

**City of Logan Amended**

**Manual of  
STANDARD  
SPECIFICATIONS**

**ATTENTION:**

This Document only includes those sections edited by Logan City. All other sections can be found in the original version of the 2007 Edition of APWA Manual of Standard Specifications at the following link:

[http://utah.apwa.net/chapters/utah/specs/Standard  
%20Specifications/Index%20-%20Standard%](http://utah.apwa.net/chapters/utah/specs/Standard%20Specifications/Index%20-%20Standard%20Specifications)

**2007  
EDITION**

**As Published by the Utah Chapter  
of the American Public Works Association  
and the Utah Chapter of The Associated  
General Contractors of America  
and  
Amended and Edited by the City of Logan**

## **PREFACE**

This document contains amendments of the 2007 APWA Manual of Standard Specifications as decided on and approved by the City Engineer. It is not a comprehensive source of all standard specifications required by the City of Logan, but is a supplement to the existing standards as published by APWA. All construction work in the City of Logan is required to follow these modifications to the original 2007 APWA publication. Where no amendments are provided, APWA 2007 governs.

Vertical lines are drawn to the left of this document to indicate changes made to the APWA publication. Removed text has been stricken out with a line. New text and changed text appears underlined and in red if printed in color and dark grey if printed in black and white.

The table of contents includes the section number, section name, original page number of the section as found in the 2007 APWA manual (in parenthesis), and the page number of the section in this document.

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**SECTION 01 43 00 AMENDED  
QUALITY ASSURANCE**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

A. CONTRACTOR quality assurance responsibilities.

**1.2 WORKMANSHIP**

- A. Employ workers, Subcontractors and Suppliers who can produce the specified quality.
- B. Supervise and manage workmanship and site conditions so work complies with Contract Document.
- C. Comply with industry standards except where more restrictive tolerances, specified requirements, or precise workmanship is required.

**1.3 INSTALLER**

A. Qualifications: Employ installers with at least 3 years of successful installation experience on work similar to that required for Project.

B. Certificates: When required or requested by ENGINEER, submit copy of installer's certifications issued by certification agency.

**Deleted:** B. Certificates: When required or request by ENGINEER, submit copy of installer's certifications issued by certification agency.¶

C. Field Services;

- 1. Examine areas and conditions under which materials and products are to be installed.
- 2. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer.
- 3. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration and racking.
- 4. Make new finishes match adjacent or old finishes.

**1.4 MANUFACTURER**

A. Qualifications: Employ firms regularly engaged in manufacture of materials and products of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Instructions: When required in individual section, submit manufacturer's instructions in the quantity required for product data, delivery, handling, storage, assembly, installation, start-up, adjusting, balancing, and finishing as appropriate.

- 1. Should instructions conflict with Contract Documents, request clarification before proceeding.
- 2. Require compliance with instructions in full detail, including each step in sequence.

C. Certificates: When required or requested by ENGINEER, prove that manufacturer's product meets or exceeds specified requirements.

**Deleted:** C. Certificates: When required or request by ENGINEER, prove that manufacturer's product meets or exceeds specified requirements.¶

- D. Field Services: Provide qualified representative to observe field conditions, conditions of surfaces and installation, quality of workmanship and start-up of equipment. Test, adjust, and balance equipment. Make written report of observations and recommendations to ENGINEER.

### **1.5 MOCK-UPS**

- A. Erect field samples and mock-ups in location(s) acceptable to ENGINEER.
- B. Assemble and erect complete, with specified attachment and anchorage devices, flashings, seals, finishes, and similar items.

**PART 2 PRODUCTS**      **Not used**

**PART 3 EXECUTION**      **Not used**

END OF SECTION

## **SECTION 01 43 40 AMENDED RESIDENT SUPERINTENDENT**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Minimum qualifications.
- B. Duties in general.

#### **1.2 QUALIFICATIONS**

- A. Fluent in English.
- B. Completed at least three (3) projects of similar size and nature as the one specified in the Contract Documents.
- C. Capable and authorized to take prompt corrective measures to protect the environment and public health, and to protect the health and safety of workers.
- D. Authorized to approve Change Orders.

#### **1.3 DUTIES IN GENERAL**

- A. On-site Presence: Be on-site during work activity.
- B. English Proficiency: Keep a person at each work location who is fluent in English who can respond to the concerns of anybody affected by construction.
- C. Contract Documents:
  - 1. Know the content and intent of the Contract Documents.
  - 2. Keep on-site all construction Plans; Project Manual; Plans or Specifications associated with updates and Change Orders, Submittals; traffic control plans; copies of the Standard Plans and Standard Specifications.
- D. Labor: Provide adequate labor to operate construction equipment, finish concrete, perform land survey work, or to monitor or adjust traffic and pedestrian barricades.
- E. Subcontractors and Suppliers: Direct means and methods of work so their work complies with Plans and Specifications.
- F. Safety and Protection: Enforce the work site safety plan. Protect ENGINEER's personnel, the general public and the environment per state or federal Laws and Regulations.
- G. Quality Assurance: When materials and installed work require laboratory testing, verify required laboratory personnel are present to do the tests and the tests are made per industry standard.
- H. Conflicts: Notify ENGINEER of any drawing, specification, or design conflict so it can be resolved before construction is adversely affected. Recommend any desirable changes to ENGINEER.

**1.4 CONTRACTOR’S DUTIES**

- A. Empower Resident Superintendent with all necessary authority, equipment, product, labor and budget to prosecute the Work within the Contract Time.
- B. Suspend Work if Resident Superintendent is not on-site or if any of these section requirements are not being met. Contract Time shall continue to run.

C. Replace the Resident Superintendent with one acceptable to the ENGINEER or OWNER when directed by the ENGINEER or OWNER.

**Deleted:** C. Replace the Resident Superintendent with one acceptable to the ENGINEER when directed by the ENGINEER.¶

**PART 2 PRODUCTS**                      **Not Used**

**PART 3 EXECUTION**                      **Not Used**

END OF SECTION

**SECTION 01 45 00 AMENDED  
QUALITY CONTROL**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

A. CONTRACTOR quality control responsibilities.

**1.2 QUALITY ASSURANCE**

A. Employ an agency or staff to assure installed product and materials comply with Contract Documents, and to assure inspections, tests, and other services comply with industry standards.

B. Use an AMRL certified laboratory that has WAQTC certified personnel.

C. When requested by ENGINEER, provide a professional opinion from a testing agency concerning test results and quality of work covered by testing performed.

D. Do more testing, if, in ENGINEER’s opinion, work is not being adequately controlled.

**1.3 TESTING AGENCY**

Deleted: 1.4. TESTING AGENCY¶

A. Provide sufficient personnel and cooperate with ENGINEER and CONTRACTOR in performing testing service.

B. Secure samples using procedures specified in the applicable testing code.

C. Perform product testing in accordance with applicable sections of the Contract Documents.

D. Correlate tests with ENGINEER’s acceptance tests.

E. When an out-of-tolerance condition exists, perform additional control testing until tolerance is attained.

F. Report any non-compliance of materials and mixes to CONTRACTOR and ENGINEER immediately.

**1.4 SUBMITTALS – CONTRACTOR** A. Before Construction: Identify.

Deleted: 1.5. SUBMITTALS – CONTRACTOR

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1. Name, address and telephone number of testing agency.

2. Person whom agency has charged with engineering managerial responsibility.

3. Licensed professional for testing agency who is to review services.

4. Names and levels of certification and years of experience of testing agency’s laboratory and field technicians.

B. During Construction: Submit quality control test data requested by ENGINEER to demonstrate work performed complies with Contract Documents.

**1.5 SUBMITTALS – TESTING AGENCY**

Deleted: 1.6 SUBMITTALS – TESTING AGENCY

- A. During Construction: Submit field test results immediately to ENGINEER and CONTRACTOR or not later than day of test. Submit laboratory test results within 48 hours of determination.
- B. After Construction: Submit a final summary report in tabular form. Show each failed test and its corresponding passing test.
- C. Reports: Include on all reports.
  - 1. Project title, number and date.
  - 2. Date, time and location of test.
  - 3. Name and address of material Supplier.
  - 4. Identification of product being tested and type of test.
  - 5. Testing results and interpretation of results.
  - 6. Name of technician(s) who sampled and who performed test.

**1.6 LIMITS ON TESTING AGENCY** A. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.

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- B. Agency may not suspend work.
- C. Agency has no authority to determine acceptance for ENGINEER.
- D. Samples must be collected and secured only by the testing agency.

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**PART 2 PRODUCTS**

**2.1 MATERIALS**

- A. Material furnished from sources that have been found satisfactory under OWNER's or ENGINEER's normal testing and sampling procedures may be used in the Work.
- B. Materials that are supported with a Supplier's certificate of compliance may be used in the Work. Certificate must be in possession of CONTRACTOR for review by ENGINEER prior to use.

**PART 3 EXECUTION Not Used**

END OF SECTION

## SECTION 01 55 26 AMENDED TRAFFIC CONTROL

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

A. Traffic control requirements.

#### 1.2 REFERENCES

A. ASTM D 4956: Retroreflective Sheeting for Traffic Control.

B. Instructions to Flaggers. Publication of UDOT.

C. MUTCD: Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD).

#### 1.3 SUBMITTALS

A. Traffic control plan within 10 days of receiving the Notice of Intent to Award on City of Logan projects, or upon submitting application for a Work in the Right-of-Way permit.

B. Flagger or traffic control technician certificates when requested by ENGINEER.

#### 1.4 TRAFFIC CONTROL PLAN

A. Create a traffic control plan in compliance with the MUTCD. Other sources may be referenced, but in no way displace the MUTCD.

B. Include the following documentation as part of the traffic control plan.

1. Written description of phasing.
2. Drawing showing phasing (if required for clarity).
3. Drawing showing placement of traffic control devices.

C. Show how to move pedestrians through or around the Work site.

D. Show how to handle signalized intersections.

E. Meet grade, slope and protection requirement of the Americans with Disabilities Act (ADA).

#### 1.5 TRAFFIC CONTROL TECHNICIAN

A. Certified by ATSSA or AGC.FLAGGER

#### 1.6 FLAGGER

A. Certified by ATSSA, AGC or UDOT.

B. Equipment:

1. 24" x 24" "Stop/Slow" sign.
2. 6" to 8" long red wand for night flagging.
3. Light plant for night flagging.

C. Clothing:

1. Clothed; full length pants and long or short sleeved shirt.

Logan City Amendment

Updated Feb. 11, 10

**Deleted:** C. . . . Work Zone Traffic Control Guide: Publication of the UTAH LTAP Center.¶  
 D. MUTCD: Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD).

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**Deleted:** A. Traffic control plan within 10 days of receiving the Notice of Intent to Award.

**Deleted:** ¶

**Deleted:** A. Create a traffic control plan using the following resources. Resolve discrepancies between resources in descending order shown.¶  
 . . . . . 1. MUTCD.¶  
 . . . . . 2. Work Zone Traffic Control Guide.¶  
 . . . . . 3. ATSSA.

**Deleted:** ¶

2. Hard toed shoes.
3. Orange, red-orange hardhat and vest.
4. Night clothing to be reflectorized.

## PART 2 PRODUCTS

### 2.1 PAVEMENT MARKINGS, SIGNS, BARRICADES

~~A. MUTCD.~~

- B. Channelizing Devices: Crash worthy plastic cones, drums and barricades.
- C. Reflective Sheeting: ASTM D 4956.
- D. Pavement Markings: Section 32 17 23.

Deleted: A. MUTCH.

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## PART 3 EXECUTION

### 3.1 FLAGGING

- A. MUTCD.

### 3.2 TRAFFIC CONTROL DEVICES

- A. Install before work activities begin.
- B. Maintain to ensure proper, continuous function.
- C. Remove when no longer needed.

END OF SECTION

## SECTION 01 57 00 AMENDED TEMPORARY CONTROLS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Requirements for controlling surface and subsurface environmental conditions at the construction site, and related areas under the CONTRACTOR's responsibility.
- B. Requirements for removal of physical evidence of temporary controls upon completion of the Work.

#### 1.2 DESIGN

- A. Provide Professional Engineer or Professional Landscape Architect stamped design drawings and details, erosion control plan, and Storm Water Pollution Prevention Plan (SWPPP) identifying temporary controls. Deviation from the requirements in the documents provided must be approved by ENGINEER and OWNER prior to being implemented.
- B. Where and if required, the CONTRACTOR shall implement additional measures to protect the public, environment, or surrounding property, either above or below ground. Implementation shall be in accordance to established City of Logan Best Management Practices (BMPs) and Standard Details, or as required to comply with the Logan City Code and other applicable laws.
- C. Where alternative BMPs to the City of Logan BMPs and CONTRACT documents are preferred by the Contractor, the alternatives proposed must:
  - 1. Be submitted to the ENGINEER in writing, and allow at least one week for approval,
  - 2. Provide details of the BMP, identify where the BMP will be used, and quantify the unit amounts for the BMP to be used.
  - 3. Be stamped by a licensed professional engineer or professional landscape architect, and
  - 4. Include an installed unit cost for the BMP.
- D. Approval of any alternatives shall be in accordance with Section 01 24 00 VALUE ANALYSIS.

#### 1.3 FINES AND PENALTIES

- A. CONTRACTOR is responsible to install, maintain, and ensure the adequacy of the temporary controls.
- B. CONTRACTOR is solely responsible for any fines or penalties assessed under CITY, State, or Federal law for non-compliance resulting from improper maintenance of Temporary Controls, improper or lack of installation of Temporary Controls, or other negligence.

**1.4 PERMITS**

- A. Obtain all necessary permits from the required CITY, State, and Federal Agencies and pay any required fees prior to initiating any work on the site including in part:
  - 1. Notice of Intent (NOI) to construct if the site is larger than 1.0 acre from the Utah Division of Water Quality.
  - 2. Notice of Termination (NOT) to end construction if the site requires a NOI.
  - 3. Stream Alteration Permit from the State Engineers Office, Division of Water Rights if disturbing a natural water body in any way.
  - 4. Groundwater discharge permit from the Utah Division of Water Quality if groundwater is being pumped to discharge from the site.
  - 5. Construction dewatering permit from the Utah Division of Water Quality if water is being discharged from the site.
  - 6. Wetlands Mitigation Permit from the United States Army Corp of Engineers if any wetlands are on the site.
  - 7. Fire Hydrant Use Permit from the Logan City Water Department if water is used from a temporary connection or a fire hydrant for any purpose.
  - 8. For structure not in City right-of-way, obtain Grading Permit and comply with appendix J of the International Building Code.
  - 9. Any other permits that may be required by the CITY, State, or Federal agencies.
- B. Not obtaining these permits may result in fines, penalties, or criminal charges resulting from negligence.

**1.5 SUBMITTALS**

- A. Copy of all permits (1 copy of each)
- B. SWPPP (in digital .pdf format)
- C. Self inspection reports upon request of ENGINEER

**PART 2 PRODUCTS**

**2.1 MATERIALS**

A. Temporary Materials: CONTRACTOR's choice in accordance with standards and specifications. Materials used must provide the level of controls required.

Deleted: A. Temporary Materials: CONTRACTOR's choice.

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**PART 3 EXECUTION**

**3.1 NOISE CONTROL**

A. Use equipment that is equipped with noise attenuation devises. Comply with local Laws and Regulations.

B. Control construction noise from 9:30 pm to 7:00 am, Holidays, and Sundays.

Deleted: B. . Control construction noise from 9:30 pm to 7:00 am.

C. Comply with City of Logan Ordinance, Title 8.16, Sound and Vibration.

**3.2 DUST AND MUD CONTROL**

- A. Provide suitable equipment to control dust or air pollution caused by construction operations.
- B. Provide suitable mud and dirt containment, so Work site, access roadways and properties adjacent to the Work site are kept clean.

C. Comply with all requirements of the Storm Water Pollution Prevention Plan.

D. Install a tracking pad in accordance with City of Logan Standard Details as required in contract documents or as directed by ENGINEER.

E. Clean site entrance and exits regularly and daily in compliance with the erosion control plan and SWPPP, or as directed by ENGINEER.

**3.3 SURFACE WATER CONTROL**

- A. Control all on-site surface water. Provide proper drainage so flooding of the site or adjacent property does not occur.
- B. Provide and maintain ample means and devices with which to promptly remove and properly dispose of all water entering the site.
- C. Immediately prior to suspension of construction operations for any reason, provide proper and necessary drainage of Work site area.
- D. Provide berms or channels as necessary to prevent flooding or saturation of Subgrade. Promptly remove all water collecting in depressions.
- E. Dispose of water in a manner that will not cause damage to adjacent areas or facilities.

F. Install and maintain all BMPs as identified in the SWPPP and the Erosion Control Plan in the construction drawings.

G. Maintain all surface water flow paths free from obstructions and debris including materials stored on site.

H. Stabilize site at the end of construction prior to demobilization and project close out in accordance with contract drawings.

**3.4 GROUND WATER CONTROL**

A. Obtain effected property owner permission to discharge water prior to initiating work. Provide a copy of this permission, in writing, to ENGINEER.

B. Provide a dewatering system sufficient to maintain Excavations and foundations dry and free of water on a 24 hour basis.

C. Notify ENGINEER in writing, if groundwater conditions differ from conditions shown in the Bidding Documents, or in any soil test data that has been supplied.

D. Remove all dewatering facilities when no longer required.

E. Dispose of water in a manner that will not cause damage to adjacent areas or facilities.

F. Comply with SWPPP BMP's, contract documents, General Permit, and all other permit requirements.

**Deleted:** A. Provide a dewatering system sufficient to maintain Excavations and foundations dry and free of water on a 24 hour basis.

**Deleted:** ¶

**Deleted:** B. Notify ENGINEER in writing, if groundwater conditions differ from conditions shown in the Bidding Documents, or in any soil test data that has been supplied.

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**Deleted:** C. Remove all dewatering facilities when no longer required.

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**Deleted:** D. Dispose of water in a manner that will not cause damage to adjacent areas or facilities.

### 3.5 POLLUTION CONTROL

- A. Soil: Prevent contamination of soil from discharge of noxious substances (including engine oils, fuels, lubricants, etc.) during construction operations. Excavate and legally dispose of any such contaminated soil off-site, and replace with acceptable compacted fill and topsoil.
- B. Water: Prevent disposal of wastes, effluent, chemicals, or other such substances adjacent to or into streams, waterways, sanitary sewers, storm drains, or public waterways. Perform any emergency measures that may be required to contain any spillage.
- C. Air: Control atmospheric pollutants.

D. Identify with signing and other appropriate methods a storage area and containment location on site to store all fuels, chemicals, concrete wash outs, and other potential pollutants. Maintain and protect this location during construction and cleanup.

### 3.6 EROSION CONTROL

- A. Use measures such as berms, dikes, dams, sediment basins, fiber mat netting, gravel, mulches, slopes, drains and other erosion control devices or methods to prevent erosion and sedimentation.
- B. Provide construction and earthwork methods which control surface drainage from cut, fill, borrow, and waste disposal areas, to prevent erosion and sedimentation.
- C. Inspect earthwork during execution to detect any evidence of the start of erosion. Apply corrective measures as required.

D. Comply with all requirements of the SWPPP and Erosion Control Plan.

END OF SECTION

## SECTION 01 71 13 AMENDED MOBILIZATION AND DEMOBILIZATION

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

A. Mobilization and demobilization requirements.

#### 1.2 DEFINITIONS

A. Mobilization includes bringing all necessary equipment to the site to do the Work. It also includes all labor, materials, and equipment to set up temporary offices, buildings, facilities, signs, and utilities.

B. Demobilization includes removing all construction equipment and debris so site is left clean, and site stabilization and maintenance until site is fully revegetated and restored.

**Deleted:** B. Demobilization includes removing all construction equipment and debris so site is left clean.

#### 1.3 TEMPORARY FACILITIES

A. Field Office: CONTRACTOR's choice.

B. Utilities: Provide power, telephone, water, storm and sanitary facilities, and all other temporary utilities required.

C. Security and Protection: Construct and maintain temporary fencing for the protection of materials, tools, and equipment. Obtain prior approval for all fence locations.

D. Construction and Support: Set up and maintain in a neat and orderly manner temporary roads and paving, dewatering facilities, enclosures, identification signs and bulletin boards, waste disposal and temporary heat. Provide and maintain temporary all weather pedestrian walk ways and road detours.

E. Invert Cover: Install covers as shown in Standard Plans or Drawings. Installation must be tight so no debris can by-pass the cover and enter the pipes below.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

A. Temporary Materials: CONTRACTOR's choice.

## **PART 3 EXECUTION**

### **3.1 INSTALLATIONS**

- A. Relocate and modify temporary facilities as required.
- B. Install temporary utility service or connect to existing service.
- C. Locate field offices, storage sheds, sanitary facilities and other temporary construction and support facilities for easy access. Use of gasoline burning, open flame, or salamander type heating units is prohibited.
- D. Use local standards and codes for erection of adequate fences and barricades. Maintain all signing, barricades, fencing, drainage, and other items as required to protect public and private property from damage caused by construction operations.
- E. Coordinate location of storage areas to avoid interference with drainage, traffic, or private property.
- F. Provide and maintain all temporary signage required by the Work.

### **3.2 REMOVALS**

- A. Completely remove temporary materials and equipment;
  - 1. When construction needs can be met because of permanent installation.
  - 2. At completion of the Work.
- B. Clean or repair damage caused by installation or use of temporary facilities.
- C. Restore areas to original or to specified conditions at completion of the Work
- D. File Notice of Termination (NOT) (Section 01 57 00) with Utah Division of Water Quality, Department of Environmental Quality upon permanently stabilizing seventy (70) percent of the construction site. Provide a copy of the NOT to ENGINEER.

END OF SECTION

## SECTION 01 78 39 AMENDED PROJECT RECORD DOCUMENTS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

~~A. Requirements for collecting, maintaining, updating, and submitting Record Documents and As-Built Survey.~~

**Deleted:** A. Requirements for collecting, maintaining, updating, and submitting Record Documents.

#### 1.2 DEFINITIONS

A. Record Documents: Those documents maintained and annotated by CONTRACTOR during construction for the purpose of recording the "as built" condition of the Work.

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#### 1.3 CONSTRUCTION PHOTOGRAPHS

A. Provide photographs when specified in the Contract Documents starting with a series of photographs before the start of any physical construction, and continuing for as long as the Work progresses.

1. On 5 inches x 7 inches color prints or size approved by ENGINEER showing the regular progress of the Work, provide not less than 12 exposures of different subjects or angles of view each time from different locations in the Project area at intervals not exceeding one month.
2. On each print indicate the date, job title, photograph identification, and direction the camera was facing.
3. With each request for payment.
4. Upon completion of the Work, submit all negatives. ENGINEER may request an additional 10 exposures of the Work.

B. Secure ENGINEER's approval if a video tape is to be substituted for the photograph prints.

#### 1.4 DOCUMENTS ON SITE

A. Keep at job site 1 copy of each of the following, if issued for the Work.

1. Contract Drawings.
2. Project Manual.
3. Addenda.
4. Reviewed Shop Drawings, Product Data and Samples.
5. Modifications to the Contract Documents.
6. Field test records.
7. Inspection certificates.
8. Manufacturer's certificates.
9. Survey documentation.

10. Storm Water Pollution Prevention Plan.

11. Copy of all required permits and condition of permits.

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- B. Do not use Record Documents for construction purposes.
- C. Store Record Documents in a location, apart from documents used for construction.
- D. Maintain Record Documents in a clean, dry, legible condition.
- E. Provide adequate files and racks for storage of Record Documents that will allow ready access for review and updating.
- F. Make Record Documents available at all times for review and Inspection by ENGINEER.

### 1.5 MARKING DEVICES

- A. Red colored waterproof for all marking unless requested otherwise.

### 1.6 RECORDING

- A. Clearly and legibly label each document "PROJECT RECORD".
- B. Number Record Documents in a manner which will allow ready retrieval of documents and allow indexing of documents for submittal to ENGINEER.
- C. Update Record Documents as work occurs to show the current status of the Work.
- D. Do not permanently cover or conceal any work until all required information has been recorded on the Record Documents.
- E. Contract Drawings: Legibly mark contract Drawings to record following actual construction information.
  - 1. Measured depths of various elements of foundation or finish grading in relation to finish floor datum or other permanent benchmark.
  - 2. Measured horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
  - 3. Measured location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of construction.
  - 4. Field changes of dimension and detail.
  - 5. Changes made by contract Modifications.
  - 6. Details not contained in original contract Drawings.
- F. Project Manual and Addenda: Legibly update each to record:
  - 1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
  - 2. Changes made by contract Modifications.
  - 3. Other technical matters and details included in the Work, but not originally specified.
- G. Shop Drawings: Maintain reviewed Shop Drawings as Record Documents; legibly annotate drawings to record changes made to Shop Drawings.
- H. Product Data and Samples: Maintain reviewed product data and samples as Record Documents; update and document any variations from the reviewed product data and samples after acceptance.

I. As-Built Survey: Survey all key features constructed. All survey coordinates are to be in NAD 83, NAVD 88 coordinates associated with City of Logan base station. All coordinates are to be State Plane coordinates with at least two City of Logan monuments referenced. Deliver As-Built Survey in accordance with City of Logan data dictionary for ArcView shapefile(s) and in AutoCAD files(s) compatible with current City of Logan versions.

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#### 1.7 SUBMITTAL OF DOCUMENTS

- A. At the completion of the Work, submit all Record Documents.
- B. Accompany the submittal with a transmittal letter, in duplicate, containing:
  - 1. Submittal date.
  - 2. Project title and number.
  - 3. CONTRACTOR's name and address.
  - 4. Title and number of each Record Document.
  - 5. Certification that each document as submitted is complete and accurate.
  - 6. Signature of CONTRACTOR, or CONTRACTOR's authorized representative.

**PART 2 PRODUCTS      Not Used**

**PART 3 EXECUTION      Not Used**

END OF SECTION

## **SECTION 02 41 15 AMENDED PAVEMENT PULVERIZING**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Full depth reclamation.
- B. Stabilizer selection guide.

#### **1.2 REFERENCES**

- A. ASTM C 136: Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
- B. ASTM C 150: Standard Specification for Portland Cement.
- C. ASTM D 558: Standard Test Methods for Moisture-Density Relations of Soil-Cement Mixtures.
- D. ASTM C 595: Standard Specifications for Blended Hydraulic Cement.
- E. ASTM C 618: Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
- F. ASTM D 2922: Standard Test Methods for Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth).
- G. ASTM D 4318: Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- H. ASTM D 4832: Standard Test Method for Preparation and Testing of Soil-Cement Slurry Test Cylinders.

#### **1.3 SUBMITTALS**

- A. List of equipment to be used.
- B. Mix design showing percentage and quantity of stabilizer needed.
- C. Traffic control plan; Section 01 55 26.

#### **1.4 SITE CONDITIONS**

- A. Section 01 57 00; control dust.

#### **1.5 ACCEPTANCE**

- A. Gradation: Random measure.
- B. Depth: Random measure each 1,000 square yards.
- C. Density: Nuclear gage or proof roll.
- D. Quantity of stabilizer added matches submittal data.

### **PART 2 PRODUCTS**

#### **2.1 TACK COAT CURING COMPOUND**

- A. Cationic or anionic emulsified asphalt, Section 32 12 03.

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**2.2 STABILIZER**

A. Cement:

1. Type I or II, ASTM C 150, or
2. Type IP or IS; ASTM C 595.

B. Aggregate: Gravel, untreated base course, crushed Portland cement concrete.

C. Chemical Stabilizer: Use type allowed by ENGINEER.

**2.3 MIX DESIGN**

A. Gradation ASTM C 136.

<u>Sieve</u>	<u>Percent Passing by Weight</u>
3"	100
1"	85 to 95
No. 4	45 maximum

B. Stabilizer: Use the following table as a guide.

**Table 1 – Stabilizer Selection Guide**

Characteristics of Reclaimed Aggregate Before Addition of Stabilizer	Stabilizer
Asphalt binder content: greater than 15 percent.	Aggregate
More than 45 percent of material passes No. 4 sieve	Aggregate or Cement
Plasticity index (ASTM D 4318) of material passing No. 4 sieve is more than 10.	Cement or Chemical

1. Unless specified otherwise, cement stabilization per ASTM D 4832 is to be in the range of 300 to 800 psi at 7 days.

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**PART 3 EXECUTION**

**3.1 CONSTRUCTION EQUIPMENT**

A. Capable of cutting to the required depth, pulverizing, and sizing the material.

**3.2 PREPARATION**

- A. Identify location of all buried utilities.
- B. Notify neighborhood of day and time of operation.
- C. Set traffic control devices.
- D. Install invert covers.
- E. Lower Street Fixtures.
- F. Determine need for stabilizer.

**3.3 CONSTRUCTION**

- A. Pulverize full depth. Do not remove excess material until full depth pulverizing is complete.
- B. Remove excess material.
- C. Pulverize a second time if stabilizer is required.
- D. Shape, grade, roll, compact.
- E. Cure stabilized material with water or asphalt tack coat.

**3.4 FIELD QUALITY CONTROL**

- A. Reclaimed Aggregate: 95 percent minimum compaction using
  - 1. Optimum water content and maximum density, ASTM D 558, and
  - 2. Nuclear gage shallow depth, ASTM D 2922.
- B. Stabilized Reclaimed Aggregate: Proof roll (prior to cement set).

**3.5 REPAIR**

- A. Repair surface irregularities.
- B. Seal cracks in cured stabilized material.

END OF SECTION

## **SECTION 03 11 00 AMENDED CONCRETE FORMING**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Formwork for cast-in-place concrete.
- B. Openings in formwork for other affected work.
- C. Form accessories such as snap ties, bracing, etc.
- D. Stripping formwork.

#### **1.2 REFERENCES**

- A. ACI 347: Recommended Practice for Concrete Formwork.

#### **1.3 DEFINITIONS**

- A. Shoring: The activity to support formwork.
- B. Reshoring: The activity to reduce the amount of formwork supporting concrete elements. As concrete sets and strength increases, less need for formwork occurs gradually until concrete becomes free standing.

#### **1.4 SUBMITTALS**

- A. Shop Drawings: Fabrication and erection drawings of forms for specific finished concrete surfaces, as indicated. Show general construction of forms, jointing, special joints or reveals, location and pattern of form tie placement, and other items affecting exposed concrete visibility.
- B. Form Release Agent: Where concrete surfaces are scheduled to receive special finishes or applied coverings which may be affected by agent submit manufacturer's instructions for use of agent.

#### **1.5 QUALITY ASSURANCE**

- A. Designer's Qualifications: Structural professional engineer who complies with Utah licensing law, has experience in concrete formwork, and is acceptable to the authority having jurisdiction.
- B. Design Forms:
  - 1. With sufficient strength to maintain finished tolerances indicated in Section 03 35 00, to support loads, pressures, and allowable stresses as outlined in ACI 347 and for design considerations such as wind loads, allowable stresses, and other applicable requirements of local Laws and Regulations.
  - 2. To permit easy removal.
  - 3. For required finishes.
- C. The design, engineering, and construction of formwork is CONTRACTOR's responsibility.

## 1.6 JOB CONDITIONS

- A. For reference purposes, establish and maintain sufficient control points and bench marks to check tolerances. Maintain in an undisturbed condition and until final completion and acceptance of Work.
- B. Regardless of tolerances specified, allow no portion of Work to extend beyond legal boundaries.

## 1.7 FIELD SAMPLES

- A. Prepare field samples and submit per Section 01 33 00.
- B. Construct and erect sample formwork panel for architectural concrete surfaces receiving special treatment or finish as a result of formwork. Formwork to include vertical and horizontal form joints and typical rustication joints when required.
- C. Size panel to indicate special treatment or finish required, including form release agent.
- D. Remove formwork after casting concrete.

## 1.8 ACCEPTANCE

- A. Secure ENGINEER's inspection of form layout for concrete flat work.

## PART 2 PRODUCTS

### 2.1 FORM MATERIALS

- A. Faced with material which will produce smooth and uniform texture on concrete, unless indicated otherwise.
- B. Arrange facing material orderly and symmetrical, keeping number of seams to a minimum.
- C. Do not use material with raised grain, patches, or other defects which will impair texture of concrete surface.

D. User metal forms for curb and gutter work unless directed otherwise by the ENGINEER.

E. Ensure that all edge forms for sidewalk, pavements, and curb and gutters are sufficiently rigid to maintain line and grade.

### 2.2 FORMWORK ACCESSORIES

- A. Form Ties:
  - 1. Use ties constructed so that end fasteners can be removed without spalling concrete faces.
  - 2. After end fasteners of ties have been removed, embedded portion of ties are to terminate not less than 2 times the diameter or thickness of the fasteners from formed faces of concrete, but in no case greater than 3/4 inch.
  - 3. When the formed face on concrete is not exposed, form ties may be cut off flush with formed surfaces. Use ties with 3/4 inch diameter cones on both ends or an approved equal for water retaining structures.

- B. Premolded Expansion Joint Filler: Unless indicated otherwise, provide Type F1, Section 32 13 73.
- C. Form Release Agent: Colorless material which will not stain concrete, absorb moisture, impair natural bonding or color characteristics of concrete. To prevent contamination, agents used on potable water structures are subject to review by ENGINEER prior to use.
- D. Fillets for Chamfered Corners: Wood strips 1 inch x 1 inch size, maximum length possible.

## **PART 3 EXECUTION**

### **3.1 INSPECTION**

- A. Verify lines, levels, and measurements before proceeding with formwork.

### **3.2 FORM CONSTRUCTION**

- A. Make forms sufficiently tight to prevent loss of concrete.
- B. Unless indicated otherwise, place chamfer strips in corners of forms to produce beveled edges on permanently exposed exterior corners.
- C. To maintain specified finish tolerances, camber formwork to compensate for anticipated deflections.
- D. Provide positive means of adjustment using wedges, jacks, Shores, and struts to take up all settlement during concrete placing operation.
- E. Provide temporary ports in formwork to facilitate cleaning and Inspection. Locate openings at bottom of forms to allow flushing water to drain.
- F. At construction joints, overlap forms over hardened concrete at least 6 inches. Hold forms against hardened concrete to prevent offsets or loss of mortar at construction joint and to maintain true surface.
- G. Construct wood forms for wall openings to facilitate loosening, or counteract swelling.
- H. Fasten wedges used for final adjustment of forms prior to concrete placement in position after final check.
- I. Anchor formwork to Shores, supporting surfaces or members to prevent upward or lateral movement and deflection of any part of formwork system during concrete placement.
- J. Provide runways for moving equipment with struts or legs, supported directly on formwork or structural member without resting on reinforcing.
- K. Position expansion joint material and other embedded items accurately and support to prevent displacement.
- L. To prevent entry of concrete, fill voids in sleeves, inserts, and anchor slots temporarily with readily removable material.
- M. For architectural concrete, limit deflection of facing materials between studs as well as deflection of studs and walers to 0.0025 times span.

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- N. For underground concrete work, do not use soil walls for forming unless authorized by ENGINEER.

### **3.3 INSERTS, EMBEDDED PARTS, AND OPENINGS**

- A. Provide formed openings for elements embedded in or passing through concrete.
- B. Coordinate work of other sections for the forming and setting of openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.
- C. Install accessories per manufacturer's instructions. Ensure items are not disturbed during concrete placement.

### **3.4 FORM FINISHES**

- A. Use forms with smooth rubbed, scrubbed, sand floated finishes that meet ACI 347 unless indicated otherwise.
- B. For As-cast Finishes:
1. Install form panels in orderly arrangement with joints planned in approved relation to building elements.
  2. Where panel joints are recessed or otherwise emphasized, locate form ties within joints, not within panel areas.
  3. Where an as-cast finish is required, no grouting will be permitted in the finishing operation.
- C. Textured Finishes: As indicated.

### **3.5 APPLICATION OF FORM RELEASE AGENT**

- A. Apply form release agent on formwork per manufacturer's instructions. Apply prior to placing reinforcing steel, anchoring devices, and embedded items.

### **3.6 FORM REMOVAL**

- A. Do not pry against face of concrete. Use only wooden wedges.
- B. When repair of surface defects or finishing is required at an early age, remove forms as soon as concrete has hardened sufficiently to resist damage from removal operations.
- C. Remove top forms on sloping surfaces of concrete as soon as concrete has attained sufficient stiffness to prevent sagging. Perform needed repairs or treatment required on such sloping surfaces at once, followed by specified curing.
- D. Loosen wood forms for wall openings as soon as it can be accomplished without damage to concrete.
- E. Formwork for columns, walls, sides of beams, and other members not supporting the weight of concrete may be removed as soon as the concrete has hardened sufficiently to resist damage from removal.
- F. Where no Reshoring is planned, leave forms and Shoring used to support weight of concrete in beams, slabs, and other concrete members in place until concrete has attained its specified strength.

- G. Where Reshoring is planned, supporting formwork may be removed when concrete has reached 70 percent of specified strength, provided Reshoring is installed immediately.
- H. When Shores and other vertical supports are so arranged that non-load carrying, form-facing material may be removed without loosening or disturbing Shores and supports, facing material may be removed at an earlier age as directed.

### 3.7 RESHORING

- A. When Reshoring is permitted or required, plan operations in advance and obtain approval.
- B. During Reshoring do not subject concrete in beam, slab, column, or any other structural member to combined dead and construction loads and live loads in excess of loads permitted for developed concrete strength at time of Reshoring.
- C. Place Reshores as soon as practical after stripping operations are complete, but in no case later than end of working day on which stripping occurs.
- D. Tighten Reshores to carry required loads without over-stressing.
- E. Leave Reshores in place until the concrete being supported has reached its specified strength.
- F. For floors supporting Shores under newly placed concrete, level original supporting Shore or Reshore.
  - 1. Reshoring system shall have a capacity to resist anticipated loads in all cases equal to at least 1/2 the capacity of the Shoring system.
  - 2. Unless otherwise specified locate Reshores directly under a Shore.
  - 3. In multistory buildings, extend Reshoring through a sufficient number of stories to distribute the weight of newly placed concrete, forms, and construction live loads in such a manner that design loads of floors and supporting Shores are not exceeded.
- G. Design, engineering, and construction of Shoring and Reshoring is the responsibility of the CONTRACTOR.

### 3.8 REMOVAL STRENGTH

- A. When removal of formwork or Reshoring is based on concrete reaching a specified strength, it shall be assumed that concrete has reached this strength when either of the following conditions has been met:
  - 1. When test cylinders, field cured along with the concrete they represent, have reached the specified strength.
  - 2. When concrete has been cured per Section 03 39 00 for the same length of time as the site-cured cylinders that reached specified strength. Determine the length of time the concrete has been cured in the structure by cumulative number of days or fractions thereof, not necessarily consecutive, during which the air temperature is above 50 deg. F. and concrete has been damp or sealed from evaporation and loss of moisture.

**3.9 REUSE OF FORMS**

- A. Do not reuse forms if there is any evidence of surface wear or defect which would impair quality of concrete surface.
- B. Thoroughly clean and properly coat forms before reuse.

**3.10 FIELD QUALITY CONTROL**

- A. Before commencing a pour, verify connections, form alignment, ties, inserts and Shoring are placed and secure.
- B. Observe formwork continuously while concrete is being placed to verify that the forms are plumb and there are no deviations from desired elevation, alignment, or camber.
- C. If during construction any weakness develops and false-work shows undue settlement or discoloration, stop work, remove affected construction if permanently damaged, and strengthen false-work.

END OF SECTION

## **SECTION 03 30 10 AMENDED CONCRETE PLACEMENT**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Concrete placement for slabs on grade, slabs on fill, structural building frame, and other concrete components.

#### **1.2 REFERENCES**

- A. ACI 301: Specifications for Structural Concrete for Buildings.
- B. ACI 305: Hot Weather Concreting.
- C. ACI 306: Cold Weather Concreting.
- D. ACI 309: Standard Practice for Consolidation of Concrete.
- E. ASTM C 881: Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
- F. ASTM C 1059: Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.

#### **1.3 SUBMITTALS**

- A. Batch Delivery Ticket: For each batch delivered to site, identify.
  - 1. Date and Project description.
  - 2. Producer and plant.
  - 3. Name of contractor.
  - 4. Serial number of ticket.
  - 5. Mix identification.
  - 6. Truck number and time dispatched.
  - 7. Volume of concrete.
  - 8. Type and amount of cement.
  - 9. Total water and water/cement ratio.
  - 10. Water added for receiver of concrete and receiver's initials.
  - 11. Admixture types.
  - 12. Separate weights of fine and coarse aggregate.
  - 13. Statement of whether batch is pre-mixed at plant or mixed in transit.
- B. Record of Placed Concrete: Identify record date, location of pour, quantity, air temperature, and CONTRACTOR's quality control test samples taken.
- C. Bonding Compound: Identify product name, type, and chemical analysis.

#### **1.4 QUALITY ASSURANCE**

- A. Provide ACI certified finishers.

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- B. Remove and replace any placed concrete suffering hot or cold weather damage.
- C. For control testing follow Section 03 30 05 requirements.

## 1.5 ACCEPTANCE

### A General:

1. Price adjustment, Section 01 29 00. CONTRACTOR may request ENGINEER determine appropriate Modifications or payment adjustments to correct Defective Work.
  2. Dispute resolution, Section 01 35 10 and Section 03 30 05.
- B. Concrete work that fails to meet any of the following requirements will be considered defective. Replace any Defective Work at no additional cost to the OWNER.
1. Placement:
    - a. Reinforcing steel size, quantity, strength, position, damage, or arrangement is not as specified or does not comply with code.
    - b. Formwork differs from required dimensions or location in such a manner as to reduce concrete's strength or load carrying capacity or physical esthetics.
    - c. Workmanship likely to result in deficient strength.
  2. Finishing:
    - a. Concrete exposed to view has defects that adversely affect appearance.
    - b. Slab tolerances of Section 03 35 00 are not met.
  3. Protection:
    - a. Method of curing is not as specified.
    - b. Inadequate protection of concrete during early stages of hardening and strength development from
      - 1) temperature extremes.
      - 2) rapid moisture loss.
    - c. Mechanical injury, construction fires, accidents, or premature removal of formwork likely to result in deficient strength development.

## PART 2 PRODUCTS

### 2.1 MATERIALS

- A. Concrete, Section 03 30 04. Class as indicated.
1. For roadway cuts, Section 33 05 25.
- B. Bonding compound, ASTM C 1059. Either polyvinyl acetate base or acrylic base latex.
1. Use type I in areas not subject to high humidity or immersion in water with minimum bond strength of 400 psi.

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- 2. Use type II in areas subject to high humidity or immersion in water with minimum bond strength of 1250 psi.
- C. Vapor retarder, 10 mil thick clear polyethylene sheet. Type recommended for below grade application.
- D. Forms, Section 03 11 00.
- E. Reinforcement, Section 03 20 00.
- F. Coverings and curing compound, Section 03 39 00.
- G. Shrinkage compensating grout, Section 03 61 00.
- H. Epoxy adhesive, Section 03 61 00.

**PART 3 EXECUTION**

**3.1 PREPARATION**

- A. Notify ENGINEER minimum 24 hours prior to commencement of concrete placement operations.
- B. Do not allow construction loads to exceed structural capacity.
- C. Clean previously placed concrete. Apply bonding compound per manufacturer's instructions.
- D. At locations where new concrete is dowelled to existing work, drill, remove dust, insert and pack steel dowels with shrink compensating grout.

E. Remove and regrade surfaces which contain frost, ice, mud, or water at no cost to the CITY.

**3.2 EXAMINATION**

- A. Verify items to be cast into concrete are accurately placed and held securely.
- B. Verify slump, air content range, mix identify, and batch time on delivery ticket matches mix design.
- C. Verify slab steel mats are supported by steel chairs, precast concrete blocks, or other slab bolsters. Do not pour if absent.

**3.3 DELIVERY**

- A. Slump and Air Content: Keep slump and air content within the allowable range.
- B. Placement Time:

<b><u>Air</u></b>	<b><u>Time</u></b>
<b><u>Temperature</u></b>	<b><u>After Initial Batching</u></b>
Less than 90 deg. F.	1-1/2 hours
Greater than 90 deg. F.	1-hour (without retarder)
Greater than 90 deg. F.	1-1/2 hours (with retarder)

To increase time past 1-1/2 hours, a hydration stabilizer that is acceptable to Supplier may be used.

- C. Tempering:
  - 1. Water may be added if all following conditions are met.

