Preparation of Sub Grade. Sub grade shall be compacted to not less than:
  - 1. For cohesive soils, 90% of Modified Proctor at +2%, of optimum moisture content or 95% Standard Proctor at +2%, of optimum moisture content.
  - 2. For noncohesive soils, 92% Modified Proctor at +2% of optimum moisture content or 97% Standard Proctor at +2% of optimum moisture content.
  - 3. For expansive soils, 88% Modified Proctor at 3% above optimum moisture content or 93% Standard Proctor at 1% above optimum moisture content.

When the temperature of the surrounding atmosphere is fifty degrees (50) Fahrenheit or above, the sub grade and/or base course shall be lightly moistened immediately before the placement of the concrete.

- D. Placement and Finish. The concrete shall be placed in the forms and thoroughly spaded so that there will be no air spaces in the mass. The drive approaches shall be brought to proper surface by running a straightedge over the forms with a sawing motion so as to fill all holes and depressions. Immediately after using the straight-edge, the surface shall be floated with a wood float. Just before the concrete takes its initial set, the surface shall be brushed with a soft bristle brush so as to remove all trowel marks and leave a uniform appearance. Brushing shall be at right angles to the curb line. No more concrete shall be poured in one day than can be finished before dark the same day. No concrete that has begun to set shall be deposited in the forms.
- E. Curing and Protection. The concrete shall be protected and cured as specified previously in Section 508.
- F. Measurement and Payment. Driveway Approaches shall be paid for at the contract unit price for each square yard actually installed. This item includes forming and form removal, purchase and placement of concrete, finishing and curing of concrete, grading, compaction, and any other work items required by the plans and specifications.

**509.6 Concrete Roof Drain Pan**

- A. General. Concrete Roof Drain Pan shall be constructed as per the crossspan section 509.4 requirements.
- B. Measurement and Payment. Shall be paid for at the contract unit price for each unit actually installed. Each gutter apron with monolithic curb radius shall be paid for separately. This item includes forming and form removal, purchase and placement of concrete, finishing and curing of concrete, grading, compaction, and any other work items required by the plans and specifications.

**509.7 Saw cut Concrete Pavement**

- A. General. Contractor shall perform saw cutting of existing concrete pavement or asphalt pavement as shown on the approved plans. The contractor shall complete saw cut operations to a depth to allow for the satisfactory removal of pavement surfaces. Satisfactory means the saw cut shall extend into the sub-base, beyond the existing pavement surface, to allow for a clean removal of the existing pavement.
- B. Measurement and Payment. Shall be paid for at the contract unit price for each lineal foot actually installed. This item all equipment, material, labor, all permitting and traffic control requirements to perform this work in accordance with the plans and specifications.

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## SECTION 800 WORK ZONE TRAFFIC CONTROL

### 801 GENERAL

Traffic control shall conform to the ordinances and regulations of the City of Colorado Springs and in particular to Section 22-1-315 of the City Code, "Work Zone Traffic Control".

Construction signing and marking shall conform to the Manual of Uniform Traffic Control Devices for Streets and Highways, U.S. Department of Transportation, latest edition and revisions thereto, City of Colorado Springs Supplement to MUTCD for Traffic Control for Street Construction Utility Work and Maintenance Operations and the State of Colorado Department of Highways Standard Specifications for Road and Bridge Construction (latest edition), Section 614, "Traffic Control Devices", and Section 713, "Traffic Control Materials".

### 802 SCOPE

This work shall consist of furnishing and maintaining in place all barricades, warning signs, lights, and other safety devices required to protect the work, divert traffic, and warn pedestrians of open excavations, unfilled trenches, and other areas or conditions which might be hazardous or dangerous during daylight or darkness.

Detours shall be maintained throughout the period of construction in such a manner as to provide the least amount of disruption to normal traffic flow.

The Contractor shall strictly adhere to all time limits and other restrictions.

### 803 MATERIALS

All Traffic Control Devices shall conform to Section 614, "Traffic Control Devices", and Section 713, "Traffic Control Materials", of the State of Colorado Department of Highways Standard Specification for Road and Bridge Construction (latest edition), unless variations are authorized by the City.

#### 803.1 Reflective Sheeting

All signs, barricades, and cones shall be reflectorized as required by the Manual on Uniform Traffic Control Devices.

- A. The type of reflective sheeting shall comply with the following minimum requirements:
  1. On low speed streets with posted speed limits of 40 M.P.H. or lower, smooth surface enclosed lens Type II retroreflective sheeting

- shall be used.
2. On high speed streets with posted speed limits over 40 M.P.H, high performance bead- encapsulated or microprisms Type IIA and Type III retroreflective sheeting shall be used.
- B. In no case shall sheeting with a specific brightness value fall below the original requirement. Any sign, barricade, cone, etc. on which the reflective sheeting falls below the requirement shall be replaced at the Contractor's expense.

## **804 CONSTRUCTION STAGING**

The Engineer shall coordinate with the City Traffic Engineering Division to determine the site-specific staging and/or phasing requirements. The Contractor shall schedule the work in such a manner as to comply with the staging and/or phasing requirements contained in the contract documents.

## **805 CONSTRUCTION REQUIREMENTS**

### **805.1 General**

The Contractor shall maintain a twenty-four (24) hour, seven (7) days a week (including weekends and holidays) emergency service to remove, install, relocate, and maintain warning devices. The Contractor shall furnish to the City the name and telephone number of the Traffic Control Supervisor responsible for emergency service.

In the event the Traffic Control Supervisor does not respond within two (2) hours, or the City deems it necessary to call out other forces to accomplish emergency services, the Contractor will be held responsible for the cost of such emergency services, without reimbursement.