- a. The mix design water/cement ratio is not exceeded.
  - b. The delivery ticket allows for addition of water based upon water/cement ratio.
  - c. The amount of water added is accurately measured to within 1 gallon of the design addition.
  - d. Water addition is followed by 3 minutes of mixing at mixing speed prior to discharge.
  - e. Supplier and CONTRACTOR mutually agree on who is authorized to add water.
2. Do not add water after 1 cubic yard of concrete has discharged from the delivery vehicle.
- D. Super-plasticizer: Comply with manufacturer's requirements. If none, then as follows.
1. If added at site, add agent using injection equipment capable of rapidly and uniformly distributing the admixture to the concrete. Prior to discharge, mix for a minimum of 5 minutes at a drum rate not less than 12 rpm or more than 15 rpm.
  2. If added at plant; do not deliver to site unless batch delivery ticket displays water/cement ratio prior to super-plasticizer addition.

### **3.4 CONCRETE PLACEMENT**

- A. Place concrete, ACI 301.
1. Hot Weather Placement: ACI 305. If the rate of evaporation approaches 0.2 lb./ft<sup>2</sup>/hr. precautions against plastic shrinkage cracking are necessary. (i.e. dampening Subgrade and forms; placing concrete at the lowest possible temperature; erecting windbreaks and sunshades; fog sprays; use of evaporation retardants; or rescheduling time of placement).
  2. Cold Weather Placement: ACI 306. Non-chloride accelerating admixture may be used in concrete work placed at ambient temperatures below 50 deg. F. Use of admixtures will not relax cold weather placement, curing, or protection requirements.
- B. Concrete Temperature: Keep mixed concrete temperature at time of placement between 60 deg. F. and 90 deg. F.
- C. Do not disturb reinforcement, inserts, embedded parts, and formed joints.
- D. Do not break or interrupt successive pours such that cold joints occur.
- E. Honeycomb or embedded debris in concrete is not acceptable.

### **3.5 JOINTS AND JOINT SEALING**

- A. Steel edging and jointing tools are acceptable. Preferred are magnesium, aluminum or wood tools
- B. Pavement joint sealing, Section 32 13 73.

### **3.6 CONSOLIDATION**

- A. Keep spare vibrator available during concrete placement operations, ACI 309.

**3.7 FINISHING**

A. Section 03 35 00 and as follows.

Table 1 – Finishes	
Type of work	Type of finish
Sidewalks, garage floors, ramps, exterior concrete Pavement	Broom or belt finish
Exterior platforms, steps, and landings, exterior and interior pedestrian ramps, not covered by other finish materials	Non-slip finish
Surfaces intended to receive bonded applied cementitious applications	Scratched finish
Surfaces intended to receive roofing, except future floors, waterproofing membranes, and roof surfaces that are future floors or sand bed terrazzo	Floated finish
Floors and roof surfaces that are floors intended as walking surfaces or to receive floor coverings	Troweled
Unpainted concrete surfaces not exposed to public view	Rough as-cast form finish
Unpainted concrete surfaces exposed to public view	Smooth as-cast form finish
Concrete surfaces to receive paint or plaster	Grout cleaned finish

**3.8 CURING**

A. Section 03 39 00. Use a membrane forming compound unless specified otherwise.

**3.9 PROTECTION AND REPAIR**

A. Protection: Section 01 66 00.

1. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, graffiti, and mechanical injury.
2. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

B. Repair:

1. Modify or replace concrete not conforming to required levels, lines, details, and elevations.
2. Structural analysis and additional testing may be required at no additional cost to OWNER when the strength of a structure is considered potentially deficient.
3. To patch imperfections refer to Section 03 35 00 requirements.
4. Remove graffiti and mechanical injury.

END OF SECTION

## SECTION 05 05 23 AMENDED

### BOLTS, NUTS AND ACCESSORIES

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Steel bolts, nuts, washers, clamps, straps, rods and accessories.
- B. Galvanize bolts, nuts and accessories unless specified otherwise.

##### 1.2 REFERENCES

- A. AISC M011: Manual of Steel Construction.
- B. ASME B1.1: Unified inch Screw Threads (UN and UNR Thread Form), Supplement.
- C. ASTM A 126: Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
- D. ASTM A 197: Standard Specification for Cupola Malleable Iron.
- E. ASTM A 307: Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
- F. ASTM A 325: Standard Specification for High-Strength Bolts for Structural Steel Joints.
- G. ASTM A 506: Standard Specification for Steel, Sheet and Strip, Alloy, Hot-Rolled and Cold-Rolled, Regular Quality and Structural Quality.
- H. ASTM A 575: Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades.
- I. ASTM F 593: Standard Specifications for Stainless Steel Bolts, Hex Cap Screws, and Studs.

#### PART 2 PRODUCTS

##### 2.1 MATERIALS

- ~~A. Bolts, Nuts, Accessories: zinc plated steel, Section 05 05 10 (except if stainless steel).~~
- B. All sizes bolts and nuts, American Standard machined heavy hexagon heads with class 2 fit and threads, ASME B 1.1.
- C. Standard Bolts: Steel, ASTM A 307.
- D. High Strength Bolts: Steel, ASTM A 325.
- E. Anchor Bolts: Steel, ASTM A 307, or ASTM F 593 stainless steel when indicated.
- F. Washers: Grey iron, ASTM A 126.
- G. Clamps and Straps: Steel, ASTM A 506.
- H. Rods: Steel, ASTM A 575.
- I. Rod Coupling: Malleable iron, ASTM A 197.

Deleted: A. Bolts, Nuts, Accessories: galvanized steel, Section 05 05 10 (except if stainless steel).

Deleted: ¶

**PART 3 EXECUTION****3.1 INSTALLATION**

- A. Torque all nuts and bolts by procedures contained in AISC M011 to secure items requiring fastening.
- B. Extend bolt through nut not less than 1/4 inch beyond nut.

END OF SECTION

**SECTION 06 61 00 AMENDED**  
**ROUGH CARPENTRY**

Replace this section with the International Building Code as adopted by the City of Logan (Logan City Code, Title 15, Chapter 4, Section 010) and as defined by the Utah Code Annotated, Chapter 56, Title 58.

**SECTION 13 34 19 AMENDED**  
**METAL BUILDING**

Replace this section with the International Building Code as adopted by the City of Logan (Logan City Code, Title 15, Chapter 5, Section 010) and as defined by the Utah Code Annotated, Chapter 56, Title 58.

**SECTION 22 05 00 AMENDED  
MECHANICAL GENERAL REQUIREMENTS**

Replace this section with the International Building Code as adopted by the City of Logan (Logan City Code, Title 15, Chapter 5, Section 010) and as defined by the Utah Code Annotated, Chapter 56, Title 58.

**SECTION 22 11 13 AMENDED**  
**FACILITY WATER DISTRIBUTION PIPING**

Replace this section with the International Building Code as adopted by the City of Logan (Logan City Code, Title 15, Chapter 5, Section 010) and as defined by the Utah Code Annotated, Chapter 56, Title 58.

**SECTION 26 05 00 AMENDED**  
**ELECTRICAL GENERAL REQUIREMENTS**

Replace this section with the International Building Code as adopted by the City of Logan (Logan City Code, Title 15, Chapter 5, Section 010) and as defined by the Utah Code Annotated, Chapter 56, Title 58.

**SECTION 26 05 13 AMENDED  
CONDUCTORS AND CABLES**

Replace this section with the International Building Code as adopted by the City of Logan (Logan City Code, Title 15, Chapter 5, Section 010) and as defined by the Utah Code Annotated, Chapter 56, Title 58.

**SECTION 26.05.33 AMENDED**  
**RACEWAY**

Replace this section with the International Building Code as adopted by the City of Logan (Logan City Code, Title 15, Chapter 5, Section 010) and as defined by the Utah Code Annotated, Chapter 56, Title 58.

**SECTION 26 05 34 AMENDED**  
**ELECTRICAL BOXES AND FITTINGS**

Replace this section with the International Building Code as adopted by the City of Logan (Logan City Code, Title 15, Chapter 5, Section 010) and as defined by the Utah Code Annotated, Chapter 56, Title 58.

**SECTION 26 09 26 AMENDED**  
**PANEL BOARD**

Replace this section with the International Building Code as adopted by the City of Logan (Logan City Code, Title 15, Chapter 5, Section 010) and as defined by the Utah Code Annotated, Chapter 56, Title 58.

**SECTION 26 13 13 AMENDED  
CIRCUIT BREAKER**

Replace this section with the International Building Code as adopted by the City of Logan (Logan City Code, Title 15, Chapter 5, Section 010) and as defined by the Utah Code Annotated, Chapter 56, Title 58.

**SECTION 26 29 13 AMENDED**  
**MOTOR CONTROLLER**

Delete this section and replace with project specifications compliant with the International Building Code as adopted by the City of Logan (Logan City Code, Title 15, Chapter 5, Section 010) and as defined by the Utah Code Annotated, Chapter 56, Title 58.

## SECTION 26 56 19 AMENDED ROADWAY LIGHTING

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Materials and procedures for installing roadway lighting system.
- B. Testing, painting, restoration and salvage.
- C. Related work includes but is not limited to,
  - 1. Landscape restoration, Section 32 92 00 or Section 32 93 13.
  - 2. Pavement restoration, Section 33 05 25.

#### 1.2 REFERENCES

- A. ASTM B 3: Standard Specification for Soft or Annealed Copper Wire.
- B. ASTM B 8: Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
- C. ASTM D 2301: Standard Specification for Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape.
- D. IES: Illuminating Engineering Society.
- E. NEMA 250: Enclosures for Electrical Equipment (1000 Volts Maximum).

~~F. International Electric Code as adopted by the City of Logan (Logan City Code, Title 15, Chapter 4, Section 010).~~  
~~G. SSPC PS 1.4: Three-Coat Oil-Alkyd (Lead-and-Chromate-Free) Painting System for Galvanized or Non-Galvanized Steel (with Zinc Dust-Zinc Oxide Linseed Oil Primer).~~

Deleted: F. NFPA 70: National Electric Code.

Deleted: ¶

H. UL: Underwriters' Laboratories, Inc.

#### 1.3 SUBMITTALS

- A. Shop Drawings and Product Data: Complete, bound, indexed, large enough for all items included. When requested, supplement the following list by such other data as may be required, including detailed scale drawings and wiring diagrams of any special equipment and of any proposed deviation from the Contract Documents.
  - 1. Performance data for luminaires, including lighting contours on the roadway surface and average maintained level of light in foot-candles.
  - 2. Shop drawings for luminaires showing pertinent physical characteristics, type of light source, and wattage.
  - 3. Shop drawings of ornamental poles.
  - 4. Luminaire supports.
  - 5. Pole bases.

6. Wiring schematic.
  7. Fixture mounting height.
  8. Drawing showing location of poles and underground power conduit.
- B. Warranties and instruction sheets.
- C. Testing results.

#### **1.4 MAINTAINING EXISTING AND TEMPORARY ELECTRICAL SYSTEMS**

- A. Notify ENGINEER prior to performing any work on existing systems.
- B. Allow 20 feet minimum overhead clearance across thoroughfares and 12 feet minimum clearance above sidewalk areas. Do not run temporary conductor on top of the ground or across any sidewalk area unless protected in an electrical raceway and barricaded.
- C. Maintain existing electrical systems or approved temporary replacements, in effective operation for the benefit of the traveling public during the progress of the Work, except when shutdown is permitted to allow for alteration or removal of the systems. Do not interfere with the regular lighting schedule.

### **PART 2 PRODUCTS**

#### **2.1 EXISTING MATERIALS**

- A. Where existing systems are to be modified, incorporate existing material in revised system, Salvage or abandon as indicated.

#### **2.2 CONDUCTORS**

- A. Materials: Solid or stranded copper of size indicated conforming to ASTM B 3 and ASTM B 8. Insulation; RHH-RHW-USE grade cross link polyethylene compound.
- B. Splicing: Compatible with cable insulation and water seal for underground use. Comply with UL code.
- C. Conduit: As indicated. Section 26 05 33.
- D. Color and coding of 120/240 volt, Section 26 05 13.

#### **2.3 POLES AND LUMINAIRE SUPPORTS**

- A. Provide poles and luminaire supports conforming to the height, type, configuration, and base detail indicated.

#### **2.4 JUNCTION BOXES**

- A. Buried type; Section 26 05 34 and as follows.
1. Precast reinforced concrete in paved surfaces.
  2. Plastic in landscaped surfaces.
- B. Cover Stencil: "Street Lighting". Where box contains street lighting voltage greater than 600 volts, stencil "High Voltage".

**2.5 INSULATING TAPE**

- A. Type 1 vinyl chloride, ASTM D 2301.

**2.6 LUMINAIRE**

- A. Luminaire: Die cast aluminum housing complete with reflector, refractor, lamp socket, slipfitter, replaceable air filter, ballast components or as indicated.
1. Lamp wattage, voltage, and IES distribution type as indicated.
  2. Not less than 10 degrees of adjustment above a horizontal position, and not less than 5 degrees of adjustment from a vertical position.
  3. Lower housing door assembly removable with quick disconnect plugs to permit field maintenance or upgrading to other lamp types.
  4. Glare shields when indicated.
- B. Mercury Constant Wattage Regulated Ballasts: Prewired ballast with minimum primary power factor of 90 percent with normal secondary load with sufficient open circuit voltage to start lamps at minus 20 deg.
- F. Ballast shall provide regulation within 5 percent variation in lamp watts with a 10 percent variation in primary voltage.
- C. High Pressure Sodium Lamps: 250 or 400 watts as indicated.
- D. Bonding and Grounding: Copper wire strap No. 6 AWG minimum.
- E. Paint: None.

**2.7 CONTROL EQUIPMENT**

- A. Photo-electric control sensitive between 1 and 5 foot candles, minimum.
- B. Failure of any electrical component will energize the lighting circuit.
- C. Control Relay Contacts Rating: Switch on at 3,000 watts minimum.
- D. Remote Control Relays: Normally open.
- E. Relays: Either mechanical armature type or mercury tube type, single or double pole, or as indicated.
1. Mechanical armature type: An operating coil (120 volts), a laminated core, a laminated armature, terminals and silver alloy contacts.
  2. Mercury tube type: An operating coil, hermetically sealed mercury tubes and terminals. Contacts shall be made either mercury to mercury or between mercury and alloy resistant to arcing and mercury amalgamation.
- F. Enclosure: NEMA 250 Type 4 with dead front panel, keyed padlock
- G. Paint: Waterproof paint.

**2.8 POLYSULFIDE BASE, SINGLE COMPONENT SEALANT**

- A. Chemical curing; capable of being continuously immersed in water, withstand movement up to 20 percent of joint width, and satisfactorily applied throughout a temperature range to 40 to 80 deg. F., Shore A hardness of minimum 15 and maximum 50; nonstaining and nonbleeding; color as selected by ENGINEER.

**2.9 CONCRETE AND GROUT**

- A. Cast-in-place concrete: Class 3000, Section 03 30 04.
- B. Grout: Cement, Section 03 61 00.

**PART 3 EXECUTION****3.1 PREPARATION**

- A. Coordinate utility locations; Section 01 31 13.
- B. Excavate; Section 31 23 16 and backfill; Section 33 05 20.
- C. Do not disturb roadway surface, sidewalk, curb, gutter, or other obstructions without approval.
- D. Do not block or restrict pedestrian traffic, vehicle traffic, drainage or utilities.
- E. Barricade all Excavations in traveled ways.
- F. Compact excavated Trench material; Section 33 05 20 to the requirements of the adjacent areas.
- G. After backfilling Excavations, maintain smooth and well-drained surfaces until permanent repairs are effected.
- H. Legally dispose of all excess or waste material.

**3.2 POLE FOUNDATION**

- A. Construct foundation per details indicated and Section 34 41 13.
- B. Locations:
  - 1. 18 inches clear from pull box.
  - 2. Not in pedestrian access way.
  - 3. Unless specified otherwise:
    - a. 5 feet from new tree.
    - b. 10 feet from existing tree, driveway, or hydrant.
    - c. Center of park strip or 24 inches clear from top back of curb on wide park strips.

**3.3 CONDUIT INSTALLATION**

- A. Use rigid steel conduit in areas subject to vehicular load, on the surface of structures, inside of structures and foundations, between structures, and the adjacent pull boxes located next to structures.
- B. Place conduit as follows.

<u>Location</u>	<u>Depth of Burial, inches</u>
In front of curb faces	36 to 60
Back of the back of curb	24 to 36
Railroad tracks	36 to 60
Primary power cables	40 minimum

- C. Use sizes of conduit indicated or use larger sizes for any run at no additional cost to OWNER. No expanding or reducing fittings will be permitted.
- D. Make field cuts square and true so that the ends will come together for full circumference. Paint threads on all rigid steel conduit with rust preventive paint before couplings are made. Repair damaged coating on galvanized steel conduit.
- E. Cap all conduit ends with standard pipe caps until wiring is installed. When caps are removed from metallic conduit, provide threaded ends and approved conduit bushings.
- F. Clean all existing underground conduit to be incorporated into new system with a mandrel and blow out with compressed air. Where existing rigid steel conduit systems are to be modified or extended, install rigid steel conduit.
- G. Make changes in direction by bending the conduit to a radius which will meet code or, preferable, by the use of standard bends or elbows.
- H. Install a No. 12 AWG pull wire or equivalent strength cord in all conduits which are to receive future conductors. Leave at least 2 feet of pull wire extending beyond each end of the conduit run and secure.
- I. Center conduit ends within the bolt circle of traffic signal poles or pedestals.
- J. Pack conduit ends with sealant after conductors are installed.
- K. Cap all conduit terminated without a pull box and identify its location by monumenting.

### 3.4 CONDUCTOR INSTALLATION

- ~~A. Install wiring per the appropriate articles of International Electric Code. Neatly arrange wiring within cabinets, junction boxes, etc.~~
- B. Splice only at junction boxes, transformer leads, in pole bases, or at control equipment. Splice conductors as per manufacturer's recommendations and codes. Provide a fused connector between the line and the ballast, accessible at the hand holes located in the poles.
- C. Provide conduit to separate low-voltage conductors from high-voltage conductors in the same raceway (i.e. poles).
- D. Splice insulation shall consist of layers of vinyl chloride, electrical insulating tape applied to a thickness equal to and well lapped over the original insulation to provide uninterrupted underwater operation.
- E. Leave 2 feet of slack at each pole. Leave 18 inches of slack above top of pull box grade.
- F. Mark termination of each conductor. Where circuit and phase are clearly indicated by conductor insulation, bands need not be used, otherwise use bands.

**Deleted:** A. Install wiring per the appropriate articles of NFPA 70. Neatly arrange wiring within cabinets, junction boxes, etc.

**Deleted:** ¶

### 3.5 GROUNDING INSTALLATION

- A. Effectively ground metallic cable sheaths, metal conduit, nonmetallic conduit grounding wire, ballast and transformer cases, service equipment, anchor bolts, metal poles, and pedestals, and make mechanically and electrically secure to form a

- continuous system. Use a copper wire strap for bonding and grounding jumpers of the same cross-sectional area as No. 6 AWG for all lighting systems.
- B. Ground one side of the secondary circuit of series-multiple and step-down transformers. Ground metal conduit, service equipment, and neutral conductor at service point as required by NEC and electricity company with grounding conductor No. 6 AWG or larger.
  - C. In all nonmetallic (PVC) type conduit, provide a No. 8 AWG bare copper wire continuously and ground at each junction box.
  - D. At each multiple service point, unless otherwise indicated, furnish a ground electrode. Use copper coated ground electrodes of steel or iron in one piece lengths at least 3/4 inch in diameter. Do not use electrodes of nonferrous materials less than 1/2 inch in diameter.
  - E. Bond metal poles by means of a No. 8 AWG bonding wire attached from a grounding bushing to a foundation bolt or to a 3/16 inch or larger brass or bronze bolt installed in the lower portion of the pole.
  - F. On wood poles, ground all equipment mounted less than 8 feet above the ground surface.
  - G. Ground metallic conduit or bonding conductor system at intervals less than 500 feet to one of the following:
    - 1. 1 inch galvanized pipe driven 8 feet deep.
    - 2. 1/2 inch copper rod driven 8 feet deep.
    - 3. Metal water main with the approval of the water company. Clean water main thoroughly prior to connection.
  - H. Use galvanized grounding bushings and bonding jumpers for bonding of metallic conduit in a concrete pull box. Use lock nuts for bonding of metallic conduit in steel pull boxes, one inside and one outside of the box.
  - I. Pull Boxes: Install 3/4 inch x 10 feet copper clad ground rods at each pull box, 6 inches above bottom. Ground all metal parts, neutral and ground wire with #6 B.C. Use exothermic weld or hammerlock connection.

### **3.6 JUNCTION AND PULL BOX INSTALLATION**

- A. Install at the locations indicated, and at additional points when conduit runs are more than 200 feet. Without additional compensation cost to OWNER and at CONTRACTOR's convenience add such additional boxes as may be desired to facilitate the work.
- B. Rest bottom of pull box firmly on a 12 inches thick bed of 1 inch crushed rock extending a minimum of 6 inches beyond the outside edge of box.
- C. Establish grade of top of boxes as for foundations.
- D. Place long side of box parallel to curb unless indicated.
- E. Use box extensions if ballasts or transformers are installed in box.
- F. Do not install boxes in Driveway aprons.

### 3.7 LUMINAIRES AND BALLASTS INSTALLATION

- A. Immediately prior to installation, clean all light control surfaces, refractors, and reflectors to provide the maximum lumen output possible. Clean per the luminaire manufacturer's recommendations.
- B. Mount at the height indicated.
- C. Adjust luminaires uniformly to give the optimum light distribution.

### 3.8 PAINTING

- A. Apply coatings, Section 09 91 00.
- B. Recoat all painted equipment when relocated.
- C. Use 2 coats of paint on relocated and new work.

### 3.9 FIELD QUALITY CONTROL

- A. Conduct the following tests on all lighting circuits and record the date and time of test.
  1. Test for continuity of each circuit.
  2. Test for grounds in each circuit.
  3. Megger test at 500 volts DC on each completed lighting circuit. The insulation resistance to ground shall be not less than 10 megohms.
  4. Test voltage and current on each circuit.
- B. Functional Test:
  1. Perform a functional test in which it is demonstrated that each and every part of the system functions as specified or intended.
  2. A functional test for each new or modified electrical system will consist of not less than 5 days of continuous, satisfactory operation. If unsatisfactory performance of the system develops, correct the condition and repeat the test until the 5 day continuous satisfactory operation is obtained.
  3. Do not start functional tests or turn-ons on Friday, or on the day preceding a legal holiday.
  4. Shutdowns caused by factors beyond CONTRACTOR's control will not constitute discontinuity of the functional test.
- C. Replace or correct any material revealed by these tests to be faulty.
- D. Provide equipment, personnel, cable connections, and electrical energy for testing. Certify that each circuit has been completely tested and testing procedures are satisfied.

### 3.10 SALVAGE

- A. Terminate all conduit abandoned in place at least 5 inches below finished grade.
- B. Exercise care in removing equipment to be reused or salvaged so that it will remain in the condition existing prior to its removal.

**3.11 RESTORATION**

- A. Replace damaged equipment, concrete work or other fixtures disturbed or damaged by the installation.
- B. Restore or replace roadway pavement cuts, Section 33 05 25.
- C. Restore or replace disturbed plantings in landscaped areas.

END OF SECTION

## **SECTION 31 05 10 AMENDED**

### **BOUNDARY MARKERS AND SURVEY MONUMENTS**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Materials and procedures for installing boundary markers and survey monuments.

##### **1.2 PERFORMANCE REQUIREMENTS**

- A. Identify the land surveyor who set the marker plates and reference marks.
- B. For vertical control datum use Mean Sea Level datum adjusted by United States Coast and Geodetic Survey for the location of survey.
- C. Vertical Accuracy: 3rd order.
- D. Make all individual tape measurements to the nearest 0.01 of a foot, with tape corrections for temperature, sag, suspension, etc. noted on all field notes requiring such measurements.
- E. Horizontal Accuracy:
  - 1. 1:10,000 minimum for urban areas.
  - 2. 1:20,000 minimum for metropolitan areas.

##### **1.3 SUBMITTALS**

- A. Survey notes and drawings showing:
  - 1. All monuments found, set, reset, or replaced, describing their kind, size, and location and giving other data relating thereto.
  - 2. Lines of survey, concrete structures containing reference marks, types of marks installed, distances and angles from monument referenced.
  - 3. Witness monuments, basis of bearings, bearings, length of lines to monuments or corners witnessed and scale of drawing.
  - 4. Errors of closure and method of adjustment.
  - 5. Memorandum of oaths and certificates.
  - 6. Narrative describing purpose of survey.
  - 7. Any other data necessary for the interpretation of the various items and locations of the points, lines, and areas shown.
- B. Copies of plats filed with the County Recorder.

##### **1.4 QUALITY ASSURANCE**

- A. Use a land surveyor who complies with Utah licensing law and who is acceptable to the OWNER to supervise the setting or resetting of monuments and boundary markers.
- B. Make surveys in conformance with the accepted practice of land surveying and comply with all pertinent Laws and Regulations of land survey regulatory agencies and authority having jurisdiction.

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**PART 2 PRODUCTS****2.1 MONUMENT**

- A. Monument Post: Minimum 3 feet long, precast or cast-in-place concrete. Make exposed surface of finished monument posts uniform, even texture, and free of holes, cracks, and chipped edges.
- B. Marker Plate: Brass or bronze or as indicated.

**2.2 FRAME AND COVER**

- A. Asphalt coated, heavy duty, cast iron, Section 05 56 00.

**2.3 LOT LINE WITNESS MARKER**

- A. Brass surveyor's tag or brass nail set in a lead filled hole in concrete.

**2.4 REBAR CORNER MARKER**

- A. No. 5 rebar, at least 18 inches long with the top fitted with a nonferrous survey cap and stamped with land surveyor's registration number.

**2.5 PIPE CORNER MARKERS**

- A. 1 inch internal diameter galvanized steel pipe at least 18 inches long, or 2 inches internal diameter galvanized steel pipe at least 36 inches long.
- B. Fit pipe with concrete or mortar plug, tagged with surveyor's license number.
- C. Fix tag in concrete or mortar plug with a 1 inch minimum long bent brass brad.

**2.6 FIELD NOTE PAPER**

- A. 20 pound bond paper minimum with format of documents acceptable to OWNER.

**2.7 CONCRETE**

- A. Cast-in-place: Class 4000 minimum, Section 03 30 04 or
- B. Precast: Class 5000 minimum, Section 03 40 00.

**PART 3 EXECUTION****3.1 PREPARATION**

- A. Identify utility locations, Section 01 31 13.
- B. Excavation, Section 31 23 16.

**3.2 HORIZONTAL CONTROL**

- A. Set base horizontal ground control upon a minimum of 2 United States Coast and Geodetic Survey triangulation stations or equivalent, and tie to the Lambert Conformal Conic Projection for Establishment of the State Plane Coordinate System with Local Datum Adjustment within the Project area.

**3.3 BEARING BASE**

- A. Refer all directional measurements to one "bearing base". Actual measurements may be equated to bearings and linear measurements shown on any record (i.e., plats,

official maps, descriptions, or approved field notes of lines resurveyed that are shown on such records used in the survey).

**3.4 TIE TO EXISTING MONUMENTS**

- A. Tie into a monument which has State Plane Coordinates if the monument is within 1/2 mile of the proposed survey site or at a selected location.

**3.5 CORNER MARKERS**

- A. Site Boundary: Install pipe corner markers.
- B. Lot Boundary: Install rebar corner markers for lot corners. Do not use rebar where pipe corner markers are installed as a boundary marker and a corner marker.

**3.6 LOT LINE WITNESS MARKER**

- A. Witness all lot lines by installing 1/2 inch surveyor tags in sidewalk. If sidewalk does not exist, install tags in curb or mass concrete.

**3.7 MONUMENTS**

- A. Locate monument post so reference point falls within 1 inch diameter circle in the center of marker plate. Install marker plate in survey monument post before the concrete has acquired its initial set.

B. Compact backfill soil to 95 percent or greater, Modified Proctor Density, Section 31 23 26.

**Deleted:** B. Compact backfill soil; Section 33 05 05 to a Modified Proctor Density of 95 percent or greater.  
**Deleted:** ¶

- C. Set top of frames and covers 1/4 inch lower than Pavement surface. Recess marker plate a minimum of 4 inches below cover.
- D. Install monument so frame and cover does not contact monument or marker plate.

**3.8 DAMAGED MONUMENTS**

- A. Replace survey control monuments which are disturbed or destroyed by CONTRACTOR.
- B. If OWNER allows replacement of project survey control monuments which are lost or destroyed, use a licensed land surveyor to re-establish control monuments based upon original survey control.

**3.9 REFERENCE MARKS**

- A. Section 01 17 24.

END OF SECTION

## **SECTION 31 05 13 AMENDED COMMON FILL**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Common fill materials.

#### **1.2 REFERENCES**

- A. ASTM C 136: Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
- B. ASTM D 1883: Standard Test Method for CBR (California Bearing Ratio) of Laboratory-Compacted Soils.
- C. ASTM D 2487: Standard Test Method for Classification of Soils for Engineering Purposes.
- D. ASTM D 2844: Test Method for Resistance R-Value and Expansion Pressure of Compacted Soils.
- E. ASTM D 3282: Standard Practice for Classification of Soils and Soil- Aggregate Mixtures for Highway Construction Purposes.
- F. ASTM D 3740: Standard Recommended Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

#### **1.3 SUBMITTALS**

- A. Prior to delivering material to site, identify.
  - 1. Name of Supplier and source, and
  - 2. Gradation of common fill material.
- B. If a change in source of material is required, submit name of Supplier, source and gradation analysis of material prior to delivery to site.

#### **1.4 QUALITY ASSURANCE**

- A. Use a laboratory that follows and complies with Section 01 45 00 and ASTM D 3740.
- B. Reject common fill products that do not meet requirements of this section.
- C. Remove any product found defective after installation and install acceptable product at no additional cost to OWNER.

#### **1.5 ACCEPTANCE**

- A. General:
  - 1. Acceptance is by Lot. One Lot is one day's production.
  - 2. Dispute resolution; Section 01 35 10.
- B. Roadway Backfill: Sub-lot size is 5,000 tons.

**PART 2 PRODUCTS****2.1 BORROW**

A. Classifications A-1-a through A-4, ASTM D 3282.

**2.2 GRANULAR BORROW**

A. Classifications A-1-a, A-1-b, A-2-4, or A-3, ASTM D 3282.

B. Material meets design CBR-value (ASTM D 1883) or R value (ASTM D 2844) for suitability of source, not for project control testing.

**2.3 GRANULAR BACKFILL BORROW**

A. Classification A-1, ASTM D 3282.

B. Well graded.

C. Particle size; 2 inch maximum.

D. Material meets design CBR-value (ASTM D 1883) or R value (ASTM D 2844) for suitability of source, not for project control testing.

**2.4 RECYCLED FILL**

A. Material: Pulverized portland cement concrete, pulverized asphalt pavement or combination, either mixed with or not mixed with a new aggregate.

B. Gradation: Meet the requirements of this Section based upon use; e.g. borrow, granular borrow, granular backfill borrow, etc.

**2.5 NATIVE**

~~A. When allowed by ENGINEER, material obtained from Excavations may be used as fill, provided organic material, rubbish, debris, and other objectionable materials are removed and CONTRACTOR has submitted the appropriate Proctor data (see Section 31 23 26).~~

**Deleted:** A. When allowed by ENGINEER, material obtained from Excavations may be used as fill, provided organic material, rubbish, debris, and other objectionable materials are removed and CONTRACTOR has submitted the appropriate Proctor data (see Section 33 05 05).¶

**2.6 CLAY**

A. Classification CL, CL-ML, or ML, ASTM D 2487.

B. Free of organic matter, frozen material, debris, rocks, and deleterious materials.

C. Homogeneous, relatively uniform.

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**2.7 SAND**

A. Friable river or bank aggregate, free of loam and organic matter. Graded as follows.

<u>Sieve</u>	<u>Percent Passing by Weight</u>
3/8	100
100	1 – 10

**2.8 GRAVEL**

A. Material: Rock, stone, or other high quality mineral particle or combination.

B. Gradation: ASTM D 448 narrow band.

**1. Sewer Rock.**

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<u>Nominal Size</u>	<u>ASTM Size No.</u>
3.5 to 1.5"	1
2.5 to 1.5"	2
2 to 1"	3
1.5 to 3/4"	4
1 to 1/2"	5

## 2. Pea Gravel.

<u>Nominal Size</u>	<u>ASTM Size No.</u>
3/4 to 3/8"	6
1/2 to No. 4	7
3/8 to No. 8	8
No. 4 to No. 16	9
No. 4 (screenings)	10

## 2.9 TOPSOIL

### A. Chemical Characteristics:

1. Acidity/alkalinity range: pH 5.5 to 7.7
2. Soluble Salts: Less than 2.0 mmhos/cm.
3. Sodium Absorption Ratio (SAR): less than 3.0
4. Nitrogen (NO<sub>3</sub>N): 48 ppm minimum
5. Phosphorus (P): 11 ppm minimum
6. Potash (K): 130 ppm minimum
7. Iron (Fe): 5.0 ppm minimum

### B. Physical Characteristics:

1. Fertile, loose, friable.
2. Containing more than 2 percent organic matter.
3. Free of weeds, subsoil, lumps or clods of hard earth, plants or their roots, sticks, toxic minerals, chemicals and stones greater than 1-1/2 inch diameter.

### 4. Composition.

<u>Material</u>	<u>Percent Passing</u>
Sand	15 – 60
Silt	10 – 70

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Clay

5 – 30

**2.10 PIT RUN**

- A. Material: Gravel materials must be rock, stone, or other high quality mineral materials in combination.
- B. Classifications GW, GM, ASTM D 3282.
- C. Material must be well graded as demonstrated by gradation/sieve analysis.
- D. Grading requirements as follows.

<u>Sieve</u>	<u>Percent Passing</u> <u>By Weight</u>
<u>3"</u>	<u>100</u>
<u>No. 10</u>	<u>&lt; 50</u>
<u>No. 40</u>	<u>&lt; 30</u>
<u>No. 200</u>	<u>&lt; 15</u>

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**2.11 SOURCE QUALITY CONTROL**

- A. Verify gradation, ASTM C 136.
- B. Select Samples on a random location and time basis.
- C. If tests indicate materials do not meet specified requirements, change materials and retest at no additional cost to OWNER.

Deleted: 2.10 SOURCE QUALITY CONTROL

Deleted: ¶

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- A. Trenches, Section 33 05 20.
- B. Structures, Section 31 23 23.
- C. Pavements, Section 32 05 10.
- D. Landscaping, Section 32 91 19.

Deleted: B. Structures or landscaping, Section 31 23 23.

Deleted: ¶

END OF SECTION

## **SECTION 31 05 15 AMENDED CEMENT TREATED FILL**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Controlled low-strength material (CLSM) requirements.

#### **1.2 REFERENCES**

- A. ASTM C 25: Standard Test Methods for Chemical Analysis of Limestone, Quicklime, and Hydrated Lime.
- B. ASTM C 33: Standard Specification for Concrete Aggregates.
- C. ASTM C 39: Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- D. ASTM C 51: Standard Definitions of Terms Relating to Lime and Limestone (As Used by the Industry).
- E. ASTM C 110: Standard Test Methods for Physical Testing of Quicklime, Hydrated Lime, and Limestone.
- E. ASTM C 150: Standard Specification for Portland Cement.
- F. ASTM C 260: Standard Specification for Air-Entraining Admixtures for Concrete.
- G. ASTM C 494: Standard Specification for Chemical Admixtures for Concrete.
- H. ASTM C 595: Standard Specification for Blended Hydraulic Cement.
- I. ASTM C 618: Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
- J. ASTM D 4832: Standard Test Method for Preparation and Testing of Soil-Cement Slurry Test Cylinders.

#### **1.3 SUBMITTALS**

- A. Material analysis.
- B. Engineered design calculations.

#### **1.4 ACCEPTANCE**

- A. General:
  - 1. Acceptance is by Lot. One Lot is one day's production.
  - 2. If non-complying fill material has been installed and no price for the material is specified, apply price adjustment against cost of work requiring material as part of its installation. Section 01 29 00.
  - 3. Dispute resolution, Section 01 35 10.
- B. Lime or Asphalt Cement Treated Backfill: Data sheet.
- C. Cement Treated Flowable Fill:
  - 1. Sub-lot Size:

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- a. Trench backfill, 100 cubic yards.
  - b. Roadway backfill, 250 cubic yards
2. Lot is acceptable if strength deviations are within pay factor 1.00 limits. At ENGINEER's discretion, a Lot with a sub-lot test deviation in Reject may stay in place at 50 percent cost.

<u>Pay Factor</u>	<u>28 day Compressive Strength, psi</u>
1.00	less than 60
0.75	60 to 120
Reject	greater than 120

## 1.5 SAFETY

- A. Protect persons and property from lime or quicklime handling operations.

## PART 2 PRODUCTS

### 2.1 CEMENT TREATED FLOWABLE FILL

- A. Cement:
1. Types I or II, ASTM C 150 or
  2. Types IP or IS, ASTM C 595.
- B. Aggregate: Non-plastic sand, ASTM C 33.
- C. Water: Non-detrimental.
- D. Admixtures: As needed for strength and flowability.
1. Pozzolan (fly ash): ASTM C 618.
    - a. Class C or Class F.
    - b. Loss on ignition plus or minus 3 percent.
  2. Air: 4 percent to 35 percent, ASTM C 173.

E. Strength: 60 psi maximum in 28 days per ASTM D 4832.

**Deleted:** E. Mix Design: 60 psi maximum in 28 days per ASTM D 4832.

### 2.2 LEAN CONCRETE

- A. Physical Characteristics:
1. Cement: ASTM C 150, Type II .
  2. Slump: 1 to 4 inches.
  3. Strength: 750 psi minimum in 7 days.
- B. Aggregate: Section 03 30 04. Submit substitute gradations for acceptance prior to beginning construction. Do not substitute gradations without approval.

### 2.3 LIME TREATED FILL

- A. Aggregate: Non-plastic crushed aggregate base, Section 32 11 23; or Common fill, Section 31 05 13.

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B. Water: Non-detrimental.

C. Lime: Dry hydrated lime or quicklime, ASTM C 25, ASTM C 51, and ASTM C 110.

1. Minimum Chemical Composition:

a. Hydrated Lime ( $\text{Ca}(\text{OH})_2$ ); 85 percent of chemical.

b. Quicklime ( $\text{CaO}$ ); 90 percent of chemical.

2. Gradation: ASTM C 136.

Table 1 – Hydrated Lime and Quicklime Percent Passing by Weight		
Sieve	Hydrated Lime ( $\text{Ca}(\text{OH})_2$ )	Quicklime ( $\text{CaO}$ )
No. 4	100	100
No. 30	95 – 100	–
No. 100	–	0 – 20
No. 200	75 – 100	–

NOTES  
 (a) Hydrated Lime: Washed Sample for 15 minutes plus or minus 1 minute, ASTM C 110.  
 (b) Quicklime: Dry sieving only.

## 2.4 ASPHALT TREATED FILL

A. Cement:

1. Medium-setting emulsified asphalt, Section 32 12 09, or

2. Medium-cure cutback asphalt Section 23 12 09.

B. Aggregate:

1. Non-plastic crushed aggregate base, Section 32 11 23.

2. Common fill, Section 31 05 13.

3. RAP, Section 32 01 16.

C. Water: Non-detrimental.

## PART 3 EXECUTION

### 3.1 FIELD QUALITY CONTROL

A. Cement Treated Fill (Flowable Fill):

1. Mold 3 test cylinder, ASTM D 4832. Test cylinders at 28 days.

2. If a cylinder test shows improper sampling, molding, handling, curing, or testing, discard the cylinder. Use remaining cylinders to determine average strength.

END OF SECTION

## **SECTION 31 05 19 AMENDED GEOTEXTILES**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Geotextile fabrics.

#### **1.2 REFERENCES**

- A. ASTM D 146: Standard Methods of Sampling and Testing Bitumen- Saturated Felts and Woven Fabrics for Roofing and Waterproofing.
- B. ASTM D 276: Standard Test Methods for Identification of Fibers in Textiles.
- C. ASTM D 882: Standard Test Methods for Tensile Properties of Thin Plastic Sheeting.
- D. ASTM D 3786: Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics - Diaphragm Bursting Strength Tester Method.
- E. ASTM D 4354: Standard Practice for Sampling of Geotextiles for Testing.
- F. ASTM D 4355: Standard Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon - Arc Type Apparatus).
- G. ASTM D 4491: Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
- H. ASTM D 4533: Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
- I. ASTM D 4632: Standard Test Method for Breaking Load and Elongation of Geotextiles (Grab Method).
- J. ASTM D 4751: Standard Test Method for Determining Apparent Opening Size for a Geotextile.
- K. ASTM D 4759: Standard Practice for Determining Specification Conformance of Geosynthetics.
- L. ASTM D 4833: Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
- M. ASTM D 4873: Standard Guide for Identification, Storage, and Handling of Geotextiles.
- N. ASTM E 96: Standard Test Methods for Water Vapor Transmission of
- O. ASTM E 154: Standard Methods of Testing Materials for Use as Vapor Barriers Under Concrete Slabs and as Ground Cover in Crawl Spaces.

#### **1.3 DEFINITIONS**

- A. MARV (acronym for minimum average roll value): A statistical value of a particular test property embracing 95 percent confidence level of all possible values of that property. For a normally distributed set of data, it is approximately the mean value plus and minus two standard deviations.

**1.4 SUBMITTALS**

- A. Submit prior to use:
  - 1. Sample of geotextile.
  - 2. Manufacturer's certificate that each fabric complies with requirements of this section.

**1.5 DELIVERY STORAGE AND HANDLING**

- A. Label fabric, ASTM D 4873.
- B. Deliver geotextile dry, in a wrapping that protects it from the elements during shipping and storage. Keep fabric dry.
- C. Protect geotextile from ultraviolet light and temperature greater than 140 deg. F. until application.

**1.6 QUALITY ASSURANCE**

- A. Provide manufacturer's on-site technical supervision and assistance.

**PART 2 PRODUCTS****2.1 GEOTEXTILE - GENERAL**

- A. Stated values are for non-critical, non-severe applications.
- B. Fabric consists of synthetic fibers at least 85 percent by weight of polyolefins, polyesters or polyamides.
- C. Resistant to chemical attack, rot and mildew.
- D. No tears or defects that adversely alter fabric's physical properties.
- E. All numerical values represent minimum average roll values in the weaker principal direction.

(CONTINUED ON NEXT PAGE)

**2.2 STABILIZATION-SEPARATION GEOTEXTILES**

A. Woven or non-woven fabric. Meet the following properties and survivability ratings.

Table 1 – Stabilization-Separation Geotextile						
Property	ASTM	MARV				
		Moderate		High		
		Woven	Non-woven	Woven	Non-woven	
Grab Tensile Strength, lbs.	D 4632	180	115	270	180	
Grab Elongation, percent	D 4632	<50	>50	<50	>50	
Trapezoid Tear, lbs.	D 4533	70	40	100	75	
Puncture Resistance, lbs.	D 4833	70	40	100	60	
Apparent Opening Size, (AOS-US Sieve)	D 4751	≥ 30	≥ 60	≥ 30	≥ 60	
<b>Construction Survivability</b>						
Subgrade, CBR		1	1 – 2	1 – 2	> 2	
Tire Pressure, psi		<50	>50	<50	>50	
6 inches Cover Thickness	NR	NR	H	H	M	M
12 inches Cover Thickness	NR	NR	H	M	M	M
18 inches Cover Thickness	H	M	M	M	M	M

Where H = High; M = Medium; NR = Not Recommended

**2.3 SILT FENCE GEOTEXTILE**

A. Use woven fabric. Meet standard or high performance properties.

Table 2 – Silt Fence Geotextile				
Property	ASTM	MARV		
		Standard	High	
Grab Tensile Strength, lbs. (a)	D 4632	90	120	
Grab Elongation, percent	D 4632	< 40	< 40	
Flux, gal/min/ft <sup>2</sup>	D 4491	15	90	
Apparent Opening Size, (AOS-US sieve)	D 4751	> 20	> 30	
Ultraviolet Degradation, percent	D 4355	70	90	

**NOTES**  
 (a) Percent of tensile strength retained determined after weathering, ASTM D 4355 for 500 hours

- B. High performance fence to have tape yarns in one principle direction only.
- C. Add stabilizers or inhibitors to make the filaments resistant to sunlight or heat deterioration.
- D. Finish edges to prevent outer yarn from pulling away from the fabric.
- E. Sheets of fabric may be sewn or bonded together. Provide minimum width recommended by manufacturer.
- F. No deviation from any requirement in Table 2 due to the presence of seams.
- G. Manufactured with pockets for posts, hems with cord, or with posts preattached using staples or button head nails.