### **805.2 Existing Traffic Control Devices**

Prior to commencing work in the vicinity of any existing Traffic Control Devices, the Contractor shall coordinate with the City Traffic Engineering Division in the removal of devices which need to be removed or relocated to accommodate the work. The Contractor shall store all devices in a safe and secure manner throughout the period of work and assume responsibility for temporary devices if necessary.

Upon completion of the work in the vicinity of the previously removed Traffic Control Devices, the Contractor shall reinstall the devices as directed by the City Traffic Engineering Division. Any Traffic Control Devices damaged during removal, relocation storage, or reinstallation shall be repaired or replaced by the Contractor at their expense.

The removal relocations, storage, and reinstallation of existing devices shall not be paid for separately, but shall be considered as incidental to the project.

### **805.3 Traffic Control Plans**

- A. Submittal. The Contractor shall submit Traffic Control Plans in drawing form for the review and approval of the City Traffic Engineering Division. A Traffic Control Plan Submittal Form shall accompany each submittal. The Submittal Form shall be completed in its entirety (blank spaces, "same", and "ditto" shall not be accepted). The Traffic Control Supervisor shall provide a night telephone number to assure twenty-four (24) hour availability.

Traffic Control Plans for street closure and major detours of local and/or through traffic shall be submitted to the City Traffic Engineering Division at least ten (10) calendar days in advance of the closure or detouring.

Traffic Control Plans not involving closures or major detours shall be submitted a minimum of seventy-two (72) hours (three City business days) prior to implementation.

No phase of construction shall commence until the Traffic Control Plan has been approved. Approved Traffic Control Plans shall not be revised without prior approval of the City Traffic Engineering Division. Revisions shall be submitted in accordance with the above requirements.

- B. Format. Traffic Control Plans shall include detailed signing, barricading, and traffic detouring information for each phase or stage of construction including as a minimum: type and number of devices, working hours, number and location of flaggers, and time restrictions, if any.
- C. Copies of Approved Plan. Copies of the approved Traffic Control Plans shall be available on-site at all times; the Contractor shall provide copies to the Project Engineer, Traffic Engineer, and Project Inspector.

### **805.4 Traffic Control Supervisor**

- A. Qualifications. The Contractor shall designate a Traffic Control Supervisor who shall perform the Traffic Control Management and shall be responsible for maintaining all Traffic Control Devices in compliance with the approved Traffic Control Plan.

The Traffic Control Supervisor shall be either an employee of the Contractor, other than the Superintendent, or an employee of a firm which has a subcontract for the overall Traffic Control Management for the project. The Traffic Control Supervisor shall be currently certified by the

American Traffic Safety Services Association or Colorado Contractors Association as a Worksite Traffic Control Supervisor.

The name and qualifications, including a copy of the American Traffic Safety Services Association certification, of the Traffic Control Supervisor shall be submitted to the Engineer and the Engineer's approval shall be obtained prior to commencing construction. The Traffic Control Supervisor shall have an up-to-date copy of part VI of the Manual of Uniform Traffic Control Devices (and revisions thereof) and City of Colorado Springs Supplement to MUTCD for Traffic Control for Construction, Utility Work and Maintenance Operations available on-site at all times.

- B. Duties. The Traffic Control Supervisor duties shall include, but not be limited to:
1. Preparing, revising, and submitting the Traffic Control Plan as required.
  2. Direct supervision of project flaggers.
  3. Coordinating all Traffic Control operations, including those of subcontractors and suppliers.
  4. Coordinating project activities with appropriate police and fire control agencies.
  5. Maintaining a project Traffic Control diary which shall become a part of the Division's project records.
  6. Inspecting Traffic Control Devices on every calendar day that Traffic Control Devices are in use. (By the Traffic Control Supervisor or his approved representative).
  7. Insuring that Traffic Control Devices are functioning as required.
  8. Overseeing all requirements covered by the plans and specifications which contribute to the convenience, safety and orderly movement of traffic.
- C. Working Hours. The Traffic Control Supervisor shall be available on a twenty-four (24) hour per day basis. The Contractor shall make arrangements so that the Traffic Control Supervisor, or his representative as approved by the City, will be available on every working day and upon the request of the Engineer.

Should the Contractor fail to maintain the work within the specified limits, the Engineer or the City Traffic Engineering Division shall direct that all operations be suspended until the work is returned to the specified limits.

Any costs incurred by the Contractor due to such suspension shall be at the Contractor's expense and no additional compensation or time extensions shall be made therefor.

**805.5 Pedestrian Traffic Control**

Throughout construction, the Contractor shall maintain pedestrian walkways along both sides of all public streets unless otherwise approved by the City Traffic Engineering Division. Said pedestrian walkways shall be a minimum of four (4) feet wide and shall be safely delineated. Pedestrian walkways shall be surfaced in a manner approved by the Engineer and shall be safely maintained and kept clear of all debris and obstructions (including tools, equipment, and materials). Unless otherwise specified in the contract documents, pedestrian walkways shall be supplied and maintained by the Contractor at his expense.

**805.6 Access to Adjacent Properties**

The Contractor shall notify all affected residents and/or property owners a minimum of 48-hours prior to restricting normal access from public streets to adjacent properties. The Contractor shall inform each resident and/or property owner of the nature of the access restriction, the approximate duration of the restriction, and the best alternate access route for that particular property. Any closure of access to or from adjacent property shall be submitted to the Engineer and approved prior to implementation.