**2.4 EROSION CONTROL GEOTEXTILES**

A. Use woven or non-woven fabric.

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Table 3 – Erosion Control Geotextile				
Property	ASTM	MARV		
		Class A	Class B	Class C
Grab Tensile Strength, lbs. (a)	D 4632	300	200	100
Grab Elongation, percent	D 4632	>15	>50	>50
Puncture Resistance, lbs.	D 4833	100	60	30
Trapezoid Tear, lb.	D 4533	80	50	40
Flux, gal/min/ft <sup>2</sup>	D 4491	25	25	25
Apparent Opening Size, (AOS-US sieve)	D 4751	>59	>59	>59
Ultraviolet Degradation, percent	D 4355	70	70	70
Permittivity, sec. <sup>-1</sup> (b)	D 4491	0.1	0.1	0.1
NOTES (a) Percent of tensile strength retained determined after ultraviolet weathering, ASTM D 4355 for 500 hours. (b) This number reflects typical not minimum values for this test method only. The k value of the geotextile shall be greater than the k value of the soil.				

- B. Class A erosion control applications are those where the geotextile is used under conditions where installation stresses are greatest (more severe than Class B, i.e., stone placement height should be no more than 5 feet and stone weights should not exceed 250 pounds).
- C. Class B erosion control applications for geotextiles are used under conditions where installation stresses are more severe than Class C, i.e., stone placement height should be less than 3 feet and stone weights should not exceed 250 pounds.
- D. Class C erosion control applications are those where the geotextile is used in structures or under conditions where the geotextile is protected by a sand cushion or by "zero drop height" placement of stone.

**2.5 ROADWAY PAVEMENT GEOTEXTILES**

- A. Sheet Fabric: Non-woven. Heat bonded only on one side to assist in preventing bleed through of tack coat and sticking of fibers to wheels of laydown equipment.

Table 4 – Roadway Paving Geotextile			
Property	ASTM	MARV	
		Standard	Heavy Duty
Grab Tensile Strength, lbs. (a)	D 4632	80	120
Grab Elongation, percent	D 4632	50	50
Asphalt Retention, gal/yd <sup>2</sup>	--	0.2	0.3
Melting Point, deg. F.	D 276	300	300
Ultraviolet Degradation	D 4355	70	70
Apparent Opening Size, (AOS-US sieve)	D 4751	≥ 60	≥ 60
NOTES (a) Percent of tensile strength retained determined after ultraviolet weathering, ASTM D 4355 for 500 hours.			

- B. Crack Patch Fabric: Needle-punched non-woven coated with asphalt cement and a rubberized asphalt adhesive.

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Table 5 – Crack Patching Geotextile		
Property	ASTM	MARV
Strip Tensile, lbs/in (a)	D 882	50
Puncture resistance, lb	E 154	200
Permeance, perms	E 69 Method B	0.10 (max)
Pliability (b)	D 146	No crack in fabric or rubberized asphalt
NOTES (a) Using 12 in/min test speed and 1" initial distance between grips. (b) Using 180 degree bend on 1/4" mandrel at -25 deg. F.		

**2.6 DRAINAGE GEOTEXTILES**

A. Use non-woven fabric.

Table 6 – Drainage Geotextile			
Property	ASTM	MARV	
		Class A	Class B
Grab Tensile Strength, lbs. (a)	D 4632	200	100
Grab Elongation, percent	D 4632	>50	>50
Puncture Strength, lbs.	D 4833	60	30
Trapezoid Tear, lbs.	D 4533	50	40
Flux, gal/min/ft <sup>2</sup>	D 4491	25	25
Apparent Opening Size, (AOS - US Sieve)	D 4751	>59	>59
Permittivity, sec. <sup>-1</sup> (b)	D 4491	0.1	0.1
NOTES (a) Percent of tensile strength retained determined after ultraviolet weathering, ASTM D 4355 for 500 hours. (b) The k value of the geotextile shall be greater than the k value of the soil. This number reflects typical not minimum values for this test method only.			

B. Class A drainage applications are for fabrics where installation stresses are more severe than Class B, i.e. very coarse sharp angular aggregate is used, a heavy degree of compaction (greater than or equal to 95 percent Standard Proctor, Section 31.23.26) is specified or depth of Trench is greater than 10 feet deep.

**Deleted:** B. Class A drainage applications are for fabrics where installation stresses are more severe than Class B, i.e. very coarse sharp angular aggregate is used, a heavy degree of compaction (greater than or equal to 95 percent Standard Proctor, Section 31.23.36) is specified or depth of Trench is greater than 10 feet deep.¶

C. Class B drainage applications are those where fabric is used with smooth graded surfaces having no sharp angular projections, no sharp angular aggregate, compaction requirements are light, (less than 95 percent Standard Proctor Density, Section 31.23.26), and Trenches are less than 10 feet deep

**Deleted:** C. Class B drainage applications are those where fabric is used with smooth graded surfaces having no sharp angular projections, no sharp angular aggregate, compaction requirements are light, (less than 95 percent Standard Proctor, Section 31.23.36), and Trenches are less than 10 feet deep.

**2.7 WEED BARRIER GEOTEXTILE**

A. Use non-woven fabric.

Table 7 – Weed Barrier Geotextile		
Property	ASTM	MARV
		Standard
Grab Tensile Strength, lbs. (a)	D 4632	90
Grab Elongation, percent	D 4632	>50
Puncture Strength, lbs.	D 4833	25
Trapezoid Tear, lbs.	D 4533	30
Apparent Opening size (AOS - US Sieve)	D 4751	>49
Ultraviolet Degradation, percent	D 4355	70
<b>NOTES</b> (a) Percent of tensile strength retained determined after ultraviolet weathering, ASTM D 4355 for 500 hours.		

**2.8 POSTS**

- A. Minimum length: 4 feet.
- B. Steel: Round, U shaped, T shaped, or C shaped with a minimum weight of 1.3 pounds per foot, and have projections for fastening wire.
- C. Wood as follows:
  - 1. Soft wood posts at least 3 inches in diameter, or nominal 2 x 4 inches and straight to provide a fence without noticeable misalignment.
  - 2. Hard wood post providing a minimum cross sectional area of 2.25 square inches.
- D. Fasteners for Wooden Posts:
  - 1. Wire staples No. 17 gage minimum with a crown at least 3/4 inches wide and legs at least 1/2 inch long.
  - 2. Nails 14 gage minimum, 1 inch long with 3/4 inch button heads.

**2.9 SOURCE QUALITY CONTROL**

- A. Sampling practices, ASTM D 4354.
- B. Conformance verification, ASTM D 4759.

**PART 3 EXECUTION**

**3.1 STABILIZING POOR LOAD BEARING SOILS**

- A. Remove all organic material larger than 1 inch in diameter from the Subgrade and grade to elevations required for overlaying backfill.
- B. Compact Subgrade to the extent allowed by the condition of the substrate.
- C. Roll fabric onto Subgrade so Subgrade remains smooth. Do not drag.
- D. Fold or overlap geotextile in direction of drainage.
- E. Provide fabric overlap joints as follows.

Table 8 – Geotextile Overlap		
Soil CBR Rating	Overlap Required	
	Unsewn, inches	Sewn, inches
Less than 1	--	4
1-2	36	4
2-3	30	3
3-5	24	--
Greater than 5	18	--

NOTES  
 (a) Sewn seams, both factory and field seams shall conform to 90 percent of the grab tensile strength requirements.

- F. Place granular material on top of fabric and spread carefully to insure no puncture. Minimum backfill lift on fabric; 6 inches.
- G. Cover fabric with 12 inches of sand before placing rock larger than 4 inches diameter on top of fabric.
- H. Avoid sudden stops or turning motions by equipment operating on aggregate placed over the fabric.
- I. Compact backfill soils over fabric to 95 percent or greater, Standard Proctor Density, Section 31 23 26.
- J. Repair any puncture by covering with new fabric using the same overlap dimensions indicated in Table above.
- K. Cover fabric within 14 days of deployment.

**Deleted:** I. Compact backfill soils over fabric; Section 33 05 05 to a Standard Proctor Density of 95 percent or greater.

**Deleted:** ¶

**3.2 SILT FENCE**

- A. Beginning work means acceptance of existing conditions.
- B. The quantity of temporary silt fences may be increased, decreased, or eliminated entirely at CONTRACTOR's discretion at no additional cost to OWNER. Maintain the silt fence until the Work is accepted or until the fence and silt accumulations are removed.
- C. Clear area of any debris and obstructions that may damage geotextile.
- D. Place post in all low points.
- E. Install posts a maximum of 8 feet apart with at least 18 inches in the ground. If not possible to achieve depth, secure posts to prevent overturning.
- F. Attach filter fabric by wire, cord, pockets, staples, nails, or other effective means.
  - 1. When using a wire support fence, provide at least 6 horizontal wires with a minimum of 12 gage wire. Space vertical wires 6 inches maximum. Secure geotextile to the up slope side of the post. Extend wire into the Trench a minimum of 2 inches and extend a maximum of 36 inches above the ground surface.
- G. Install fabric so 6 to 8 inches of fabric is left at the bottom to be buried. Splice together only at support posts with any a minimum overlap of 18 inches. Extend buried portion 6 inches deep and the rest upstream of the fabric fence.
- H. Sediment Removal: Remove sediment before deposit reaches 1/2 of the height of the silt fence, or extend height of silt fence. After removal of sediment, dress landscape.

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- I. Schedule of Locations: Typical locations include the toe of fill slopes, the downhill side of fill slopes, the downhill side of large cut areas, and at natural drainage areas. Limit geotextile materials to handle an area equivalent to 1,000 square feet per 10 feet of fence. Use caution should site slope be steeper than 1:1, and water flow rates exceed 1 cubic foot per second per 10 feet of fence face.

### 3.3 EROSION CONTROL

- A. Install fabric in locations shown on the Drawings.
- B. Unless otherwise specified, the geotextile shall be overlapped a minimum of 2 feet at all longitudinal and transverse joints, or the geotextile shall be sewn.
- C. If overlapped, the geotextile shall be placed so that the upstream sheet overlaps the downstream sheet.
- D. For placement on slopes, each strip shall overlap the next downhill strip.
- E. The geotextile shall be anchored using key Trenches or aprons at the crest and toe of the slope.
- F. Pins, usually 18 inches in length, may be helpful in securing the geotextile during installation.
- G. Repair: Place patch over damaged area and extend 3 feet beyond the perimeter of the tear or damage.

### 3.4 ROADWAY PAVING FABRICS

- A. Preparing Asphalt Concrete Surface:
1. Brush road surface clean of debris, dust and gravel. Remove all water from surface and allow to dry.
  2. Patch holes and level any uneven areas with asphalt concrete.
  3. Fill cracks between 1/8 inch to 1/2 inch with asphalt cement. Allow cement to cure prior to geotextile placement.
  4. Clean cracks larger than 1/2 inch to a depth of 3 inches and fill with asphalt concrete. Where Pavement is severely cracked, rutted, deformed or distressed, secure approval for providing an asphalt concrete leveling course prior to geotextile placement.
- B. Tacking Asphalt Surface for Pavement Fabric: Use tack asphalt recommended by fabric manufacturer. Apply tack as follows:
1. Dry Pavement surface; 0.20 to 0.30 gallons per square yard. Within street intersections, on steep grades and in zones where vehicle speed changes are commonplace, reduce the application rate to no less than 0.20 gallons per square yard.
  2. Heavy duty fabrics; 0.30 to 0.40 gallons per square yard.
  3. Provide a tack width equal to geotextile width plus 6 inches.
  4. Apply tack only as far in advance of geotextile installation as is appropriate to insure a tacky surface at the time of geotextile placement.

5. Allow tack time to cure with no moisture remaining prior to placing the geotextile and overlay.
6. Clean excess tack material from the road surface.

C. Placement of Fabric:

1. Place paving fabric into the asphalt with a minimum amount of wrinkling or folding. Wrinkles or folds in excess of 1 inch shall be slit and laid flat.
2. Shingle-lap all transverse joints and slit folds or wrinkles in the direction of the paving operation.
3. Maximize geotextile contact with the Pavement surface by brooming or pneumatic rolling.
4. Additional hand-placed asphalt may be required at laps and repairs.

D. Protection and Repair:

1. Do not allow traffic except necessary construction equipment and emergency vehicles to drive on the fabric.
2. Turn paver and other vehicles gradually and keep turning to a minimum to avoid movement and damage to the geotextile. Do not permit abrupt starts and stops.
3. Remove and replace damaged geotextile with the same type of geotextile, and shingle-lap the overlaps in the direction of paving. Restrict overlaps to a maximum of 6 inches.

### 3.5 SUBSURFACE DRAINAGE

- A. Excavate Trench to size and depth indicated.
- B. Cut fabric to width required and place in Trench. Prevent damage to geotextile.
- C. Overlap geotextile 12 inches or the full width of the Trench, whichever is less at the top of the Trench.
- D. Overlap successive pieces of geotextile a minimum of 12 inches in the direction of flow.
- E. Place fill to hold fabric in place.
- F. Repair any damage to geotextile by placing patches extending 3 feet in all directions beyond the damaged area.

G. Cover fabric within 14 days of deployment.

### 3.6 WEED BARRIER

- A. Preparation:
  1. Remove sharp objects, large stones and undesirable vegetation.
  2. If placing geotextile over existing bed, cut an "X" over each plant and push geotextile under plant base. If placing over new bed, roll geotextile over soil and cut an "X" for each plant hole. Fold excess geotextile under and cover with specified landscaping materials.
- B. Surface Cover: Provide a minimum of 4 inches of cover on all areas on the geotextile unless otherwise specified by ENGINEER. If using large landscape rock, increase

thickness of cover material over geotextile to 3 times the diameter of the largest rock material. Do not leave any portion of geotextile exposed to direct sunlight.

- C. Repair: Repair immediately. Clear the damaged area plus an additional 3 feet and apply geotextile patch.
- D. Maintenance: Maintain surfaces and supply additional landscape materials where necessary, including areas affected by erosion.

### **3.7 FIELD QUALITY CONTROL**

- A. Reject fabric at the time of installation, if it has defects, rips, holes, flaws, deterioration, or damage incurred during manufacture, transportation, handling or storage.

END OF SECTION

## **SECTION 31 05 21 AMENDED GEOGRIDS/GEOCOMPOSITES**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Geogrid and geocomposite material requirements.

#### **1.2 REFERENCES**

- A. ASTM D 4354: Standard Practice for Sampling of Geotextiles for Testing.
- B. ASTM D 4759: Standard Practice for Determining Specification Conformance of Geosynthetics.
- C. ASTM D 4873: Standard Guide for Identification, Storage, and Handling of Geotextiles.
- D. ASTM D 5321: Standard Practice for Determining the Coefficient of Soil and Geosynthetic by Direct Shear.
- E. ASTM D 6213: Standard Tests to Evaluate the Chemical Resistance of Geogrids to Liquids.
- F. ASTM D 6637: Standard Test Method for Determining Tensile Properties of Geogrid.
- G. FHWA-SA-96-071: Mechanically Stabilized Earth Walls and Reinforced Soil Slopes Design and Construction Guidelines.

#### **1.3 DEFINITIONS**

- A. Geocomposite: Fabric composed of a geogrid and geotextile.
- B. MARV: Defined in Section 31 05 19.

#### **1.4 SUBMITTALS**

- A. Geogrid sample.
- B. Geocomposite sample
- C. Manufacturer's warranty.
- D. Installer's warranty.

#### **1.5 DELIVERY STORAGE AND HANDLING**

- A. Label, handle and store product, ASTM D 4873.
- B. Deliver product dry, in a plastic wrapping that protects the entire roll.
- C. Protect product from ultraviolet light and temperature greater than 160 deg. F. until application. Cover product within 14 days of deployment.

#### **1.6 QUALITY ASSURANCE**

- A. Provide manufacturer's on-site technical supervision and assistance if required for manufacturer's warranty.

**1.7 WARRANTY**

- A. Manufacturer: Warrant product for a period of 20 years on a prorated basis against manufacturing defects, workmanship, and deterioration due to exposure to the elements.
- B. Installer: Warrant material and workmanship for 2 years.

**PART 2 PRODUCTS**

**2.1 GEOGRID/GEOCOMPOSITES - GENERAL**

- A. Synthetic fiber net at least 85 percent by weight of polypropylene, polyethylene, polyester, polyvinyl alcohol, or polyamide.
- B. Resistant to chemical attack, rot and mildew.
- C. No tears or defects that will adversely alter properties of product.

**2.2 ROADWAY PAVEMENT GEOCOMPOSITE**

- A. Placement is between asphalt layers. Product is geogrid glued to a lightweight non-woven bitumen coated geotextile.

Table 1 – Roadway Pavement Geocomposite		
Property	ASTM	MARV
Ultimate Tensile Strength, lb/ft	D 6637	3425 x 3425
Tensile Strength at 3 percent Strain, lb/ft	D 6637	825 x 825
Melting Point (geogrid), deg. F.	–	490
Softening Point (geotextile), deg. F.	–	220

**2.3 ROADWAY AGGREGATE GEOGRID**

- A. Subbase geogrid is placed on the Subgrade below new fill or crushed aggregate base.
- B. Base course geogrid is placed between fills or crushed aggregate bases.

Table 2 – Roadway Aggregate Geogrid			
Property	ASTM	MARV	
		Subbase	Base Course
Ultimate Tensile Strength, lbs/ft.	D 6637	900 x 1400	900 x 1400
Tensile Strength at 2 percent Strain, lbs/ft.	D 6637	–	300 x 445
Tensile Strength at 5 percent Strain, lbs/ft.	D 6637	580 x 920	–
Coefficient of Direct Shear	D 5321	1.0	1.0
Chemical Resistance range, pH	D 6213	2 – 12	2 – 12
Aperture Size range, inches	Measured	0.5 – 1.3	0.5 – 1.3
Open Area, percent	-	50 – 80	50 – 80

**2.4 EMBANKMENT GEOGRID**

- A. Geogrid is used for earth slope and retaining wall reinforcement.

Table 3 – Embankment Geogrid				
Property	ASTM	MARV		
		Type 1	Type 2	Type 3
Long Term Design Strength, lb/ft	(a)	700	1300	1900
Chemical resistance, pH	D 6213	2 – 12	2 – 12	2 – 12
Aperture Size inches	Measured	0.8 – 1.2	0.8 – 1.2	0.8 – 1.2
NOTES				
(a) FHWA-SA-96-071.				

**2.5 CLAMPS, TAPE, RUBBER PADS**

A. Recommended by manufacturer.

**2.6 SOURCE QUALITY CONTROL**

- A. Sample geogrids and geocomposites using ASTM D 4354 standard practices.
- B. Verify specification conformance, ASTM D 4759.

**PART 3 EXECUTION**

**3.1 PREPARATION**

- A. Instruct workers about protecting product of this section.
- B. Repair damage to Subgrade surface prior to installation.
- C. Round edges of Excavation and grade changes.

**3.2 GRANULAR BASE REINFORCEMENT**

- A. Deploy each panel per manufacturer’s recommendations.
- B. Provide sufficient material to allow for expansion and contraction.
- C. Do not fold. Do not tie overlaps.
- D. Install panels so overlapping panel is upgrade of the underlying panel.
- E. Provide geogrid overlap as follows.

<b>Soil</b>	<b>Recommended</b>
<b><u>CBR Rating</u></b>	<b><u>Overlap</u></b>
3 +	0.5 feet
2 – 3	1.0 feet
1 – 2	2.0 feet
less than 1	3.0 feet

F. Provide a minimum fill thickness of six inches prior to operating tracked vehicles over geogrid.

**3.3 ASPHALT CONCRETE PAVEMENT REINFORCEMENT**

- A. Clean the surface of the asphalt concrete base course.
- B. Seal cracks wider than 1/8 of an inch. Repair larger cracks, Potholes, depressions, and irregularities.

- C. Spray on tack coat uniformly at 0.08 - 0.10 gal/yd<sup>2</sup> and place geogrid on the tack coat.
- D. Overlap in a shingle fashion in the direction of overlay placement. Overlap all roll edges and ends six inches.
- E. Place 2 inches minimum asphalt concrete over the geogrid. Compact, Section 32 12 16.

### 3.4 SOIL REINFORCEMENT

A. Compact Embankment Subgrade.

B. Place Embankment geogrid at the locations and elevations shown on the Plans or controlled by the geogrid manufacturer. Place any specified free draining crushed aggregate base above the geogrid. Compact to 95 percent or greater, Standard Proctor Density, Section 31 23 26.

**Deleted:** B. Place Embankment geogrid at the locations and elevations shown on the Plans or controlled by the geogrid manufacturer. Place any specified free draining crushed aggregate base above the geogrid. Compact the fill to a standard proctor of 95 percent or greater.

### 3.5 PROTECTION

A. At least 6 inches of fill cover is required if tracked vehicles are operated over geogrid.

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END OF SECTION

## SECTION 31 23 16 AMENDED EXCAVATION

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Excavation and disposal of excavated materials.
- B. Protection of existing facilities, utilities, and structures affected by excavation.

#### 1.2 DEFINITIONS

- A. Extra Excavation: Upper limit of Excavation is proposed excavation limit. Lower and lateral limits are as authorized by ENGINEER.
- B. Classified Excavation: The excavation of specified materials.
- C. Incidental Excavation: Excavation done for CONTRACTOR's benefit, excavation error, dewatering of Excavation, slough, or over-break.
- D. Unclassified Excavation: The excavation of all materials encountered regardless of the nature, size, or manner in which they are removed. Presence of isolated boulders or Rock fragments will not be sufficient cause to change classification of surrounding materials.

#### 1.3 STORAGE AND HANDLING

- A. Stockpile excavated material to cause a minimum of inconvenience to public and provide for emergency services as necessary.
- B. Provide free access to all existing fire hydrants, water and gas valves, and meters.
- C. Provide free flow of storm water in all gutters, conduits, and natural water courses.
- D. Utilize traffic control signs, markers, and procedures in product storage and handling activities.
- E. Promptly remove other material from site.

#### 1.4 SITE CONDITIONS

- A. Prior to excavation, photograph existing surfaces along which work may take place in order to determine, after construction is completed, whether any damage to existing improvements occurred prior to construction operations. Refer to construction photograph requirements, Section 01 78 39.
- B. Perform Incidental Excavation at no additional cost to OWNER.

#### **1.5 Permitting**

- A. Prior to initiating any excavation within Logan City, obtain the necessary permits as listed in 1 57 00. See Logan City Engineering website for a listing of permits and the related contact information**

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**PART 2 PRODUCTS****2.1 MATERIALS FOR OVER EXCAVATED AREAS**

- A. Common fill, Section 31 05 13.
- B. Crushed aggregate base, Section 32 11 23.
- C. Stabilization fill, crushed aggregate base or common fill with maximum rectilinear particle size of 2 inches.
- D. Stabilization fabric, Section 31 05 19.

**PART 3 EXECUTION****3.1 PREPARATION**

- A. Use white paint and mark the proposed Excavation.
- B. Call the one-call center and wait the required amount of time. Color of one call center marks indicate the following.
  - 1. White: Proposed Excavation
  - 2. Pink: Temporary survey markings
  - 3. Red: Electric power lines, cables, conduit and lighting cables
  - 4. Yellow: Gas, oil, steam, Petroleum or gaseous materials
  - 5. Orange: Communications, alarm, signal, cables or conduits.
  - 6. Blue: Potable water.
  - 7. Purple: Reclaimed Water, irrigation and slurry lines
  - 8. Green: Sewer and storm drain lines

**3.2 PROTECTION**

- A. Identify required lines, grades, contours, and benchmarks, Section 01 71 23.
- B. Pothole, expose or otherwise locate utilities as necessary to give utility company at least 4 days notice to protect, preserve, or relocate a utility that interferes with or may be damaged by excavation work.
- C. Where utilities or structures conflict with design grades, report conflict to the appropriate utility company and ENGINEER 14 days prior to the initiation of work within the conflict area.
- D. For temporary controls, refer to Section 01 57 00.
- E. Support and protect from damage any existing facility and structure that exists in, passes through, or passes under the site.
- F. No Contract Time extension shall be granted and no additional compensation shall be made if CONTRACTOR fails to pothole and identify buried utilities or structures which conflict with the Work.

**3.3 TOPSOIL**

- A. Excavate topsoil only to depth that will preserve topsoil quality.

B. Do not mix topsoil with subsoil during stockpiling or spreading.

### 3.4 LANDSCAPE SPRINKLER SYSTEMS

A. Protect existing landscape sprinkler systems.

B. When disturbance of existing sprinkler system is required, interrupt and repair system so operation of system is maintained.

### 3.5 SHORING

A. Slope, shore, sheet, brace or otherwise support Excavations over 4 feet deep, Section 31 41 00.

B. When soil conditions are unstable, Excavations shallower than 4 feet deep must also be sloped, supported or shored.

### 3.6 DEWATERING

A. Keep Excavation free from surface and ground water.

B. If ground water table is in the intended construction operations, dewater Excavations.

C. If there are no olfactory or visual indications of contamination in the water, discharge according to requirements of Federal, State or local agency having jurisdiction.

D. If any evidence of contamination in the water, based on olfactory or visual indications, cease excavation work until potential risks are evaluated. During evaluation, handle water as a contaminated material.

E. Pay for damages and costs resulting from dewatering operations.

### 3.7 GENERAL EXCAVATION REQUIREMENTS

A. Excavate topsoil from areas to be relandscaped or regraded and other marked areas.

B. Excavate site to line and grade indicated.

C. Carefully excavate soils in vicinity of buried utility marks placed by the one-call center.

D. Where soil has been softened or eroded by flooding or hardened by drying during unfavorable weather, rework all damaged areas or replace with approved material at no additional cost to OWNER.

E. Notify ENGINEER of unexpected subsurface conditions.

F. Underpin adjacent structure, service utilities and pipe chases that may be damaged by Excavation work.

G. Protect Excavation walls as required. If conditions permit, slope Excavation Sides to maintain a safe and clean working area. Remove loose materials.

H. Where ENGINEER deems Subgrade material to be susceptible to frost heave or otherwise unsatisfactory, excavate additional depth.

### 3.8 ROADWAY EXCAVATION

A. In advance of setting line and grade stakes, clean Subgrade area of brush, weeds, vegetation, grass, and debris. Drain all depressions or ruts that contain water.

B. Backfill and compact over excavation, Section 33 05 05.

[B. Backfill and compact over excavation, Section 31 23 26.](#)

**3.9 STRUCTURAL AND LANDSCAPE EXCAVATION**

- A. Provide Shoring, cribs, cofferdams, caissons, pumping, bailing, draining, sheathing, bracing, and related items.
- B. For piling work, coordinate special requirements for piling. Protect Excavation walls.
- C. If conditions permit, slope Excavation Sides as excavation progress. Maintain a safe and clean working area.
- D. Support Excavations. Do not interfere with the bearing of adjacent foundations, pipelines, etc.

**3.10 TRENCH EXCAVATION**

- A. Grade bottom of Trenches to provide uniform bearing surface.
- B. If necessary, make bellholes and depressions required to complete joining of pipe or box.
- C. Limit width of Trench excavations to the dimensions suitable for worker access per pipe manufacturer's recommendation. Provide enough space for compaction equipment. Notify ENGINEER if excavation operations exceed any indicated line and grade limits.

D. In public right-of-way and regardless of trench depth, trenches shall not be left open overnight. Backfill and compact excavations or provide a bridge plate sufficient for the required traffic loads.

**Deleted:** D. In public thoroughfares and regardless of Trench depth, limit length of open Trenches to 200 lineal feet day or night. Provide barricading, Section 01 55 26. Protect Trenches over night

E. If the bottom of the trench is unsuitable for pipe foundation; notify the ENGINEER immediately before performing any further excavation. Upon receiving approval, over excavate a minimum of four (4) inches and replace with granular backfill material, sand, or pea gravel (31 05 13) as directed by ENGINEER.

F. Protect trench and workers in trench in compliance with Occupational Safety and Health Administration; Labor (29 CFR, Part 1926 Current edition, Subpart P, Excavations)

**3.11 Tunneling and Boring**

A. Obtain authorization from the City Engineer prior to tunneling or boring under existing curb and gutter, sidewalk, or pavement. The necessary approvals will include special construction requirements including grout backfill or others as appropriate.

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**3.12 EXTRA EXCAVATION**

- A. If unstable material is encountered at the bottom or face of any Excavation, do not perform extra excavation without written consent.
- B. Correct excavations beyond the specified lines and grades by filling and compacting the resulting voids with acceptable fill.
- C. Volume of Excavation within any specified pay limit will be determined by the method of average-end-areas in the original position.

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**3.13 TOLERANCE**

**A. Grading: Top surface of Subgrade equal plus or minus 1 inch.**

**Deleted: 3.12 TOLERANCE**

**Deleted: A. Grading: Top surface of Subgrade = plus or minus 1 inch.¶**

END OF SECTION

## **SECTION 31 23 23 AMENDED BACKFILLING FOR STRUCTURES**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Structural backfill materials.
- B. Structural backfilling requirements.

#### **1.2 SUBMITTALS**

- A. Submit maximum laboratory dry density and optimum laboratory moisture content for:
  - 1. Subgrade material, and
  - 2. Each type of fill to be used.
- B. Upon ENGINEER's request, submit a written quality control Inspections and testing report describing source and field quality control activities performed by CONTRACTOR and its Supplier.

#### **1.3 QUALITY ASSURANCE**

- A. Do not change material sources, or aggregate without ENGINEER's knowledge.
- B. Reject backfill material that does not comply with requirements specified in this section.

#### **1.4 STORAGE**

- A. Safely stockpile backfill materials.
- B. Separate differing materials, prevent mixing, and maintain optimum moisture content of backfill materials.
- C. Avoid displacement of and injury to Work while compacting or operating equipment.
- D. Movement of construction machinery over Work at any stage of construction is solely at CONTRACTOR's risk.

#### **1.5 SITE CONDITIONS**

- A. Do not place, spread, or roll any backfill material over material that is damaged by water. Remove and replace damaged material at no additional cost to OWNER.
- B. Control traffic and erosion. Keep area free of trash and debris. Repair settled, eroded, and rutted areas.
- C. Reshape and compact damaged structural section to required density.

#### **1.6 ACCEPTANCE**

- A. General:
  - 1. Native material may be wasted if there is no additional cost to substitute material acceptable to ENGINEER.
  - 2. For material acceptance refer to.

- a. Common fill, Section 31 05 13.
  - b. Crushed aggregate base, Section 32 11 23.
  - c. Cement treated fill, Section 31 05 15.
- B. Structure Backfilling: One test per Lot.

Table 1 – Lot Size for Structural Backfilling Operations		
Structure Type	Test Criteria	Lot Size
Strip Footings	Standard (a)	Subgrade: 200 lineal feet
	Modified (a)	Crushed aggregate base: 200 lineal feet per lift.
Structure Footing excluding strip footings	Standard (a)	Subgrade: 225 square feet.
	Modified (a)	Crushed aggregate base: Each 225 square feet per lift
Embankments	Standard (a)	Fill: 625 square feet per lift
Miscellaneous small structures (e.g. Manholes, drainage boxes, etc.)	Standard (a)	Subgrade: Each footprint area Fill: Each lift
	Modified (a)	Crushed aggregate base: Each lift
NOTES		
(a) Proctor density, Section 31 23 26		
(b) Lift thickness before compaction is 8 inches.		

Table 1 – Lot S	
Structure Type	To
Strip Footings	St Mo
Structure Footing excluding strip footings	St Mo
Embankments	St
Miscellaneous small structures (e.g. Manholes, drainage boxes, etc.)	St Mo
NOTES	
(a) Proctor density, Se	
(b) Lift thickness befor	

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**1.7 WARRANTY**

- A. Restore incidentals damaged by settlement at no additional cost to OWNER.

**PART 2 PRODUCTS**

**2.1 BACKFILL MATERIALS**

- A. Common fill, Section 31 05 13.
- B. Crushed aggregate base, Section 32 11 23.
- C. Cement treated fill, Section 31 05 15.

**2.2 ACCESSORIES**

- A. Water:
  - 1. Make arrangements for sources of water during construction and make arrangements for delivery of water to site.
  - 2. Comply with local Laws and Regulations at no additional cost to OWNER when securing water from water utility company.

**PART 3 EXECUTION**

**3.1 PREPARATION**

- A. Verify:
  - 1. Stockpiled fill meets gradation requirements.

- 2. Foundation walls are braced to support surcharge forces imposed by backfilling operations, areas to be backfilled are free of debris, snow, ice or water.
- 3. Ground surface is not frozen.
- B. If subgrade is not readily compactable secure written authorization for extra excavation and backfill, Section 31 23 16.
- C. Identify required line, levels, contours, and datum.
- D. Stake and flag locations of underground utilities.
- E. Upon discovery of unknown utility or concealed conditions, notify ENGINEER.

**3.2 PROTECTION**

- A. Protect existing trees, shrubs, lawns, existing structures, fences, roads, sidewalks, paving, curb and gutter and other features.
- B. Protect above or below grade utilities. Contact utility companies to repair damage to utilities. Pay all cost of repairs.
- C. Protect Subgrade from desiccation, flooding and freezing.
- D. Do not fill adjacent to structures until Excavation is checked by ENGINEER.
- E. Do not use compaction equipment adjacent to walls or retaining walls that may cause wall to become over-stressed or moved from alignment.
- F. Do not disturb or damage foundation perimeter drainage, foundation, damp-proofing, foundation waterproofing and protective cover, or utilities in Trenches.
- G. Restore any damaged structure to its original strength and condition.

**3.3 LAYOUT**

- A. Maintain all benchmarks, control monuments and stakes, whether newly established by surveyor or previously existing. Protect from damage and dislocation.
- B. If discrepancy is found between Contract Documents and site, ENGINEER shall make such minor adjustments in the Work as necessary to accomplish the intent of Contract Documents without increasing the Cost of the Work to CONTRACTOR or OWNER.

**3.4 FOUNDATIONS AND SLABS ON GRADE**

- A. Place backfill materials in lifts not exceeding 8 inches after compaction.
- B. Do not backfill against walls until concrete has obtained 14 day strength. Backfill against foundation walls simultaneously on each side.
- C. Fill unauthorized excavations with material acceptable to ENGINEER at no additional cost to OWNER.
- D. Do not damage adjacent structures or service lines.
- E. Where flowable fill is used, use fill that flows easily and vibration for compaction is not required.

**3.5 MODIFIED BACKFILL LAYER METHOD**

- A. Refer to Section 33 05 20.

**3.6 COMPACTION**

~~A. Compact backfill; Section 31 23 26 to the following maximum dry densities.~~

Deleted: A. Compact backfill; Section 33 05 05 to the following maximum dry densities.

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1. Under Footings: 98 percent.
2. Interior Crawl Spaces: 90 percent.
3. Interior Slab-On-Grade: 98 percent.
4. Side of Foundation Walls and Retaining Walls:
  - a. Exterior: 95 percent.
  - b. Interior: 98 percent.
5. Miscellaneous Structures: 95 percent.

### **3.7 CLEANING**

- A. Remove stockpiles from the site. Grade site surface to prevent free standing surface water.
- B. Leave borrow areas clean and neat.

END OF SECTION

## **SECTION 31 23 26 AMENDED COMPACTION**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Compaction of granular fill materials.

#### **1.2 REFERENCES**

- A. ASTM D 698: Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kNm/m<sup>3</sup>)).
- B. ASTM D 1557: Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
- C. ASTM D 2216: Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock.
- D. ASTM D 2922: Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- E. ASTM D 3017: Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
- F. ASTM D 3282: Standard Practice for Classification of Soils and Soil- Aggregate Mixtures for Highway Construction Purposes.
- G. ASTM D 3740: Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

#### **1.3 DEFINITIONS**

- A. A-1 Soil: Defined in ASTM D 3282.
- B. Modified Proctor Density: The maximum laboratory density, as defined in and determined by ASTM D 1557 using procedure A, B or C as applicable.
- C. Relative Density (or Relative Compaction): The ratio of field dry density to the maximum laboratory density expressed as a percentage.
- D. Standard Proctor Density: The maximum laboratory density, as defined in and determined by ASTM D 698 using procedure A, B or C as applicable.

#### **1.4 QUALITY ASSURANCE**

- A. Use a laboratory that follows and complies with ASTM D 3740.

### **PART 2 PRODUCTS Not Used**

### **PART 3 EXECUTION**

#### **3.1 COMPACTION**

- A. Moisten or dewater backfill material to obtain optimum moisture for compaction.

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- B. Correct deficient compaction conditions. Replace or repair materials and damaged facilities.
- C. When no density compactive effort is specified, compact the entire area to eliminate unstable zones.

**3.2 FIELD QUALITY CONTROL**

A. Testing: Perform control testing of materials. Perform additional testing at no additional cost to OWNER.

- 1. Because of changes in source of materials or proportions requested by CONTRACTOR.
- 2. Because of Failure of materials to meet specification requirements.
- 3. For other testing services needed or required by CONTRACTOR.

B. Report: For each material tested, record the following.

- 1. Vertical and horizontal location of the test.
- 2. Optimum laboratory moisture content.
- 3. Field moisture content.
- 4. Maximum laboratory dry density.
- 5. Field density.
- 6. Percent compaction results.

▼ 7. Certification of test results by Independent Testing Agency.

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C. Optimum Soil Density: Use ASTM D 2216 and the following industry standards.

- ▼ 1. For A-1 Soils: Method C of ASTM D 1557 (Modified Proctor)
- ▼ 2. For All Other Soils: Method C of ASTM D 698 (Standard Proctor).

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**Deleted:** 2. For All Other Soils: Use test method C of ASTM D 698 (Standard Proctor).

D. Field Density:

- 1. Use ASTM D 3017 and test method C of ASTM D 2922 for shallow depth nuclear testing.
- 2. No density determinations are required on any material containing more than 65 percent material retained on the number 10 sieve or more than 60 percent material retained on the number 4 sieve. In lieu of reporting densities in such cases, report the sieve analysis to document the material type.

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END OF SECTION

**SECTION 31 25 00 AMENDED  
EROSION AND SEDIMENTATION CONTROL**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Erosion control and slope protection facilities including blankets or mulches.
- B. Construction of drainage facilities to protect work area.

**1.2 SUBMITTALS**

- A. Submit prior to using:
  - 1. Sample of blanket or geotextile materials.
  - 2. Mulch formula.
  - 3. Revegetation mixture listing
  - 4. Plant list.
  - 5. Geotextile manufacturer's certification.

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- B. Application rate of fiber mulches recommended by tackifier manufacturer.

**1.3 DELIVERY, STORAGE AND HANDLING**

- A. Deliver seed in original containers with certified germination test results showing analysis of seed mixture, percentage of pure seed, year of production, and date of packaging. Damaged packages are not acceptable. Store seed free of moisture.
- B. Deliver fertilizer in waterproof bags showing weight, chemical composition and name of manufacturer.
- C. Deliver blanket in original wrapping showing name of manufacturer and product weight.
- D. Deliver plant materials immediately prior to placement.
- E. Replace plant when original root protection system (burlap bag wrap of earth ball, plastic container with special plant bedder, etc.) has been broken or displaced prior to planting.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- A. Riprap: Rock, Section 31 37 00.
- B. Blankets: Uniform open weave jute, wood fiber, biodegradable or photodegradable synthetic fiber matting.
- C. Geotextiles: Refer to fabric in Section 31 05 19.
- D. Erosion Control Vegetation Mats: Permanent three dimensional mats which allow for revegetation where high water flows are expected.

E. Fiber Mulches: Straw, hay, wood or paper, or Engineer approved compost free from weeds or foreign matter detrimental to plant life.

**Deleted:** E. Fiber Mulches: Straw, hay, wood or paper free from weeds or foreign matter detrimental to plant life.

F. Mulch Binder: Vegetable based gel tackifier with growth stimulant.

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G. Topsoil and Fertilizer: Refer to Section 31 05 13 and Section 32 92 00.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Remove foreign materials, roots, rocks, and debris.
- B. Grade to eliminate rough spots, and ponding areas.
- C. Grade soil to drain perimeter water away from protected areas.
- D. As applicable.
  - 1. Temporary controls, Section 01 57 00.
  - 2. Grass, Section 32 92 00.

### 3.2 SLOPE PROTECTION BLANKET

- A. Cover seeded slopes where grade is greater than 3 horizontal to 1 vertical with blanket. Roll down over slopes carefully and loosely without stretching or pulling.
- B. Lay blanket smoothly on prepared soil surface. Bury top end of each section in a narrow Trench. Leave 24 inches overlap from top roll over bottom roll. Leave 12 inches overlap over adjacent section.
- C. Toe-in top end of each section in narrow Trench at least 12 inches deep. Toe-wrap fabric at bottom of slope.
- D. Staple loosely the outside edges and overlaps.
- E. In ditches, lay matting in upstream direction. Overlap and staple ends 6 inches with upstream section on top.
- F. If natural drainage water traverses protected or controlled area; construct a channel or riprap according to Drawings and Section 31 37 00.
- G. Lightly dress slopes with topsoil to ensure close contact between cover and soil.
- H. Present alternative methods of protection for approval prior to starting any work.

### 3.3 GEOTEXTILE

- A. Placement, Section 31 05 19.

### 3.4 MULCHES

- A. Apply mulches at the rate indicated.
- B. When installed with a tackifier, apply at the rate recommended by the tackifier Supplier.

C. Apply seed mix onto prepared seed bed prior to applying compost mulch. If compost is used, mix compost with 50 percent wood chips. Incorporate tackifier into compost prior to application. Apply the greater of 1 inch in depth or as specified by the ENGINEER.

**3.5 SURFACE COVER**

- A. Grass, Section 32 92 00.
- B. Ground cover, Section 32 93 13.

**3.6 MAINTENANCE**

- A. Maintain surfaces and supply additional topsoil where necessary, including areas affected by erosion.
- B. Protect and repair geotextiles, Section 31 05 19.
- C. Keep surface of soil damp only as necessary for seed germination.
- D. Apply water slowly so surface of soil will not puddle and crust.
- E. Replant damaged grass areas showing root growth Failure, deterioration, bare or thin spots, and eroded areas.
- F. Re-fertilize 60 days after planting.
- G. Remove weeds that are over 3 inches high.

END OF SECTION

## SECTION 31 41 00 AMENDED SHORING

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Shoring for open Excavations requiring a Protective System.
- B. Underpinning to stabilize adjacent structure.

#### 1.2 References

A. Use only shoring and shielding systems in compliance with Code of Federal Regulations (CFR) 29, Part 1926, Subpart P, latest revision.

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#### 1.3 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. In trenching, two Protective Systems are required if each Side of the Trench is to be shored. The use of a Trench Box shall be classified as one Protective System.
- B. Payment covers the cost of the Protective System to a depth of 3 feet below the Excavation elevations indicated. Allowance for extra cost may be made, based upon the actual cost to the CONTRACTOR of constructing, extending or reconstructing any Protective System that may be necessary to carry the excavation to the required depth which is greater than 3 feet below the Excavation elevations indicated. The extra cost will be paid for by **Change Order**.
- C. Excavation in Lieu of Protective System: When Protective Systems are indicated and with the written approval of the ENGINEER the actual installation of the Protective Systems are not made, the CONTRACTOR will be paid in full for the Protective System bid item, which includes all extra excavation, extra backfill, backfill compaction, or other incidental work performed by CONTRACTOR in lieu of constructing the Shoring or underpinning.

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MEASUREMENT AND PAYMENT¶

#### 1.4 DEFINITIONS

- A. Accepted Engineering Practices: Those requirements or practices that are compatible with standards required by a duly licensed or recognized authority.
- B. Benching: A method of protecting persons and property against cave-ins by excavating the Sides of an Excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.
- C. Excavation: Any man-made cut, cavity, or depression in an earth surface, including Trenches, formed by earth removal and producing unsupported earth conditions (Sides). If installed forms or similar structures reduce the depth-to-width relationship, an excavation may become a Trench.
- D. Failure: The permanent deformation or breakage of a structural member or connection; or the collapse of all or part of an Excavation.
- E. Protective System: Any recognized method of protecting persons and property against cave-ins, the collapse of adjacent structures, or material that may fall or roll from an

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Excavation Side or into an Excavation. Protective systems include Support Systems, Sloping and Benching systems and Shield systems.