Any signs damaged as a result of the Contractor's work shall be repaired or replaced to the requirements of the City Traffic Engineering Division; said repair or replacement shall be at the Contractor's expense.

**806 MEASUREMENT AND PAYMENT**

Work performed under this section shall be paid for on a Lump Sum basis, with 40% due at the First Progress Payment, 30% due at the Second Progress Payment, and 30% due at the Final Progress Payment

**806.1 Incidental to Project**

When Traffic Control is not shown in the bid schedule as a separate item, the work shall not be paid for separately, but will be considered as incidental to the project.

**807 PAYMENT REDUCTION FOR NON-COMPLIANCE****807.1 Incidental to Project**

The payment shall be reduced by an amount equal to one (1) percent of the total contract amount for each day that the Contractor is not in compliance with the approved Traffic Control Plan and/or the requirements of this section.

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## **SECTION 900 CONSTRUCTION SURVEYS**

### **901 GENERAL**

The following shall pertain to all construction surveying activities associated with the project.

### **902 SCOPE**

The work consists of performing all surveys, measurements, and computations required by this specification.

### **903 EQUIPMENT AND MATERIALS**

Equipment for construction surveys shall be of a quality and condition to provide the required accuracy. The equipment shall be maintained in good working order and in proper adjustment at all times. Records of repairs, calibration tests, accuracy checks, and adjustments shall be maintained and be available for inspection by the engineer. Equipment shall be checked, tested, and adjusted as necessary in conformance with manufacturer's recommendations.

Material is field notebooks, stakes, templates, platforms, equipment, spikes, steel pins, tools, and all other items necessary to perform the work specified.

### **904 QUALITY OF WORK**

All work shall follow recognized professional practice and the standards of the industry unless otherwise specified in section 910 of this specification. The work shall be performed to the accuracy and detail appropriate for the type of job. Notes, sketches, and other data shall be complete, recorded neatly, legible, reproducible and organized to facilitate ease in review and allow reproduction of copies for job documentation. Survey equipment that requires little or no manual recording of field data shall have survey information documented as outlined in section 910 of this specification.

All computations shall be mathematically correct and shall include information to identify the bid item, date, and who performed, checked, and approved the computations. Computations shall be legible, complete, and clearly document the source of all information used including assumptions and measurements collected.

If a computer program is used to perform the computations, the contractor shall provide the engineer with the software identification, vendor's name, version number, and other pertinent data before beginning survey activities. Computer generated computations shall show all input data including values assigned and assumptions made.

The elevations of permanent and temporary bench marks shall be determined and recorded to the nearest 0.01 foot. Differential leveling and transit traverses shall be of such precision that the error of vertical closure in feet shall not exceed plus or minus 0.1 times the square root of the traverse distance in miles. Linear measurements shall be accurate to within 1 foot in 5,000 feet, unless otherwise specified in section 910 of this specification. The angular error of closure for transit traverses shall not exceed 1 minute times the square root of the number of angles turned.

The minimum requirements for placing slope stakes shall be at 100-foot stations for tangents, as little as 25 feet for sharp curves, breaks in the original ground surface and at any other intermediate stations necessary to ensure accurate location for construction layout and measurement. Slope stakes and cross sections shall be perpendicular to the centerline. Significant breaks in grade shall be determined for cross sections. Distances shall be measured horizontally and recorded to the nearest 0.1 foot. Side shots for interim construction stakes may be taken with a hand level. Unless otherwise specified in section 910 of this specification, measurements for stationing and establishing the location of structures shall be made to the nearest 0.1 foot.

Elevations for concrete work, pipes, and mechanical equipment shall be determined and recorded to the nearest 0.01 foot. Elevations for earth work shall be determined and recorded to the nearest 0.1 foot.

### **905 PRIMARY CONTROL**

The baselines and bench marks for primary control, necessary to establish lines and grades needed for construction are shown on the drawings and have been located on the job site.

These baselines and bench marks shall be used as the origin of all surveys, layouts, and measurements to establish construction lines and grades. The contractor shall take all necessary precautions to prevent the loss or damage of primary control points. Any stakes or control points lost or damaged by construction activity will be reestablished by the contractor or at contractor expense.

### **906 CONSTRUCTION SURVEYS**

Before work starts that requires contractor performed surveys, the contractor shall submit in writing for the engineer's review: the name, qualifications, and experience of the individuals to be assigned to the survey tasks.

Contractor performed surveys shall include:

- checking and any supplemental or interim staking
- performing quantity surveys, measurements, and computations for progress payment
- other surveys as described in section 910 of this

## **907 STAKING**

The construction staking required for the item shall be completed before work on any item starts. Construction staking shall be completed as follows or as otherwise specified in section 9 of this specification:

### **907.1 Clearing and Grubbing**

The boundary of the area(s) to be cleared and grubbed shall be staked or flagged at a maximum interval of 200 feet, closer if needed, to clearly mark the limits of work. When contractor staking is the basis for determining the area for final payment, all boundary stakes will be reviewed by the engineer before start of this work item.

### **907.2 Excavation and Fill**

Slope stakes shall be placed at the intersection of the specified slopes and ground line. Slope stakes and the reference stakes for slopes shall be marked with the stationing, required cut or fill, slope ratio, and horizontal distance from the centerline or other control line. The minimum requirements for placing slope stakes is outlined in section 904, Quality of work.

### **907.3 Structures**

Centerline and offset reference line stakes for location, alignment, and elevation shall be placed for all structures.