- F. Shield: A structure that is able to withstand the forces imposed on it by a cave-in and thereby protect persons and property within the structure without preventing a cave-in. Shields may be permanent structures or may be designed to be portable and moved along as work progresses. Portable Shields used in Trenches are usually referred to as "trench boxes" or "trench shields".
- G. Shoring: A structure that supports the Sides of an Excavation and thereby protects persons and property by preventing cave-ins.
- H. Side: Vertical or inclined earth surface formed at the outer edges of an Excavation.
- I. Sloping: A method of protecting persons and property against cave-ins by excavating to form Sides that are inclined away from the Excavation, the angle of incline being of such a degree for the conditions of exposure that a cave-in will not occur.
- J. Support System: A structure that protects persons and property by providing support to an adjacent structure, underground installation, or the Sides of an Excavation.
- K. Trench: A narrow Excavation made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench is not greater than 15 feet.
- L. Trench Box: See Shield.
- M. Unfractured Rock: Rock that can be excavated with vertical Sides and remain intact while exposed. Fractured Rock is considered equivalent to unfractured Rock when the material on the Side or Sides of the Excavation is secured against cave-in or movement by Rock bolts, netting, or other means approved by a professional engineer.

**1.5 DESIGN OF PROTECTIVE SYSTEMS**

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- A. Design Support Systems, Shield systems, and the structural components of these systems, and Sloping and Benching systems to resist all loads that are intended to be imposed or transmitted to them.
- B. Design system for any hydrostatic pressure in the Sides of an Excavation.
- C. Treat all soils within the Boundary of the City of Logan as Class C soils unless more stringent requirements are required as defined in CFG 29, Part 1926, Subpart P.

**1.6 SUBMITTALS**

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- A. Submit a Protective System plan when requested.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- A. CONTRACTOR's choice.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Make safe or remove trees, surface encumbrances which are hazardous to Shoring operations.
- B. Provide adequate ventilation of Excavations.
- C. Control dust and groundwater.

### **3.2 STABILITY OF ADJACENT STRUCTURES**

- A. Support adjoining buildings, walls, sidewalks, Pavements, or other structures endangered by excavation operations.
- B. Excavation below level of base of footing of any structural foundation or wall shall not be permitted except as follows:
  - 1. Underpinning or other Support Systems is provided to ensure stability of structure, or
  - 2. Excavation is in Unfractured Rock, or
  - 3. A professional engineer determines in writing that such work will in no way pose a hazard to persons and property or the integrity of the structure.

### **3.3 PROTECTION OF PERSONS AND PROPERTY**

- A. Protect from cave-ins. Install a Support System, by Sloping, by Benching, by use of a Shield system, or by use of a combination of these methods.
- B. Scale to remove loose material. Use Rock bolting, wire mesh, installation of protective barricades, or provide equivalent protection.
- C. Stairway, Ladder, Ramp: Comply with OSHA.
- D. Protect against cave-ins from vibratory loads adjacent to excavation operations.

### **3.4 INSPECTIONS**

- A. Inspect Excavations daily for evidence of possible cave-ins, indications of Failure of Protective Systems, or other hazardous conditions.
- B. Upon discovery of hazardous conditions, cease all work in the Excavations until additional precautions have been taken to ensure persons and property safety.

### **3.5 SHIELD SYSTEMS**

- A. Minimize the time the Sides of the Excavation remain unsupported.
- B. Do not subject Shield systems to loads other than those considered for in their design.
- C. Remove persons and property from Excavation when portable Shields are being relocated.

### **3.6 INSTALLATION AND REMOVAL OF SUPPORT SYSTEMS**

- A. Do not overload Support Systems.
- B. Install additional members to carry the loads imposed upon the Support System when temporary removal of individual members is necessary.

- C. When removing the Support System, release member by member slowly to avoid Failure of the remaining members or cave-ins.
- D. Coordinate backfilling to minimize time an unsupported Excavation remains open.

END OF SECTION

**SECTION 32 01 05 AMENDED  
INFORMATION, REGULATORY,  
AND WARNING SIGNS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Information, regulatory, and warning signs but not street name signs or construction signs.

**1.2 REFERENCES**

- A. MUTCD: Manual on Uniform Traffic Control Devices for Streets and Highways.
- B. APA: American Plywood Association.
- C. ASTM B 209: Standard Specification for Aluminum and Aluminum- Alloy Sheet and Plate.
- D. FS L-P 380: Plastic Molding Material Methacrylate.
- E. FS L-S-300: Sheeting and Tape, Reflective: Nonexposed Lens.
- F. PS 1: Construction and Industrial Plywood.

**1.3 DEFINITIONS**

- A. For definition purposes, the various types of signs are identified by a combination of letter and number. The letter represents the type of sign panel construction and the number represents the type of lettering and symbols to be used as follows:
  - 1. Panel Type:
    - a. Panel Type A: Reflectorized sheeting on sheet aluminum.
    - b. Panel Type B: Reflectorized sheeting on plywood.
  - 2. Letter Type:
    - a. Letter Type 1: Reflectorized demountable cutout letters, symbols, and borders with prismatic reflectors.
    - b. Letter Type 2: Opaque legend and borders.
    - c. Letter Type 3: Reflectorized permanently attached cutout letters, symbols, and borders or reflectorized screen processed letters, symbols, and borders.

**1.4 SUBMITTALS**

- A. Submit shop drawings of support structures prior to fabrication.
- B. Submit sample of each color of reflective sheeting including manufacturer's name and product number.
- C. Provide location, type, and signing description for approval by ENGINEER prior to beginning construction.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- A. Sheet Aluminum Sign Blank: 0.1 inch thick ASTM B 209 alloy 6061-T6.
- B. Aluminum Extrusion Sign Blank: 0.1 inch thick ASTM B 209 alloy 6063-T5 and 6063-T6.
- C. Softwood Plywood Sign Blank: PS 1 Group 1 with each panel bearing initials DFPA Grade - Trademark of the American Plywood Association; painted to ENGINEER's choice of color unless indicated.
- D. Posts: Galvanized structural steel, U-shaped, T-shaped, C-shaped, box-shaped, or round tube, Section 05 12 00, with 3/8 inch diameter mounting holes.
- E. Fabricated Supports: Galvanized steel, Sections 05 12 00 and 05 05 10.
- F. Reflective Sheeting: Reflective per FS L-S-300 requirements with 2,200 hours minimum durability.
- G. Nonreflective Sheeting: Nonchalking, weather resistant transparent plastic having a protected adhesive backing and a smooth flat outer surface with glass spheres embedded within.
- H. Prismatic Reflectors: Methyl methacrylate lens meeting FS L-P-380 requirements with aluminum frame.
- I. Bolts, Nuts, Accessories: Galvanized steel, Section 05 05 23.
- J. Cast-in-place Concrete: Class 3000, Section 03 30 04.

### **2.2 COLORS AND FORMAT**

- A. Sign Colors and Format: Conform to MUTCD.
- B. Provided colors of same reflectorized hue in daylight and night under artificial white illumination.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Identify utility location, Section 01 31 13.
- B. Excavation, Section 31 23 16.

### **3.2 INSTALLATION**

- A. Do not remove a sign that is being replaced until the new sign is placed and uncovered.
- B. Unless indicated otherwise use clearance and locations shown in MUTCD. Install posts plumb and in proper alignment.
- C. Establish proper elevation and orientation of all signs, structures, and determine proper sign post lengths as dictated by construction slopes.

- D. Cover signs that require temporary covering with a porous cloth or fiber material folded over the sign edges and secured at the rear of the sign in such a manner that the sign is not damaged. Maintain covering until removal.
- E. Construct sign post foundations with concrete conforming to indicated dimensions. Finish foundations flush with or below natural ground.
- F. Construct overhead support structures where indicated. Support sign by mounting posts on anchor bolts placed in reinforced concrete foundations. Construct signs horizontal and perpendicular to roadway. The minimum allowable vertical clearance from the high point of Pavement is 16.5 feet.

### **3.3 WORKMANSHIP**

- A. Carefully fabricate and erect signs. Damage signs will be rejected.
- B. Make all vertical joints and cuts flat and true.
- C. Elevator bolts may be used or bolt holes relocated where conflict exists with sign border, legend, or copy.
- D. Lay out and properly balance on the sign face all Type 1 legend and copy before fastening. Plug holes left by shifting of copy or legend with the same type screw used to fasten the legend.
- E. Wash all sign faces prior to Final Inspection, Section 01 74 13.

END OF SECTION

## **SECTION 32 01 13 AMENDED SLURRY SEAL**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Stone and paving asphalt slurry evenly spread as a roadway surface treatment.

#### **1.2 REFERENCES**

- A. ASTM C 88: Standard Test Method for Soundness of Aggregates by use of Sodium Sulfate or Magnesium Sulfate.
- B. ASTM C 117: Standard Method of Test for Amount of Material Finer Than 0.075 mm Sieve in Aggregate.
- C. ASTM C 131: Standard Test Method for Resistance to Degradation of Small-Size coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- D. ASTM C 136: Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
- E. ASTM D 242: Standard Specification for Mineral Filler for Bituminous Paving Mixtures.
- F. ASTM D 1664: Standard Test Method for Coating and Stripping of Bitumen-Aggregate Mixtures.
- G. ASTM D 2419: Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
- H. ASTM D 3319: Standard Test Method for Accelerated Polishing of Aggregates Using the British Wheel.
- I. ASTM D 3628: Standard Practice for Selection and Use of Emulsified Asphalts.
- J. ASTM D 3910: Standard Practices for Design, Testing, and Construction of Slurry Seal.
- K. ASTM D 5821: Standard Test Method for Determining the percentage of Fractured Particles in Coarse Aggregate.

#### **1.3 SUBMITTALS**

- A. Traffic control plan, Section 01 55 26.
- B. Mix Design: 10 days prior to use, submit proportions of aggregate, filler, water and emulsions in the mix.
- C. Equipment: Submit list of construction equipment to be used.
- D. Asphalt Bill of Lading: Identify.
  - 1. Weight of asphalt.
  - 2. Weight of emulsified asphalt (after water has been added).
  - 3. Paving asphalt complies with Section 32 12 03 requirements.

- E. Quality Control Report: Upon ENGINEER's request, submit a written quality control inspections and testing report describing source and field quality control activities performed by CONTRACTOR's Supplier and CONTRACTOR.

#### **1.4 QUALITY ASSURANCE**

- A. Determine emulsion weights by mix design.
- B. Do not change source of emulsified asphalt or aggregate without supporting changes in mix design data.
- C. Reject coating products that do not meet requirements of this Section.

#### **1.5 WEATHER**

- A. Temperature:
  - 1. Apply seal coat when air and roadbed temperatures in the shade are 45 deg. F. and rising.
  - 2. Do not apply seal coat if pavement or air temperature is below 55 deg. F. and falling or if the finished product will freeze before 24 hours.
- B. Moisture: Do not apply seal coat during rain, unsuitable weather, or if humidity prolongs curing.

#### **1.6 NOTICE**

- A. Send written notice to residents and businesses within affected area at least 3 days before applying slurry seal.
- B. Indicate application time and when new surface can be used.
- C. Warn of potential vehicle tow away and other construction issues affecting neighborhood..
- D. Should work not occur on specified day, send a new notice.

#### **1.7 ACCEPTANCE**

- A. General:
  - 1. Acceptance is by Lot. Lot is specified below.
  - 2. If non-complying material has been installed and no price for the material is specified, apply price adjustment against cost of work requiring material as part of its installation, Section 01 29 00.
  - 3. Dispute resolution, Section 01 35 10.
  - 4. Opening slurry seal surface to traffic does not constitute acceptance.
- B. Slurry Seal Materials:
  - 1. Paving Asphalt: Acceptance is not specified in this Section. Refer to Section 32 12 03 for acceptance.
  - 2. Aggregate: Lot size is one day's production with 300 tons sub-lots. Collect Samples randomly from hauling equipment and test gradation, ASTM C 136. Lot will be acceptable if,
    - a. Average gradation of each sieve for the Lot is within Target Grading Band for that sieve, and

- b. Number of Samples in Lot with any sieve measurement outside of Target Grading Band does not exceed 2, and
  - c. No Sample varies from Target Grading Band by more than target tolerance on any one sieve.
3. Price Adjustment: Aggregate gradation defects may be accepted if 5 percent price reduction is applied against Lot for each condition not met. Maximum price reduction for a Lot is 10 percent.
- C. Placement: Accepted on a block-by-block basis.
- 1. Mat Appearance: Installation must survive the following visual examinations.
    - a. No free liquid drains out of mat edges.
    - b. No drag marks or streaking.
    - c. No debonding due to road contaminants.
    - d. Straight longitudinal edges with proper joints.
  - 2. Price Adjustment: Appearance defects may be accepted if 5 percent price reduction is applied against the Lot for each condition not met. Maximum price reduction for the Lot is 10 percent.

**PART 2 PRODUCTS**

**2.1 PAVING ASPHALT**

A. Tack coat: Section 32 12 14.

Deleted: A. Tack Coat: Section 32 12 14.

B. Emulsified asphalt: ASTM D 3628 or as indicated.

Deleted: ¶

1. Residual asphalt shall constitute at least 60 percent of the emulsion by weight.

Deleted: B. Emulsified Asphalt: ASTM D 3628 or as indicated.

2. The Saybolt Furol viscosity of the emulsion at 77 deg. F., ASTM D 2170 not greater than 50 seconds.

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Deleted: 1. The residual asphalt shall constitute at least 60 percent of the emulsion by weight.

**2.2 WATER**

A. Clean, non-detrimental, free from harmful chemicals.

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**2.3 AGGREGATE**

A. Material: Stone, slag, or other high quality particle or combination with the following physical properties. For heavy-duty surface applications use 100 percent crushed material.

Deleted: 2. The Saybolt Furol viscosity of the emulsion at 77 deg. F., ASTM D 2170 shall not exceed 50 seconds.

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- 1. Angularity (fractured faces): Greater than 80 percent of particles by weight with at least 1 mechanically fractured faces or clean angular faces, ASTM D 5821.
- 2. Hardness (toughness): less than 35 percent wear of aggregate retained on the No. 8 sieve, ASTM C 131.
- 3. Weight Loss (soundness): less than 10 percent for combined coarse and fine aggregate when subjected to 5 cycles of sodium sulfate, ASTM C 88.
- 4. Polishing: Greater than 38, ASTM D 3319.
- 5. Water Absorption: Less than 1.25 percent.

- B. Gradation: ASTM C 136. Graded by dry weight on a percent passing basis. Gradation must not vary from a high limit on one screen to a low limit on the next.
1. Target Gradation Curve must lie within one of the following Master Grading Bands. Field samples shall not vary from the Target Gradation Curve by more than the Target Tolerance.

Table 1 – Master Grading Band and Target Tolerance Limits				
US Sieve Size	Master Grading Band Limits			Target Tolerance Percent
	SS-I	SS-II	SS-III	
3/8 in.	–	100	100	–
No. 4	100	90 – 100	70 – 90	+/- 5
No. 8	90 – 100	65 – 90	45 – 70	+/- 5
No. 16	65 – 90	45 – 70	28 – 50	+/- 5
No. 30	40 – 65	30 – 50	19 – 34	+/- 5
No. 50	25 – 42	18 – 30	12 – 28	+/- 4
No. 100	15 – 30	10 – 21	7 – 18	+/- 3
No. 200	10 – 20	6 – 15	5 – 15	+/- 2
NOTES				
(a) Portion retained on the No. 4 sieve clean and free of clay coatings.				
(b) Portion passing No. 200 sieve determined by ASTM C 117 includes mineral fillers.				

## 2.4 MINERAL FILLER

- A. ASTM D 242.
- B. Portland cement, hydrated lime, limestone dust, flyash, or aluminum sulfate to regulate setting time and improve workability.
- C. Limestone dust, fly ash, and rock dust to alter aggregate gradation.

## 2.5 MIX DESIGN

- A. Proportioning: Use the consistency test of ASTM D 3910 to determine optimum ratio of aggregate, filler, water, and emulsion.
- B. Cure Time: Select to meet opening to traffic requirements.
- C. Stripping: More than 90 percent of bituminous-coated particles retain asphalt coating, ASTM D 1664.

## PART 3 EXECUTION

### 3.1 CONSTRUCTION EQUIPMENT

- A. Use equipment capable of applying at least 15,000 square yards of material per day.
- B. Use a continuous-flow mixing unit capable of accurately delivering a predetermined portion of aggregate, water, and asphalt emulsion to the mixing chamber.
- C. Prevent loss of slurry from the distributor by using a mechanical type squeegee distributor equipped with flexible material in contact with the surface.
- D. Provide a lateral control device and a flexible strike-off capable of being adjusted to lay the slurry at the mix design application rate.

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### 3.2 PREPARATION

#### A. General:

1. Fat or bleeding Pavements may require scratch course application.
2. Cracked or porous pavements may require thin SSI slurry surface treatment.
3. Asphalt concrete inlay may be required in rut deformations.

#### B. Protection:

1. Protect trees, plants and other ground cover from damage.
2. Prune trees; Section 32 01 93. Allow equipment passage underneath. Repair tree damage at no additional cost to OWNER.
3. Install invert covers.
4. Mask Street Fixtures.
5. Protect curb, gutter, and sidewalk from spatter, mar or overcoat.

#### C. Traffic Control:

1. Control pedestrian and vehicular traffic, Section 01 55 26. Do not proceed without flaggers.
2. Protect slurry seal from traffic until cured. Cure time depends on type of asphalt, mixture characteristics and weather.
3. Do not apply lane marking tape or paint until layout and placement has been verified with ENGINEER.

#### D. Surface Repair: Patch holes, raveled areas, and low areas with asphalt concrete.

#### E. Crack Repair: Section 32 01 17.

1. Remove plant materials from cracks, edges and joints.
2. Blow cracks clean.
3. Seal cracks with crack pouring asphalt. Remove excess asphalt.
4. Allow crack seal to dry before applying slurry seal.

#### F. Cleaning:

1. Remove mud spots, sand, dust, oil, vegetation and other objectionable material.
2. Remove loose material that may cause drag marks.
3. Do not flush water over cracked Pavement.

#### G. Existing Roadway Striping: Use reflective tabs to mark roadway striping before applying slurry seal.

#### H. Tack Coat:

1. Apply tack coat to high-absorbent, polished, oxidized, or raveled asphalt surfaces or to concrete or brick surfaces.
2. Apply tack coat and pave over concrete Cover Collars.
3. Use the same asphalt emulsion as used in slurry seal application.

### 3.3 APPLICATION

#### A. General:

1. Application rates:
  - a. SS-I: 8 to 12 pounds per square yard.
  - b. SS-II: 12 to 16 pounds per square yard.
  - c. SS-III: 15 to 18 pounds per square yard.
2. Machine meter settings must match mix design. Water and mineral filler may be changed per mix design; otherwise, a new mix design is required.

#### B. In the Spreader Box:

1. Do not exceed 4-minutes total mixing time.
2. No additional water.
3. No lumping, balling or unmixed aggregate.
4. No segregation of the emulsion and aggregate fines from the coarse aggregate.
5. No breaking of emulsion.
6. No overloading. Carry a sufficient amount of slurry in all parts of the spreader for complete coverage.

#### C. Spreading:

1. Dampen surface immediately prior to application of slurry seal. All surfaces are to be uniformly damp with no free water standing on the surface or in cracks when seal coat is applied.
2. If coarse aggregate settles to bottom of mix, remove slurry from pavement.
3. Except for lanes in which 2 or more boxes are used in tandem in placing slurry, do not seal adjacent lanes until at least 2 hours have elapsed between placing one lane and that of adjacent lane. Lap adjacent lanes at edges to provide complete sealing at overlap.
4. When sealing short lanes, the waiting period may be omitted if the adjacent lane can be sealed before emulsion in the previously sealed lane has broken and started to cure.
5. In areas where spreader box cannot be used, apply slurry by hand.

#### D. Joints:

1. Correct any joints or cracks not filled by slurry seal.
2. Do not permit build-up on longitudinal or transverse joints.
3. Smooth thick spots before emulsion breaks so a uniform surface with no breaks or discontinuities is obtained.

#### E. Lines

1. Mask off end of streets and intersections to provide straight lines.
2. Make straight lines along lip of gutter and shoulders. No runoff on these areas permitted.

3. Vary edge lines no more than 2 inches per 100 feet.

#### **3.4 AFTER APPLICATION**

- A. Do not permit traffic on slurry seal until cured.
- B. Leave no streaks caused by oversized aggregate, or buildup on squeegees.
- C. Leave no holes, bare spots, or cracks.
- D. The slurry, when cured shall present a uniform, skid-resistant appearance with all cracks filled.
- E. Do not apply traffic and lane marking tape or paint until layout and placement has been verified by ENGINEER.

#### **3.5 FIELD QUALITY CONTROL**

- A. ASTM C 136. If tests show aggregate gradation non-compliance, either remove the material or blend in other aggregates to bring it into compliance. This may require a new mix design. Screening may be required at the stockpile to remove any defective material.

#### **3.6 REPAIR**

- A. Remove spatter or mar from curb and gutter, sidewalk, guard rails and guide posts at no additional cost to OWNER.
- B. Remove slurry seal from Street Fixtures.
- C. Make correction lines straight. Provide good appearance.
- D. Fill any joints or cracks that are not covered by slurry seal. Leave no streaks, holes, bare spots, or cracks through which liquids or foreign matter could penetrate the underlying Pavement.
- E. Repair collateral damage caused by construction.

END OF SECTION

## SECTION 32 01 91 AMENDED TREE ROOT CUTTING

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Cutting and removing tree roots.
- B. Protecting surface improvements from future tree root growth.

#### 1.2 REFERENCES

- A. International Society of Arboriculture. (ISA).

#### 1.3 PROJECT CONDITIONS

- A. Provide written watering instructions to neighbors in property abutting the tree root cuts to advise them of the tree's watering requirements.

#### 1.4 QUALITY ASSURANCE

- A. Provide an ISA certified arborist to observe tree root cutting. Upon ENGINEER's request, provide a copy of the arborist's ISA certificate and registration number on file with the State Division of Commercial Code.

### PART 2 PRODUCTS Not Used

### PART 3 EXECUTION

#### 3.1 AVOIDING ROOT CUTS

- A. When placing or replacing concrete sidewalk;

- 1. Contact ENGINEER when roots are encountered. Do not adjust alignment to curve around, over or away from tree trunks unless directed by ENGINEER.
- 2. Adjust thickness and concrete contraction score marks only when directed by ENGINEER.

**Deleted:** 1. Adjust alignment to curve around, over or away from tree trunks. Do not proceed in this work until alignment has been reviewed by ENGINEER

**Deleted:** 2. Adjust thickness and concrete contraction score marks.

**Deleted:** ¶

- B. When replacing concrete curb and gutter.

- 1. Adjust thickness and concrete contraction score marks over tree roots only if directed by ENGINEER.
- 2. Do not vary gutter invert from straight grade.

**Deleted:** 1. Adjust thickness and concrete contraction score marks over tree roots.

**Deleted:** ¶

#### 3.2 CUTTING TREE ROOTS

- A. Never cut buttress roots [i.e. roots at the broadened base of the tree trunk] without written authorization of CITY FORESTER. Avoid injury to trunk.
- B. Keep root cutting at least 4 feet away from tree trunk. Limit cutting to one side of tree unless authorized otherwise in writing by arborist.

**Deleted:** A. Never cut buttress roots [i.e. roots at the broadened base of the tree trunk] without written authorization of arborist. Avoid injury to trunk.

**Deleted:** ¶

- C. Cut roots clean and straight (no ragged or torn edges). Use an axe, saw, or appropriate equipment that properly cuts roots. Do not make partial root cuts.
- D. Do not injure roots to remain.
- E. Cut roots back to root laterals.

### **3.3 BACKFILLING**

- A. Backfill all cut and exposed roots the same day of root cutting, or cover with wood chips, mulch and water until backfilling is accomplished.
- B. Place soil below root cut.
- C. To prevent vertical root growth, place an impermeable membrane over root cuts. Bend membrane edges to plane below cut root. Place backfill materials adjacent to and above impermeable membrane.

### **3.4 PROTECTION**

- A. After cutting roots of tree.
  - 1. Immediately water tree after backfilling.
  - 2. Apply a minimum of 1 inch of water over the entire area under the tree canopy and well beyond over a period of 4 hours.
  - 3. Restrict water runoff.

END OF SECTION

## SECTION 32 01 93 AMENDED PRUNING TREES

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Pruning branches of existing trees.

#### 1.2 REFERENCES

- A. ANSI A 300: Tree Care Operation- Tree, Shrub, and Other Woody Plants.
- B. ANSI Z 133.1: Pruning, Trimming, Repairing, Maintaining, and Removing Trees, and Cutting Brush- Safety Requirements.
- C. International Society of Arboriculture. (ISA) - Current Standards for Pruning.
- D. Utah Community Forest Council: Utah Shade Tree Pruning Standards

#### 1.3 SUBMITTALS

- A. Tree protection plan that identifies trees to be pruned and reasons for pruning.
- B. Upon ENGINEER's request, submit a copy of the arborist's certificate from ISA and registration number on file with the State Division of Commercial Code.
- C. Provide pruning plan to the CITY FORESTER for approval prior to performing any pruning. Identify method of pruning and any paints and disinfectants to be used and methods of application.

#### 1.4 QUALITY ASSURANCE

- A. Provide an ISA certified arborist to observe tree pruning. Upon ENGINEER's request, provide a copy of the arborist's ISA certificate and registration number on file with the State Division of Commercial Code.

### PART 2 PRODUCTS

#### 2.1 PRUNING PAINT

- A. Formulated for horticultural application to cut or damaged plant tissue.

#### 2.2 DISINFECTANT

- A. Chlorine based.

### PART 3 EXECUTION

#### 3.1 PREPARATION

- A. Pruning work in any publicly owned right of way requires CONTRACTOR notifying the adjacent property owner and giving them a brief description of why and how the work will be done. Notification needs to be given at least 2 weeks before any work is done so the property owner has a chance to respond if they choose to do so. The

arborist selected to provide pruning service shall provide the notices. A written record of delivery dates of notices by address is required of the arborist.

- B. Pruning trees on private property require tree owner approval. ENGINEER and CONTRACTOR shall jointly contact the owners for approval prior to performing any work.

### 3.2 TREE PRUNING

- A. Adhere to safety requirements, ANSI A133.1
- B. Conform to ANSI A300 and the Utah Shade Tree Pruning Standards when pruning.
- C. Conform to OSHA 1910.269 if there are power or communication lines within the area occupied by the tree's branches or adjacent to the tree.
- D. Remove tree branches extending over the roadway to provide a clear height of
1. 16 feet over the travel lane.\*
  2. 14 feet over the Driveway.
  3. 12 feet over finished grade.
  4. 6 feet over street light.
  5. 12 feet over signal light.
- \* The travel lane means the lane vehicles typically use for travel which is different than the parking lane which is the lane adjacent to the street along the curb normally used for parking.
- E. The contracted arborist may need to reduce the above referenced clearances based on tree size, species, or location.
- F. Remove dead, diseased, damaged, broken, hanging, obstructing, crossing or weak branches.
- G. Prune trees to make them shapely, symmetrical, and typical of the natural form of the species being pruned. Thin no more than 25 percent of the live canopy. Do not remove branches that would deform the appearance of the tree.
- H. Cut deadwood back to existing callous growth. **Do not remove callous growth.**
- I. Reduce length of limbs as ordered by ENGINEER.
- J. Do not remove any live branch larger than 6 inches in diameter unless authorized by ENGINEER.
- K. pre-cut branches to reduce weight of final cut. Select final cuts by the location of the branch bark ridge and branch collar.
- L. No intermodal final cuts permitted unless authorized by ENGINEER.
- M. The use of climbing spurs (gaffs) are prohibited.
- N. Disinfect pruning equipment that comes in contact with diseased plant material. Remove disinfectant from equipment prior to proceeding with work.
- O. Use the "Natural Target" or "Drop Crotch" pruning method when removing limbs.
- P. Do not top, pollard, stub or dehorn any tree.

- Q. Make all pruning cuts sufficiently close to the trunk or parent limbs without cutting into or removing the "branch collar" or the "branch bark ridge".

### **3.3 BRANCH DISPOSAL**

- A. Remove branches from site.
- B. Remove all wood chips.

END OF SECTION

## **SECTION 32 05 10 AMENDED BACKFILLING ROADWAYS**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Roadway backfill materials.
- B. Roadway backfilling requirements.

#### **1.2 DEFINITIONS**

- A. Embankment: A raised earthen structure to carry a roadway.
- B. Pavement: Artificially covered surfaces including but not limited to roadway surfaces, parking lot surfaces, sidewalks, curb, gutter, curb ramps, Driveway ramps, etc.
- C. Subgrade: A surface of earth or Rock leveled off as to receive backfill materials.

#### **1.3 SUBMITTALS**

- A. Submit maximum laboratory dry density and optimum laboratory moisture content for:
  - 1. Subgrade material, and
  - 2. Each type of fill to be used.
- B. Submit aggregate batch delivery tickets showing name of material source, Serial number of ticket; date and truck number; name of Supplier; job name and location; volume of material delivered, And aggregate classification.
- C. Upon ENGINEER's request, submit a written quality control Inspections and testing report describing source and field quality control activities performed by CONTRACTOR and its Suppliers.

#### **1.4 QUALITY ASSURANCE**

- A. Do not change material sources, or aggregate without ENGINEER's knowledge.
- B. Reject backfill material that does not comply with requirements specified in this section.

#### **1.5 STORAGE**

- A. Safely stockpile backfill materials.
- B. Separate differing materials, prevent mixing, and maintain optimum moisture content of backfill materials.
- C. Avoid displacement of and injury to Work while compacting or operating equipment.
- D. Movement of construction machinery over Work at any stage of construction is solely at CONTRACTOR's risk.

#### **1.6 SITE CONDITIONS**

- A. Do not place, spread, or roll any backfill material over material that is damaged by water. Remove and replace damaged material at no additional cost to OWNER.

- B. Control traffic and erosion. Keep area free of trash and debris. Repair settled, eroded, and rutted areas.
- C. Reshape and compact damaged structural section re required density.
- D. Soil Cement: Do not spread soil cement mixture when air temperature is less than 40 deg. F. in the shade.
- E. Drainage: Immediately prior to suspension of construction operations for any reason, provide proper and necessary drainage of Work area.

**1.7 ACCEPTANCE**

A. General:

- 1. Native material may be wasted if there is no additional cost to substitute material acceptable to ENGINEER.
- 2. For material acceptance refer to.
  - a. Common fill, Section 31 05 13.
  - b. Crushed aggregate base, Section 32 11 23.
  - c. Cement treated fill, Section 31 05 15.

B. Backfilling: One test per Lot.

Table No.1 – Lot Sizes		
Material	Test Criteria	Lot Size
Subgrade	Standard (a)	1000 square yards
Common Fill	Standard (a)	<u>PCC or AC Surface Course</u> : 1,000 square yards per lift
		<u>Driveway Approach</u> : 400 square feet per lift
		<u>Sidewalk</u> : 400 lineal feet per lift
Crushed Aggregate Base	Modified (a)	<u>PCC or AC Surface Course</u> : 1,000 square yards per lift
		<u>Driveway Approach</u> : 400 square feet per lift
		<u>Sidewalk</u> : 400 lineal feet per lift
		<u>Curb, Gutter, and Waterways</u> : 200 lineal feet per lift
Flowable Fill	Strength (b)	250 cubic yards
NOTES		
(a) Proctor density, Section 31 23 26		
(b) Cement treated fill, Section 31 05 15		
(c) Lift thickness before compaction, 8 inches.		

Material	Test Crit
Subgrade	Standard
Common Fill	Standard
Crushed Aggregate Base	Modified
Flowable Fill	Strength
NOTES	
(a) Proctor density, Se	
(b) Cement treated fill,	
(c) Lift thickness befor	

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**1.8 WARRANTY**

- A. Any settlement noted in Embankment or Pavement construction will be considered to be caused by improper compaction methods and shall be corrected at no cost to the OWNER.
- B. Restore incidentals damaged by settlement at no additional cost to OWNER.

**PART 2 PRODUCTS****2.1 BACKFILL MATERIALS**

- A. Common Fill, Section 31 05 13.
- B. Crushed aggregate base, Section 32 11 23.
- C. Cement treated fill, Section 31 05 15.

**2.2 ACCESSORIES**

- A. Water:
  - 1. Make arrangements for sources of water during construction and make arrangements for delivery of water to site.
  - 2. Comply with local Laws and Regulations at no additional cost to OWNER when securing water from water utility company.
- B. Geotextile Fabric, Section 31 05 19.

**PART 3 EXECUTION****3.1 PREPARATION**

- A. Verify.
  - 1. Backfill material meets gradation requirements.
  - 2. Areas to be backfilled are free of debris, snow, ice or water, and
  - 3. Bearing surfaces are not frozen.
- B. If extra excavation is required, secure ENGINEER's written permission and follow Section 31 23 16 requirements.
- C. Place geotextile fabrics, Section 31 05 19.

**3.2 SUBGRADE PREPARATION**

- A. Protect Subgrade from desiccation, flooding, and freezing.
- B. If ground water table is in the intended construction operations, dewater.
- C. Before beginning backfilling operations over Subgrade, secure ENGINEER's review of Subgrade surface preparations.

**3.3 EMBANKMENTS**

- A. Place backfill material in lifts not exceeding 8 inches after compaction.
- B. Build shoulders to a grade higher than that of adjacent fills. Provide surface runoff at all times.
- C. Commence compaction along edge of area to be compacted and gradually advance toward center.
- D. Operate compaction equipment along lines parallel or concentric with the center-line of the Embankment being constructed.
- E. Do not damage subsurface structures or utilities.

**3.4 BASE COURSES**

- A. Place backfill material in lifts not exceeding 8 inches before compaction.
- B. Maintain moisture content in compaction operations.
- C. Avoid segregation when spreading backfill. Keep surfaces free from pockets of coarse and fine aggregate.
- D. Rework fills which do not conform to compaction requirements until requirements are met.
- E. Protect cement treated fill against freezing and traffic for 7 days.

**3.5 MODIFIED BACKFILL LAYER METHOD**

- A. Section 33 05 20.

**3.6 COMPACTION**A. Compact backfill, Section 31 23 26 as follows.

- 1. A-1 soils: greater than or equal to 95 percent of a Modified Proctor Density.
- 2. Other soils: greater than or equal to 95 percent of a Standard Proctor Density.

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**3.7 COMPRESSIVE STRENGTH**

- A. Where a flowable fill is used, provide compressive strength indicated in Section 31 05 15.

**3.8 PROOF ROLLING TEST**

- A. Prior to placing fill material for roadbed backfills, proof roll Subgrade using gross weight of 18,000 pounds/tandem axle, with a tire pressure at least 90 psi.
- B. All proof roll passes will traverse the Subgrade parallel to the roadbed centerline. All subsequent passes will be offset 1/2 the vehicle width until the entire Subgrade is tested.
- C. ENGINEER will analyze, determine, designate and measure the areas, if any, requiring additional compaction or reconstruction.
- D. Once Subgrade passes the proof rolling test, protect the surface from construction operations and traffic damage. Repair all cuts, ruts, and breaks. Keep surface in a satisfactory condition until geotextile fabric or base course has been placed.

**3.9 CLEANING**

- A. Remove stockpiles from the site upon Work Completion. Grade site to prevent free standing surface water.
- B. Leave borrow areas clean and neat.

END OF SECTION

## **SECTION 32 11 23 AMENDED CRUSHED AGGREGATE BASE**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Treated or untreated base course requirements.

#### **1.2 REFERENCES**

- A. ASTM C 29: Standard Test Method for Unit Weight and Voids in Aggregate.
- B. ASTM C 131: Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- C. ASTM C 136: Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
- D. ASTM D 75: Standard Practice for Sampling Aggregates.
- E. ASTM D 448: Standard Classification for Sizes of Aggregate for Road and Bridge Construction.
- F. ASTM D 1883: Standard Test Method for CBR (California Bearing Ratio) of Laboratory-Compacted Soils.
- G. ASTM D 2419: Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
- H. ASTM D 3665: Standard Practice for Random Sampling of Construction Materials.
- I. ASTM D 3740: Standard Recommended Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- J. ASTM D 4318: Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- K. ASTM D 5821: Standard Test Method for Determining the percentage of Fractured Particles in Coarse Aggregate.

#### **1.3 DEFINITIONS**

- A. Aggregate Grading Band: Allowable deviation from Target Gradation Curve based upon the number of gradation tests in a Lot. It is possible that gradation for any sieve may lie outside of its respective Master Grading Band limits.
- B. Master Grading Band: Gradation limits allowed for various sieve sizes ranging from the maximum size sieve to the No. 200 sieve.
- C. Mean of Deviations: The sum of the absolute values of the variance between each screen target value and each measured value divided by the number of tests in the Lot.
- D. RAP (acronym for reclaimed asphalt pavement): See Section 32 01 16.
- E. Target Gradation Curve: A smooth locus of points within the limits of the Master Grading Band.

1.4 SUBMITTALS

A. Name of Supplier and aggregate source.

B. Target Gradation for each sieve size.

C. Material properties report.

1. The report is for suitability of source and not for project control.

2. Date of report must be within 360 days of the date of submission. Tests in the report must not be older than 90 days from the date of the report.

3. A new report may be required if gradation target is changed.

D. Prior to start of work submit relative density and relative moisture content for each crushed aggregate base to be used in the work.

1.5 QUALITY ASSURANCE

A. Use a laboratory that follows and complies with Section 01 45 00 and ASTM D 3740.

1.6 ACCEPTANCE

A. General:

1. Defective work, Section 01 29 00.

2. Dispute resolution, Section 01 35 10.

3. ENGINEER is not obligated to accept changes in gradation target after any material is delivered to site.

4. Observation of CONTRACTOR's field quality control testing does not constitute acceptance. Such testing; however, may be used by ENGINEER for acceptance if the following conditions are met.

a. ENGINEER accepts qualifications of CONTRACTOR's testing agency.

b. CONTRACTOR has a quality control plan similar to AASHTO R 9.

c. Test results are submitted promptly.

d. Acceptance criteria are met.

C. Gradation: Lot size is 500 cubic yards. Collect samples from grade prior to compaction. Conduct at least 1 gradation test for each Lot. Material not within tolerance may remain in-place at ENGINEER's discretion provided density requirements are met. Tolerance deficiency must be corrected before placement continues.

D. Relative Density: Lot size is 10,000 cubic yards. Conduct at least 1 laboratory determination to be used as a standard for field density and field moisture content determinations.

E. Field Density:

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1. ENGINEER is not obligated to ... [1]

Table 1- P:		
Criteria	Pay Factor	1
		Sam
1/2" Sieve	1.00	0-1
	0.95	16-1
	0.90	18-1
	0.80	20-2
	0.70	22-2
3/8" Sieve	1.00	0-1
	0.95	16-1
	0.90	18-1
	0.80	20-2
	0.70	22-2
No. 4 Sieve	1.00	0-1
	0.95	15-1
	0.90	18
	0.80	19-2
	0.70	21-2
No. 16 Sieve	1.00	0-1
	0.95	12-1
	0.90	14
	0.80	15-1
	0.70	17

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Table 1- F		
Criteria	Pay Factor	1
		Sam
No. 50 Sieve	1.00	0-
	0.95	10
	0.90	11
	0.80	12-
	0.70	14
No. 200 Sieve	1.00	0-
	0.95	4.6-
	0.90	5.3-
	0.80	5.7-
	0.70	6.5-

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1. Lot size is one day's placement. Number of density tests varies according to placement type and sub-lot size. Conduct at least 1 field determination in each sub-lot. Select test locations randomly.

<u>Table 1 - Placement Type and Sub-lot Size</u>	
<u>Placement Type I</u> <u>Pavement (includes curb, gutter, and waterway when in conjunction with pavement placement)</u>	<u>1,000 square yards</u>
<u>Placement Type II</u> <u>Curb, gutter, waterway</u> <u>Sidewalk</u> <u>Driveway approach, curb cut assembly, waterway transition structure, flatwork</u>	<u>200 lineal feet</u> <u>400 lineal feet</u> <u>800 square feet</u>
<u>Placement Type III</u> <u>Landscaping and other non-structural, non-load bearing areas</u>	<u>--</u>

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**PART 2 PRODUCTS**

**2.1 UNTREATED BASE COURSE**

A. Material: Crushed rock, gravel, sand or other high quality mineral particle, or combination that is well graded, clean, hard, tough, durable, sound, free of organic matter, free of chemical or petroleum contamination, and meets the following physical properties.

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Physical Properties
Dry Rodded Unit Weight
Liquid Limit, max.
Plastic Index, max.
Sand Equivalent, min.
Wear (hardness), max.
Gradation
Two Fractured Faces, n
CBR, min.
NOTES
(a) Liquid limit, plasticity index
(b) Wear: Retained on No. 20 sieve
(c) CBR: Use a 10 lb hammer
(d) Faces: Retained on No. 20 sieve

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Table 2 – Properties					
Physical Property	Units	Aggregate Class			ASTM Test
		A	B	C	
Dry Rodded Unit Weight, min.	lb/ft <sup>3</sup>	75			C 29
Liquid Limit, max.		25			D 4318
Plastic Index, max.		0	0	6	D 4318
Sand Equivalent, min.	percent	35			D 2419
Wear (hardness), max.	percent	50			C 131
Gradation		Table 3			C 136
Two Fractured Faces, min.	percent	50	—	—	D 5821
CBR, min.	percent	70	55	—	D 1883

NOTES

(a) Liquid limit, plastic limit, sand equivalent: Passing No. 40 sieve.  
 (b) Wear: Retained on No. 8 sieve.  
 (c) Faces: Retained on No. 4 sieve.  
 (d) CBR: Use a 10 lb surcharge measured at 0.20 inch penetration at 95 percent of modified Proctor. A reduction in aggregate class may be accepted providing any costs for difference in excavation, backfill, and alternate design for CBR does not increase Contract Price.

B. Gradation, ASTM C 136: Graded by dry weight on a percent passing basis. Gradation must not vary from a high limit on one screen to a low limit on the next. Target gradation for each sieve size must lie within the master grading band limits. Field gradation shall not vary from target by more than the target tolerance.

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Table 3 - Job Mix Formula				
US Sieve Size	Master Grading Bands Limits			Target Tolerance Percent
	Grade 1-1/2	Grade 1	Grade 3/4	
1-1/2"	100	—	—	-
1"	90 - 100	100	—	-
3/4"	70 - 85	—	100	+/- 9
1/2"	65 - 80	79 - 91	—	+/- 9
3/8"	55 - 75	—	78 - 92	+/- 9
No. 4	40 - 65	49 - 61	55 - 67	+/- 7
No. 16	25 - 40	27 - 35	28 - 38	+/- 5
No. 200	7 - 11	7 - 11	7 - 11	+/- 3

NOTES

(a) Percent passing based on total aggregate (dry weight), and fine and coarse aggregate having approximately the same bulk specific gravities.  
 (b) Target tolerance for 3/4 sieve in Grade 3/4 is not applicable.

Ta	
US Sieve Size	Grad
2"	
1-1/2"	
1"	
3/4"	81
1/2"	67
3/8"	
No. 4	43
No. 16	23
No. 200	6

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At ENGINEER's option, a change in the job mix formula may require a new material properties report.

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**2.2 ASPHALT TREATED BASE COURSE**

A. Meet requirements of this Section Article 2.1 and the following.

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- 1. Sand equivalent and fractured face measured after asphalt residue is burned off.
- 2. Plasticity and wear requirements apply to virgin aggregate portion only.
- 3. Allowable asphalt content is controlled by CBR.
- B. If aggregate contains RAP.
  - 1. Screen crushed RAP to remove debris.
  - 2. Mechanically blend virgin and RAP aggregates. Do not use windrows for blending.

**2.3 CRUSHED CONCRETE BASE COURSE**

- A. Meet requirements of this section article 2.1 and the following.
  - 1. Cement with its chemical components is allowed.
  - 2. Wear test and fractured face test not required.

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**2.4 SOURCE QUALITY CONTROL**

- A. Sampling Protocol: Random location selection, ASTM D 3665. Sample Collection, ASTM D 75.
- B. Reject crushed aggregate base products that do not meet requirements of this Section.
- C. Testing Protocol: Gradation, ASTM C 136. Maximum density, ASTM D 1557. Optimum moisture content, ASTM D 2216.