## **908 RECORDS**

All survey data shall be recorded in fully identified standard hard-bound engineering survey field notebooks with consecutively numbered pages. All field notes and printed data shall include the purpose or description of the work, the date the work was performed, weather data, sketches, and the personnel who performed and checked the work. Electronically generated survey data and computations shall be bound, page numbered, and cross referenced in a bound field notebook containing the index for all survey activities. All work shall follow recognized professional practice.

The construction survey records shall be available at all times during the progress of the work for examination and use by the engineer and when requested, copies shall be made available. The original field notebooks and other records shall be provided to and become the property of the owner before final payment and acceptance of all work.

Complete documentation of computations and supporting data for progress payments shall be submitted to the engineer with each invoice for payment as specified in section 909 of the specification.

**909 MEASUREMENT AND PAYMENT**

Work performed under this section shall be paid for on a Lump Sum basis, with 40% due at the First Progress Payment, 30% due at the Second Progress Payment, and 30% due at the Final Progress Payment.

Compensation for any item of work described in the contract, but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the item to which they are made subsidiary are identified in section 910 of this specification.

**910 ITEMS OF WORK AND CONSTRUCTION DETAILS**

Bid Item: Construction Surveys

- Before beginning work the contractor will review with the contracting officer's representative (COR) all details involved in the proposed surveys such as: personnel performing the work; special requirements for the surveys; layout surveys; and proposed line and grade of the work.
- The COR will be responsible for performing initial and final surveys for final quantity calculations.
- Copies of the survey notes shall be provided each week to the COR as layout surveys progress.
- The contractor shall be responsible for re-staking any original government layout, contractor layout, or references that are removed or destroyed.
- Documentation of surveys and computations shall be submitted to the COR.
- Measurement and Payment shall be by Method 2. Work performed under this section shall be paid for on a Lump Sum basis, with 40% due at the First Progress Payment, 30% due at the Second Progress Payment, and 30% due at the Final Progress Payment.

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## **SECTION 1000 MOBILIZATION**

### **1001 GENERAL**

Mobilization shall include obtaining all permits; moving all plant and equipment onto the site; furnishing and erecting plants, temporary buildings, and other construction facilities; implementing security requirements, all as required for the proper performance and completion of the WORK. Mobilization shall include the following principal items:

1. Moving all the CONTRACTOR's plant and equipment required for operations onto the site.
2. Providing all on-site communication facilities, including radios and cellular phones.
3. Providing on-site sanitary facilities.
4. Obtaining all required permits.
5. Having all OSHA-required notices and establishment of safety programs.
6. Having the CONTRACTOR's superintendent at the jobsite full time.
7. Submitting initial submittals.

### **1002 MEASUREMENT AND PAYMENT**

Work performed under this section shall be paid for on a Lump Sum basis, with 40% due at the First Progress Payment, 30% due at the Second Progress Payment, and 30% due at the Final Progress Payment.

The CONTRACTOR's attention is directed to the condition that no payment for Mobilization, or any part thereof, will be approved for payment under the Contract Documents until all Mobilization items listed above have been completed as specified.

As soon as practicable, after receipt of Notice to Proceed, the CONTRACTOR shall submit a breakdown showing the estimated value of each major component of Mobilization to the ENGINEER for approval. When approved by the ENGINEER, the breakdown will be the basis for initial progress payments in which Mobilization is included.

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## SECTION 1100 CLEARING AND GRUBBING

### 1101 GENERAL

#### 1101.1 Section Includes

This WORK consists of clearing, grubbing, removing, and disposing of vegetation and debris within the limits of the PROJECT site as shown on the DRAWINGS and as required by the WORK. Vegetation and objects designated to remain shall be preserved free from injury or defacement

### 1102 EXECUTION

#### 1102.1 General

OWNER will designate all trees, shrubs, plants, and other objects to remain. Any object that is designated to remain and if damaged shall be repaired or replaced as directed by OWNER, at CONTRACTOR's expense.

No material or debris shall be disposed of within the PROJECT limits. This WORK consists of clearing, grubbing, removing, and disposing of vegetation and debris within the limits of the PROJECT site as shown on the DRAWINGS and as required by the WORK. Vegetation and objects designated to remain shall be preserved free from injury or defacement

#### 1102.2 Construction

Clearing and grubbing shall extend to the toe of fill or the top of cut slopes or as designated on the DRAWINGS.

All surface objects, trees, stumps, roots, and other protruding obstructions not designated to remain shall be cleared and grubbed, including mowing, as required.

Undisturbed stumps, roots, and nonperishable solid objects located two (2) feet or more below subgrade or embankment slope may remain in place.

In areas to be rounded at the tops of backslopes, stumps shall be removed to at least two (2) feet below the surface of the final slope line.

CONTRACTOR shall scalp the areas within the excavation or embankment grading limits. Scalping shall include the removal from the ground surface of sawdust, and other vegetation matter.

Except in areas to be excavated, all holes resulting from the removal of obstructions shall be backfilled with suitable material and compacted in accordance with Section 31 23 00, Excavation and Fill.

Native boulders that are uncovered during excavation shall be returned to OWNER's stockpile location. The amount shall be reasonable and determined between OWNER and CONTRACTOR.

All cleared timber shall be removed from the PROJECT and shall become the property of CONTRACTOR.

Branches on trees or shrubs shall be removed as directed. All trimming shall be one in accordance with good tree surgery practices. Cement and aggregates shall be stored in such a manner as to prevent deterioration or the intrusion of foreign material.

### **1103 MEASUREMENT AND PAYMENT**

Measurement will be on an area basis. The work to be paid for will be the number of acres acceptably cleared and grubbed, including scalping, within the limits shown on the plans or staked by the engineer.