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**PART 3 EXECUTION**

**3.1 SUB-BASE PREPARATION**

- A. Trenches, Section 33 05 20.
- B. Structures, Section 31 23 23.
- C. Landscaping, Section 32 91 19.
- D. Pavements, Section 32 05 10.

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**3.2 PLACEMENT**

- A. General:
  - 1. Provide uniform lifts not exceeding 6 inches thick after compaction.
  - 2. Maintain optimum moisture content plus or minus 2 percent.
  - 3. Use appropriate compaction equipment.
  - 4. Do not place additional material on any unaccepted layer or on any frozen surface.
- B. Placement Type and Aggregate Class:

Placement Type	Location	Class		
		A	B	C
I	<u>Pavement (includes curb, gutter and waterway in conjunction with pavement placement).</u>	X		

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<u>II</u>	<u>Concrete flatwork (includes driveway approach, curb cut assembly, curb, gutter, sidewalk, waterway, etc.)</u>	<u>X</u>	<u>X</u>	
<u>III</u>	<u>Landscapes (includes non-structural, non-load bearing areas)</u>	<u>X</u>	<u>X</u>	<u>X</u>

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C. Compaction:

1. Type I and Type II Placement: 95 percent minimum.
2. Type III Placement: Compaction effort is suitable to overlying surface, or installation, or use. Verify compaction effort with ENGINEER.

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D. Finish: Uniform with surface deviation no more than 3/8 of an inch from line and grade in 10 feet in any direction.

**3.3 FIELD QUALITY CONTROL**

- A. Sampling Protocol: Random location selection, ASTM D 3665. Sample collection, ASTM D 75.
- B. Testing Protocol: Gradation, ASTM C 136. Field density, ASTM D 2922. Moisture content, ASTM D 3017.

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**3.4 REPAIR OR REMOVAL**

- A. If product is correctable and at no additional cost to OWNER, provide laboratory data showing design CBR has not been reduced and material in-place has been compacted to **97 percent** minimum.
- B. Remove any product that cannot be corrected and install acceptable product at no additional cost to OWNER.

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END OF SECTION

## **SECTION 32 12 05 AMENDED ASPHALT CONCRETE**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Composition of asphalt - aggregate mix.
- B. This specification does not apply to polymer modified asphalt concrete. Refer to Section 32 12 06.

#### **1.2 REFERENCES**

- A. AI Manual Series No. 2: Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.
- B. AASHTO T 324: Hamburg Wheel-track Testing of Compacted Hot-Mix Asphalt (HMA).
- C. ASTM C 29: Standard Test Method for Unit Weight and Voids in Aggregate.
- D. ASTM C 88: Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
- E. ASTM C 117: Standard Test Method for Materials Finer Than 0.075mm (No. 200) Sieve in Mineral Aggregates by Washing.
- F. ASTM C 131: Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- G. ASTM C 136: Standard Method for Sieve Analysis of Fine and Coarse Aggregate.
- H. ASTM C 142: Standard Test Method for Clay Lumps and Friable Particles in Aggregates.
- I. ASTM D 75: Standard Practice for Sampling Aggregates.
- J. ASTM D 140: Standard Practice for Sampling Bituminous Materials.
- K. ASTM D 242: Standard Specification for Mineral Filler for Bituminous Paving Mixtures.
- L. ASTM D 979: Standard Methods for Sampling Bituminous Paving Mixtures.
- M. ASTM D 2419: Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
- N. ASTM D 3203: Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.
- O. ASTM D 3381: Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction.
- P. ASTM D 3515: Standard Specification for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.

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- Q. ASTM D 3665: Standard Practice for Random Sampling of Construction Materials.
- R. ASTM D 3666: Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Bituminous Paving Materials.
- S. ASTM D 4318: Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- T. ASTM D 4552: Standard Practice for Classifying Hot-Mix Recycling Agents.
- U. ASTM D 4791: Standard Test Method for Flat or Elongated Particles in Coarse Aggregate.
- V. ASTM D 4867: Standard Test Method for Effect of Moisture on Asphalt Concrete Paving Mixtures.
- W. ASTM D 5444: Standard Test Method for Mechanical Size Analysis of Extracted Aggregate.
- X. ASTM D 5581: Standard Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus (6-jnch\_Diameter Specimen)
- Y. ASTM D 5821: Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate.
- Z. ASTM D 6307: Standard Test Method for Determining Asphalt Content of Hot-Mix Asphalt by Ignition Method.
- AA. ASTM D 6373: Standard Specification for Performance Graded Asphalt Binder.

### 1.3 DEFINITIONS

- A. Asphalt-Aggregate Designator: Alpha-numeric code that indicates type and grade of asphalt, and type and grade of aggregate in an asphalt-aggregate mix. For example;
  - 1. "AC-20-DM-3/4" means asphalt-aggregate mix shall be composed of AC-20 type and grade asphalt cement and DM-3/4 type and grade aggregate.
  - 2. "RA-1-DM-1" means asphalt-aggregate mix shall be composed of RA-1 type and grade asphalt recycling agent and DM-1 type and grade aggregate.
  - 3. "RS-1-SS-II" means asphalt-aggregate mix shall be composed of RS-1 type and grade asphalt emulsion and SS-II type and grade aggregate.
- B. Mean of Deviations: Defined in Section 32 11 23.

### 1.4 SUBMITTALS

- A. **Quality Assurance:** Submit names, certification levels, and years of experience of testing agency's field technicians that are assigned to the Work. Verify laboratory complies with ASTM standards.
- B. **Mix Design:** Submit.
  - 1. Date of mix design. If older than 365 days, recertify mix design.
  - 2. Asphalt cement source, type and chemical composition.
  - 3. Aggregate gradation target.

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~~4. Paving asphalt target percentage, dust to asphalt ratio, moisture sensitivity (tensile strength ratio), stability, flow and voids in the bituminous mix.~~

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- 5. Paving asphalt grade if RAP is used in the mix.
- 6. RAP, mineral filler, antistripping, and recycle agent percentages.
- C. **Pre-approved mix design**, submit name and address of Supplier.
- D. **Before changing mix design**, submit a new design and give ENGINEER 10 days to evaluate the changes.
- E. **Source Quality Control Inspections and Testing Report**: If requested, submit report describing CONTRACTOR’s and Supplier’s quality control activities and test results.

**1.5 QUALITY ASSURANCE**

- A. Use a laboratory that follows and complies with ASTM D 3666.
- B. Do not change aggregate source or paving asphalt source without ENGINEER’s written approval.
- C. Do not use non-complying sources.

**1.6 ACCEPTANCE**

- A. General:
  - 1. Acceptance is by Lot. One Lot is one day’s production.
  - 2. If non-complying material has been installed and no price for the material is specified, apply price adjustment against cost of work requiring material as part of its installation, Section 01 29 00.
  - 3. Dispute resolution, Section 01 35 10.
- B. Installation: Accepted as specified in Section 32 12 16.
- C. Materials:
  - 1. At the Source:
    - a. Aggregate: Verify gradation. Collect sample from conveyor belt or stockpile if belt is not accessible.
    - b. Paving Asphalt: See Section 32 12 03 provisions.
    - c. Mix: 325 deg. F. maximum in transport vehicle.
  - 2. At the Site:
    - a. One sub-lot is 500 tons.
    - ~~b. Sampling: One random samples per sub-lot. Location as follows.~~
      - 1) Behind paver before compaction, or
      - 2) Where sub-lot exhibits non-uniform appearance.
    - c. Sampling Protocol: ASTM D 3665 and ASTM D 979.
  - 3. At the Laboratory:
    - a. Air Voids:

Deleted: b. . Sampling: Two random samples per sub-lot. Location as follows.  
Deleted: ¶

- 1) Basis of evaluation is laboratory compacted samples (not field compacted samples).
  - 2) If test results are not within this Section’s limits, options include correction of production procedures or alternate mix design acceptable to ENGINEER.
- b. Dust to asphalt ratio.
- c. Asphalt Content, Aggregate Gradation: Lot is acceptable if test deviations are within pay factor 1.00 limits. At ENGINEER’s discretion, a Lot with a sub-lot test deviation greater than pay factor 0.85 limits may stay in place at 50 percent cost.

Table 1 – Pay Factors for Non-complying Materials						
Criteria	Pay Factor	Range of Mean of Deviations of Tests Results from the Design Mix Target in Percentage Points				
		500 Tons	1,000 Tons	1,500 Tons	2,000 Tons	≥2,500 Tons
Asphalt Content	1.00	0.00–0.70	0.00–0.54	0.00–0.46	0.00–0.41	0.00–0.38
	0.975	0.71–0.80	0.55–0.61	0.47–0.52	0.42–0.46	0.39–0.43
	0.95	0.81–0.90	0.62–0.68	0.53–0.58	0.47–0.52	0.44–0.47
	0.90	0.91–1.00	0.69–0.75	0.59–0.64	0.53–0.56	0.48–0.52
	0.85	1.01–1.10	0.76–0.82	0.65–0.69	0.57–0.61	0.53–0.56
1/2" and larger Sieve	1.00	0.0–10.9	0.0–7.3	0.0–6.5	0.0–5.6	0.0–5.2
	0.975	11.0–12.9	7.4–8.3	6.4–7.1	5.7–6.3	5.3–5.8
	0.95	13.0–13.9	8.4–9.3	7.2–7.9	6.4–7.0	5.9–6.4
	0.90	14.0–14.9	9.4–10.3	8.0–8.7	7.1–7.7	6.5–7.1
	0.85	15.0–16.0	10.4–11.3	8.8–9.5	7.8–8.4	7.2–7.7
3/8" Sieve	1.00	0.0–9.9	0.0–6.9	0.0–5.9	0.0–5.3	0.0–4.9
	0.975	10.0–10.9	7.0–7.8	6.0–6.6	5.4–6.9	5.0–5.5
	0.95	11.0–11.9	7.9–8.7	6.7–7.3	6.0–6.6	5.6–6.1
	0.90	12.0–13.9	8.8–9.6	7.4–8.0	6.7–7.2	6.2–6.6
	0.85	14.0–15.0	9.7–10.5	8.1–8.9	7.3–7.9	6.7–7.2
No. 4 Sieve	1.00	0.0–9.9	0.0–6.7	0.0–5.7	0.0–5.2	0.0–4.8
	0.975	10.0–11.0	6.8–7.6	5.8–6.3	5.3–5.8	4.9–5.4
	0.95	11.1–11.9	7.7–8.5	6.4–6.9	5.9–6.4	5.5–5.9
	0.90	12.0–12.9	8.6–9.4	7.0–7.5	6.5–7.0	6.0–6.5
	0.85	13.0–14.0	9.5–10.2	7.6–8.0	7.1–7.6	6.6–7.0
No. 8 Sieve	1.00	0.0–7.9	0.0–5.6	0.0–4.8	0.0–4.3	0.0–4.0
	0.975	8.0–8.9	5.7–6.3	4.9–5.4	4.4–4.8	4.1–4.5
	0.95	9.0–9.9	6.4–7.0	5.5–6.0	4.9–5.3	4.6–4.9
	0.90	10.0–10.9	7.1–7.7	6.1–6.6	5.4–5.8	5.0–5.4
	0.85	11.0–12.0	7.8–8.5	6.7–7.2	5.9–6.4	5.5–5.8

No. 16 Sieve	1.00	0.0-7.9	0.0-5.2	0.0-4.6	0.0-4.2	0.0-3.9
	0.975	8.0-8.9	5.3-5.8	4.7-5.1	4.3-4.6	4.0-4.3
	0.95	9.0-9.9	5.9-6.4	5.2-5.6	4.7-5.1	4.4-4.7
	0.90	10.0-10.9	6.5-7.0	5.7-6.1	5.2-5.5	4.8-5.1
	0.85	11.0-12.0	7.1-7.6	6.2-6.6	5.6-5.9	5.2-5.4
No. 50 Sieve	1.00	0.0-6.9	0.0-4.3	0.0-3.8	0.0-3.4	0.0-3.2
	0.975	7.0-7.9	4.4-4.8	3.9-4.1	3.5-3.8	3.3-3.5
	0.95	8.0-8.9	4.9-5.3	4.2-4.5	3.9-4.1	3.6-3.8
	0.90	9.0-9.9	5.4-5.8	4.6-4.9	4.2-4.4	3.9-4.1
	0.85	10.0-11.0	5.9-6.4	5.0-5.5	4.5-4.9	4.2-4.5
No. 200 Sieve	1.00	0.0-3.0	0.0-2.4	0.0-2.0	0.0-1.8	0.0-1.7
	0.975	3.1-3.5	2.5-2.7	2.1-2.2	1.9-2.0	1.8-1.9
	0.95	3.6-4.0	2.8-3.0	2.3-2.4	2.1-2.2	2.0-2.1
	0.90	4.1-4.5	3.1-3.3	2.5-2.7	2.3-2.4	2.2-2.3
	0.85	4.6-5.0	3.4-3.6	2.8-3.0	2.5-2.6	2.4-2.5
NOTES						
(a) Test paving asphalt content using a burn-off oven, ASTM D 6307.						
(b) Determine aggregate gradation by extraction, ASTM D 5444.						

**PART 2 PRODUCTS**

**2.1 PAVING ASPHALT**

A. Asphalt Cement: Section 32 12 03. Substitutes for asphalt cement are as follows.

ASTM D 3381

ASTM D 6373

AC 10

PG 58-22 or PG 58-28

AC 20

PG 64-22

Deleted: . . . AC 10 . PG 64-22 or PG 70-28¶  
 . . . AC 20 . PG 70-28¶

B. Recycle Asphalt: Section 32 12 03.

**2.2 AGGREGATE**

A. Material: Clean, hard, durable, angular, sound, consisting of crushed stone, crushed gravel, slag, sand, or combination.

B. Source: Use the following requirements to determine suitability of aggregate source and not for project control.

1. Coarse Aggregate:

- a. Angularity (fractured faces), ASTM D 5821: 50 percent maximum by weight of particles with at least 2 fractured faces.
- b. Hardness (toughness), ASTM C 131: 40 percent minimum wear of aggregate retained above the No. 4 sieve unless specific aggregates having higher values are known to be satisfactory.
- c. Flat or Elongated Particles, ASTM D 4791: 20 percent maximum retained above 3/8 inch sieve has a 3:1 length to width ratio.

2. Fine Aggregate:

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- a. Friable Particles, ASTM C 142: 2 percent maximum passing No. 4 sieve.
- b. Plasticity, ASTM D 4318: Aggregate passing No. 40 sieve is non-plastic even when filler material is added to the aggregate.
  - 1) Liquid limit: Less than 25.
  - 2) Plastic limit: Less than 6.

**2.3 ADMIXTURES**

- A. Reclaimed Asphalt Pavement (RAP) Aggregate: Restrictions include.
  - 1. 15 percent by weight maximum providing grading and voids in the bituminous mix are met.
  - 2. Greater than 15 percent requires separate mix design.
- B. Mineral Filler: ASTM D 242.
- C. Recycle Agent: ASTM D 4552.
- D. Antistrip: Heat stable cement slurry or lime slurry.

**2.4 MIX DESIGN**

A. Selection of Materials:

1. Paving Asphalt, Section 32 12 03:

- a. Light Traffic Classification: AC-10 or AC-20.
- b. Medium Traffic Classification: AC-20.
- c. Heavy Traffic Classification: ENGINEER's choice.
- d. RA: For hot-laid recycled asphalt pavement. Choice by CONTRACTOR.

**Deleted:** a. AC-10 or AC-20: Light traffic pavement.¶  
 b. AC-20: Medium traffic pavement.¶  
 c. RA: For hot-laid recycled asphalt pavement. Choice by CONTRACTOR.

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2. Aggregate: This Section Article 2.2.

3. Admixture: This Section article 2.3.

- a. RAP: Adjust paving asphalt grade to account for RAP binder viscosity.
- b. Cement or Hydrated Lime: Add if mix is moisture sensitive.

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B. Selection of Design Aggregate Structure:

1. Gradation: Maximum particle size is 1/2 compacted lift thickness.

- a. Target Gradation Curve: Use DM-3/4N gradation band within Logan City unless approved otherwise by ENGINEER.

**Deleted:** a. Target Gradation Curve must lie within one of the Master Grading Bands in the following table, or

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b. If acceptable to ENGINEER, use fractionated proportioning to select or adjust

Table 2 – Master Grading Bands							
Sieve Size	Dense				Open	Friction	
	DM-1	DM-3/4N	DM-3/4	DM-1/2	OM-1/2	FM-1	FM-2
1 inch	100						
3/4 inch		100				100	
1/2 inch	75 – 91	74 – 99		100	100	90 – 100	100
3/8 inch		69 – 91	75 – 91		93 – 100	60 – 100	90 – 100
No. 4	47 – 61	49 – 65	46 – 62	60 – 80	36 – 44	15 – 40	30 – 50
No. 8		33 – 47			14 – 21	4 – 12	5 – 15
No. 16	23 – 33	21 – 35	22 – 34	28 – 42			
No. 50	12 – 22	6 – 18	11 – 23	11 – 23			2 – 5
No.200	3 – 7	2 – 6	3 – 7	3 – 7	2 – 4	2 – 5	

NOTES  
 (a) Gradation expressed in percent passing by weight, ASTM C 136.  
 (b) It is assumed fine and coarse aggregate have same bulk specific gravity.  
 (c) Friction Mixture: See ASTM D 3515.  
 (d) DM -3/4N is 100% crushed.  
 (e) Percentage of fines passing No. 200 sieve determined by washing, ASTM C 117.

gradation.

2. Aggregate Blend:

- a. Dry-rodded Unit Weight, ASTM C 29: 75 pounds per cubic foot minimum.
- b. Weight Loss (soundness), ASTM C 88: 16 percent maximum using sodium sulfate.
- c. Clay Content (cleanliness), ASTM D 2419: Sand equivalent value after going through the dryer or prior to the drum mixer.
  - 1) 45 percent minimum if Medium Traffic Classification.
  - 2) 60 percent minimum if Heavy Traffic Classification.
 The sand equivalent requirement is waived for the RAP aggregate but applies to the remainder of the aggregate blend.

C. Selection of Mix Properties: Use Marshall volumetric mix design, AIMS-2/

1. Stability, Flow Voids: If traffic classification is not specified elsewhere, use Medium Traffic Classification. UNDER NO CONDITIONS WILL "Light" traffic classification be used.

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Deleted: C. Selection of Admixture: CONTRACTOR's choice.¶  
 1. . RAP: Adjust paving asphalt grade to account for RAP binder viscosity.¶  
 2. . Cement or Hydrated Lime: Add if mix is moisture sensitive.¶  
 D. Selection of Mix Properties: Use AI Manual Series No. 2 procedure for stability, flow and voids.

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Deleted: 1. . Stability, Flow Voids: If traffic classification is not specified elsewhere, use Medium Traffic Classification.

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Tab
Crit
Number of compacted specimen
Stability, lbs., minimum
Flow, in 0.01 inch un
Voids in Mineral Aggregate percent minimum
1" nominal maximum
3/4" nominal maximum
1/2" nominal maximum
3/8" nominal maximum
Voids in Bituminous
NOTES
(a) Traffic Classification
Light: (ESAL <
Class I: Parki
light traffic far
Medium: (ESAL
Class II: Resi
Class III: Urb
Heavy: (ESAL :
Class IV: Urb
industrial stree
Class V: Urba
freeways, expr
principal arter

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Table 3 – Stability, Flow, Voids Limits			
Criteria	Traffic Classifications		
	Light	Medium	Heavy
Number of compaction blows each end of specimen	35	50	75
Stability, lbs., minimum	750	1200	1800
Flow, in 0.01 inch units	10 – 18	10 – 18	10 – 18
Voids in Mineral Aggregate (VMA), percent minimum			
1" nominal maximum particle size	13	13	13
3/4" nominal maximum particle size	14	14	14
1/2" nominal maximum particle size	15	15	15
3/8" nominal maximum particle size	16.5	16.5	16.5
Voids in Bituminous Mix, percent	3 – 5	3 – 5	3 – 5
<p>NOTES</p> <p>(a) Traffic Classifications:</p> <p>    <b>Light:</b> (ESAL &lt;10<sup>4</sup> per year)                  Class I: Parking lots, Driveways, light traffic residential streets, light traffic farm roads.</p> <p>    <b>Medium:</b> (ESAL between 10<sup>4</sup> and 10<sup>6</sup> per year)                  Class II: Residential streets, rural farm and residential roads.                  Class III: Urban minor collector streets, rural minor collector roads.</p> <p>    <b>Heavy:</b> (ESAL &gt;10<sup>6</sup> per year)                  Class IV: Urban minor arterial and light industrial and light industrial streets, rural major collector and minor arterial highways.                  Class V: Urban major arterial and heavy industrial streets, freeways, expressways, arterial highways, rural interstate and other principal arterial highways.</p>			
<p>(b) Stability, Flow, Voids: ASTM D 5581.</p> <p>(c) VMA: ASTM D 3203</p> <p>(d) Nominal maximum particle size is the largest sieve size listed in this Section upon which any material is retained.</p>			

2. Dust to Asphalt Ratio: 0.8 to 1.6.

3. Moisture Sensitivity (tensile strength ratio) ASTM D 4867: 0.80 or greater using freeze -thaw conditioning and test specimen compacted at 7 percent plus or minus 1 percent air voids.

**Deleted:** 3. Moisture Sensitivity, ASTM D 4867: Tensile strength ratio less than 0.80 using freeze-thaw conditioning. Test specimen shall be 150 mm in diameter and 95 mm in height and compacted at 7 percent plus or minus 1 percent air voids)

**2.5 SOURCE QUALITY CONTROL**

A. General: Collect samples, ASTM D 3665. Do not change sampling points.

1. Aggregate sampling, ASTM D 75.
2. Paving asphalt sampling, ASTM D 140. Test for viscosity and penetration.

B. Asphalt-Aggregate Mix: Sample, ASTM D 979. Test for the following.

1. Air voids, ASTM D 3203 or ASTM D 5581.
2. Paving asphalt content, ASTM D 6307.
3. Aggregate gradation, ASTM D 5444.

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**Deleted:** 4. Rut Susceptibility, AASHTO T 324: Maximum rut depth is 10 mm at 20,000 passes.¶

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- 4. Tensile strength of bitumen-aggregate mixtures, ASTM D 4867.
- C. Mixing Plant: ASTM D 3515.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

A. Pavement placement, Section 32 12 16.

B. Pavement restoration, Section 33 05 25.

END OF SECTION

Deleted: A. Roadway paving, Section 32 12 17.

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Deleted: B. Patching, Section 33 05 25.

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## SECTION 32 12 06 AMENDED SUPERPAVE

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Composition of performance grade asphalt - aggregate mix.

#### 1.2 REFERENCES

- A. AASHTO T304: Uncompacted Void Content of Fine Aggregate
- B. AASHTO T312: Standard Method of Test for Preparing and Determining the Density of Hot-Mix Asphalt (HMA) Specimens by Means of the Superpave Gyrotory Compactor.
- C. AASHTO T 324: Hamburg Wheel-track Testing of Compacted Hot-Mix Asphalt (HMA).
- D. AI SP-2: Superpave Series No. 2.
- E. ASTM C 29: Standard Test Method for Unit Weight and Voids in Aggregate.
- F. ASTM C 88: Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
- G. ASTM C 131: Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- H. ASTM C 142: Standard Test Method for Clay Lumps and Friable Particles in Aggregates.
- I. ASTM C 242: Standard Specification for Mineral Filler for Bituminous Paving Mixtures.
- J. ASTM D 75: Standard Practice for Sampling Aggregates.
- K. ASTM D 140: Standard Practice for Sampling Bituminous Materials.
- L. ASTM D 979: Standard Methods for Sampling Bituminous Paving Mixtures.
- M. ASTM D 2041: Standard Test Method for Theoretical Maximum Specific Gravity of Bituminous Paving Mixtures.
- N. ASTM D 2419: Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
- O. ASTM D 3203: Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.
- P. ASTM D 3515: Standard Specification for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
- Q. ASTM D 3665: Standard Practice for Random Sampling of Construction Materials.
- R. ASTM D 3666: Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Bituminous Paving Materials.

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- S. ASTM D 4318: Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- T. ASTM D 4552: Standard Practice for Classifying Hot-Mix Recycling Agents.
- U. ASTM D 4791: Standard Test Method for Flat or Elongated Particles in Coarse Aggregate.
- V. ASTM D 4867: Standard Test Method for Effect of Moisture on Asphalt Concrete Paving Mixtures.
- W. ASTM D 5444: Standard Method for Mechanical Size Analysis of Extracted Aggregate.
- X. ASTM D 5821: Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate.
- Y. ASTM D 6307: Standard Test Method for Asphalt Content of Hot-Mix Asphalt by Ignition Method.

**1.3 DEFINITIONS**

- A. Asphalt-Aggregate Designator: Alpha-numeric code that indicates nominal maximum size of aggregate, and type and grade of asphalt in aggregate-asphalt mix. For example; "12.5 PG70-28" means aggregate asphalt mix shall be composed of an aggregate gradation with a 12.5 mm nominal maximum size and a performance grade asphalt binder designed to perform between temperatures of 70 deg C. and -28 deg C.
- B. ESAL (acronym for equivalent single axle load): Number used in designing Pavement thickness. It relates axle load of any mass and number to an equivalent number (18,000 lb).
- C. Mean of Deviations: Defined in Section 32 11 23.
- D. Nominal Maximum Size: One sieve size larger than first sieve size retaining more than 10 percent of the Sample. The nominal maximum size sieve will retain a minimum of 0 and a maximum of 10 percent of the sample. Maximum size is one sieve size larger than the nominal maximum size.

**1.4 SUBMITTALS**

- A. **Quality Assurance:** Submit names, certification levels, and years of experience of testing agency’s field technicians that are assigned to the Work. Verify laboratory complies with ASTM standards.
- B. **Mix Design:** Submit.
  - 1. Date of mix design. If older than 365 days, recertify mix design.
  - 2. Paving asphalt source, type, and chemical composition.
  - 3. Aggregate gradation target.
  - 4. Temperature of mix at plant and in the field for optimum field compaction.

5. Paving asphalt target percentage, dust to asphalt ratio, moisture sensitivity (tensile strength ratio), voids in the mineral aggregate (VMA) and voids filled with asphalt (VFA).

**Deleted:** 3. Nominal maximum size of aggregate.

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**Deleted:** 5. Paving asphalt target, dust to asphalt ratio, rut susceptibility, moisture sensitivity (tensile strength), voids in the mineral aggregate (VMA) and voids filled with asphalt (VFA).

6. RAP, mineral filler, antistripping, and recycle agent percentages.

7. Compaction at  $N_{max}$ .

C. **Pre-approved mix design**, submit name and address of Supplier.

D. **Before changing mix design**, submit a new design and give ENGINEER 10 days to evaluate the changes.

E. **Source Quality Control Inspections and Testing Report**: If requested, submit report describing CONTRACTOR's and Supplier's quality control activities and test results.

## 1.5 QUALITY ASSURANCE

A. Use a laboratory that follows and complies with ASTM D 3666.

B. Do not change aggregate source or paving asphalt source without ENGINEER's written approval.

C. Do not use non-complying sources.

## 1.6 ACCEPTANCE

A. General:

1. Acceptance is by Lot. One Lot is one day's production.

2. If non-complying material has been installed and no price for the material is specified, apply price adjustment against cost of work requiring material as part of its installation. Section 01 29 00.

3. Dispute resolution, Section 01 35 10.

B. Installation: Accepted as specified in Section 32 12 16.

C. Materials:

1. At the Source:

a. Aggregate: Verify gradation prior to the drum mixer or after going through the drier.

b. Paving Asphalt: See Section 32 12 03 provisions.

c. Mix: 325 deg. F. maximum in transport vehicle.

2. At the Site:

a. One sub-lot is 500 tons.

b. Sampling: One random sample per sub-lot. Location as follows.

1) Behind paver before compaction, or

2) Where sub-lot exhibits non-uniform appearance.

c. Sampling Protocol: ASTM D 3665 and ASTM D 979.

3. At the Laboratory:

a. Air Voids:

1) Basis of evaluation is laboratory compacted samples (not field compacted samples).

Deleted: b. . Sampling: Two random samples per sub-lot. Location as follows.

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- 2) If test results are not within this Section's limits, options include correction of production procedures or alternate mix design acceptable to ENGINEER.
- b. Dust to asphalt ratio.
- c. Asphalt Content, Aggregate Gradation: Lot is acceptable if test deviations are within pay factor 1.00 limits. At ENGINEER's discretion, a Lot with a sub-lot test deviation greater than pay factor 0.85 limits may stay in place at 50 percent cost.

Table 1 – Pay factors for Non-complying Materials					
Criteria	Pay Factor	Range of Mean of Deviations of Tests Results from Design Mix Target in Percentage Points			
		500 Tons	1,000 Tons	1,500 Tons	≥ 2,000 Tons
Asphalt Content	1.00	0.0 – 0.7	0.0 – 0.54	0.0 – 0.46	0.0 – 0.41
	0.975	0.71 – 0.8	0.55 – 0.61	0.47 – 0.52	0.42 – 0.46
	0.95	0.81 – 0.9	0.62 – 0.68	0.53 – 0.58	0.47 – 0.52
	0.90	0.9 – 1.0	0.69 – 0.75	0.59 – 0.64	0.53 – 0.56
	0.85	1.01 – 1.1	0.76 – 0.82	0.65 – 0.69	0.57 – 0.61
≥ 12.5 mm Sieve	1.00	0.0 – 10.0	0.0 – 7.3	0.0 – 6.3	0.0 – 5.6
	0.975	11.0 – 12.0	7.4 – 8.3	6.4 – 7.1	5.7 – 6.3
	0.95	13.0 – 13.9	8.4 – 9.3	7.2 – 7.9	6.4 – 7.0
	0.90	14.0 – 14.9	9.4 – 10.3	8.0 – 8.7	7.1 – 7.7
	0.85	15.0 – 16.0	10.4 – 11.3	8.8 – 9.5	7.8 – 8.4
9.5 mm Sieve	1.00	0.0 – 9.9	0.0 – 6.9	0.0 – 5.9	0.0 – 5.3
	0.975	10.0 – 10.9	7.0 – 7.8	6.0 – 6.6	5.4 – 5.9
	0.95	11.0 – 11.9	7.9 – 8.7	6.7 – 7.3	6.0 – 6.6
	0.90	12.0 – 13.9	8.8 – 9.6	7.4 – 8.0	6.7 – 7.2
	0.85	14.0 – 15.0	9.7 – 10.5	8.1 – 8.9	7.3 – 7.9
4.75 mm Sieve	1.00	0.0 – 9.9	0.0 – 6.7	0.0 – 5.7	0.0 – 5.2
	0.975	10.0 – 10.9	6.8 – 7.6	5.8 – 6.3	5.3 – 5.8
	0.95	11.0 – 11.9	7.7 – 8.5	6.4 – 6.9	5.9 – 6.4
	0.90	12.0 – 12.9	8.6 – 9.4	7.0 – 7.5	6.5 – 7.0
	0.85	13.0 – 14.0	9.5 – 10.2	7.6 – 8.0	7.1 – 7.6
2.36 mm Sieve	1.00	0.0 – 7.9	0.0 – 5.6	0.0 – 4.8	0.0 – 4.3
	0.975	8.0 – 8.9	5.7 – 6.3	4.9 – 5.4	4.4 – 4.8
	0.95	9.0 – 9.9	6.4 – 7.0	5.5 – 6.0	4.9 – 5.3
	0.90	10.0 – 10.9	7.1 – 7.7	6.1 – 6.6	5.4 – 5.8
	0.85	11.0 – 12.0	7.8 – 8.5	6.7 – 7.2	5.9 – 6.4
0.075 mm Sieve	1.00	0.0 – 3.0	0.0 – 2.4	0.0 – 2.0	0.0 – 1.8
	0.975	3.1 – 3.5	2.5 – 2.7	2.1 – 2.2	1.9 – 2.0
	0.95	3.6 – 4.0	2.8 – 3.0	2.3 – 2.4	2.1 – 2.2
	0.90	4.1 – 4.5	3.1 – 3.3	2.5 – 2.7	2.3 – 2.4
	0.85	4.6 – 5.0	3.4 – 3.6	2.8 – 3.0	2.5 – 2.6
NOTES					
(a) Test bitumen content using a burn-off oven, ASTM D 6307.					
(b) Determine aggregate gradation by extraction, ASTM D 5444.					

## **PART 2 PRODUCTS**

### **2.1 PAVING ASPHALT**

- A. Performance Grade Asphalt Binder (PGAB): Section 32 12 03.
1. Blending with polymers or natural asphalts is CONTRACTOR's choice.
  2. Do not use acid blends without documentation supporting need.
  3. As a rule of thumb, if the two numbers in an asphalt binder designation are added together and are greater than 90, then the binder will most likely contain a polymer or natural asphalt.
- B. Recycle Asphalt: Section 32 12 03.

### **2.2 AGGREGATE**

- A. Material: Clean, hard, durable, angular, sound, consisting of crushed stone, crushed gravel, slag, sand, or combination.
- B. Source: Use the following requirements to determine suitability of aggregate source and not for project control.
1. Coarse Aggregate:
    - a. Angularity (fractured faces), ASTM D 5821: At least one fracture as follows.
      - 1) 55 percent minimum if ESALs are less than 0.3 million.
      - 2) 85 percent minimum if ESALs are more than 0.3 million.
    - b. Hardness (toughness), ASTM C 131: Retained above 2.36 mm sieve.
      - 1) 40 percent maximum if ESALs are less than 0.3 million.
      - 2) 35 percent maximum if ESALs are more than 0.3 million.
    - c. Flat and Elongated Particles, ASTM D 4791: 20 percent maximum retained above the 9.5 mm sieve has a 3:1 length to width ratio.
  2. Fine Aggregate:
    - a. Angularity, AASHTO T304: 45 percent minimum uncompact void content.
    - b. Friable Particles, ASTM C 142: 2 percent maximum by weight passing 4.75 mm sieve.
    - c. Plasticity, ASTM D 4318: Aggregate passing 4.75 mm sieve is non-plastic even when filler material is added to the aggregate.
      - 1) Liquid limit: Less than 25.
      - 2) Plastic limit: Less than 6.

### **2.3 ADMIXTURES**

- A. Reclaimed Asphalt Pavement (RAP) Aggregate: Restrictions include.
1. 15 percent by weight maximum providing grading, VMA and VFA are met.
  2. Greater than 15 percent requires separate mix design.
- B. Mineral Filler: ASTM D 242.
- C. Recycle Agent: ASTM D 4552.

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D. Antistrip: Heat stable, cement slurry, or lime slurry.

**2.4 MIX DESIGN**

A. Selection of Materials:

1. Paving Asphalt. Section 32 12 03.
  - a. PG70-28: Less than 3 million EASLs.
  - b. PG70-28: 3 million to 30 million EASLs.

2. Aggregate: This Section Article 2.2.

3. Admixture: This section article 2.3.

- a. RAP: Adjust pavement asphalt grade to account for RAP binder viscosity.
- b. Cement or Hydrated Lime: Add if mix is moisture sensitive.

B. Selection of Design Aggregate Structure.

1. Gradation: Maximum particle size is 1/4 compacted lift thickness.

- a. Target Gradation Curve must lie within one of the following Master Grading Bands. It must lie below the restricted zone if ESAL is 30 million or more, otherwise it may lie above, below, or pass through the zone.
- b. If acceptable to ENGINEER, use fractionated proportioning to select or adjust gradation.

**Deleted:** a. Target Gradation Curve must lie within one of the following Master Grading Bands. It must lie below the restricted zone in traffic class IV and traffic class V (Table 3 Section 32 12 05). In all other classes it may lie above, below, or pass through the zone.

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Table 2 – Master Grading Bands					
Sieve Size (mm)	Aggregate Grade				
			12.5	9.5	
Control Sieves	37.5	100.0	–	–	–
	25	90 – 100	100.0	–	–
	19	< 90	90 – 100	100	–
	12.5	–	< 90	90 – 100	100
	9.5	–	–	< 90	90 – 100
	4.75	–	–	–	< 90
	2.36	19 – 45	23 – 49	28 – 58	32 – 6
Restricted Zone	0.075	1 – 7	2 – 8	2 – 10	2 – 10
	4.75	39.5	–	–	–
	2.36	29.8 – 30.8	34.6	39.1	47.2
	1.18	18.1 – 24.1	22.3 – 28.3	25.6 – 31.6	31.6 – 37.6
	0.6	13.6 – 17.6	16.7 – 20.7	19.1 – 23.1	23.5 – 27.5
	0.3	11.4	13.7	15.5	18.7

**NOTES**  
 (a) Gradation in percent passing by weight, ASTM D 4759.  
 (b) It is assumed fine and coarse aggregate have same bulk specific gravity.  
 (c) Percentage of fines passing 0.075 mm control sieve determined by washing per ASTM C 117.

2. Aggregate Blend:

- a. Dry-rodded Unit Weight, ASTM C 29: 75 pounds per cubic foot minimum.

- b. Weight Loss (soundness), ASTM C 88: 16 percent maximum using sodium sulfate.
- c. Clay Content (cleanliness), ASTM D 2419: Sand equivalent value after going through the dryer or prior to the drum mixer.
  - 1) 45 percent minimum if ESALs are less than 0.3 million.
  - 2) 0 percent minimum if ESALs are more than 0.3 million. The sand equivalent requirement is waived for the RAP aggregate but applies to the remainder of the aggregate blend.

**C. Selection of Mix Properties: Use Superpave volumetric mix design, AI SP-2.**

1. Compaction:

Table 4 – Compaction Parameters			
20 Year design ESALs (Million)	N <sub>initial</sub> / % of G <sub>mm</sub>	N <sub>design</sub> / % of G <sub>mm</sub>	N <sub>max</sub> / % of G <sub>mm</sub>
Less than 0.3	6 / ≤ 91.5	50 / 96	75 / ≤ 98
0.3 to <3	7 / ≤ 90.5	75 / 96	115 / ≤ 98
3 to <30	8 / ≤ 89	100 / 96	160 / ≤ 98
30 or more	9 / ≤ 89	125 / 98	205 / 98

NOTES

- (a) N = Number of gyrations.
- (b) G<sub>mm</sub> = maximum specific gravity of mix, ASTM D 2041 (Rice method)
- (c) Specific gravity of specimen: AASHTO T 312.
- (d) 20 year design ESALs defined as follows.
  - Less than 0.3 = Very light traffic (local /county roads; city streets where truck traffic is prohibited)
  - 0.3 to 3 = Medium traffic (collector roads; most county roadways)
  - 3 to 30 = Medium to high traffic (city streets, state routes; US highways; some rural interstates)
  - 30 or more = High traffic (most of the interstate system; climbing lanes; truck weighing stations)

**Deleted:** C. Selection of Admixture:¶  
 1. RAP: Adjust pavement asphalt grade to account for RAP binder viscosity.¶  
 2. Cement or Hydrated Lime: Add if mix is moisture sensitive.¶  
 D. Selection of Mix Properties: Use AI SP-2 volumetric procedure.

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20 Year design ESALs (Million)
Less than 0.3
0.3 to <3
3 to <30
30 or more

NOTES

- (a) N = Number of gy
- (b) G<sub>mm</sub> = maximum sp
- (c) Specific gravity o
- (d) 20 year design ES
  - Less than 0.3 =
  - 0.3 to 3 = colle
  - 3 to 90 = city s
  - 30 or more = ir

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2. Voids in the mineral aggregate (VMA) at N<sub>design</sub>:

<u>Nominal Maximum Size</u>	<u>Voids (VMA)</u>
37.5 mm	11 to 13 percent
25.0 mm	12 to 14 percent
19.0 mm	13 to 15 percent
12.5 mm	14 to 16 percent
9.5 mm	16 percent minimum

3. Voids filled with asphalt (VFA) at N<sub>design</sub>:

<b>20 Year Design ESALs (million)</b>	<b>Voids Filled with Asphalt (VFA)</b>
Less than 0.3	70 – 80 percent
0.3 to <3	65 – 78 percent
3 to <30	65 – 75 percent
30 or more	65 – 75 percent

- a. For 9.5 mm nominal maximum size mixtures, the specified VFA range is 73 percent to 76 percent for design traffic levels 3 million ESALs or greater.
  - b. For 25.0 mm nominal maximum size mixtures, the specified lower limit of the VFA is 67 percent for design traffic levels less than 0.3 million ESALs.
  - c. For 37.5 mm nominal maximum size mixtures, the specified lower limit of the VFA is 64 percent for all design traffic levels.
4. Dust to Asphalt Ratio:
- a. 0.6 to 1.2 if aggregate gradation passes through or over the restricted zone.
  - b. 0.8 to 1.6 if aggregate gradation passes under the restricted zone.

5. Moisture Sensitivity (tensile strength ratio) ASTM D 4867: 0.80 or greater using freeze-thaw conditioning and test specimen compacted at 7 percent plus or minus 1 percent air voids.

**Deleted:** 5. Moisture Sensitivity, ASTM D 4867: Tensile strength ratio less than 0.80 using freeze-thaw conditioning. Test specimen shall be 150 mm in diameter and 95 mm in height and compacted at 7 percent plus or minus 1 percent air voids.

**2.5 SOURCE QUALITY CONTROL**

- A. General: Collect Samples randomly, ASTM D 3665. Do not change sampling points.
  - 1. Aggregate sampling, ASTM D 75.
  - 2. Paving asphalt sampling, ASTM D 140.
- B. Asphalt-aggregate mix sampling, ASTM D 979. Test for
  - 1. Air voids, ASTM D 3203.
  - 2. Paving asphalt content, ASTM D 6307.
  - 3. Aggregate gradation, ASTM D 5444.
  - 4. Tensile strength of bitumen-aggregate mixtures, ASTM D 4867.
- C. Mixing Plant: ASTM D 3515.

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**Deleted:** 6. Rut Susceptibility, AASHTO T 324: Maximum rut depth is 10 mm at 20,000 passes.¶

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- A. Pavement placement, Section 32 12 16.
- B. Pavement restoration, Section 33 05 25.

**Deleted:** A. Pavement placement, Section 32 12 17.

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END OF SECTION

**SECTION 32 12 16 AMENDED**  
**PLANT-MIX - ASPHALT PAVING**

**PART 1 GENERAL****1.1 SECTION INCLUDES**

- A. Place Superpave or plant-mix asphalt concrete in base, leveling and surface courses, or overlay.

**1.2 REFERENCES**

- A. AASHTO T 324: Hamburg Wheel-track Testing of Compacted Hot- Mix Asphalt (HMA).
- B. ASTM D 979: Standard Practice for Sampling Bituminous Paving Mixtures.
- C. ASTM D 2041: Standard Test Method for Theoretical Maximum Specific Gravity of Bituminous Paving Mixtures.
- D. ASTM D 3549: Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.
- E. ASTM D 3665: Standard Practice for Random Sampling of Construction Materials.
- F. ASTM E 950: Standard Test Method for Measuring the Longitudinal Profile of Traveled Surfaces with an Accelerometer Established Inertial Profiling Reference.
- G. ASTM E 1274: Standard Test Method for Measuring Pavement Roughness Using a Profilograph.

**1.3 SUBMITTALS**

- A. Before Delivery:
  - 1. Traffic control plan, Section 01 55 26.
  - 2. Type and number of rollers.
  - 3. Manufacturer's certificate of compliance for paving geotextiles, Refer to Section 31 05 19.
  - 4. Location and name of asphalt concrete production facility.
  - 5. Proof of profilograph and profilograph operator certification.
- B. At Delivery: Supply batch ticket identifying.
  - 1. Serial number of ticket.
  - 2. Date and truck number.
  - 3. Job name, location, and mix identification.
  - 4. Type, grade, and weight of asphalt.
  - 5 Type, grade, and weight of aggregate.
  - 6. Mix design method.
- C. After Delivery:
  - 1. Profile deviation report.

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- 2. Profile roughness index report.
- 3. Quality Control Inspections and Testing Report: Upon ENGINEER’s request, submit report describing source and field quality control activities and test results performed by CONTRACTOR and CONTRACTOR’s Suppliers.

**1.4 QUALITY ASSURANCE**

- A. Do not change asphalt or aggregate sources until ENGINEER accepts new source and new mix design.
- B. Reject product and work that does not meet requirements of this Section.
- C. Remove product found defective after installation and install acceptable product at no additional cost to OWNER.
- D. Foreman of paving crew has completed at least three (3) projects of similar size and nature.