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## **SECTION 1200 SIGN PANEL AND POST**

### **1200.1 DESCRIPTION**

The work to be performed under this section shall consist of furnishing, placing and installing all sign panel(s) and post.

### **1200.2 MATERIAL**

- All Material shall be provided in accordance with the latest edition of the MUTCD.

### **1200.3 CONSTRUCTION METHODS**

- All installation shall be performed in accordance with the latest edition of the MUTCD.

### **1200.4 QUALITY CONTROL**

Contractor shall coordinate with City of Fountain Engineer for inspection of the signs and post. All signs and post shall meet the reflectivity and installation requirements set forth in the latest edition of the MUTCD.

### **1200.5 MEASUREMENT AND PAYMENT**

Sign Panel and Posts that is accepted by the Engineer will be measured by each unit installed as required by the approved plan and/or as set forth in the Bid proposal. Payment will be made for each this item of work. This payment shall be full compensation for all materials, tools, equipment, and labor necessary to complete the work under this section in accordance with the plans and specifications. The two items of work associated to this are:

- Sign Panel – Each
- Sign Panel and Post – Each

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## SECTION 1300 PERMEABLE PAVERS

**SCOPE:** The work under this Section includes the furnishing of all labor and materials necessary for the construction and installation of permeable pavers according to the plans and these specifications.

### 1301 GENERAL

#### 1301.1 Summary

- A. Section Includes
  - 1. Permeable interlocking concrete pavers.
  - 2. Crushed stone bedding material.
  - 3. Open-graded subbase aggregate.
  - 4. Open-graded base aggregate.
  - 5. Bedding and joint/opening filler materials.
  - 6. Edge restraints.
  - 7. [Geotextiles].
  - 8.
- B. Related Sections
  - 1. Section 300: Aggregate Base Course

#### 1301.2 References

- A. American Society for Testing and Materials (ASTM)
  - 1. C 131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
  - 2. C 136, Method for Sieve Analysis for Fine and Coarse Aggregate.
  - 3. C 140, Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
  - 4. D 448, Standard Classification for Sizes of Aggregate for Road and Bridge Construction.
  - 5. C 936, Standard Specification for Solid Interlocking Concrete Pavers.
  - 6. C 979, Specification for Pigments for Integrally Colored Concrete.

7. D 698, Test Methods for Moisture Density Relations of Soil and Soil Aggregate Mixtures Using a 5.5-lb (2.49 kg) Rammer and 12 in. (305 mm) drop.
  8. D 1557, Test Methods for Moisture Density Relations of Soil and Soil Aggregate Mixtures Using a 10-lb (4.54 kg) Rammer and 18 in. (457 mm) drop.
  9. D 2922 Standard Test Methods for Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth).
  10. D 4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
- B. Interlocking Concrete Pavement Institute (ICPI)
1. Permeable Interlocking Concrete Pavement manual.
  2. Permeable Design Pro software for hydrologic and structural design

### 1301.3 SUBMITTALS

- A. In accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.
- B. Paver manufacturer's/installation subcontractor's drawings and details: Indicate perimeter conditions, junction with other materials, expansion and control joints, paver [layout,] [patterns,] [color arrangement,] installation [and setting] details. Indicate layout, pattern and relationship of paving joints to fixtures, and project formed details.
- C. Minimum 3 lb (2 kg) samples of subbase, base and bedding aggregate materials.
- D. Sieve analysis of aggregates for subbase, base and bedding materials per ASTM C 136.
- E. Project specific or producer/manufacturer source test results for void ratio and bulk density of the base and subbase aggregates.
- F. Soils report indicating density test reports, classification, and infiltration rate measured on-site under compacted conditions, and suitability for the intended project.
- G. Erosion and sediment control plan.
- H. [Stormwater management (quality and quantity) calculations; structural analysis for vehicular applications] using ICPI Permeable Interlocking Concrete Pavements manual, Permeable Design Pro or design methods and models.
- I. Permeable concrete pavers:
  1. Paver manufacturer's catalog sheets with product specifications.
  2. [Four] representative full-size samples of each paver type, thickness, color, and finish. Submit samples indicating the range of color expected in the finished installation.
  3. Accepted samples become the standard of acceptance for the work of this Section.
  4. Laboratory test reports certifying compliance of the concrete pavers with ASTM C 936.

5. Manufacturers' material safety data sheets for the safe handling of the specified paving materials and other products specified herein.
  6. Paver manufacturer's written quality control procedures including representative samples of production record keeping that ensure conformance of paving products to the product specifications.
- J. Paver Installation Subcontractor:
1. Demonstrate that job foremen on the project have a current certificate from the Interlocking Concrete Pavement Institute Concrete Paver Installer Certification program.
  2. Job references from projects of a similar size and complexity. Provide Owner/Client/General Contractor names, postal address, phone, fax, and email address.
  3. Written Method Statement and Quality Control Plan that describes material staging and flow, paving direction and installation procedures, including representative reporting forms that ensure conformance to the project specifications.

#### 1301.4 QUALITY ASSURANCE

- A. Paver Installation Subcontractor Qualifications:
1. Utilize an installer having successfully completed concrete paver installation similar in design, material and extent indicated on this project.
  2. Utilize an installer with job foremen holding a record of completion from the Interlocking Concrete Pavement Institute PICP Installer Technician Course.
- B. Regulatory Requirements and Approvals: All installations shall meet the requirements of the City of Fountain and be approved by the City Engineer or City representative in charge.
- C. Review the manufacturers' quality control plan, paver installation subcontractor's Method Statement and Quality Control Plan with a pre-construction meeting of representatives from the manufacturer, paver installation subcontractor, general contractor, engineer and/or owner's representative.
- D. Mock-Ups:
1. Install a 10 ft x 10 ft (3 x 3 m) paver area.

*Note: Mechanized installations may require a larger mock up area. Consult with the paver installation contractor on the size of the mock up.*

2. Use this area to determine surcharge of the bedding layer, joint sizes, and lines, laying pattern, color and texture of the job.
3. This area will be used as the standard by which the work will be judged.
4. Subject to acceptance by owner, mock-up may be retained as part of finished work.

5. If mock-up is not retained, remove and properly dispose of mock-up.

### **1301.5 DELIVERY, STORAGE, AND HANDLING**

- A. General: Comply with Division 1 Product Requirement Section.
- B. Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.
- C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged container packaging with identification tags intact on each paver bundle.
  1. Coordinate delivery and paving schedule to minimize interference with normal use of buildings adjacent to paving.
  2. Deliver concrete pavers to the site in steel banded, plastic banded, or plastic wrapped cubes capable of transfer by forklift or clamp lift.
  3. Unload pavers at job site in such a manner that no damage occurs to the product or existing construction
- D. Storage and Protection: Store materials in protected area such that they are kept free from mud, dirt, and other foreign materials.

### **1301.6 ENVIRONMENTAL REQUIREMENTS**

- A. Do not install in rain or snow.
- B. Do not install frozen bedding materials.

### **1301.7 MAINTENANCE**

- A. Extra materials: Provide 20 square yards of additional pavers to the City of Fountain for storage and reference and additional material for use by owner for maintenance and repair.
- B. Pavers shall be from the same production run as installed materials.

## **1302 PRODUCTS**

### **1302.1 PAVING UNITS**

- A. Manufacturer: Pavestone Company 800-245-7283.
- B. Permeable Interlocking Concrete Paver Units:
  1. Paver Type: Owner to specify type (Eco-Enviro Stone™. Uni Eco-Stone®. InfiltraStone™) prior to Bid.
    - Material Standard: Comply with ASTM C 936.
    - Color and finish: Owner to specify color and finish prior to Bid.
    - Color Pigment Material Standard: Comply with ASTM C 979.

- Size: Minimum 3-1/8 inches thick. Owner to specify paver length and width prior to Bid.

### 1302.2 PRODUCT SUBSTITUTIONS

- Extra Paving Units: Substitutions to product specified will not be accepted after ten calendar days prior to project bid date.
- Stone Gradations: Permitted for gradations for crushed stone jointing material, base and subbase materials. Base and subbase materials shall have a minimum 0.32 void ratio. All substitutions shall be approved in writing by the project engineer.

### 1302.3 CRUSHED STONE FILLER, BEDDING, BASE AND SUBBASE

- Extra crushed stone with 90% fractured faces, LA Abrasion < 40 per ASTM C 131.
- Do not use rounded river gravel for vehicular applications.
- All stone materials shall be washed with less than 2% passing the No. 200 sieve.
- Joint/opening filler, bedding, base and subbase: conforming to ASTM D 448 gradation as shown in Tables 1, 2 and 3 below:

*Note: No. 89 or No. 9 stone may be used to fill pavers with narrow joints.*

**Table 1**

#### **ASTM No. 8 Grading Requirements Bedding and Joint/Opening Filler**

Sieve Size	Percent Passing
12.5 mm (1/2 in.)	100
9.5 mm (3/8 in.)	85 to 100
4.75 mm (No. 4)	10 to 30
2.36 mm (No. 8)	0 to 10
1.16 mm (No. 16)	0 to 5

**Table 2 ASTM No. 57 Base  
Grading Requirements**

Sieve Size	Percent Passing
37.5 mm (1 1/2 in.)	100
25 mm (1 in.)	95 to 100
12.5 mm (1/2 in.)	25 to 60
4.75 mm (No. 4)	0 to 10
2.36 mm (No. 8)	0 to 5

**Table 3**

#### **Grading Requirement for ASTM No. 2 Subbase Sieve Size Percent Passing 75 mm**

Sieve Size	Percent Passing
75 mm (3 in.)	100
63 mm (2 1/2 in.)	90 to 100
50 mm (2 in.)	35 to 70
37.5 mm (1 1/2 in.)	0 to 15

19 mm (3/4 in.) 0 to 5

#### 1302.4 ACCESSORIES

- A. Provide accessory materials as follows:
1. Edge Restraints
    - Curb edging shall be installed as specified in the approved plan set
  2. Geotextile:
    - Material Type and Description: Shall conform to AASHTO M288 Geotextiles requirements.
    - Manufacturer: Acceptable to interlocking concrete paver manufacturer.

### 1303 EXECUTION

#### 1303.1 ACCEPTABLE INSTALLERS

- A. Contractor shall supply a list of approved paver installation subcontractors..

#### 1303.2 EXAMINATION

*Note: The elevations and surface tolerance of the soil subgrade determine the final surface elevations of concrete pavers. The paver installation contractor cannot correct deficiencies in excavation and grading of the soil subgrade with additional bedding materials. Therefore, the surface elevations of the soil subgrade should be checked and accepted by the General Contractor or designated party, with written certification presented to the paver installation subcontractor prior to starting work.*

- A. Acceptance of Site Verification of Conditions:
1. General Contractor shall inspect, accept and certify in writing to the paver installation subcontractor that site conditions meet specifications for the following items prior to installation of interlocking concrete pavers.