**1.5 WEATHER**

- A. Do not pave until air temperature is 45 deg F. and rising.
- B. Cease paving if air temperature falls below 50 deg F.
- C. Do not pave if surface is wet or weather is unsuitable.
- D. Do not pave if wind or ground cools mix material before compaction.

**1.6 NOTICE**

- A. Send written notice to residents and businesses within affected area at least 3 days before start of paving.
- B. Indicate paving time and when new surface can be used.
- C. Warn of potential vehicle tow away and other construction issues affecting neighborhood.
- D. Should work not occur on specified day, send a new notice.

**1.7 ACCEPTANCE**

A. General:

- 1. Acceptance is by Lot. 2. Observation of CONTRACTOR's field quality control testing does not constitute acceptance. Such testing; however, may be used by ENGINEER for acceptance providing the following conditions are met.
  - a. ENGINEER accepts qualifications of CONTRACTOR's testing agency.
  - b. CONTRACTOR has a quality control plan similar to AASHTO R 9.
  - c. Test results are submitted promptly.
  - d. Acceptance criteria are met.
- 3. If non-complying material has been installed and no price for the material is specified, apply price adjustment against cost of work requiring material as part of its installation. Section 01 29 00.
- 4. Dispute resolution, Section 01 35 10.

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Deleted: 2. If non-complying material has been installed and no price for the material is specified, apply price adjustment against cost of work requiring material as part of its installation. Section 01 29 00.

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Deleted: 3. Dispute resolution, Section 01 35 10.

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5. Opening a paved surface to traffic does not constitute acceptance.

B. Mix: Accepted as specified in Section 32 12 05, or Section 32 12 06.

C. Mix Temperature at Site:

- 1. Reject mixes exceeding 325 deg F. in transport vehicle.
- 2. Dispose of cold mix in paver hopper as thin spread underlay.

D. Grade, Cross Slope: Verify tolerances are not exceeded.

E. Compaction: Basis for acceptance is core density, non-destructive density, or control strip density with visual observation. Use core density unless specified otherwise.

1. Core Density: This method compares the average density of cores extracted from a pavement surface to maximum theoretical density.

- a. Lot: 1,000 square yards or part thereof. A Lot is acceptable if average core density does not exceed pay factor 1.00 limits.

Table 1 – Compaction Pay Factors		
Pay Factor	Density, in Percent (ASTM D 2041)	
	Average	Lowest Test
0.70	More than 96	–
1.00	92 to 96	89 or greater
0.90	92 to 96	Less than 89
Reject	Less than 92	–
NOTES (a) At CONTRACTOR's discretion and expense, do Hamburg wheel track test (AASHTO T 324) on 3 additional random core samples from a non-complying sub-lot. The sub-lot will be accepted if average rut depth is less than 10 mm at 20,000 passes.		

Table 1 – Compaction Pay Factors		
Pay Factor	Density, in Percent (ASTM D 2041)	
	Average	Lowest Test
0.70	More than 96	–
1.00	92 to 96	89 or greater
0.90	92 to 96	Less than 89
0.80	Less than 92	89 or greater
Reject	Less than 92	Less than 89
NOTES (a) ENGINEER may accept a Lot in Reject at 50 percent cost, or at a pay factor cost recommended by an Independent Testing Agency.		

- b. Sampling Protocol: ASTM D 3665 for random test location selection with at least 2 test locations per Lot. ASTM D 5361 for collection and 3 core samples

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**Deleted:** C. Installation:¶

- 1. Mix Temperature:¶
  - a. . Reject mixes exceeding 325 deg F. in transport vehicle.¶
  - b. . Dispose of cold mix in paver hopper as thin spread underlay.¶
- 2. Compaction and Thickness:¶
  - a. . Lot size is 1,000 square yards or part thereof.¶
  - b. . Verify with at least 2 tests per Lot.¶
  - c. . Select test locations by ASTM D 3665 and sample per ASTM D 979 after compaction.¶
  - d. . Compaction determinations are full core depth or overlay depth in overlay construction.¶
  - e. . Thickness measurement will not apply in overlay construction.¶
  - f. . Based upon core samples, compaction and thickness is acceptable if test deviations are within pay factor 1.00 limits. At ENGINEER's discretion, a Lot with a sub-lot test deviation greater than Reject may stay in place at 50 percent cost.

**Deleted:** 3. Grade, Cross Slope: Verify tolerance is not exceeded.¶

4. Roughness: Verify "must grind" bumps are removed and tolerance for profile roughness index is not exceeded.

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per test location. Samples are full depth or overlay depth in overlay construction.

c. Testing Protocol: ASTM D 2725 for core density and ASTM D 2041 (Rice) for maximum theoretical density.

**2. Non-Destructive Density Testing by Gage:**

a. Lot: One days' production with 1,000 square yard sub-lots. A Lot is acceptable when density does not exceed pay factor 1.00 limits in Table 1.

b. Sampling Protocol: ASTM D 3665 for random test location selection with at least 1 test location per Lot.

c. Testing Protocol: ASTM D 2950 (nuclear gage) or AASHTO TP 68 (Non-nuclear gage) and ASTM D 2041 for maximum theoretical density.

**3. Control Strip:**

a. Lot: One days' production.

b. Sampling Protocol: Not required after rolling pattern is determined.

c. Testing Protocol: ASTM D 5581 and D 2041 to determine rolling pattern for 94 percent compaction, thereafter visual examination.

F. Roughness: Verify "must grind" bumps are removed and tolerance for profile roughness index is not exceeded.

**G. Thickness:**

1. Lot Size: 1,000 square yards or part thereof.

2. Sampling Protocol: ASTM D 3665 and ASTM D 5361 with at least 2 test location per Lot and 3 core samples per test location. Samples are full depth. Thickness not measured in overlay construction.

3. Testing Protocol: ASTM D 3549.

4. Minimum Specified Thickness: A Lot specified to have minimum thickness will be accepted if all measurements meet or exceed minimum. If thickness is deficient, additional material may be placed over the Lot if there is no asphalt feathering; placement matches this section's thickness tolerance; surface continues to drain; and ride quality tolerance is met.

5. Actual Specified Thickness: A Lot specified to have actual thickness is acceptable if average measurement does not exceed deficiency limits for thickness pay factor 1.00.

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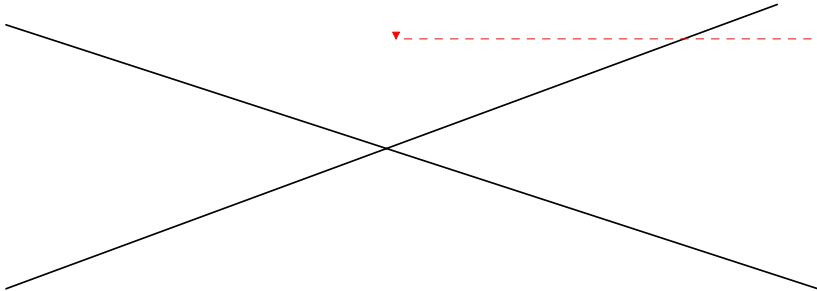


Table	
Pay Factors	
1.00	
0.90	
0.70	
Reject	

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Table 2 – Pay Factors	
Thickness Pay Factors	Deficiency Limits in Inches
1.00	0.00 to 0.375
0.90	0.375 to 0.50
0.70	0.51 to 0.75
Reject	0.76 to 1.00

NOTES  
 (a) ENGINEER may accept a Lot in Reject at 50 percent cost; or at a pay factor cost recommended by an Independent Testing Agency.

**1.8 WARRANTY**

A. Joints at Street Fixtures: If 1/2 inch or wider before end of one year Correction Period, seal joints with asphalt rubber or rubberized asphalt per Section 32 01 17.

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**PART 2 PRODUCTS**

**2.1 MATERIALS**

- A. Asphalt concrete, Section 32 12 05.
- B. Superpave, Section 32 12 06.
- C. Prime coat, Section 32 12 13.
- D. Tack coat, Section 32 12 14.
- E. Paving geotextile, Section 31 05 19.
- F. Paving geogrid, Section 31 05 21.

**PART 3 EXECUTION**

**3.1 CONSTRUCTION EQUIPMENT**

- A. Lay Down Machine: Use track equipment when operating on fabrics, geogrids or Pavement mats hotter than 180 deg. F.
- B. Compactors: Steel wheel static or vibratory. Use pneumatic tire roller for intermediate rolling only.

**3.2 PREPARATION**

- A. General:
  - 1. Coordinate utility location, Section 01 31 13. Contact utility companies and other agencies, for dangerous concentration of combustible, flammable, or explosive matter.
  - 2. Lower Street Fixtures if paving machine is not capable of passing over the fixtures.

3. Remove vegetation from cracks, edges and joints. Sweep surface clean. Blow cracks clean. Remove leaves.
  4. Fill cracks and fix Potholes, Section 32 01 17.
  5. Stabilize concrete Subgrade slabs.
- B. Trees, Plants, Ground Cover:
1. Protect trees, plants and other ground cover from damage.
  2. Prune trees, Section 32 01 93 to allow equipment passage underneath. Repair tree damage at no additional cost to OWNER.
- C. Traffic Control:
1. Provide worker and public safety, Section 01 55 26.
  2. Apply temporary traffic and lane marking tape or paint after layout has been verified with ENGINEER.
- D. Aggregate Base Course:
1. Verify base course is placed to grade and compacted.
  2. If indicated, follow Section 31 25 00 for herbicide treatment or Section 32 12 13 for prime coat.

**3.3 TEMPORARY SURFACING**

- A. Place, roll, maintain, remove and dispose of temporary surfaces.
- B. In sidewalk areas construct temporary Pavements at least 1 inch thick and in all other areas at least 2 inches thick. At major intersections and other critical locations a greater thickness may be required.

**Deleted:** E. Tack Coat: Apply tack coat, Section 32 12 14 if inlay or subbase Pavement surface is dirty or older than 24 hours.¶

**3.4 PLACE PAVING FABRIC**

- A. Section 31 05 19.

**3.5 PLACE PAVEMENT MIXTURE**

- A. General:
1. Provide continuous forward movement such that minimum temperature 10 feet behind paver is as follows.

Table 3 – Minimum Temperature, Degrees F.						
Air Temperature Deg F.	Compacted Mat Thickness					
	3/4"	1"	1-1/2"	2"	3"	4"+
45 – 50	–	–	–	–	280	265
50 - 59	–	–	–	280	270	255
60 - 69	–	–	285	275	265	250
70 - 79	285	285	280	270	265	250
80 - 89	280	275	270	265	260	250
90 +	275	270	265	260	250	250

2. Do not leave unsafe butt joints if paving operation stops.
3. Barricade or eliminate fall off edges.

B. Overlays or Subsequent Lifts:

1. Allow new base Pavement or new inlay Pavement to harden (cure) prior to placing overlays.
2. Apply tack coat per Section 32 12 14 if inlay or sub-base pavement surface is dirty or older than 24 hours.

C. Irregular Areas: Handwork is acceptable if specified grades, slopes, compaction and smoothness is achieved.

D. Compaction:

1. Do not over compact or under compact.
2. Complete compaction before temperature drops to 180 deg. F.

E. Joints:

1. Construct joints to have same texture, density and smoothness as other sections of new Pavement course.
2. Clean contact surfaces and apply tack coat. Ensure continuous bond between old and new Pavements, or between successive day's work.
3. Offset longitudinal joints a minimum of 12 inches in succeeding courses and at least 6 feet transversely to avoid a vertical joint through more than one course. In the top course restrict longitudinal joint to 1 foot either side of lane lines.
4. Prevent traffic, including construction traffic, from crossing vertical edges. Apply tack coat to vertical edges prior to making another pass with the paver if the mix has cooled to 90 deg. F.

3.6 TOLERANCES

A. Compaction: Refer to this section article 1.7.

B. Lift Thickness:

1. Not less than 2 times the maximum aggregate size in compacted asphalt concrete mixes.
2. Not less than 4 times the nominal maximum aggregate size in compacted SUPERPAVE mixes.

3. Not more than limits established by pneumatic or vibratory compactor equipment manufacturer.

C. Grade: 1/8 inch in 10 feet parallel to centerline.

D. Cross Slope: 1/4 inch in 10 feet perpendicular to centerline except at cross section grade breaks.

E. Roughness:

Deleted: A. Compaction: 94 percent plus or minus 2 percent of theoretical maximum specific gravity, ASTM D 2041 (Rice Method).

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Deleted: 3. Not more than limits established by pneumatic or vibratory compactor equipment manufacturer.

Speed and Traffic Class	
0 to 29 mph	I or I III or I
30 to 44 mph	I or I III or I
45 mph +	All Clas

NOTES  
 (a) Use a zero blanki  
 (b) As a minimum, tr  
 (c) Traffic class is de  
 (d) IRI (International  
 (e) PI (Profile Index)

Deleted:

Table 4 – Roughness Tolerance							
Speed mph	Traffic Class		Profile Roughness Index, (PRI) Inches / Mile				Profile Deviation Inches/25 feet Maximum
	AC	Superpave	IRI		PI		
			Min	Max	Min	Max	
0 to 29 mph	I or II	< 0.3	–	–	–	–	0.4
	III or IV	0.3 to < 3	129	177	46	66	0.4
30 to 44 mph	I or II	0.3 to < 3	90	115	35	50	0.4
	III or IV	3 to 30	70	90	21	35	0.4
45 mph +	All Classes	30 or More	–	70	–	21	0.3

NOTES  
 (a) Use a zero blanking band.  
 (b) As a minimum, trace right wheel path in direction of travel  
 (c) Traffic class is defined in Section 32 12 05 and Section 32 12 06.  
 (d) IRI (International Roughness Index), ASTM E 950  
 (e) PI (Profile Index), ASTM E 1274.

1. Profile Deviation: Begin traces 50 feet before edge of new pavement and end traces 50 feet after edge of new pavement. Areas exceeding profile deviation tolerance are “must grind” areas.
2. Profile Roughness Index: (PRI)
  - a. Lot is 0.1 lane mile (528 feet long one lane wide). Add segments shorter than 250 feet to preceding Lot. Treat partial segments longer than 250 feet as a Lot.
  - b. Exclude from the Lot are turn lanes, parking lanes, medians, Street Fixtures, crowns of intersecting streets, bridge decks, grades greater than 8 percent, and vertical curves less than 1,000 feet radius (including super-elevation transitions).

**3.7 PROTECTION AND REPAIR**

A. General: All expenses are at no cost to OWNER.

B. Protection.

1. Protect all structures, including curb, gutter, sidewalks, guard rails and guide posts.
2. Remove spatter, over-coat, or mar.
3. Do not discharge bituminous materials into borrow pits or gutters.
4. Protect hot pavement from traffic until mixture has cooled enough not to become marked.
5. Protect neighborhood, storm drains and down-stream fish habitat.

C. Repair.

1. Corrective Action for Profile Deviations (“Must Grinds”): Grinding is acceptable, Section 02 41 14. Apply Section 32 12 03 cationic or anionic emulsion and sand friction blotter over grind areas.
2. Corrective Action for Profile Roughness Index: Grinding is acceptable. Skin patch for depressions is not acceptable. Raise depressions by milling and inlay. Re-profile corrected segments to verify index meets tolerance. Apply a Section 32 12 03 cationic or anionic emulsion and sand friction blotter over grind areas.

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3. When thickness is deficient, place additional material over deficient areas. DO NOT skin patch. Mill for inlay if necessary.
4. Defective Joints, Seams, Edges: Repair.
5. Unacceptable Paving: Remove and replace.

END OF SECTION

## SECTION 32 12 17 AMENDED COLD-MIX - ASPHALT PAVING

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Placing cold mix asphalt concrete in base, leveling, and surface courses.
- B. Asphalt concrete material is not specified in this Section. Refer to Section 32 12 05 or 32 12 06.

#### 1.2 REFERENCES

- A. ASTM D 1461: Standard Test Method for Moisture or Volatile Distillates in Bituminous Paving Mixtures.
- B. ASTM D 2041: Standard Test Method for Theoretical Maximum Specific Gravity of Bituminous Paving Mixtures.
- C. ASTM D 2170: Standard Test Method for Kinematic Viscosity of Asphalts (Bitumens).
- D. ASTM D 2399: Standard Practice for Selection of Cutback Asphalts.
- E. ASTM D 3628: Standard Practice for Selection and Use of Emulsified Asphalts.
- F. ASTM D 5581: Standard Test Method for Resistance to Plastic flow of Bituminous Mixtures Using Marshall Apparatus (6 inch-Diameter Specimen).

#### 1.3 SUBMITTALS

- A. Traffic control plan, Section 01 55 26.
- B. Laboratory mix design, Section 32 12 05.

C. Batch Delivery Tickets: Submit ticket for each batch delivered to the Work site. Include information specified in Section 32 12 16.

**Deleted:** C. Batch Delivery Tickets: Submit ticket for each batch delivered to the Work site. Include information specified in Section 32 12 17.

#### 1.4 WEATHER

A. Section 32 12 16.

**Deleted:** ¶

#### 1.5 NOTICE

A. Section 32 12 16.

**Deleted:** A. Section 32 12 17.

**Deleted:** ¶

#### 1.6 ACCEPTANCE

A. Section 32 12 16.

**Deleted:** A. Section 32 12 17

**Deleted:** ¶

**Deleted:** A. Section 32 12 17.

**Deleted:** ¶

### PART 2 PRODUCTS

#### 2.1 MATERIALS

- A. Paving asphalt, Section 32 12 03: Emulsified asphalt or medium curing cutback asphalt. If type is not indicated CONTRACTOR is to select as follows:
  - 1. Emulsified Asphalt, ASTM D 3628.
  - 2. Cutback Asphalt, ASTM D 2399.

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- B. Aggregate, Section 32 12 05: Use an aggregate containing not more than the 2 percent moisture. If more, dry before asphalt is applied. An exception may be made for unusually porous material, when laboratory tests indicate excess moisture will not produce an unstable mix.

### PART 3 EXECUTION

#### 3.1 CONSTRUCTION EQUIPMENT

~~A. Lay-down Machine: Use track equipment when operating on fabrics or geogrid.~~

**Deleted:** A. Laydown Machine: Use track equipment when operating on fabrics or geogrid.

- B. Compactors: Steel wheeled static or vibratory. Any use of a pneumatic tire roller is for intermediate compaction only.

**Deleted:** ¶

#### 3.2 PREPARATION

A. Trees, Plants, Ground Cover:

1. Protect trees, plants and other ground cover from damage.
2. Prune trees, Section 32 01 93 to allow equipment passage underneath. Repair tree damage at no additional cost to the OWNER.

B. Traffic Control:

1. Control pedestrian and vehicular traffic, Section 01 55 26.
2. Apply temporary traffic and lane marking tape or paint after layout and placement has been verified with ENGINEER.

#### 3.3 PREPARATION OF AGGREGATE

- A. On unpaved surfaces, prime coat whole roadway surface receiving coldmix application, Section 32 12 13.
- B. Place aggregate to be mixed with bitumen on the prepared base in a uniform windrow or windrows.
- C. Notify ENGINEER 48 hours in advance of applying the bituminous material to permit check of the aggregate with respect to volume, moisture content, and unit weight, and the proper amount of bituminous material to be used.

#### 3.4 PROPORTIONING AND MIXING

- A. Unless specified otherwise, method of mixing may be selected from a traveling mixer method, stationary mixer method, or blade mixing method.
- B. Traveling Mixer Method:
1. Accomplish mixing by means of mixer that will thoroughly blend the aggregate and bitumen. Use metering devices that will accurately introduce required quantity of bitumen during the mixing process. Produce a satisfactory mixture that is uniform in appearance, texture and bitumen content, and free from pockets of segregated aggregates.
  2. When necessary, supplement travel plant mixing with blade mixing to obtain the desired degree of aeration of the mix. Continue mixing until not more than 50 percent of the original volatiles present in the bituminous material remain in the mix, ASTM D 1461.

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C. Blade Method:

1. Spread the windrowed aggregate on the prepared base, after which, uniformly apply the bituminous material over the aggregate.
2. Apply the bituminous material in 2 or more applications over a section of definite limits. Limit the amount of bitumen spread in any 1 application to 0.50 gallon per square yard. Exercise care to avoid overlapping of spreads onto adjoining sections. Immediately after each application, partially mix the bituminous material with the aggregate.
3. After the last application of bituminous material and partial mixing, windrow the entire mass of bitumen and aggregate and mix by blading the material from side to side of the roadway. Blade to produce a satisfactory mixture that is uniform in appearance, texture, and bitumen content, and free from pockets of segregated aggregates and continue until not more than 50 percent of the original volatiles present in the bitumen remain in the mix, ASTM D 1461. While mixing, take care to avoid cutting into the underlying base course or contaminating the bituminous mixture with earth or other foreign matter.

D. Stationary Mixer Method:

1. Dry the aggregate to the optimum moisture content prior to mixing. Use the same application of bituminous material and mixing as required for traveling mixer.
2. After mixing, haul and place the material on the roadway surface in windrows. All requirements as to uniformity, percent of volatiles, and textures are as required for traveling mixer which may require supplemental blade mixing.

3.5 TEMPERATURE CONTROL

- A. Maintain the temperature range of the asphalt road mix material at the time of application so that the viscosity will be between 50 and 200 centistokes, ASTM D 2170.

3.6 PLACING PAVEMENT MIXTURE

- A. At the end of each day's work or when the work is interrupted by adverse weather conditions, blade all loose material into a windrow, whether mixing is completed or not. Do not leave material spread on the roadbed overnight.
- B. When mixing has been completed, form the mixture in a windrow or windrows and spread in such a manner that the finished surface conforms to the elevations, grades, and cross-sections indicated.

3.7 TOLERANCES

A. Section 32 12 16.

Deleted: A. Section 32 12 17.

3.8 PROTECTION AND REPAIR

A. Section 32 12 16.

Deleted: A. Section 32 12 17.

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END OF SECTION

## **SECTION 32 13 13 AMENDED CONCRETE PAVING**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Concrete base course and concrete surface course.
- B. Concrete product is not specified in this Section. Refer to Section 03 30 04.

#### **1.2 REFERENCES**

- A. ACI 305: Hot Weather Concreting.
- B. ACI 306: Cold Weather Concreting.
- C. APWA Plan No. 261: Manual of Standard Plans for Concrete Pavement Joints.
- D. ASTM A 307: Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
- E. ASTM C 39: Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- F. ASTM C 78: Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).
- G. ASTM C 150: Standard Specification for Portland Cement.
- H. ASTM C 172: Standard Method of Sampling Freshly Mixed Concrete.
- I. ASTM D 3549: Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.
- J. ASTM D 5249: Standard Specification for Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland-Cement and Asphalt Joints.
- L. ASTM E 950: Standard Test Method for Measuring the Longitudinal Profile of Traveled Surfaces with an Accelerometer Established Inertial Profiling Reference.
- M. ASTM E 1274: Standard Test Method for Measuring Pavement Roughness Using a Profilograph.

#### **1.3 SUBMITTALS**

- A. Before delivery.
  - 1. Traffic control plan, Section 01 55 26.
  - 2. Joint layout plan.
  - 3. Curing plan. Describe method to prevent excessive concrete temperatures and water evaporation that could impair strength or serviceability of the concrete. Refer to ACI 305.
  - 4. Proof of finisher's ACI certification.
  - 5. Make and model name of paving machine.
  - 6. Concrete mix design and number, Section 03 30 04.

7. Proof of profilograph calibration and profilograph operator certification.
8. Manufacturer's recommended installation procedures for joint sealing material which, when accepted by ENGINEER, will become the basis for accepting or rejecting actual installation procedures used in the Work.

B. At Delivery: Batch ticket, Section 03 30 10.

C. After delivery.

1. Profile deviation report.
2. Ride index report.
3. Upon ENGINEER's request, submit a written quality control inspections and testing report describing source and field quality control activities and test results performed by CONTRACTOR and CONTRACTOR's Supplier.

#### **1.4 QUALITY ASSURANCE**

- A. Do not change concrete Supplier until ENGINEER accepts new source and new mix design.
- B. Reject product that does not meet requirements of Section 03 30 04.
- C. Remove product found defective after installation and install acceptable product at no additional cost to OWNER.
- D. Foreman of paving crew has completed at least three (3) projects of similar size and nature.

#### **1.5 WEATHER**

- A. Hot weather, ACI 305.
- B. Cold weather, ACI 306.

#### **1.6 NOTICE**

- A. Send written notice to residents and businesses within affected area at least 3 days before start of paving.
- B. Indicate paving time and when new surface can be used.
- C. Warn of potential vehicle tow away and other construction issues affecting neighborhood.
- D. Should work not occur on specified day, send a new notice.

#### **1.7 ACCEPTANCE**

A. General:

1. Acceptance is by Lot. Lot size is specified below.
2. If non-complying material has been installed and no price for the material is specified, apply price adjustment against cost of work requiring material as part of its installation. Section 01 29 00.
3. Dispute resolution, Section 01 35 10 and Section 03 30 05.
4. Opening a paved surface to traffic does not constitute acceptance.

B Concrete Mix:

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1. Testing Frequency: Section 03 30 05. Sample per ASTM C 172.
2. Temperature, Slump, Air: Lot size is 1 random batch. Reject noncomplying batches until 2 consecutive batches are compliant then continue in random batch testing for acceptance.
3. Strength: Lot is acceptable if strength test deviations are within pay factor 1.00 limits. At ENGINEER's discretion, a Lot with a sub-lot test deviation greater than Reject may stay in place at 50 percent cost.

- a. Compression: ASTM C 39. Lot size is 500 square yards.

<b><u>Pay Factor</u></b>	<b><u>PSI Below 28 day Compressive Strength</u></b>
1.00	0
0.98	1 to 100
0.94	101 to 200
0.88	201 to 300
0.80	301 to 400
Reject	Greater than 400

- b. Flexural: ASTM C 78. Lot size is 750 square yard.

<b><u>Pay Factor</u></b>	<b><u>PSI Below 28 day Flexure Strength</u></b>
1.00	0
0.95	1 to 29
0.85	30 to 60
Reject	Greater than 60

C. Installation:

1. Placement, finishing and protection, Section 03 30 10.
  - a. Verify grade, cross slope, finish and dimensions.
  - b. No standing water in curb and gutter.
2. Thickness. Lot size is 1,000 square yards.
  - a. Thickness will be determined on ASTM D 3549 cored or sawed specimens. Acceptance will be based on the average of all Lot thickness tests.

<b><u>Pay Factors</u></b>	<b><u>Tolerance (inches less than specified thickness)</u></b>
1.00	0.00 to 0.25
0.90	0.26 to 0.50
0.70	0.51 to 0.75
0.50	0.76 to 1.00

- b. When any thickness measurement is less than specified by more than 1 inch, the actual thickness of the Pavement will be determined by taking additional cores at intervals less than 10 feet parallel to the centerline in each direction from the affected location, until in each direction a core is found which is not deficient by more than 1 inch. Exploratory cores for deficient thickness will not be used in averages for price adjustments.
  - c. Payment may be made for areas deficient in thickness by more than 1 inch at 50 percent. If not, remove and replace.
  - d. Price adjustments and Pavement removal will be applied only to those areas showing the deficient thickness which is defined by an additional set of cores taken at the 100 percent pay point as determined in a straight line basis between the original cores. If the second set of cores is deficient, the area will be defined on a straight-line basis using all scores for the different pay factors.
3. Roughness: "Must grind" bumps are removed and tolerance for profile roughness index is not exceeded.

## **PART 2 PRODUCTS**

### **2.1 CONCRETE**

#### A. Compression Design:

1. Cast-in-place: Class 4000, Section 03 30 04.
2. Slump per accepted mix design.

#### B. Flexure Design.

1. Tensile Strength: 650 psi per ASTM C 78.
2. Cement Content: 6.5 bags.
3. Water Cement Ratio: 0.44 maximum by weight (prior to pozzolan exchange), ACI 318.
4. Entrained Air: 5 to 7 percent, ASTM C 231 (pressure).
5. Slump per accepted mix design

### **2.2 MISCELLANEOUS MATERIALS**

- A. Reinforcement: Grade 60 ksi galvanized or epoxy coated steel, Section 03 20 00.
- B. Hook Bolts: Steel, ASTM A 307 Grade A nuts and bolts, internally and externally threaded.
- C. Expansion Joint Filler: F1 sheet, Section 32 13 73.
- D. Contraction Joint Filler (Backer Rod): Type 1 round, closed cell, ASTM D 5249.
- E. Contraction Joint Sealant: HAS1, HAS4, or CAS6, Section 32 13 73.
- F. Curing Compound: Liquid membrane, Section 03 39 00.
- G. Bond Breaker: Wax based compound.
- H. Grout: Epoxy adhesive, Section 03 61 00.

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- I. Evaporative Reducer: Water-based mono-molecular polymer liquid at application rates recommended by the manufacturer. Not to be used as a finishing aid.

### **PART 3 EXECUTION**

#### **3.1 PREPARATION**

A. General:

1. Coordinate utility location, Section 01 31 13. Contact utility companies and other agencies, for dangerous concentration of combustible, flammable, or explosive matter.
2. Lower Street Fixtures if paving machine is not capable of passing over fixtures.
3. Coat surface of Street Fixtures with oil to prevent bond with concrete Pavement.
4. Remove sand, leaves and other objectionable materials prior to placing the paving course.
5. Notify ENGINEER minimum 24 hours prior to commencement of concreting operations.

B. Trees, Plants, Ground Cover:

1. Protect trees, plants and other ground cover from damage.
2. Prune trees, Section 32 01 93 to allow equipment passage underneath. Repair tree damage at no additional cost to the OWNER.

C. Traffic Control:

1. Provide worker and public safety, Section 01 55 26.
2. Apply temporary traffic and lane marking tape or paint after placement layout has been verified with ENGINEER.

D. Base Course:

1. Follow Section 31 25 00 for herbicide treatment.
2. Verify base course is placed to grade, compacted and dampened.
3. If indicated, apply prime coat, Section 32 12 13.

- E. Cement Treated or Lean Concrete Base: Remove loose material from surface of cement treated or lean concrete base course immediately before placing concrete surface course. Moisten the surface but do not place concrete over puddled water. Apply a double coat of bond breaker prior to placing surface concrete.

#### **3.2 FORM CONSTRUCTION**

A. Section 03 11 00.

B. Check formwork for grade and alignment variance from the following tolerances:

1. Top of forms not more than 1/4 inch from true grade.
2. Vertical face on longitudinal axis not more than 1/4 inch from true line.

C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

### 3.3 REINFORCEMENT PLACEMENT

- A. Section 03 20 00.
- B. Interrupt reinforcement at expansion joints.
- C. Use load transfer bars on longitudinal construction and transverse construction joints.
- D. Use smooth dowel in expansion joints.
- E. Keep load transfer bars and dowels in vertical center of concrete and perpendicular to the joint during concrete placement.
- F. Position mats on bar chair supports and properly tie before any concrete is poured. Keep mats clean, free from rust, flat, and free of distortions. Straighten bends, kinks, and other irregularities or replace units before concrete placement. Provide a minimum of 2 inch overlap to adjacent mats.

### 3.4 JOINTS

- A. General:
  - 1. Review joint layout with ENGINEER.
  - 2. Follow Section 32 13 73 requirements.
  - 3. Follow joint requirements in APWA Plan No. 261.
- B. Construction Joint: Construction joints (contact joints) (cold joints) are those made by placing concrete against cured concrete.
  - 1. The contact joint between separately laid lanes cannot deviate from a true line by more than 1/4 inch in any direction at any point.
  - 2. Tie both sides of longitudinal and transverse construction joints together with tie bars or key-way. Before placing concrete in adjoining slab, straighten tie bars to 0.1 feet of straight position.
  - 3. Do not cause edge slump when placing tie-bars or by over-working edge of slab.
- C. Contraction Joints: Contraction joints (crack control joints) are scorelines made to force crack joint locations in concrete. Keep a minimum of 3 working power saws on the Project when concrete operations are underway. Saw all joints before uncontrolled shrinkage cracking takes place. Do not tear or ravel concrete during sawing.
  - 1. Joint spacing measured in feet = twice the slab thickness measured in inches or a maximum of 15 feet.
  - 2. Joint Depth = T/3.
  - 3. Use of a mechanical control joint-void former in lieu of saw cutting or tooling is acceptable.
  - 4. Longitudinal Joints: Make longitudinal joints the same dimension as transverse joints.
  - 5. Make transverse joints across width of the Pavement full length and meet curb and gutter joints.
  - 6. Leave forms in place until paving operations are resumed on the other side of the joint.

#### D. Volunteer Crack Joint:

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1. If a volunteer crack joints falls within 5 feet of the location of proposed contraction joint, omit the contraction joint.
2. Rout volunteer crack joints to a 1-1/4 inch depth by 3/8 inch width. Clean and fill crack joint with backer rod and joint sealant.
3. When crack joints occur within 2 feet of expansion or construction joints, replace panel. Use saw cuts and tie-bars or dowels in cut planes.

E. Expansion Joints:

1. If a deformed rebar is used in an expansion joint, provide sleeve for movement.
2. Secure fillers to prevent movement. When butted together, do not leave voids or gaps between filler units.
3. Set joint fillers full depth if no joint sealant is specified.
4. Recess joint fillers if backer rods and joint sealant are specified or provide a plastic cap.

F Joint Sealing: Section 32 13 73.

G If CONTRACTOR chooses to open the roadway to construction or public traffic prior to final sawing and sealing, install backer rod in the initial (green) cut to prevent entrance of incompressibles.

### 3.5 CONCRETE PLACEMENT

A. Section 03 30 10.

- B. At the beginning of concrete placement, test slump and air. If corrections are necessary, placement may proceed after 2 subsequent and consecutive batches pass testing.
- C. **Any delay in excess of 15 minutes from placing to start of finishing operations is cause for stopping placement work.**
- D. Do not place concrete until concrete sub base and surface course forms have been checked for line and grade. Moisten sub base if required to provide a uniform dampened condition at time of concrete placement. Do not place concrete around Manholes or other structures until they are at required finish elevation and cross-slope.
- E. Prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.
- F. Do not place concrete in a longitudinal section until test specimens from the adjacent lane have attained an ASTM C 78 flexural strength (modulus of rupture) of 450 psi.
- G. Deposit and spread concrete in a continuous operation between transverse joints. If interrupted for more than 1/2 hour, place a construction joint.
- H. Place the concrete to the full width of the Pavement in a single construction operation unless indicated otherwise.

**3.6 FINISHING**

- A. Section 03 35 00.
- B. Any delay in excess of 30 minutes for completing the finishing operation is cause for stopping concrete placing to correct the difficulties.
- C. After striking-off and consolidating concrete, smooth surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.
- D. After floating, test slab for trueness with a straight edge. Distribute concrete as required to remove surface irregularities. Refloat repaired areas to provide a continuous smooth finish.
- E. Round edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool. Eliminate tool marks.
- F. Surface Texture: After floating when excess moisture or surface sheen has disappeared.
  - 1. For speed less than 45 mph: 1/16 inch deep burlap drag, turf drag, or broom.
  - 2. For speed greater than 45 mph: 1/8 inch deep groove placed 80 degrees to center line and randomly spaced between 3/8 and 1-1/2 inches.
- G. Do not remove forms for at least 24 hours after concrete has been placed. After form removal, clean ends of joints and patch any minor honeycombed areas. Remove and replace areas or sections with major defects.

**3.7 CURING**

- A. Section 03 39 00.
- B. Type II Class A or B (white pigmented) membrane forming compound applied in two directions for total white coverage on all exposed surfaces after texturing.
- C. Eliminate thermal shock of concrete by keeping cure temperature close to ground and air temperature.

**3.8 TOLERANCES**

- A. Grade: 1/8 inch in 10 feet parallel to centerline.
- B. Cross Slope: 1/4 inch in 10 feet perpendicular to centerline except at cross section grade breaks.
- C. Thickness: Not less than 1/4 inch deficient.
- D. Roughness:

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Speed and Traffic Class	
0 to 29 mph	I or III or
30 to 44 mph	I or III or
45 mph +	All Cla
NOTES	
(a) Use a zero blankin	
(b) As a minimum, tra	
(c) Traffic class defin	
(d) IRI (International I	
(e) PI (Profile Index).	

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Table 1 – Roughness Tolerance							
Speed mph	Traffic Class		Profile Roughness Index, (PRI) Inches / Mile				Profile Deviation Inches/25 feet Maximum
	AC	Superpave	IRI		PI		
			Min	Max	Min	Max	
0 to 29 mph	I or II	< 0.3	–	–	–	–	0.4
	III or IV	0.3 to < 3	129	177	46	66	0.4
30 to 44 mph	I or II	0.3 to < 3	90	115	35	50	0.4
	III or IV	3 to 30	70	90	21	35	0.4
45 mph +	All Classes	30 or More	–	70	–	21	0.3

NOTES  
 (a) Use a zero blanking band.  
 (b) As a minimum, trace right wheel path in direction of travel  
 (c) Traffic class is defined in Section 32 12 05 and Section 32 12 06.  
 (d) IRI (International Roughness Index), ASTM E 950  
 (e) PI (Profile Index), ASTM E 1274.

1. Profile Deviation: Begin traces 50 feet before edge of new pavement and end traces 50 feet after edge of new pavement. Areas exceeding profile deviation tolerance are “must grind” areas.
2. Profile Roughness Index: (PRI)
  - a. Lot is 0.1 lane mile (528 feet long one lane wide). Add segments shorter than 250 feet to preceding Lot. Treat partial segments longer than 250 feet as a Lot.
  - b. Exclude from the Lot are turn lanes, parking lanes, medians, Street Fixtures, crowns of intersecting streets, bridge decks, grades greater than 8 percent, and vertical curves less than 1,000 feet radius (including super-elevation transitions).

**E. Dowel Bar:**

1. Skew is 0.375 inches per 12 inches (3 percent) in the horizontal and vertical planes.
2. Embedment is 6 inches minimum.
3. Position in slab is center plus or minus 1/2 inch.

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**3.9 OPENING TO TRAFFIC**

A. Not less than 3,000 psi compressive or 400 psi flexure strength.

**3.10 PROTECTION AND REPAIR**

A. General: All expenses are at no cost to OWNER.

B. Protection: Section 03 30 10 and as follows.

1. Do not allow steel wheel rollers or steel wheel vehicles on the concrete Pavement. Keep traffic and construction equipment off at least 10 days after concrete placement or until 100 percent of the design strength has been achieved and verified by either
  - a. Maturity meter.
  - b. Concrete cylinders.

- 2. If construction traffic is permitted, keep Pavement clean. Remove surface stains and spillage of materials as they occur.
- 3. Remove saw-cut dust immediately. Protect neighborhood, storm drains and downstream fish habitat.

C. Repair: Section 03 30 10.

~~1. Corrective Action for "Must Grinds": Grinding per Section 02 41 14 is acceptable after concrete cure. Apply a water repelling product, Section 07 19 00 over planed surfaces.~~

**Deleted:** 1. Corrective Action for "Must Grinds": Grinding per Section 02 41 14 is acceptable after concrete cure.

~~2. Corrective Action for Profile Roughness Index: Grinding is acceptable. Re-profile corrected segments to verify ride index meets tolerance. Apply a water repelling product, Section 07 19 00 over planed surfaces.~~

**Deleted:** 2. Corrective Action for Profile Roughness Index: Grinding is acceptable. Re-profile corrected segments to verify ride index meets tolerance.

3. Corrective Action for Cracks: Consider repair options published in Guidelines by the American Concrete Pavement Association (ACPA). Do not begin corrective work until ENGINEER agrees with repair option. Drill test cores when necessary to determine magnitude. Fill holes with Portland cement concrete bonded to Pavement with epoxy adhesive.

**Deleted:** ¶

END OF SECTION

## **SECTION 32 13 73 AMENDED CONCRETE PAVING JOINT SEALANTS**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Joints and joint sealants in horizontal traffic surfaces for concrete sidewalks, curb, gutter and Pavement slabs.

#### **1.2 REFERENCES**

- A. ASTM C 920: Standard Specification for Elastomeric Joint Sealants.
- B. ASTM D 545: Standard Methods of Testing Preformed Expansion Joint Fillers for Concrete Construction (Nonextruding and Resilient Types).
- C. ASTM D 994: Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
- D. ASTM D 1190: Standard Specification for Concrete Joint Sealer, Hot-Poured Elastic Type.
- E. ASTM D 1191: Standard Method for Testing Concrete Joint Sealers.
- F. ASTM D 1751: Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- G. ASTM D 1752: Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
- H. ASTM D 1850: Standard Specification for Concrete Joint Sealer, Cold-Application Type.
- I. ASTM D 1851: Standard Methods of Testing Concrete Joint Sealers, Cold-Application Type.
- J. ASTM D 2240: Standard Test Method for Rubber Property - Durometer Hardness.
- K. ASTM D 2628: Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.
- L. ASTM D 3405: Standard Specification for Joint Sealants, Hot-Poured, For Concrete and Asphalt Pavements.
- M. ASTM D 3406: Standard Specification for Joint Sealant, Hot-Applied, Elastomeric-Type, for Portland Cement Concrete Pavements.
- N. ASTM D 3407: Standard Methods of Testing Joint Sealants, Hot-Poured, For Concrete and Asphalt Pavements.
- O. ASTM D 3408: Standard Methods of Testing Joint Sealants, Hot-Poured, Elastomeric-Type, for Portland Cement Concrete Pavements.
- P. ASTM D 3542: Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Bridges.

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- Q. ASTM D 3569: Standard Specification for Joint Sealant, Hot-Applied, Elastomeric, Jet-Fuel-Resistant-Type for Portland Cement Concrete Pavements.
- R. ASTM D 3575: Standard Test Method for Flexible Cellular Materials Made from Olefin Polymers.
- S. ASTM D 3581: Standard Specification for Joint Sealant, Hot-Poured, Jet-Fuel-Resistant Type, for Portland Cement Concrete and Tar-Concrete Pavements.
- T. ASTM D 3582: Standard Methods for Testing Joint Sealant, Hot-Poured, Jet-Fuel-Resistant Type, for Portland Cement Concrete and Tar-Concrete Pavements.
- U. ASTM D 3583: Standard Methods of Testing Joint Sealant, Hot-Applied, Elastomeric-Type, for Portland Cement Concrete Pavements, or Joint Sealant, Hot-Applied, Elastomeric, Jet-Fuel-Resistant-Type, for Portland Cement Concrete Pavements.
- V. ASTM D 5249: Standard Specification for Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland-Cement and Asphalt Joints.
- W. ASTM D 5893: Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.
- X. FS SS-S-200: Sealants, Joint, Two Component, Jet-Fuel Resistant, Cold-Applied, for Portland Cement Concrete Pavement.

### **1.3 SYSTEM PERFORMANCES**

- A. Pavement joints include longitudinal and transverse expansion joints, contraction joints, construction joints, and crack control joints.
- B. Provide joint sealants that maintain watertight and airtight continuous seals.

### **1.4 SUBMITTALS**

- A. Manufacturer's certification that product was manufactured, tested and supplied per source quality control requirements specified herein, together with a report of the test results and the date each test was completed.
- B. Manufacturer's instruction for joint preparation, type of cleaning and installation.
- C. Manufacturer's Product Data and Samples for each joint sealant product required.
- D. Safety data sheets.

### **1.5 QUALITY ASSURANCE**

- A. Installation of joint systems are to follow manufacturer's published directions.
- B. For cold applied joint sealant installation, use installers approved by the joint sealant Supplier.
- C. Obtain joint sealing materials from a single manufacturer for each different product required.

### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials to site in original unopened containers or bundles with labels identifying manufacturer, product name and designation, color, expiration period for use, pot life, cure time, and mixing instructions for multi-component materials.

- B. Store and handle materials in compliance with manufacturer's recommendations to prevent deterioration; or damage due to moisture, high or low temperatures, contaminants, or other causes.

## **PART 2 PRODUCTS**

### **2.1 GENERAL**

- A. Compatibility: Provide joint fillers, sealant backings, sealants, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

### **2.2 JOINT VOID - FORMER**

- A. Plastic with a water stop.
- B. 1/4 depth of concrete structural section.