*Note: Compaction of the soil subgrade is optional and should be determined by the project engineer. If the soil subgrade requires compaction, compact to a minimum of 95% standard Proctor density per ASTM C 698. Compacted soil density and moisture should be checked in the field with a nuclear density gauge or other test methods for compliance to specifications. Stabilization of the soil and/or base material may be necessary with weak or continually saturated soils, or when subject to high wheel loads. Compaction will reduce the permeability of soils. If soil compaction is*

*necessary, reduced infiltration may require drain pipes within the open-graded subbase to conform to local storm drainage requirements.*

- Verify that subgrade preparation, compacted density and elevations conform to specified requirements.
  - Provide written density test results for soil subgrade to the Owner, General Contractor and paver installation subcontractor.
  - Verify location, type, and elevations of edge restraints, [concrete collars around] utility structures, and drainage pipes and inlets.
2. Do not proceed with installation of bedding and interlocking concrete pavers until subgrade soil conditions are corrected by the General Contractor or designated subcontractor.

### **1303.3 PREPARATION**

- A. Verify that the soil subgrade is free from standing water.
- B. Stockpile joint/opening filler, base and subbase materials such that they are free from standing water, uniformly graded, free of any organic material or sediment, debris, and ready for placement.
- C. Edge Restraint Preparation:
  1. Install edge restraints per the drawings [at the indicated elevations].

### **1303.4 INSTALLATION**

- A. General
  1. Any excess thickness of soil applied over the excavated soil subgrade to trap sediment from adjacent construction activities shall be removed before application of the [geotextile] and subbase materials.
  2. Keep area where pavement is to be constructed free from sediment during entire job. [Geotextiles] Base and bedding materials contaminated with sediment shall be removed and replaced with clean materials.
  3. Do not damage drainpipes, overflow pipes, observation wells, or any inlets and other drainage appurtenances during installation. Report any damage immediately to the project engineer.
- B. Geotextiles
  1. Place on [bottom and] sides of soil subgrade. Secure in place to prevent wrinkling from vehicle tires and tracks.
  2. Overlap a minimum of [0.3 m (12 in.)] [0.6 m (24 in.)] in the direction of drainage.
- C. Open-graded subbase and base

*Note: Compaction of areas or sites that cannot accommodate a roller vibratory compactor may use a minimum 13,500 lbf (60 kN) vibratory plate compactor with a*

*compaction indicator. At least two passes should be made over each lift of the subbase and base aggregates.*

1. Moisten, spread and compact the No. 2 subbase in 4 to 6 in. (100 to 150 mm) lifts [without wrinkling or folding the geotextile. Place subbase to protect geotextile from wrinkling under equipment tires and tracks.]
2. For each lift, make at least two passes in the vibratory mode then at least two in the static mode with a minimum 10 t (8 T) vibratory roller until there is no visible movement of the No. 2 stone. Do not crush aggregate with the roller.
3. The surface tolerance of the compacted No. 2 subbase shall be  $\pm 2$  1/2 in. ( $\pm 65$ mm) over a 10 ft (3 m) straightedge.
4. Moisten, spread and compact the No. 57 base layer in one 4 in. (100 mm) thick lift. On this layer, make at least two passes in the vibratory mode then at least two in the static mode with a minimum 10 t (8 T) vibratory roller until there is no visible movement of the No. 57 stone. Do not crush aggregate with the roller.

*Note: At the option of the designer, this supplemental test method noted below can be used to establish a consistent methodology for in-situ density data collection of open-graded aggregate base layer (typically ASTM No. 57 stone). This test method can assist contractors in reaching adequate job site compaction and offer an additional level of confidence for the project owner and designer. This test method is appropriate for pavement subject to consistent vehicular traffic such as parking lots and roads. It is not needed for pedestrian areas and residential driveways.*

5. Use part of the compacted base area as a control strip for density testing by the selected testing Company.
  - The selected Testing Company shall supply nuclear moisture/density gauges and ancillary equipment required to conduct density and moisture content measurements for compaction of the No. 57 aggregate drainage layer. Qualified testing laboratory operators/gauges may conduct compaction testing. Each gauge operator shall be trained in the safe operation, transportation and handling of the gauge. The registered owner of the gauge shall have and maintain a valid Radioisotope License for each gauge.
  - Each gauge shall have been calibrated within the last 12 months, either by the manufacturer or other qualified agent, against certified density and moisture reference blocks. The density standard count and the moisture standard count shall be within 2 percent and 4 percent respectively, of the most recent calibration values. A certificate of calibration for each gauge shall accompany each gauge.
6. Target Density

- Determine a target density on the control strip during under the following conditions: (1) after initial placement and compaction of the base aggregate layer (2) when there is a perceptible change in the appearance or gradation of the aggregate, (3) when there is a change in the source of aggregate.
- Test field density according to ASTM D 2922 Standard Test Methods for Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (shallow Depth). Field density tests shall be performed on compacted base materials to determine within acceptable limits of a target density.

#### 7. Control Strip

- The Testing Company shall construct a control strip for the determination of a target density consisting of a single uniform lift as specified in the contract documents, but not more than 4 in. (100 mm) thick and covering approximately 600 yd<sup>2</sup> (500 m<sup>2</sup>) in area. No testing shall be performed within 10 ft (3 m) from any unrestrained outside edge of the work area. The control strip may be incorporated into the project upon acceptance of density measurements by the Testing Company.
- During construction of the control strip, the surface of the aggregate shall be visibly moist and maintained as such throughout construction and compaction.
- After initial placement of the aggregate base material, the compaction equipment shall make two passes over the entire surface of the control strip. Field densities and field moisture contents, using the backscatter/indirect method, shall be determined at five randomly selected locations at least 15 ft (5 m) apart. The dry density and moisture content shall be calculated for each of these locations and the average shall be used as initial values. The maximum compacted thickness of the aggregate base layer measured for density shall be 4 in. (100 mm).
- The compaction equipment shall then make two additional passes over the entire surface of the control strip. After compaction, three separate, random field density and moisture content determinations shall be made, using the backscatter/indirect method, and a new average dry density and moisture content shall be calculated.
- If the new average dry density exceeds the previous value by more than 1.2 pcf (20 kg/m<sup>3</sup>) then two additional passes of the equipment shall be carried out as described above. If the new average dry density does not exceed the previous value by more than 1.2 pcf (20 kg/m<sup>3</sup>), then compaction of the control strip will be considered satisfactory and complete.
- Upon satisfactory completion of the control strip, an additional seven (7) field density and moisture tests, using the backscatter/indirect method, shall be taken at random locations

and the dry density and moisture content values shall be determined. The final dry density and moisture content of the control strip shall be the average of these seven values plus the three most recent values obtained upon completion.

8. Compaction
  - Use a smooth dual or single smooth drum, minimum 10 t (8 T) vibratory roller or a minimum 13,500 lbf (60 kN), reversible vibratory plate compactor with a compaction indicator without crushing the aggregate base.
  - Compact aggregates without crushing them.
9. Test Report
  - test report shall include the following:
    - 1) Project description.
    - 2) Sketch of test area and test locations.
    - 3) Aggregate type and layer thicknesses.
    - 4) Aggregate characteristic properties: gradation, void ratio, bulk density.
    - 5) Compaction equipment type and weight.
    - 6) Static or vibratory compaction.
    - 7) Number of passes of the compaction equipment.
    - 8) Test number and location.
    - 9) Individual and average field wet density, moisture content, and dry density values determined after each compaction operation in accordance with ASTM D 2922 Standard Test Methods for Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth).
    - 10) Calculation of target density.
- D. The surface tolerance the compacted No. 57 base should not deviate more than.  $\pm 1$  in. (25 mm) over a 10 ft (3 m) straightedge.

*Note: As an alternative test method, in-place density of the base aggregate may be checked per ASTM D 4254. Compacted density should be 95% of the laboratory index density established for the base layer.*

- E. Bedding layer
  1. Moisten, spread and screed the No. 8 stone bedding material.
  2. Fill voids left by removed screed rails with No. 8 stone.
  3. The surface tolerance of the screeded No. 8 bedding layer shall be  $\pm 3/8$  in (10 mm) over a 10 ft (3 m) straightedge.
  4. Do not subject screeded bedding material to any pedestrian or vehicular traffic before paving unit installation begins.
- F. Permeable interlocking concrete pavers and joint/opening fill material
  1. Lay the paving units in the pattern(s) and joint widths shown on the drawings. Maintain straight pattern lines.
  2. Fill gaps at the edges of the paved area with cut units. Cut pavers subject to tire traffic shall be no smaller than 1/3 of a whole unit.

3. Cut pavers and place along the edges with a [double-bladed splitter or] masonry saw.
4. Fill the openings and joints with [No. 8] stone.

*Note: Some paver joint widths may be narrow and not accept most of the No. 8 stone. Use joint material that will fill joints such as washed ASTM No. 89 or No. 9 stone.*

5. Remove excess aggregate on the surface by sweeping pavers clean.
6. Compact and seat the pavers into the bedding material using a low-amplitude, 75-90 Hz plate compactor capable of at least 5,000 lbf (22 kN). This will require at least two passes with the plate compactor.
7. Do not compact within 6 ft (2 m) of the unrestrained edges of the paving units.
8. Apply additional aggregate to the openings and joints if needed, filling them completely. Remove excess aggregate by sweeping then compact the pavers. This will require at least two passes with the plate compactor.
9. All pavers within 6 ft (2 m) of the laying face must be left fully compacted at the completion of each day.
10. The final surface tolerance of compacted pavers shall not deviate more than  $\pm 3/8$  (10 mm) under a 10 ft (3 m) long straightedge.
11. The surface elevation of pavers shall be 1/8 to 1/4 in. (3 to 6 mm) above adjacent drainage inlets, concrete collars or channels.

### **1303.5 FIELD QUALITY CONTROL**

- A. After sweeping the surface clean, check final elevations for conformance to the drawings.
- B. Lippage: No greater than 1/8 in. (3 mm) difference in height between adjacent pavers.

*Note: The surface of the pavers may be 1/8 to 1/4 in. (3 to 6 mm) above the final elevations after compaction. This helps compensate for possible minor settling normal to pavements.*

- C. The surface elevation of pavers shall be 1/8 to 1/4 in. (3 to 6 mm) above adjacent drainage inlets, concrete collars or channels.
- D. Bond lines for paver courses:  $\pm 1/2$  in. ( $\pm 15$  mm) over a 50 ft (15 m) string line.

### **1303.6 PROTECTION**

- A. After work in this section is complete, the General Contractor shall be responsible for protecting work from sediment deposition and damage due to subsequent construction activity on the site.
- B. PICP installation contractor shall return to site after 6 months from the completion of the work and provide the following as required: fill paver joints with stones, replace broken or cracked pavers, and re-level settled pavers to initial elevations. Any additional work shall be considered part of original bid price and with no additional compensation.

#### **1304 MEASUREMENT AND PAYMENT**

Permeable Pavers shall be measured by the square yard, and will be paid for at the contract unit price per square yard. This payment shall be full compensation for all materials, tools, equipment, and labor necessary to complete the work under this section in accordance with the plans and these specifications. This pay item shall also include joint filler material in accordance with these specifications.