### **2.3 JOINT FILLER - SHEET TYPE**

- A. **F-1:** Bituminous (asphalt or tar) mastic, ASTM D 994. Formed and encased between 2 layers of bituminous saturated felt or 2 layers of glass-fiber felt.
- B. **F-2:** Cane or other cellulosic fiber, ASTM D 1751. Saturated with asphalt.
- C. **F-3:** Granulated cork, ASTM D 1751. In an asphalt binder; encased between 2 layers of asphalt saturated felt or 2 layers of glass-fiber felt.
- D. **F-4:** Sponge rubber fully compressible, ASTM C 1752. With resiliency recovery rate of 90 percent minimum.
- E. **F-5:** Cork, ASTM C 1752. Impregnated and bound with asphalt, compressible with resiliency recovery rate of 90 percent if not compressed more than 50 percent of original thickness.
- F. **F-6:** Plastic foam (for cold-applied sealants only). Preformed, compressible, resilient, non-waxing, non-extruding strips of flexible, non-gassing plastic foam; non-absorbent to water and gas; 30 lb/ft<sup>3</sup> density maximum, And of size and shape to control sealant depth and performance.

### **2.4 JOINT FILLER - BACKER ROD, TAPE, POURED FILL TYPE**

- A. Backer material, ASTM D 5249 for cold- and hot-applied joint sealant in portland cement concrete or asphalt Pavements joints.
  - 1. Type 1: Round rods.
  - 2. Type 2: Sheets or strips, laminated or skived.
  - 3. Type 3: Poured fills which completely fill Pavement joint.

### **2.5 JOINT SEALANT - GENERAL**

- A. Color of exposed joint sealant indicated, or if not, as selected from manufacturer's standard colors.

### **2.6 JOINT SEALANT - HOT-APPLIED**

- A. **HAS-1:** Asphalt base type, ASTM D 3405.

- B. **HAS-2:** Thermoplastic type, ASTM D 3581. Jet-fuel resistant without rubber unless indicated otherwise.
- C. **HAS-3:** Elastic type, ASTM D 1190.
- D. **HAS-4:** Elastomeric type, ASTM D 3406. One component, for Portland cement concrete Pavements.
- E. **HAS-5:** Elastomeric type, ASTM D 3569. One component, jet-fuel resistant, for Portland cement concrete Pavements.

**2.7 JOINT SEALANT - COLD-APPLIED**

- A. **CAS-1:** Elastomeric type, ASTM C 920. Chemically curing, for vehicular or pedestrian use, and types of construction other than highway and airfield Pavements and bridges and joint substrates indicated; Type S or M; Grade P or NS; Class 25; Use T, NT, M and O.

1. Self leveling.

2. Shore A Hardness: ASTM D 2240: 40 plus or minus 5.

3. Final cure: 4 days maximum.

4. Service range: -10 to 150 deg. F.

Deleted: 2. Shore A Hardness: 40 ± 5  
ASTM D 2240.

Deleted: ¶

- B. **CAS-2:** Mastic type, ASTM D 1850. Single or multiple component; for joints having a minimum width of 1/2 inch.
- C. **CAS-3:** Coal-tar modified urethane, FS SS-S-200. One part, jet fuel resistant; Type H.
- D. **CAS-4:** Elastomeric preformed polychloroprene type with lubricant adhesive and indicated movement ratio.
  - 1. For concrete Pavement seal, ASTM D 2628.
  - 2. For concrete bridge seals, ASTM D 3542.
- E. **CAS-5:** Silicone type, ASTM D 5893. Single component, non-sag or self leveling, chemically curing sealant based on polymers of polysiloxane structure intended for use in portland cement concrete Pavements.
- F. **CAS-6:** Asphalt base meeting ASTM D 3405.
- G. **CAS-7:** Olefin polymer, ASTM D 3575 as follows.
  - 1. Tensile elongation 255 percent plus or minus 20 percent, Suffix T.
  - 2. Tensile strength 115 psi minimum, Suffix T
  - 3. Density 2.9 plus or minus 3 lbs/cf, Suffix W, Method A
  - 4. Water Absorption 0.025 lbs/sf maximum, Suffix L.

**2.8 SOURCE QUALITY CONTROL**

- A. Preformed Expansion Joint Fillers: Nonextruding and resilient types, ASTM D 545.
- B. Hot-Applied Joint Sealants:
  - 1. Elastic type used in concrete Pavements, bridges, other structures, ASTM D 1191.
  - 2. Bituminous type for hydraulic and asphaltic concrete Pavements, ASTM D 3407.
  - 3. Elastomeric type for hydraulic concrete Pavement, ASTM D 3408.

- C. Jet-Fuel-Resistant Joint Sealant: Hot-applied, ASTM D 3582 and ASTM D 3583.
- D. Cold-Applied Mastic Joint Sealant: Cold-applied, ASTM D 1851.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Remove oil, grease, wax, form-release-agents, curing compounds, bitumens, laitance and old chalking material by sandblast, or water blast as recommended by manufacturer of sealant. Maximum sand blast angle, 25 degrees plus or minus 5 degrees.
- B. Clean and dry with air blast. Do not contaminate air blast with oils or lubricants.
- C. Remove frost and moisture in concrete joint substrates before commencing sealing.
- D. Install bond breaker tape where needed or required by manufacturer's recommendations to ensure that elastomeric sealants will perform properly.

### **3.2 JOINT SEALING**

- A. General:
  - 1. Install sealants in uniform, continuous ribbons without gaps or air pockets, with complete bonding of joint surfaces on opposite sides.
  - 2. Except as otherwise indicated, fill sealant rabbet flush with surface.
  - 3. Where horizontal joints are between a horizontal surface and vertical surface, fill joint to form a slight cove so that joint will not trap moisture and dirt.
- B. Depths: Saw cut joints if necessary to provide the required sealant thickness and depth. Install sealant to depths indicated or, if not indicated, as recommended by sealant manufacturer, but within the following general limitations measured at center (thin) section of bead:
  - 1. For sidewalks, Pavements, and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75 percent of joint width, but not more than 5/8 inch deep nor less than 3/8 inch deep.
  - 2. For normal moving joints sealed with elastomeric sealants but not subject to traffic, fill joints to a depth equal to 50 percent of joint width, but not more than 1/2 inch deep nor less than 1/4 inch deep.
  - 3. For joints sealed with non-elastomeric sealants and caulking compounds, fill joints full depth.
- C. Spillage: Do not allow poured sealant compound to overflow or spill onto adjoining surfaces or to migrate into voids of adjoining surfaces. Clean adjoining surfaces to eliminate evidence of spillage.
- D. Heating: Do not use overheated hot-applied sealants.
- E. Edges: Unless indicated otherwise, recess exposed edges of gasket and exposed joint fillers slightly behind adjoining surfaces so compressed units will not protrude from joints.

**3.3 CURING AND CLEANING**

- A. Cure sealants and caulking compounds per manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesive strength and surface durability.
- B. Clean off excess sealants or sealant smears adjacent to joints as work progresses. Use methods and cleaning materials approved by manufacturers of joint sealant and of products in which joints occur.
- C. Remove protective coating and oil from metals with solvent recommended by the sealant manufacturer.

**3.4 PROTECTION**

- A. Protect joint sealant during and after curing period from contact with contaminating substances or from damage resulting from deterioration or damage at time of Substantial Completion.
- B. If damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealant immediately and reseal joints with new materials to produce joint sealer installations with repaired areas indistinguishable from original work at no additional cost to OWNER.

END OF SECTION

## **SECTION 32 14 13 AMENDED PRECAST CONCRETE UNIT PAVING**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Mortarless interlocking concrete pavers for sidewalks, roadways and similar pavings.

#### **1.2 REFERENCES**

- A. ASTM C 33: Standard Specification for Concrete Aggregates.
- B. ASTM C 67: Standard Method of Sampling and Testing Brick and Structural Clay Tile.
- C. ASTM C 136: Standard Method for Sieve Analysis for Fine and Coarse Aggregates.
- D. ASTM C 140: Standard Method of Sampling and Testing Concrete Masonry Units.
- E. ASTM C 144: Standard Specification for Aggregate for Masonry Mortar.
- F. ASTM C 150: Standard Specification for Portland Cement.
- G. ASTM C 936: Standard Specification for Solid Interlocking Concrete Paving Units.
- H. ASTM C 979: Coloring Agents for Concrete.
- I. ASTM D 1557: Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using a 10 lb (4.54-kg) Rammer and an 19-In. (457-mm) Drop.
- J. ASTM D 3786: Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics Diaphragm Bursting Strength Tester Method.
- K. ASTM D 4751: Standard Test Method for Determining Apparent Opening Size for a Geotextile.
- L. ICPI: Interlocking Concrete Paver Institute.

#### **1.3 SUBMITTALS**

- A. Data sheets for
  - 1. Bedding sand gradation.
  - 2. Joint sand gradation.
  - 3. Joint sand stabilizer.
  - 4. Paver strength and absorption. Test results not older than 365 days.
- B. Certification that paver unit complies with ASTM C 936.

#### **1.4 QUALITY ASSURANCE**

- A. Installer must have successfully completed at least 3 unit paver applications of similar size and scope and will assign mechanics from these earlier applications to the Project, of which one will serve as lead mechanic.
- B. Installer will have on site during the course of paving personnel who is knowledgeable of ICPI technical bulletins.

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**1.5 PRODUCT HANDLING**

- A. Protect unit pavers against soilage. Protect sand against intermixture with earth or other types of materials.
- B. Do not build on frozen Subgrade or setting beds.
- C. Remove damaged pavers.

**PART 2 PRODUCTS**

**2.1 CONCRETE PAVERS**

- A. Solid interlocking units per ASTM C 936 with spacer bars.
  - 1. Cement: ASTM C 150 hydraulic cement.
  - 2. Aggregates: ASTM C 33 sand and natural aggregates (washed and graded with no expanded shale or light weight aggregates).
  - 3. Average Compressive Strength: Greater than 8,000 psi with no individual unit test less than 7,200 psi.
  - 4. Average Absorption: Less than 5 percent with no individual unit greater than 7 percent, ASTM C 140.
  - 5. Freeze-Thaw: Resistance to 50 cycles, ASTM C 67.
  - 6. Efflorescence Prevention: Admixture per recommendation of manufacturer.
- B. Shape: 200 mm x 100 mm unless specified elsewhere.
- C. Thickness:
  - 1. Sidewalks: 60 mm.
  - 2. Roadways: 80 mm.
  - 3. Crosswalks: 80 mm.
  - 4. Driveway Approaches: 80 mm.
- D. Color: Reddish brown using an inorganic mineral oxide.

**2.2 BEDDING AND JOINT SAND**

- A. Clean, non-plastic, naturally occurring silica sand conforming to ASTM C 33 or ASTM C 144, with no more than 5 percent acid soluble material.
- B. Gradation must not vary from the high limit on one sieve to the low limit on the next. Graded by dry weight to pass sieves per ASTM C 136 as follows.

<u>Sieve</u>	<b>Bedding Sand <u>ASTM C 33</u></b>	<b>Joint Sand <u>ASTM C 144</u></b>
3/8 inch	100	--
No. 4	95 to 100	100
No. 8	85 to 100	95 to 100
No. 16	50 to 85	50 to 100
No. 30	25 to 60	40 to 100
No. 50	5 to 30	20 to 40
No. 100	2 to 10	10 to 25

No. 200

0 to 1

0 to 10

**2.3 JOINT SAND STABILIZER**

- A. Water based polymer sealer capable of penetrating the joint sand to a depth of 1/2 inch prior to polymerization.
- B. No significant discoloration.
- C. No significant static coefficient of friction reduction.

**2.4 GEOTEXTILE FILTER FABRIC**

- A. Non-woven with the following properties.
  - 1. Apparent Opening Size (OAS): ASTM D 4751, 70 sieve.
  - 2. Puncture: ASTM D 3786, 65 lbs minimum.
  - 3. Thickness: 60 mils average.
- B. Consult fabric manufacturer if,
  - 1. Subgrade CBR less than 2, or
  - 2. Surfaces are subject to highway or industrial loads.

**2.5 SOURCE QUALITY CONTROL**

- A. ICPI member manufacturer.
- B. Concrete masonry units, ASTM C 140.

**PART 3 EXECUTION**

**3.1 INSPECTION**

- A. Verify Subgrade is compacted, ready to receive substrate materials, and is sloped to drain.

**3.2 PREPARATION**

- A. Layout: Check final elevations and patterns for conformance to Drawings.
- B. Installation over soil base.
  - 1. Place specified base course over compacted Subgrade at specified thickness.
  - 2. ~~Compact to 95 percent or greater of Modified Proctor Density, Section 31 23 26.~~
  - 3. Soil base surface tolerance is 3/8 inch in 10 feet.
- C. Installation over concrete base.
  - 1. Fill drainage holes in concrete base with bedding sand.
  - 2. Cover filled drainage holes with geotextile.

Deleted: 2. Compact to greater than 95 percent ASTM D 1557.

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**3.3 INSTALLATION**

- A. Bedding Sand:
  - 1. Place and screed allowing for paver height and compaction.
  - 2. After screeding, do not disturb or compact. Fill screed rails voids with loose sand.
  - 3. Remove all compressions in the bedding sand.

4. Remove from bedding sand any concrete dust or waste from the paver cutting operation

**B. Cutting Pavers:**

1. Point up joints to provide a neat, uniform appearance.
2. Minimum cut length is 3/4 paver, or 1/2 paver providing adjacent paver is also reduced no more than 1/2 its original length.
3. Cut vertical faces with masonry saw.
4. No chipping or breaking for shaping.
5. No modification of top or bottom face of paver.

**C. Pavers:**

1. Do not install paver over saturated or dry sand. Sand should be damp.
2. Paver surface to be 1/8 to 3/16 inch above grade or edge restraints after compaction.
3. Keep paver lines straight, true, and square.
4. Use a low amplitude, high frequency plate vibrator capable of at least 5,000 lbf at a frequency of 75 hz to 10 hz.
5. Do not vibrate within 6 feet of an unrestrained edge of pavers.

**D. Joint Width:**

1. 1.5mm–4mm.
2. Maximum 50 percent between 2mm–3mm and 10 percent between 3mm–4mm in any 3 feet square area.

**E. Joint Sand and Stabilizer:**

1. After setting pavers, sweep joint sand into joints and vibrate again until joints are full.
2. Bedding sand may be used for joint sand, however, extra effort in sweeping and compacting the pavers may be required in order to completely fill the joints.
3. After final vibration remove excess sand and debris.
4. Apply joint sand stabilizer within 1 week of installing joint sand.

### **3.4 TOLERANCES**

A. Lippage: 1/16 inch maximum elevation difference unit to unit.

B. Cross Slope: 1/8 inch in 10 feet.

C. Longitudinal:

1. Sidewalks: 1/8 inch in 10 feet.

2. Roadway:

a. 1/8 inch in 10 feet parallel to centerline.

b. 1/4 inch in 10 feet perpendicular to centerline except at cross section grade breaks.

**3.5 PROTECTION AND REPAIR**

A. Provide final protection and maintain conditions in a manner acceptable to installer.

B. Repair:

1. Remove and replace non-matching pavers or pavers which are chipped, broken, stained or otherwise damaged. Fill joints with joint sand and compact with plate compactor.
2. Remove excess sand.

END OF SECTION

## **SECTION 32 16 13 AMENDED DRIVEWAY, SIDEWALK, CURB, GUTTER**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Concrete flatwork such as but not limited to waterways, waterway transition structures, sidewalks, curbs, gutters, Driveway Approaches.

#### **1.2 REFERENCES**

- A. American Public Works Association (Utah Chapter).
  - 1. Plan 205: Curb and Gutter.
  - 2. Plan 209: Curbs.
  - 3. Plan 211: Waterway.
  - 4. Plan 213: Waterway Transition Structure.
  - 5. Plan 215: Dip Driveway Approach.
  - 6. Plan 216: Mountable curb driveway approach.
  - 7. Plan 221: Flare Driveway Approach.
  - 8. Plan 225: Open Driveway Approach.
  - 9. Plan 229: Pipe Driveway Approach.
  - 10. Plan 231: Concrete Sidewalk.
- B. ASTM A 36: Standard Specifications for Structural Steel.
- C. ASTM C 39. Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- D. ASTM C 172: Standard Method of Sampling Freshly Mixed Concrete.

#### **1.3 DEFINITIONS**

- A. Driveway: A paved or unpaved vehicular thoroughfare outside of, but connected to a public road right-of-way or highway right-of-way.
- B. Driveway Approach: (1) A vehicular thoroughfare connecting a public road or highway to a driveway. (2) A concrete structure composed of sidewalk, apron and any curb and gutter abutting the apron. When an apron is built as a bridge over curb and gutter, the bridge is included in this definition.

#### **1.4 SUBMITTALS**

- A. Traffic control plan, Section 01 55 26.
- B. Concrete mix design, Section 03 30 04.
- C. Batch ticket, Section 03 30 10.
- D. Quality Control Inspections and Testing Report: Upon ENGINEER's request, submit a report describing source and field quality control activities and test results performed by CONTRACTOR and CONTRACTOR's Suppliers.

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**1.5 NOTICE**

- A. Send written notice to residents and businesses within affected area at least 3 days before work starts.
- B. Indicate when concrete work will take place and when driveway approach can be used.
- C. Warn of potential vehicle tow away and other construction issues affecting neighborhood.
- D. Should work not occur on specified day, send a new notice.

**1.6 ACCEPTANCE**

A. General:

- 1. Acceptance is by Lot. One Lot is one day’s production.
- 2. If non-complying material has been installed and no price for the material is specified, apply price adjustment against cost of work requiring material as part of its installation. Section 01 29 00.
- 3. Dispute resolution, Section 01 35 10 and Section 03 30 05.

B. Concrete Mix:

- 1. Testing Frequency: Section 03 30 05. Sample per ASTM C 172.
- 2. Temperature, Slump, Air: Lot size is 1 random batch. Reject noncomplying batches until 2 consecutive batches are compliant then proceed in random batch testing for acceptance.
- 3. Strength: ASTM C 39. Lot size is 50 cubic yards. At ENGINEER’s discretion, a Lot with sub-lot test deviations greater than Reject may stay in place at 50 percent cost.

<b>Pay Factor</b>	<b>PSI Below 28 day Compressive Strength</b>
0.98	1 to 100
0.94	101 to 200
0.88	201 to 300
0.80	301 to 400
Reject	Greater than 400

C. Placement, finishing and protection, Section 03 30 10

- 1. Verify line, grade, cross slope and finish.
- 2. Flow test curb and gutter with water. No standing water in curb and gutter.

Deleted: 2. No standing water in curb and gutter.

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**PART 2 PRODUCTS**

**2.1 MATERIALS**

A. Concrete Mix.:

- 1. Cast-in-place: Class 4000, Section 03 30 04.

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2. Maximum slump per mix design.
- B. Reinforcement: Grade 60 ksi galvanized or epoxy coated steel per Section 03 20 00.
- C. Expansion Joint Filler: F1 sheet 1/2 inch thick per Section 32 13 73.
- D. Contraction Joint Filler (Backer Rod): Closed cell, Type 1 round Section 32 13 73.
- E. Contraction Joint Sealer: HAS1 or HAS4 hot applied per Section 32 13 73.
- F. Curing Compound: Membrane forming compound per Section 03 39 00.
- G. Plate Steel: ASTM A 36 galvanized per Section 05 05 10.

## **PART 3 EXECUTION**

### **3.1 CONSTRUCTION EQUIPMENT**

- A. Slip Form Machines.
  1. Placement must produce required cross-section, lines, grades, finish, and jointing as specified for formed concrete.
  2. If results are not acceptable, remove and replace work with formed concrete.

### **3.2 PREPARATION**

- A. Control pedestrian and vehicular traffic, Section 01 55 26.
- B. Examine surfaces scheduled to receive concrete formwork for defects.
- C. Do not start work until defects are corrected.
- D. Check slopes on each side of the work to ensure drainage. Failure to check and verify will result in CONTRACTOR repairing any drainage deficiencies at no additional cost to OWNER.

### **3.3 LAYOUT**

- A. Curb, Gutter, Curb and Gutter: Plan 205, 209, 211, 213.
  1. Line: Less than 1/2 inch variance in 10 feet and not more than 1 inch from true line at any location.
  2. Grade: Not more than 1/4 inch variance in 10 feet. Flood curb and gutter with water after final cure has been reached. Remove and replace any area where ponding is found.
- B. Sidewalk: Plan 231.
  1. Cross slope 2 percent.
  2. Landing slope 2 percent maximum in any direction.
  3. Ramp slope, Section 32 16 14.
- C. Driveway Approaches: Plan 215, 216, 221, 225, 229.

### **3.4 CONCRETE PLACEMENT**

- A. Section 03 30 10.
- B. Make sure base course is uniformly damp at time of concrete placement.
- C. Obtain ENGINEER's review of base course and forms before placing concrete.

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- D. Do not use methods that segregate the mix.
- E. Place concrete so time between end of placement and beginning of finishing is less than 15 minutes.
- F. Consolidate concrete with vibrator or other acceptable method. Do not use mechanical vibrators. Prevent dislocation of inserts.

### 3.5 CONTRACTION JOINTS

#### A. Geometrics:

##### 1. Tooled Joints (Score Lines):

- Depth =  $T/4$ . T is the depth of the concrete slab in inches.
- Top radius = 1/2 inch.

##### 2. Saw Cut Joints: Saw joints before uncontrolled shrinkage cracking occurs. Do not tear or ravel concrete during sawing.

##### 3. Template Joints: 1/8 to 3/16 inch wide 1/4-depth of slab.

#### B. Sidewalks.

##### 1. At intervals equal to the width of the sidewalk and transverse to the line of walk.

##### 2. Radial at curbs and walk returns.

##### 3. Place longitudinal joints in walks when width of walk in feet is greater than 2 times the walk thickness in inches. (e.g. maximum width of a 4 inch thick walk before placement of a longitudinal contraction joint is 8 feet). Make longitudinal joints parallel to, or concentric with, the lines of the walk.

##### 4. In walk returns make 1 joint radially midway between the beginning of curb returns (BCR) and end of curb returns (ECR). Match longitudinal and traverse joints with the adjacent walks.

#### C. Curb, Gutter, Waterway.

##### 1. Place joints at intervals not exceeding 12 feet.

##### 2. At curb radius and walk returns make the joints radial.

##### 3. Where integral curb and gutter is adjacent to concrete Pavement, align the joints with the Pavement joints where practical.

#### D. Additional Contraction Joint Requirements: Section 32 13 73.

### 3.6 EXPANSION JOINTS

#### A. Geometrics: 1/2 inch wide full depth filler that is flush with concrete surface. Do not place seal over top of filler

#### B. Sidewalks, Sidewalk Ramps.

##### 1. Place expansion joints to separate sidewalk from utility poles, hydrants, Manhole frames, buildings and abutting sidewalks.

##### 2. Place expansion joints between the sidewalk and the back of curb returns and between the sidewalk and sidewalk ramps.

##### 3. Do not place expansion joints in sidewalk ramp surfaces.

4. Expansion joints are not required when using slip form method to place concrete except where sidewalk changes direction or where it joins foundation walls or structures.

C. Curb, Gutter, Waterway.

1. Do not place longitudinal joints in drain gutter flow-lines.
2. Where drain gutter transitions extend beyond the curb return, place expansion joints at the ends of the drain gutter transition.
3. Place expansion joints at beginning of curb radius (BCR) and end of curb radius (ECR).

D. Slip Form Work: Expansion joints are not required except at BCR or ECR.

E. Driveway Approach: Do not place expansion joints in curb returns.

F. Street Intersection Corner: Place expansion joints at BCR and ECR.

G. Additional Expansion Joint Requirements: Section 32 13 73.

### 3.7 FINISH

A. Section 03 35 00.

B. Round edges exposed to public view to a 1/2 inch radius.

C. Apply broom finish longitudinal to curb and gutter flowline.

D. Apply broom finish transverse to sidewalk centerline as follows.

1. Fine hair finish where grades are less than 6 percent.
2. Rough hair finish where grades exceed 6 percent.

E. Remove form marks or irregularities from finish surfaces.

### 3.8 CURING

A. Section 03 39 00.

B. Type ID Class A (clear with fugitive dye) membrane forming compound. Apply total coverage in 2 directions after texturing.

C. Eliminate thermal shock of concrete by keeping cure temperature even throughout extent and depth of concrete slab.

### 3.9 PROTECTION AND REPAIRS

A. General: All expenses are at no cost to OWNER.

B. Protection: Section 03 30 10.

1. Protect concrete work from deicing chemicals during the 28 day cure period.
2. Immediately after placement, protect concrete from graffiti or other types of mechanical injury.

C. Repair: Section 03 30 10.

1. Correct all humps or depressions.
2. Secure ENGINEER's acceptance of method of correction.

END OF SECTION

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## **SECTION 32 84 23 AMENDED**

### **UNDERGROUND IRRIGATION SYSTEMS**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Underground Irrigation System complete with heads, valves, controls, and accessories.

##### **1.2 REFERENCES**

- A. NFPA 70: National Electric Code.

##### **1.3 DEFINITIONS**

- A. Lateral Pipe: That system of pipes downstream of a pressure valve. Lateral pipe feeds water to sprinklers and emitters.
- B. Irrigation System: The arrangement of valves, controls, heads and accessories including lateral and mainline pipe systems.
- C. Mainline Pipe: That system of pipes upstream of a pressure pipe valve.

##### **1.4 PERFORMANCE REQUIREMENTS**

- A. Design Pressure: As indicated from connection to supply system to last head in circuit.
- B. Location of Heads: Design location is approximate. Make adjustments as necessary to avoid plantings and other obstructions.
- C. Water Coverage: Turf and other planting areas, 100 percent. Modify layout to obtain coverage and rate of application and to suit manufacturer's standard heads. Do not decrease number of heads indicated unless acceptable to ENGINEER.
- D. Pipe Testing Schedule: Section 33 08 00.
- E. Leave system dry if Work is Substantially Completed after October 15 unless directed otherwise by ENGINEER.

##### **1.5 SUBMITTALS**

- A. Product Data: Manufacturer's technical data and installation instructions.
- B. Layout Drawings: Plan layout and details illustrating piping layout to water supply location and type and coverage of heads, valves, piping circuits, controls, landscaping features, list of fittings and accessories.
- C. Pipeline Test Report: Section 33 08 00.
- D. Operation and Maintenance Data: Section 01 78 23.
  - 1. Submit instructions covering full operation, care, and maintenance of system (and controls) and manufacturers parts catalog.
  - 2. Include year-to-year schedule showing length of time each valve is to be open to provide determined amount of water, drain procedures, cleanout features, etc.

- 3. Instruct OWNER’s maintenance personnel how to operate controller and adjust sprinkler heads.
- E. Manual Valve Key Operator: Furnish 3 valve keys, 3 feet long with tee handle and key end to fit each type of valve assembly.

**PART 2 PRODUCTS**

**2.1 PIPE, FITTINGS, OTHER**

- A. Material: PVC, Section 33 05 07. Culinary water, use white or blue pipe. Irrigation water on reclaimed water, use purple pipe.
- B. Pressure Pipe: Schedule 40.
  - 1. Solvent weld smaller than 3 inches.
  - 2. Mechanical joint 3 inches and larger
- C. Lateral Pipe: Schedule 40 through 1-1/4” then Class 200, solvent welded.
- D. Fittings: Schedule 40, solvent welded or threaded.
- E. Risers: Schedule 80, threaded.
- F. Water Valve Assemblies: Schedule 80, threaded.

**2.2 VALVES**

- A. Manual Valve: Gate type with cast bonze body, resilient integral taper seat, non-rising stem, and fitted for key operation.
- B. Automatic Valve: Globe type operated by low-power replaceable solenoid, normally closed, and fitted for manual flow adjustment
- C. Automatic Drain Valve: Designed to open for drainage when line pressure drops below 3 psi. (NOT for use on mainline pipe.)

D. Manual Automatic Self Draining Valve:

- 1. 3 inches and less: Full body brass stop and waste valve with full port ball valve rated fro 200 psi static pressure minimum unless higher pressure is specified by engineer.
- 2. Greater than 3 inches: Approval required by ENGINEER.

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**2.3 DRAIN SUMP**

- A. Sewer rock or pea gravel, Section 31 05 13.

**2.4 BACKFLOW PREVENTER**

A. Manufacturer's standard, to suit sprinkler system, BACKFLOW AND CROSS CONNECTION PROTECTION, Supplementary Section 33 11 05, and the following.

- 1. Reduced Pressure Assembly.
- 2. Pressure Vacuum Breaker Assembly.
- 3. Atmospheric Vacuum Breaker Device.

Deleted: A. Manufacturer's standard, to suit sprinkler system and the following.

Deleted: 1. Double check valve.

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Deleted: 2. When underground Irrigation System is designed for liquid fertilizer, provide a reduced pressure backflow prevention device. The drain to daylight must be a minimum of 12 inches below the bottom of the release valve for devices 4 inches in diameter and smaller, or 12 inches plus the nominal diameter of the devices over 4 inches in diameter.

4. When underground Irrigation System is designed for liquid fertilizer, provide a reduced pressure backflow prevention assembly.

## 2.5 SPRINKLER HEADS

- A. Manufacturer's standard unit designed to provide uniform coverage over entire area of spray indicated at available water pressure, as follows:
1. Flush Surface: Fixed pattern, with screw-type flow adjustment.
  2. Bubbler: Fixed pattern, with screw-type flow adjustment.
  3. Shrubbery: Fixed pattern, with screw-type flow adjustment.
  4. Pop-Up Spray: Fixed pattern, with screw-type flow adjustment and stainless steel retraction spring.
  5. Pop-Up Rotary Spray: Gear driven, full circle and adjustable part circle type.
  6. Pop-Up Rotary Impact: Impact driven, full circle and part circle as indicated.
  7. Above-Ground Rotary Impact: Impact driven, full circle and part circle as indicated.

## 2.6 VALVE BOX

- A. Precast concrete or plastic with adequate hand room to operate small tools and provisions for locking cover to frame.
- B. For drain pockets, No. 2 gravel (2-1/2 inch) Section 31 05 13.

## 2.7 AUTOMATIC CONTROL SYSTEM

- A. General: Furnish low voltage system manufactured expressly for control of automatic circuit valves of underground Irrigation Systems. Provide unit of capacity to suit number of circuits.
- B. Control Enclosure - External Applications: Manufacturer's standard weatherproof enclosure with locking cover, complying with NFPA 70.
- C. Control Enclosure - Internal Applications: Manufacturer's standard with locking cover, complying with NFPA 70.
- D. Transformer: To convert service voltage to control voltage and in accordance with manufacturer's recommendations.
- E. Circuit Control: Each circuit variable from approximately 5 to 60 minutes. Include switch for manual or automatic operation of each circuit.
- F. Timing Device: Adjustable, 24 hour and 14 day clocks to operate any time of day and skip any day in a 14 day period. Allow for manual or semiautomatic operation without disturbing preset mechanical operation.
- G. Wire:
1. Provide wire for connecting remote control valves to the automatic controllers that is Type "UF", 600 volt, stranded or solid copper, single conductor wire with PVC insulation and bearing UL approval for direct underground burial feeder cable. Make all connections with UL approved type seal to make a waterproof connection. Bury wires in the same Trench as the pipe where possible.

2. Provide wire with 4/64 inch insulation, minimum covering of ICC-100 compound for positive weatherproofing protection. For wire sizes 14, 12, 10, and 8 use a single conductor solid copper wire, and for sizes 6 and 4 use stranded copper wire. Make control or "hot" wires red and all common or "ground" wires white.
3. Verify wire types and installation procedures conform to local codes.

Table 1 – Valve Wire Sizing Chart					
Voltage at Controller	Wire Control Common	Maximum Allowable Length in Feet from Controller to Valves			
		No. of Valves (Solenoids)			
		1	2	3	4
14	14	2765	1309	846	549
14	12	3393	1608	1039	673
14	10	3962	1877	1213	783
12	12	4394	2082	1346	6872
12	10	5397	2557	1652	1071
12	8	6364	3018	1949	1263
10	10	6986	3311	2140	1387

**PART 3 EXECUTION**

**3.1 EXCAVATION**

- A. Section 31 23 16.
- B. Excavate Trenches for sprinkler system pipe to provide 18 inches of cover over main lines and 10 inches over lateral lines. Before excavating, establish the location of all underground utilities and obstructions.
- C. Trench for sprinkler system to ensure proper grades and slopes to drain points.

**3.2 INSTALLATION**

- A. General: Plans are diagrammatic. Proceed with installation in accordance with the following:
  1. Run all circuit and pressure lines as indicated. Within planting areas avoid conflict with trees. Where Trenching is required in proximity to trees which are to remain, do not damage roots.
  2. Install stop and waste valves, isolation valves, vacuum breakers, pressure reduction valves, and other equipment required by local authorities according to Laws and Regulations in order to make system complete.
  3. Slope Circuit Pipe to drain.
  4. After completion of grading, seeding or sodding, and rolling of grass areas, adjust heads to be flush with finished grades.
- B. Piping:
  1. Assemble all circuit and pressure pipe in accordance with manufacturer's recommendations and assure positive drainage.

- 2. At wall penetrations, pack the opening around the pipe with Section 03 61 00 non-shrink grout. At exterior face, fill perimeter slot with backer rod and sealant. Repair below grade waterproofing and make penetration watertight.
- 3. Install PVC pipe in dry weather above 40 deg. F. Allow joint to cure a minimum of 8 hours before testing.

C. Sleeves:

- 1. Install sleeves before concrete work.
- 2. Under roadway, install PVC sleeve if cover over sleeve exceeds 2 feet, otherwise use cast iron or ductile iron sleeve.

D. Control Valves:

- 1. Install remote control valves to manufacturer's recommendation.
- 2. Use Schedule 80 PVC pipe for nipples on valve header, length as necessary. Install valves one per each plastic valve box and provide 12 inches of expansion loop slack wire at all connections inside valve box.

E. Automatic Drains: Install in accordance with manufacturer's recommendations at the low point of circuit lines. Do not use this valve on pressure pipe systems.

F. Manual Drains:

- 1. Install stop and waste per manufacturer's recommendations on upstream side and manual valve on the downstream side of backflow preventers and manual drains at lowest point along main pressure pipe downstream of backflow preventers.
- 2. Install by teeing down to 3/4 inch drain valve. Provide a drainage sump sized to receive volume of drain water.
- 3. Make manual drain valves accessible by installing an adjustable pipe sleeve to meet finished grade with locking valve marker lid flush with finish grade.

**Deleted:** 1. Install per manufacturer's recommendations on upstream and downstream side of backflow preventers and at lowest point along main pressure pipe.

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G. Quick-Coupling Valves:

- 1. Install using 3/4 inch flexible lateral with galvanized elbow and riser. Locations as indicated.

H. Backflow Preventers:

- 1. Install assembly complete for sprinkler systems with 2 drain valves and 2 shut off valves per local Laws and Regulations, and manufacturer's specifications.
- 2. In below grade installations install assemblies with drain valves. Provide open box floor with gravel drain sump.

I. Valve Access Boxes:

- 1. Install over all remote control valves, manual control valves, zone shutoff valves, gate valves or globe valves. Valves to be installed using valve markers will not require access boxes.
- 2. Install boxes on level Subgrade to proper grade and proper drainage.

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3. Provide boxes with proper length and size extensions.

J. Automatic Controller:

1. Mount the panel enclosure so adjustments can be conveniently made by the operator.
2. Ground controller per local Laws and Regulations.
3. Make all control wire connections to automatic controllers.
4. Coordinate controller installation with electrical work.

K. Wire and Electrical Work:

1. Use electrical control and ground wire suitable for sprinkler control cable of size indicated.

L. Sprinkler Heads, Emitters, Bubblers, Small Rotators (less than 10 gallons per minute).

1. Install with flexible lateral and spiral barged PVC elbows and riser (length as required).
2. Install shrub spray heads a minimum of 12 inches above finished grade of plantings.
3. Install tree bubblers 1/2 inch below crown of tree roots.
4. Flush circuit lines thoroughly. Remove all foreign materials prior sprinkler head installation.

M. Large Rotator Heads (10 gallons per minute or more): Install pressurized swings joints with O-ring seals.

N. Swivel Hose Elbows:

1. Install brass swivel hose elbows, accurately machined pipe with hose threads and "O" ring seals.

### 3.3 BACKFILLING OPERATION

A. Section 33 05 20.

- B. Backfill to 6 inches above pipe with soil free of rocks over 1 inch diameter, debris, or organic matter. Backfill final 4 inches with soil of like quality to adjacent areas.
- C. Compact backfilled Trenches thoroughly to prevent settling damage to grades or plant materials. Repair at no additional cost to OWNER.
- D. Piping may be tested in sections to expedite backfilling.

**3.4 SURFACE RESTORATIONS**

- A. Protect existing landscaping.
- B. Refer to Sections 32 92 00 and 32 93 13. Replace damaged plants and lawn areas with new to match existing.

END OF SECTION

## **SECTION 32 91 19 AMENDED LANDSCAPE GRADING**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Landscaping grading requirements.
- B. Backfill materials.

#### **1.2 SUBMITTALS**

- A. Submit maximum laboratory dry density and optimum laboratory moisture content for:
  - 1. Subgrade material, and
  - 2. Each type of fill to be used.
- B. Upon ENGINEER's request, submit a written quality control Inspections and testing report describing source and field quality control activities performed by CONTRACTOR and its Suppliers.

#### **1.3 QUALITY ASSURANCE**

- A. Do not change material sources, or aggregate without ENGINEER's knowledge.
- B. Reject backfill material that does not comply with requirements specified in this section.
- C. Landscape grading is aesthetic by nature and subject to continual monitoring and modification during the backfilling process. Work closely with ENGINEER particularly when grading and construction berms, channels, or other aesthetic considerations.

#### **1.4 STORAGE**

- A. Safely stockpile backfill materials.
- B. Separate differing materials, prevent mixing, and maintain optimum moisture content of backfill materials.
- C. Avoid displacement of and injury to Work while compacting or operating equipment.
- D. Movement of construction machinery over Work at any stage of construction is solely at CONTRACTOR's risk.

#### **1.5 SITE CONDITIONS**

- A. Do not place, spread, or roll any backfill material over material that is damaged by water. Remove and replace damaged material at no additional cost to OWNER.
- B. Control traffic and erosion. Keep area free of trash and debris. Repair settled, eroded, and rutted areas.
- C. Reshape and compact damaged structural section to required density.

**1.6 ACCEPTANCE**

- A. Native material may be wasted if there is no additional cost to substitute material acceptable to ENGINEER.
- B. For material acceptance refer to.
  - 1. Common fill, Section 31 05 13.
  - 2. Crushed aggregate base, Section 32 11 23.
  - 3. Cement treated fill, Section 31 05 15.

**1.7 WARRANTY**

- A. Any settlement noted in landscaped surfaces will be considered to be caused by improper compaction methods and shall be corrected at no cost to the OWNER.
- B. Restore incidentals damaged by settlement at no additional cost to OWNER.

**PART 2 PRODUCTS****2.1 BACKFILL MATERIALS**

- A. Common fill, Section 31 05 13.
- B. Crushed aggregate base, Section 32 11 23.
- C. Cement treated fill, Section 31 05 15.

**2.2 ACCESSORIES**

- A. Water: Make arrangements for sources of water during construction and make arrangements for delivery of water to site. Comply with local Laws and Regulations at no additional cost to OWNER when securing water from water utility company.

**PART 3 EXECUTION****3.1 PREPARATION**

- A. Identify required line, levels, contours, and datum.
- B. Stake and flag locations of underground utilities.
- C. Upon discovery of unknown utility or concealed conditions, notify ENGINEER.
- D. Verify stockpiled fill meets gradation requirements, areas to be backfilled are free of debris, snow, ice or water, and ground surface is not frozen.
- E. If subgrade is not readily compactable secure written authorization for extra excavation and backfill. Refer to Section 31 23 16.

**3.2 PROTECTION**

- A. Protect existing trees, shrubs, lawns, existing structures, fences, roads, sidewalks, paving, curb and gutter and other features.
- B. Protect above or below grade utilities. Contact utility companies to repair damage to utilities. Pay all cost of repairs.
- C. Protect Subgrade from desiccation, flooding and freezing.

- D. Do not fill adjacent to structures until Excavation is checked by ENGINEER.
- E. Do not use compaction equipment adjacent to walls or retaining walls that may cause wall to become over-stressed or moved from alignment.
- F. Do not disturb or damage foundation perimeter drainage, foundation, damp-proofing, foundation waterproofing and protective cover, or utilities in Trenches.
- G. Restore any damaged structure to its original strength and condition.

### 3.3 LAYOUT

- A. Maintain all benchmarks, control monuments and stakes, whether newly established by surveyor or previously existing. Protect from damage and dislocation.
- B. If discrepancy is found between Contract Documents and site, ENGINEER shall make such minor adjustments in the Work as necessary to accomplish the intent of Contract Documents without increasing the Cost of the Work to CONTRACTOR or OWNER.

### 3.4 GRADING

- A. Grading Intent: Spot elevations and contours indicated are based on the best available data. The intent is to maintain constant slopes between spot elevations. If a spot elevation is determined to be in error, or the difference in elevation between points change, then the minimum percentage of slope as a result of field adjustment of specific spot elevations is as follows:
  - 1. Pavement Areas: 1 percent.
  - 2. Concrete or Brick Areas: 0.30 percent.
  - 3. Lawn or Planted Area: 0.75 percent.
- B. Conduct Work in an orderly manner. Do not create a nuisance. Do not permit soil accumulation on streets or sidewalks. Do not allow soil to be washed into sewers and storm drains.
- C. Grade slopes to provide adequate drainage after compaction. Do not create water pockets or ridges. Use all means necessary to prevent erosion of freshly graded areas during construction until surfaces have been constructed and landscaping areas have taken hold.
- D. Remove surface stones greater than 1 inch from finished grading.
- E. In planting areas, provide a finished grade that conforms to Section 32 92 00 and Section 32 93 13.

### 3.6 MODIFIED BACKFILL LAYER METHOD

- A. Refer to Section 33 05 20.

### 3.7 COMPACTION

- ~~A. Compact backfill, Section 31 23 26.~~

Deleted: A. Compact backfill, Section 33 05 05

### 3.8 SURFACE RESTORATION

- A. Restore paved surfaces, Section 33 05 25.
- B. Finish landscaped surfaces with grass, Section 32 92 00 or with other ground cover, Section 32 93 13.

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1. Backfill areas to contours and elevations indicated. Do not use frozen materials.
2. Make smooth changes in grade. Blend slopes into level areas.
3. Remove surplus backfill materials from site.
4. Leave stockpile areas completely free of excess fill materials.
5. Slope grade away from building at a minimum of 3 inches in 10 feet unless specified otherwise.

### **3.9 CLEANING**

- A. Remove stockpiles from the site. Grade site surface to prevent free standing surface water.
- B. Leave borrow areas clean and neat.

END OF SECTION

## SECTION 32 93 13 AMENDED GROUND COVER

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Plants, and ground cover requirements.
- B. Bedding, topsoil, and temporary support.

#### 1.2 REFERENCES

- A. AAN: American Associations of Nurserymen, Inc.
- B. ANSI Z60.1: American Standard for Nursery Stock.
- C. FS O-F-241: Fertilizers, Mixed Commercial.

#### 1.3 QUALITY ASSURANCE

- A. Perform work in conformity with applicable requirements of AAN.
- B. Obtain nursery stock and other plant materials from acceptable sources prior to order and delivery.
- C. Provide plants free of disease and insects.

#### 1.4 SUBMITTALS

- A. Prior to planting submit samples of fertilizers and a complete listing of all plantings, origins and sizes.
- B. All necessary inspection certificates for each shipment of plants as required by Laws and Regulations.
- C. Schedule of planting times.

D. All submittals in this section are subject to approval of the City Planning Department and City Forester.

#### 1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Exercise care in digging, transporting, handling, and packing of all plants.
- B. Handle plants so roots are protected at all times. If delivery is in open vehicles, cover entire load without causing over heating.
- C. Deliver plant materials immediately prior to placement. Keep plant materials moist.
- D. Protect balls from sun and wind by covering with soil or other suitable material if not planted immediately on delivery.
- E. Store fertilizer in a weatherproof location such that its effectiveness will not be impaired.

#### 1.6 ACCEPTANCE

- A. Ball of earth surrounding roots has not been cracked or broken.
- B. Burlap, staves, and ropes required in connection with transplanting are installed.
- C. Heeled in stock from cold storage not accepted.

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1.7 WARRANTY

- A. Warrant plantings through one year plus one continuous growing season. Replace any unsatisfactory or dead plantings within 10 days of written notice. Make corrections at no additional cost to OWNER.

PART 2 PRODUCTS

2.1 GENERAL

- A. Provide plants of normal growth and uniform height, according to species, with straight canes and well developed leaders, roots, and tops.
- B. Provide plants of sizes indicated, Size stated in each case being interpreted to mean dimensions of plant as to stands in its natural position in nursery without straightening of any branches or leaders.
- C. Provide legible labels attached to all plants, specimens, bundles, boxes, bales, or other containers indicating botanical genus, species, and size of each.
- D. Plants cut back from larger sizes to meet Specifications shall be rejected.
- E. Container growth deciduous shrubs will be acceptable in lieu of bailed and burlapped deciduous shrubs subject to limitations for container grown stock.

2.2 NATIVE GRASSES AND WILDFLOWERS

- A. Mixture: 35% Bromus Marginatus (Mountain Brome), 25% Pseudoroegneria Spicata (Bluebunch Wheatgrass), 25% Elymus Trachycaulus (Slender Wheatgrass), 10% Festuca Idahoensis (Idaho Fescue), and 5% Leymus Cinereus (Great Basins Wild Rye).
- B. Purity of all seed types: 90 percent.
- C. Application Rate: 22 pounds/acre.
- D. Germination of all seed types: 90 percent.
- E. Certified weed free.

**Deleted:** A. Mixture: 77 percent Festuca ovina duriuscula (Hard Fescue) and 23% Wildflower seeds of equal proportioned quantities of the following, Aster alpinus (Alpine Aster), Campanula carpatica 'Jacqueline' (Bluebells), Coreopsis grandiflora 'Sunray' (Dwarf Coreopsis), Eschscholzia californica (California Poppy), linum Lewisii (Blue Flax), Primula (White Primrose), Tagetes (Marigold), Viguiera Multiflora (Showy golden eye).

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**Deleted:** C. Germination of all seed types: 90 percent.

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2.3 ORGANIC MULCH

- A. Horticultural grade Class A decomposed plant material, elastic and homogeneous, free of decomposed colloidal residue, wood sulphur, and iron.
- B. pH value of 5.5 to 7.5.
- C. 60 percent organic matter by weight, moisture content not exceeding 15 percent, and water absorption capacity of not less than 300 percent by weight on oven dry basis.

2.4 ACCESSORIES

- A. Fertilizer: Comply with FS O-F-241. Provide nutrients required by soil analysis. The fertilizer will be uniform in composition, dry and free flowing.
- B. Wrapping Materials: Quality burlap tightly tied around plant root system.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Plan to install materials during normal planting seasons for each type of landscape work required. Correlate planting time with specified maintenance periods and guarantee.
- B. Verify area to receive plants is to grade, all work is completed in the area, and that topsoil has been placed. Follow Section 31 23 23 grading requirements.
- C. Do not proceed with work until unsatisfactory conditions have been corrected.
- D. Examine grade, verify elevations, observe conditions under which work is to be performed, and notify ENGINEER of unsatisfactory conditions.

### **3.2 GRADING**

- A. Site tolerances.
  - 1. 12 inches minimum total topsoil depth.
  - 2. 2 inches below walks, hard surfaces or edges.
- B. Do not expose or damage existing shrub or tree roots.
- C. Slope landscape away from building for 12 feet minimum at 1/2 inch per foot minimum. Fill low spots and pockets. High point of finish grade shall be at least 6 inches below finish floor level.

### **3.3 INSTALLATION**

- A. Place plant materials for orientation approval by ENGINEER prior to installation.
- B. Set all shrubs slightly lower than finished grade. Use plant mix consisting of 3 parts topsoil and 1 part organic mulch. Do not fill around stems. Carefully place and tamp plant mix soil to fill all voids.
- C. Spread excess soil from excavated plant pits in surrounding planting beds.
- D. Sow seed at the rate of 78 pounds per acre. Rake seed into soil and top-dress all seeded areas with 1/4 inch topsoil. Do not let seed installation be subject to damage by climatic conditions.
- E. Restore Pavements, grassed areas, planted areas, and other improvements damaged to a condition equal to original conditions.

### **3.4 FERTILIZING SEEDED AREAS**

- A. Apply fertilizer in formulation and quantity required by soil analysis.
- B. Apply after fine grading and mix thoroughly into upper 2 inches of topsoil.
- C. Do not apply seed and fertilizer at same time in same machine unless one step hydro seeding is used.
- D. Lightly water to aid breakdown of fertilizer and to provide moist soil for seed.

### **3.5 CLEANING AND MAINTENANCE**

- A. Section 32 01 90.
- B. Remove from site foreign materials collected during cultivation.

C. Dispose of cleanings.

END OF SECTION

## SECTION 32 93 43 AMENDED TREE

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Supply and install tree.
- B. Site preparation and backfill requirements.

#### 1.2 REFERENCES

- A. American Public Works Associations (Utah Chapter).
  1. Plan 681: Tree
- B. American National Standards Institute.
  1. A300: Tree, Shrub and Other Woody Plant Maintenance Practices.
  2. Z60.1: American Standard for Nursery Stock.
- C. International Society of Arboriculture. (ISA).

#### 1.3 SUBMITTALS

- A. Copy of CONTRACTOR's notice to property owner. Format to be substantially as follows:

<p><b>NOTICE TO PROPERTY OWNER</b></p> <p>Your new tree is a: <u>      <i>(Name of tree)</i>      </u></p> <p>How to take care of your new tree.</p> <ul style="list-style-type: none"> <li>• Water thoroughly once ever seven to ten days during the spring, summer and fall for at least 2 years. Put your hose by the base of the tree and run water gently for about 20 minutes. Then as tree matures, water at the drip line (straight down under the tips of the branches) every 3 to 4 weeks.</li> <li>• Do not fertilize until second year and only then if needed.</li> <li>• Do not use weed killer near new trees.</li> <li>• Protect new tree from damage by cars, lawn mowers, grass trimmers, bikes, vandals, etc.</li> <li>• Maintain a mulch cover at the base of the new tree.</li> </ul>
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B. All submittals in this section are subject to approval of the City Planning Department and City Forester.

#### 1.4 QUALITY ASSURANCE

- A. Provide an ISA certified arborist to observe tree planting. Upon ENGINEER's request, provide a copy of the arborist's ISA certificate and registration number on file with the State Division of Commercial Code.

- B. Nursery: Use a company specializing in growing and cultivating trees with minimum 3 years experience.
- C. Installer: Use a company specializing in installing and planting tree.
- D. Planting Plan: Correlate planting time with specified maintenance periods and guarantee.
- E. Rejection: Reject any tree upon the following basis.
  - 1. Tree has cracked or broken ball of earth surrounding roots preparatory to or during process of planting.
  - 2. Tree was cut back from a larger plant to meet Specifications.
  - 3. Tree is not the specified size.
  - 4. Tree has been pruned improperly.
  - 5. Tree has disease or insect infestations.
  - 6. Tree was damaged during transplant.

**1.5 ACCEPTANCE**

- A. Tree will be accepted not less than 60 days after planting, watering and successful growth.

**1.6 WARRANTY**

- A. Warrant tree planting through one year plus one continuous growing season. Include coverage of trees from death, unhealthy conditions, or if tree dies from poor planting practice. Replace any unsatisfactory or dead tree within 10 days of written notice.
- B. Replacements: Provide tree of same size and species, planted in the next growing season, with a new warranty commencing on date of planting.
- C. Additional Cost: All corrective work will be at no additional cost to OWNER.

**1.7 MAINTENANCE**

- A. Period is until acceptance.
- B. Maintain tree health immediately after placement.
- C. Notify property owner of tree watering practice.
- D. Trim off dead or broken branches. Remove clippings and dead branches from the site.
- E. Control disease.

**1.8 GENERAL SPACING**

- A. The maximum spacing in parkstrips will be 30 ft. or less.

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**PART 2 PRODUCTS**

**2.1 TREE MATERIALS**

- A. Species and size specified, grown in climatic conditions similar to those in locality of the Work with branching configuration and cane requirements indicated in ANSI Z60.1.

- B. Provide tree of normal growth and uniform height, according to species, with straight trunk and well developed leaders, laterals and roots. Heeled in stock from cold storage not accepted.
- C. Provide tree size indicated, Size being interpreted to mean dimension of tree as its stand in its natural position in nursery without straightening of any branches or leaders.
- D. Provide legible labels attached to tree indicating botanical genus, species, and size.

## **2.2 SOILS**

- A. Backfill of Root Ball Pit: Native soil if not excessively rocky, compactable or clayey; otherwise amend at a rate of 2 parts native soil to 1 part topsoil. Mix together thoroughly.
- B. Topsoil: Section 31 05 13.

## **2.3 ORGANIC MULCH**

- A. Horticultural grade class A decomposed plant material, elastic and monogenous, free of decomposed colloidal residue, wood sulphur, and iron.
- B. pH value of 5.5 to 7.5.
- C. 60 percent organic matter by weight, moisture content not exceeding 15 percent, and water absorption capacity of not less than 300 percent by weight on oven dry basis.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Plan to install materials during normal planting season.
- B. Notify ENGINEER of unsatisfactory conditions.

### **3.2 EXCAVATION**

- A. Excavate only for depth of root ball.
- B. In park strips adjacent to paved thoroughfares, the traditional round hole barely big enough to accommodate the root ball is not permitted. Excavate the site in the shape of a rectangle. Make excavated area width at least twice the diameter of the tree root ball and the length at least 3 times the diameter.
  - 1. Compact both sides of the planting site that are parallel to the street.
  - 2. Loosen the sides of the planting site that are perpendicular to the street.
- C. In other landscaped areas, excavated area for tree planting at least 3 times the diameter of the root ball.
- D. Place plant materials for final orientation review by ENGINEER prior to backfilling the root ball.

### **3.3 INSTALLATION**

- A. Plan No. 681.
- B. Remove wire baskets and twine from around root ball. If possible, remove all burlap material, or remove top 1/3 from root ball.

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- C. Maintain plant in vertical position. Eliminate voids and air pockets.
- D. Remove all cardboard and twine from tree trunks.
- E. Follow arborist's instructions.

### 3.4 PRUNING

- A. Comply with ANSI A300 and directions of arborist.

### 3.5 PROTECTION

- A. Do not touch directly or indirectly any overhead wire, cable, or power line.
- B. Shelter the root ball. Do not let the root ball dry out.
- C. Do not damage any irrigation line or emitter system.
- D. Do not lift or maneuver the tree by the trunk.
- E. Do not add gravel to the bottom of the hole.
- F. Do not stake the tree unless carefully monitored by ENGINEER.
- G. Do not compact the backfill.
- H. Do not use grass clippings as mulch.
- I. Do not over water, under water, over prune, paint or wrap the trunk, or fertilize during planting.
- J. Do not forget to watch for people using the street or sidewalk while planting.
- K. Do not over prune.
- L. Do not allow grass, flowers, or vines to grow next to the trunk.
- M. Protect roots and branches of existing trees.
- N. Do not permit heavy equipment or stockpiling of materials or debris within the drip line. Do not permit earth surface within the drip line to be changed in any way except as specified.
- O. Replace existing trees damaged by construction operations at no additional cost to OWNER.

END OF SECTION

## SECTION 33 05 03 AMENDED COPPER PIPE

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Copper pipe, couplings, fittings, and joint materials for buried water utility applications.
- B. Related work includes but is not limited to,
  - 1. Excavation, Section 31 23 16.
  - 2. Trench backfill, Section 33 05 20 .
  - 3. Landscape restoration, Section 32 92 00 or Section 32 93 13.
  - 4. Pavement restoration, Section 33 05 25.

#### 1.2 REFERENCES

- A. ASTM B 88: Standard Specification for Seamless Copper Water Tube.
- B. AWWA C800: AWWA Standard for Underground Service Line Valves and Fittings.

#### 1.3 QUALITY ASSURANCE

- A. Reject any pipe that does not conform to Contract Documents or is cracked, chipped, crushed, dented, kinked, or otherwise unacceptable.

### PART 2 PRODUCTS

#### 2.1 PIPE

- A. Type K copper, ASTM B 88 Table 3, "Dimension, Weight and Tolerances," and capable of connecting to AWWA standard water service taps and fittings.
- B. Outside diameter greater than 2 inches requires ENGINEER acceptance.
- C. Smooth surface free from bumps, flexible enough to be coiled.

#### 2.2 CONNECTIONS

- ~~A. Compression. Flared connections are not allowed in the City of Logan.~~
- B. Dielectric insulating unions for dissimilar connections.
- C. Fittings, AWWA C800.

Deleted: A. Flared or compression.

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### PART 3 EXECUTION

#### 3.1 INSTALLATION

- A. Install pipe per manufacturer's instructions.
- B. Water distribution and transmission, Section 33 12 19.
- C. Irrigation System, Section 32 84 23.

END OF SECTION

## SECTION 33 05 05 AMENDED DUCTILE IRON PIPE

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Ductile iron pipe, couplings, fittings, and joint materials.
- B. Related work includes but is not limited to,
  - 1. Excavation, Section 31 23 16.
  - 2. Trench backfill, Section 33 05 20 .
  - 3. Landscape restoration, Section 32 92 00 or Section 32 93 13.
  - 4. Pavement restoration, Section 33 05 25.

#### 1.2 REFERENCES

- A. AWWA C104: American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
- B. AWWA C110: American National Standard for Ductile-Iron and Gray Iron Fittings, 3 In. Through 48 In., for Water and Other Liquids.
- C. AWWA C111: American National Standard For Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
- D. AWWA C115: American National Standard for Flanged Ductile-Iron and Gray Iron Pipe with Threaded Flanges.
- E. AWWA C151: American National Standard for Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
- F. AWWA C600: AWWA Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances.

### PART 2 PRODUCTS

#### 2.1 PIPE AND FITTINGS

##### A. Buried Applications:

- ~~1. Pressure class 350 psi ductile iron pipe, AWWA C151 with push-on joints, AWWA C111.~~
- 2. Cement lining for all pipe and fittings, AWWA C104.
- 3. Class 250 fittings, AWWA C110.
- 4. Coupler with mechanical joint fittings, AWWA C104, C110, and C111.
- ~~5. Rubber gasket slip-on pipe joints, AWWA C111 with NSF approved gasket lubricant.~~

##### B. Above Ground Applications: As buried applications, except use bolted

**Deleted:** 1. Class 52 or pressure class 350 psi ductile iron pipe, AWWA C151 with push-on joints, AWWA C111.

**Deleted:** ¶

**Deleted:** 5. Rubber gasket slip-on pipe joints, AWWA C111 with gasket lubricant.

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**Deleted:** 6. Bronze wedges with current capacity of 400 amps each for each joint as follows:¶

<b>Deleted:</b> ¶
... Pipe ... No. of¶
... Diameter ... Wedges¶
... less than 10" ... 2¶
... 10" ... 3¶
... 12" ... 4¶
... greater than 12" ... 6¶

flanged fittings, AWWA C104, C110, and C115.

## 2.2 COVERINGS

A. Buried Mechanical Joints: Poly FM Grease and 8 mil vinyl wrap plastic cover.

**Deleted:** A. Buried Mechanical Joints:  
Grease and 8 mil vinyl wrap plastic  
cover.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install pipe per manufacturer's instructions and AWWA C600.
- B. Water distribution and transmission, Section 33 12 19.
- C. Gravity water systems, Section 33 31 00 or Section 33 41 00.
- D. Irrigation Systems, Section 32 84 23.

END OF SECTION

## SECTION 33 05 06 AMENDED

### POLYETHYLENE PIPE

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Polyethylene pipe, couplings, fittings and joint materials.
- B. Related work includes but is not limited to,
  - 1. Excavation, Section 31 23 16.
  - 2. Trench backfill, Section 33 05 20 .
  - 3. Landscape restoration, Section 32 92 00 or Section 32 93 13.
  - 4. Pavement restoration, Section 33 05 25.

##### 1.2 REFERENCES

- A. AASHTO M 252: Standard Specification for Corrugated Polyethylene Drainage Pipe.
- B. AASHTO M-294: Standard Specification for Corrugated Polyethylene Drainage Pipe 300-1200 mm Diameter.
- C. AASHTO MP7-97: Standard specification for Corrugated Polyethylene Pipe – 1350 and 1500 mm Diameter.
- D. ASME B1.1: Unified Inch Screw Threads (UN and UNR Thread Form), Supplement.
- E. ASTM A 307: Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
- F. ASTM D 2239: Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Inside Diameter.
- G. ASTM D 2321: Standard Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
- H. ASTM D 2657: Standard Recommended Practice for Heat Joining of Thermoplastic Pipe and Fittings.
- I. ASTM D 2774: Standard Recommended Practice for Underground Installation of Thermoplastic Pressure Piping.
- J. ASTM D 3261: Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
- K. ASTM D 3350: Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
- L. ASTM F 477: Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- M. ASTM F 1055: Standard Specification for Electofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.
- N. AWWA C906, Polyethylene (PE) Pressure Pipe and Fittings, 4 in. (100 mm) Through 63 in. (1,575 mm), For Water Distribution and Transmission.

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O. AWWA C904, Cross-Lined Polyethylene (PEX) Pressure Pipe, 1/2 in. (12mm) Through 3 in. (76 mm), for Water Service.

P. AWWA C901, Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. (13 mm) Through 3 in. (76mm), for Water Services.

### 1.3 DEFINITIONS

- A. Standard Dimension Ratio (SDR): Average diameter of pipe divided by the minimum wall thickness. The diameter may be either inside or outside measurement depending upon which standard is referenced.
- B. Code Designation: A rating system by the Plastic Pipe Institute for smooth wall polyethylene pipe materials. The designation PE 3408 designates the type of plastic pipe (PE), the grade (34), and the hydrostatic design stress measured in units of 100 psi (08) at 23 deg C.

## PART 2 PRODUCTS

### 2.1 SMOOTH WALL PIPE SYSTEMS

- A. Material: PE 3408 per ASTM D 2239 with a minimum cell classification of 345434C per ASTM D 3350.
- B. Pipe: Smooth wall inside and out with an SDR or working pressure rating indicated or accepted by ENGINEER. Exterior markings as follows.
1. ASTM Standard Number.
  2. Pipe Size.
  3. Class and profile number.
  4. Production code.
  5. Standard dimension ratio.
- C. Fittings:
1. Resin same as pipe.
  2. Working pressure same or greater than pipe.
- D. Joints:
1. Thermally welded butt fusion, ASTM D 3261.
  2. Flanged, ASTM D 2657.
  3. Ultra high molecular weight electro-fusion tape with a polyethylene coupler meeting ASTM F 1055 requirements.

E. Color:

1. Potable water - BLUE
2. Pressurized Irrigation - BLACK or PURPLE
3. Sanitary Sewer - BLACK or GREEN

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## 2.2 CORRUGATED WALL PIPE SYSTEMS

- A. Material: Polyethylene, ASTM D 3350 with a cell class as required in AASHTO M 252, AASHTO M 294 or AASHTO MP7-97
- B. Pipe: Type S or D unless specified otherwise. Corrugations may be either annular or helical.

Type	Description
C	Circular pipe with a corrugated surface inside and out.
CP	Type C pipe with perforations
S	Circular pipe with an outer corrugated wall and a smooth inter wall
SP	Type S pipe with perforations
D	Circular pipe with a corrugated wall sandwiched between a smooth outer wall and a smooth inner wall.

### C. Fittings:

1. Blow molded with cell class 335420C, ASTM D 3350.
2. Rotational molded with cell class 213320C, ASTM D 3350.
3. Shop or field remanufactured of the same material as the pipe

### D. Joints:

1. Bell and spigot with gaskets, ASTM F 477. Foam type weather stripping not allowed.
2. Split corrugated couplings with plastic or stainless steel ties and leak resistant neoprene gasket.

## 2.3 NUTS AND BOLTS

- A. Carbon steel machined heavy hex heads, Class 2 fit, ASTM A 307; Grade B, threads, ASME B1.1.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install pipe as per manufacturer's instructions, ASTM D 2321 or ASTM D 2774.
- ~~B. Water distribution and transmission, Section 33 11 00.~~
- C. Gravity water systems, Section 33 31 00 or Section 33 41 00.
- D. Irrigation Systems, Section 32 84 23.
- E. Tape wrap steel materials for protection against corrosion after piping installation.

Deleted: B. Water distribution and transmission, Section 33 12 19.

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END OF SECTION

## **SECTION 33 05 07 AMENDED POLYVINYL CHLORIDE PIPE**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Polyvinyl chloride pipe, couplings, fittings and joint materials.
- B. Related work includes but is not limited to,
  - 1. Excavation, Section 31 23 16.
  - 2. Trench backfill, Section 33 05 20 .
  - 3. Landscape restoration, Section 32 92 00 or Section 32 93 13.
  - 4. Pavement restoration, Section 33 05 25.

#### **1.2 REFERENCES**

- A. ASTM D 1784: Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
- B. ASTM D 2241: Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR - Series).
- C. ASTM D 2321: Standard Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
- D. ASTM D 2412: Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
- E. ASTM D 2564: Standard Specification for Solvent Cement for Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
- F. ASTM D 2729: Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- G. ASTM D 2774: Standard Recommended Practice for Underground Installation of Thermoplastic Pressure Piping.
- H. ASTM D 2855: Standard Practice for Making Solvent Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.
- I. ASTM D 3034: Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- J. ASTM D 3139: Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
- K. ASTM D 3212: Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
- L. ASTM F 656: Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
- M. ASTM F 679: Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.

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N. ASTM F 949: Standard Specification for Poly(vinyl Chloride) (PVC) Corrugated sewer Pipe with a Smooth Interior and Fittings.

O. AWWA C900: AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution.

P. AWWA C905, Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14 in. Through 36 in.

Q. AWWA C909, Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 in. Through 24 in. (100 mm Through 600 mm), For Water Distribution.

### 1.3 DEFINITIONS

A. Standard Dimension Ratio (SDR): Outside diameter of pipe divided by wall thickness.

## PART 2 PRODUCTS

### 2.1 GRAVITY PIPE SYSTEMS

A. Pipe:

1. Solid smooth wall, 4 to 15 inch diameter, ASTM D 3034.
2. 18 to 27 inch diameter, ASTM F 679.
3. 4 to 10 inches diameter corrugated wall with a smooth interior, ASTM F 949.

B. Fittings: ASTM D 1784.

C. Stiffness: 50 psi minimum when measured at 5 percent deflection, ASTM D 2412.

D. Additives and Fillers: Not to exceed 10 parts by weight; 100 parts of resin in the compound.

E. Joints: Bell and spigot with flexible elastomeric seals, ASTM D 3212.

F. Flattening: No visual evidence of splitting, cracking, or breaking when flattened to 60 percent deflection, ASTM D 2412.

### 2.2 PRESSURE PIPE SYSTEMS

A. Pipe: Conform to AWWA C900 except use outside diameters defined by ductile iron pipe sizes. Dimensions, class, SDR, and tolerances per ASTM D 2241.

B. Compounds: Type 1, Grade 1, Class 12454A, ASTM D 1784.

C. Joints:

1. Bell and spigot with flexible elastomeric seals, ASTM D 3139. Use non-toxic lubricant.
2. Solvent weld, ASTM D 2564.

### 2.3 PERFORATED PIPE SYSTEMS

A. Pipe: Refer to gravity pipe products above.

B. Perforations: ASTM D 2729.

C. Joints: Push-on, solvent weld or other.

## 2.4 SOLVENT WELDS

- A. Primer, ASTM F 656.
- B. Glue, ASTM D 2564.

## 2.5 PIPE COLORS

- A. Potable water system - BLUE
- B. Sanitary Sewer - GREEN.
- C. Pressurized Irrigation (non-potable water supply) - PURPLE
- D. Pressurized Potable water - WHITE.

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## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install pipe per manufacturer's instructions, ASTM D 2321 for gravity systems, AWWA C900 or ASTM D 2774 for pressure systems, And ASTM D 2855 for underground Irrigation Systems.
- B. Water distribution and transmission, Section 33 12 19.
- C. Gravity water systems, Section 33 31 00 or Section 33 41 00.
- D. Irrigation System, Section 32 84 23.

END OF SECTION

## **SECTION 33 05 20 AMENDED BACKFILLING TRENCHES**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Trench backfill materials.
- B. Trench backfilling requirements.
- C. Surface restoration requirements.

#### **1.2 DEFINITIONS**

- A. Bedding: That surface of the Excavation or portion of the Pipe Zone below the pipe.
- B. Pipe Zone: That zone in a backfilling operation which supports, and surrounds the pipe barrel, and extends to 1 foot above the top of the pipe barrel.

#### **1.3 SUBMITTALS**

- A. Submit maximum laboratory dry density and optimum laboratory moisture content for:
  - 1. Subgrade material, and
  - 2. Each type of fill to be used.
- B. Upon ENGINEER's request, submit a written quality control Inspections and testing report describing source and field quality control activities performed by CONTRACTOR and its Suppliers.

#### **1.4 QUALITY ASSURANCE**

- A. Do not change material sources, or aggregate without ENGINEER's knowledge.
- B. Reject backfill material that does not comply with requirements specified in this section.

#### **1.5 STORAGE AND PROTECTION**

- A. Storage:
  - 1. Safely stockpile backfill materials.
  - 2. Separate differing materials, prevent mixing, and maintain optimum moisture content of backfill materials.
- B. Protection:
  - 1. During installation or repair, plug end of pipe or fitting except when installing next section of pipe or fitting.
  - 2. Avoid displacement of and injury to Work while compacting or operating equipment.
  - 3. Movement of construction machinery over Work at any stage of construction is solely at CONTRACTOR's risk.

**1.6 SITE CONDITIONS**

- A. Do not place, spread, or roll any backfill material over material that is damaged by water. Remove and replace damaged material at no additional cost to OWNER.
- B. Control traffic and erosion. Keep area free of trash and debris. Repair settled, eroded, and rutted areas.
- C. Reshape and compact damaged structural section to required density.
- D. Restore any damaged structure to its original strength and condition.
- E. Replace contaminated backfill at no additional cost to OWNER.

**1.7 SEQUENCING**

- A. Coordinate backfilling operation with pipeline commissioning requirements in Section 33 08 00.

**1.8 ACCEPTANCE**

A. General:

- 1. Native material may be wasted if there is no additional cost to substitute material acceptable to ENGINEER.
- 2. For material acceptance refer to.
  - a. Common fill, Section 31 05 13.
  - b. Crushed aggregate base, Section 32 11 23.
  - c. Cement treated fill, Section 31 05 15.

B. Trench Backfilling:

- 1. Minimum testing per lot.
- 2. Addition testing upon request of ENGINEER, not to exceed one additional test per lot, per lift at no additional cost to OWNER.
- 3. All tests shall be labeled with centerline station and offsets and project name to be considered valid tests.

Deleted: B. Trench Backfilling: One test per Lot.¶

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Table 1: Lot Size for Trench Backfilling Operation		
Material	Test Criteria	Lot size
Subgrade	Standard (a)	200 lineal feet
Common Fill	Standard (a)	200 lineal feet per lift 25 square feet of footing area per lift
Crushed Aggregate Base	Modified (a)	200 lineal feet per lift 25 square feet of footing area per lift
Flowable Fill	Strength (b)	50 cubic yards
NOTES (a) Proctor density, Section 31 23 26 (b) Compressive strength, Section 31 05 15 (c) Lift thickness above the pipe zone before compaction, 8 inches.		

Table 1: Lot	
Material	Test
Subgrade	S
Common Fill	S
Crushed Aggregate Base	M
Flowable Fill	S
NOTES (a) Proctor density, Section 31 23 26 (b) Compressive strength, Section 31 05 15 (c) Lift thickness above the pipe zone before compaction, 8 inches.	

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## 1.9 WARRANTY

- A. Any settlement noted in Trench backfill or in structures built over the Trench backfill will be considered to be caused by improper compaction methods and shall be corrected at no cost to the OWNER.
- B. Restore structures damaged by settlement at no additional cost to OWNER.
- C. Any failed tests shall be interpreted as failure of all lots installed after previous passing test and shall be corrected at no additional cost to OWNER.

## PART 2 PRODUCTS

### 2.1 BACKFILL MATERIALS

- A. Common fill, Section 31 05 13.
- B. Crushed aggregate base, Section 32 11 23.
- C. Cement treated fill, Section 31 05 15.
- D. Slag or asphalt bearing material not allowed.

### 2.2 ACCESSORIES

- A. Water: Make arrangements for sources of water during construction and make arrangements for delivery of water to site. Comply with local Laws and Regulations at no additional cost to OWNER when securing water from water utility company.
- B. Geotextile Fabric: Section 31 05 19.
- C. Identification Tape: Permanent, bright-colored, continuous-printed magnetic plastic tape, intended for direct-burial service; not less than 6 inches wide by 4 mils thick. The tape shall read "**CAUTION: BURIED INSTALLATION BELOW**". Color of tape as follows.
  - 1. Red: Electric power lines, cables, conduit and lighting cables
  - 2. Yellow: Gas, oil, steam, Petroleum or gaseous materials
  - 3. Orange: Communications, alarm, signal, cables or conduits.
  - 4. Blue: Potable water
  - 5. Purple: Reclaimed Water, irrigation and slurry lines
  - 6. Green: Sewer and storm drain lines
- D. Tracer Wire: 12 guage single strand direct bury shielded wire.

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## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Verify backfill material meets gradation requirements, foundation walls are braced to support surcharge forces imposed by backfilling operations, areas to be backfilled are free of debris, snow, ice or water, and Trench bottom is not frozen.
- B. If Subgrade is not readily compactable secure written authorization for extra excavation and backfill; Section 31 23 16.

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- C. Avoid injuring and displacement of pipe and structures while compacting soil or operating equipment next to pipeline.
- D. Place geotextile fabrics; Section 31 05 19.

### 3.2 GENERAL BACKFILLING REQUIREMENTS

- A. Protect Subgrade from desiccation, flooding and freezing.
- B. Do not damage corrosion protection on pipe.
- C. Repair or replace damaged pipe at no additional cost to OWNER.
- D. Withdraw sheathing, Shoring, piles, and similar supports as backfilling progresses. Backfill and compact all holes left by removals.
- E. Provide sufficient water quality facilities to protect downstream fish and wildlife, and to meet State water quality requirements.
- F. Water settling of Trench backfill is not permitted. "Jetting" of Trench backfill is prohibited.

### 3.3 PIPE ZONE

- A. Maintain uniform foundation along barrel of pipe with sufficient relief for joint connections.
- B. Use backfill materials meeting pipe manufacturer's recommendations. Maximum backfill particle size is 3/4 inch for plastic pipe.
- C. Do not permit free fall of backfill material which may damage pipe, pipe finish, or pipe alignment.
- D. Except where piping must remain exposed for tests, fill Pipe Zone as soon as possible.

E. The following Common Fill (31 05 13) are not allowed for the pipe zone.

1. Recycled Fill.

2. Clay.

3. Sand in the presence of water.

4. Pea Gravel in the presence of water.

5. Top Soil.

6. Pit Run.

F. Install tracer wire in contact with the exterior of the full length of the non-metallic water pipe. All wire shall be looped such that non-metallic pipes can be located over the entire length and dead ended or fully looped at valves, water meters, and fire hydrants.

G. Compact bottom of trench before starting work.

H. Compact bedding before installing pipe.

### 3.4 TRENCH ABOVE PIPE ZONE.

- A. Maximum lift thickness before compaction is 8 inches.
- B. Fill unauthorized Excavations with material acceptable to ENGINEER at no additional cost to OWNER.

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C. Do not damage adjacent structures or service lines, D. Install continuous plastic line marker directly over buried lines 30 inches above top of line, but not less than 18 inches below finished grade. When less than 48 inches of cover, install 18 inches below finished grade or as directed by ENGINEER.

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D. Install continuous plastic line marker directly over buried lines 18 inches below finished grade.  
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E. The following Common Fill (31 05 13) are not allowed for the trench above the pipe bedding unless specifically approved by the City Engineer.

- 1. Recycled Fill
- 2. Clay.
- 3. Sand.
- 4. Pea Gravel.
- 5. Native, unless approved by the ENGINEER.

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**3.5 MODIFIED BACKFILL LAYER METHOD**

A. At discretion of CONTRACTOR, backfill may be placed in thicker layers than indicated above subject to the following provisions.

- 1. CONTRACTOR proves the ability of proposed method to achieve specified average compaction density.
- 2. ENGINEER, on the basis of test results, approves the system in writing.

B. Should CONTRACTOR find it necessary to change the method or any part of it, including the source of material, or the rate of placing the material, obtain approval of ENGINEER, who may require a further trial area.

C. If testing shows a previously approved system is no longer producing the required degree of compaction, make changes to comply, and recompact areas in accordance with 1.9.C of this section, 33 05 20.

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D. Where vibration effects are creating environmental problems, make changes to eliminate problems.

**3.6 COMPACTION**

A. Compact backfill, Section 31 23 26.

- 1. A-1 soils: 95 percent or greater of a Modified Proctor Density.
- 2. Other soils: 95 percent or greater of a Standard Proctor Density.

Deleted: A. Compact backfill, Section 33 05 05.

**3.7 COMPRESSIVE STRENGTH**

A. Where a flowable fill is used, provide compressive strength indicated in Section 31 05 15. Use fill which flows easily and vibration is not required.

**3.8 SURFACE RESTORATION**

- A. Provide temporary paved surfaces where Trenches pass through roadways, Driveways or sidewalks.
- B. Restore paved surfaces; Section 33 05 25.
- C. Finish landscaped surfaces with grass, Section 32 92 00 or with other ground cover, Section 32 93 13.

**3.9 CLEANING**

- A. Remove stockpiles from the site. Grade site surface to prevent free standing surface water.
- B. Leave borrow areas clean and neat.

END OF SECTION

## **SECTION 33 05 25 AMENDED PAVEMENT RESTORATION**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Aggregate base restoration.
- B. Concrete base restoration.
- C. Surface restoration.

#### **1.2 REFERENCES**

- A. ACI 305: Hot Weather Concreting.
- B. ACI 306: Cold Weather Concreting.
- C. ASTM C 615: Standard Specification for Deformed and Plain Billet- Steel Bars for Concrete Reinforcement.
- D. ASTM C 78: Standard Test Method for Flexural Strength of Concrete (Using Simple Beam With Third-Point Loading).
- E. ASTM C 928: Standard Specification for Packaged, Dry, Rapid- Hardening Cementitious Materials for Concrete Repairs.
- F. ASTM D 1664: Standard Test Method for Coating and Stripping of Bitumen-Aggregate Mixtures.

#### **1.3 SUBMITTALS**

- A. Mix design for,
  - 1. Temporary patching material.
  - 2. Permanent cold weather patching material.
- B. Manufacturer's chemical additive data sheets.

#### **1.4 WEATHER**

- A. Asphalt Concrete Pavement Patch:
  - 1. Provide temporary or permanent cold weather asphalt patching material when air and roadbed temperature in the shade are less than 40 deg. F.
  - 2. Remove any temporary patching and provide permanent patching material when temperatures exceed 40 deg. F. CONTRACTOR may perform work after cold weather season if authorized in writing by ENGINEER.
- B. Portland Cement Concrete Pavement Patch: Comply with hot and cold weather requirements, ACI 305 or ACI 306.

#### **1.5 ACCEPTANCE**

- A. Aggregate base compaction.
- B. Asphalt concrete compaction.
- C. Grade and cross slope of pavement surface.

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## PART 2 PRODUCTS

### 2.1 MATERIALS

- A. Untreated Base Course: Section 32 11 23.
- B. Flowable Fill Base: Section 31 05 15.
- C. Portland Cement Concrete Base: Class 4000, Section 03 30 04.
- D. Tack Coat: Section 32 12 14, Grade SS-1.
- E. Permanent Warm Weather Asphalt Concrete Patching Material: Section 32 12 05, AC-20-DM-1/2 unless indicated otherwise.
- F. Permanent Cold Weather Asphalt Concrete Patching Material: MC-250-FM-1, Section 32 12 05 modified as follows.
  - 1. Asphalt Cement:
    - a. Kinematic viscosity at 140 deg F: 250 to 800 cSt.
    - b. Flash Point: 175 deg F.
    - c. Water: 0.2 percent maximum.
    - d. Distillate Test:
      - To 437 deg F: None.
      - To 500 deg F: 0 - 15 percent.
      - To 600 deg F: 15 - 75 percent.
      - To 680 deg F: 75 percent minimum.
    - e. Residue Tests:
      - Penetration at 77 deg F: None.
      - Ductility at 77 deg F: 100 cm minimum.
      - Solubility in Trichloroethylene: 99 percent minimum.
  - 2. Composition of Mixture:
    - a. Minimum Mix: 115 pounds asphalt cement per finished ton (5.75 percent).
    - b. Maximum Mix: 135 pounds asphalt cement per finished ton (6.75 percent).
    - c. Stripping: Not more than 5 percent, ASTM D 1664, after mixing.
    - d. Workability: Material stockpiled for 1 year shall be capable of being shoveled, raked, spread and compacted.
  - 3. Chemical Additives: Capable of coating wet aggregates without stripping and maintains adhesive qualities in damp or wet applications.
- G. Temporary Cold Weather Asphalt Concrete Patching Material: Type MC-250-DM-1/2, Section 32 12 05 with hydrated lime or anti-stripping agent as indicated in the mix design.
- H. Pavement Sealing:
  - 1. Slurry seal Type RS-1-SS-II, Section 32 01 13.
  - 2. Chip seal Type MC-250-CS-A, Section 32 01 14.

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- I. Portland Cement Concrete Patching Material: Class 4000, Section 03 30 05.
- J. High Early Strength Portland Cement Concrete Patching Material:
  - 1. Concrete compressive strength of 3,000 psi minimum in 4 hours.
  - 2. Cementitious Material: Rapid hardening or very rapid hardening, ASTM C 928.
  - 3. Cement content of mix, per cement manufacturer's recommendations or approved mix design.
  - 4. Non-reactive aggregates in applications subjected to wetting, extended exposure to humid atmosphere, or contact with moist ground.
- K. Pavement Marking: Tape or paint, Section 32 17 23.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. At site, post name, address and telephone number of CONTRACTOR to contact in emergencies.
- B. Notify ENGINEER within 24 hours of commencing work of this section but not less than 4 hours.
- C. Provide worker and public safety; Section 01 55 26.
- D. Cutting Pavements: Cut full depth and straight, Section 02 41 14. Remove all bonding inhibitors.

### 3.2 AGGREGATE BASE OR FLOWABLE FILL BASE

- A. Match depth of existing aggregate base or 8 inches thick minimum.
- ~~B. Place crushed aggregate base in lifts not exceeding 8 inches before compaction. Compact to 95 percent or greater. Modified Proctor Density. Section 31 23 26.~~
- C. When providing controlled low strength material (CLSM as specified in 31 05 15) match depth of existing aggregate base. Use fill that flows easily and vibration is not required. Cure the fill before placing surface patch.

**Deleted:** B. Place crushed aggregate base in lifts not exceeding 8 inches before compaction. Compact per Section 33 23 26 to a Modified Proctor Density of 95 percent or greater.

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### 3.3 CONCRETE SUBSTRATE

- A. Apply concrete bonding compound, Section 03 30 10, to edge of existing concrete. Place concrete, Section 03 30 10.

### 3.4 ASPHALT CONCRETE PATCH

- A. Match existing Pavement thickness plus 1 inch, but not less than 4 inches.
- B. Clean all vertical surfaces that butt against new patchwork. Provide full coverage spray tack coat. Do not spray tack coat on surfaces exposed to public view. Do not apply tack coat by brush.
- C. Place asphalt concrete in lifts not exceeding 3 inches after compaction
- D. Compaction: 94 percent of ASTM D 2041 (Rice) plus or minus 2 percent.
- E. Match adjacent surface slopes.
  - 1. Plane off surface distortions that exceed 1/4-inch vertical deviation in 10 feet.

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2. Coat planed surfaces with a cationic or anionic tack emulsion that complies with Section 32 12 03. Cover tack with sand.

### 3.5 PORTLAND CEMENT CONCRETE PATCH

#### A. Full Depth restorations:

1. Clean vertical surfaces in patchwork. Install dowels in vertical load bearing joints. Apply concrete bonding compound, Section 03 30 10.
2. Match adjacent surface slopes. Apply membrane forming compound, Section 03 39 00 immediately to protect work from hot or cold weather.
3. After concrete cure, plane off surface distortions that exceed 1/4 inch deviation in 10 feet. Use a water repelling product, Section 07 19 00 to water proof planed surfaces.

4. Do not allow traffic on the repaired area until concrete has achieved 3,000 psi compressive or 400 psi flexure strength.

**Deleted:** 4. Do not allow traffic on the repaired area until concrete strength is achieved

#### B. Partial Depth Patching:

1. Chip, hydro-blast or saw cut concrete to a minimum depth of 1 inch.
2. Make surfaces free of frost, ice, mud, water, grease, dirt and other materials that hamper bonding.
3. Install bonding agent per manufacturer's recommendations.
4. Apply membrane forming compound, Section 03 39 00 immediately to protect work from hot or cold weather.
5. After concrete cure, plane off surface distortions that exceed 1/4 inch deviation in 10 feet. Use a water repelling product, Section 07 19 00 to water proof planed surfaces.
6. Do not allow traffic on the repaired area until concrete strength is achieved.

### 3.6 CONCRETE PAVERS

- A. Screed Bedding with a notched and cambered screed board to achieve a crown between existing pavers. Use graded aggregate, geotextile, and bedding sand, Section 32 14 13.
- B. In asphalt concrete or portland cement concrete surfaces place pavers against Pavement cuts to form a border course, i.e. the short side of the paver against the cut except at corners.
- C. After placement, use a plate-type vibrating compactor to compact pavers. Size compactor to provide at least 5,000 lbf. force. Sweep sand into the joints and vibrate until joints are full. Remove excess sand.
- D. Match adjacent surface grades with no more than 1/4 inch vertical deviation in 10 feet.

### 3.7 PAVEMENT MARKINGS

- A. Unless indicated otherwise, repair all damaged Pavement markings with matching type of materials and installation.

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END OF SECTION

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## **SECTION 33 08 00 AMENDED COMMISSIONING OF WATER UTILITIES**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Testing requirements for potable and non-potable water piping systems.
- B. Warning: DO NOT use hydrostatic pressures described in this section for air-pressure testing.

#### **1.2 DEFINITIONS**

- A. Leakage: The quantity of water required to maintain the specified hydrostatic test pressure after the pipeline has been filled with water and the air expelled.
- B. Non-rigid Pipe: Any pipe that requires Bedding and backfill material for structural support.

#### **1.3 SUBMITTALS**

- A. Pipeline Test Report: Submit.
  - 1. Type of test.
  - 2. Identification of pipe system.
  - 3. Size, type, location and length of pipe in test section.
  - 4. Test pressure and time.
  - 5. Video cassette and log of visual examination.
  - 6. Amount of Leakage versus allowable.
  - 7. Date of test approval.
  - 8. Signature of test supervisor.
  - 9. Signature of Resident Project Representative witnessing and accepting the test.

#### **1.4 PROJECT CONDITIONS**

- A. Repair pipeline system at no additional cost to OWNER until it passes specified commissioning tests.

#### **1.5 WARRANTY**

- A. At the end of the One Year Correction Period repeat any test requested by ENGINEER to verify warranty of pipeline performance.

### **PART 2 PRODUCTS**

#### **2.1 TESTING MATERIALS**

- A. Medium: Water, air.
- B. Recording Equipment (pressure systems):
  - 1. Supply all equipment and power to perform pressure testing.

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2. Secure approval of pressure gages.
3. Locate all gages and recording equipment away from affect of sunshine or unsuitable weather conditions.
4. Place, vents, pressure taps and drains for the test. Repair pipeline at completion of test at no additional cost to OWNER.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Notify ENGINEER 48 hours in advance of test.
- B. Carry out tests as pipeline construction progresses to ensure construction methods are producing satisfactory results.
- C. Remove debris, sediment and other material from installed pipe prior to testing. Do not discharge or flush sand, gravel, concrete, debris or other foreign material into any existing pipeline system. Flushing with clean water only will be allowed but with minimal flows to eliminate exceeding capacities of the existing gravity systems. Flushing into existing pressurized water systems will not be allowed.

### 3.2 ALIGNMENT AND GRADE TEST

- ~~A. Do not allow line and grade of pipe to vary more than the LESSER of 1/2 inch in 10 feet and not more than 1 inch variance from true line at any location, and more than 20% of nominal diameter.~~
- B. Do not allow grade of pipe to vary more than 1/4 inch in 10 feet for all design grades less than or equal to 1 percent and not more than 1/2 inch total variance from true grade at any location. Also, do not allow grade of pipe to vary more than 1/2 inch in 10 feet for all design grades greater than 1 percent and not more than 1 inch total variance from true grade at any location. Theses tolerances shall be acceptable provided that such variation does not result in a level or reverse sloping invert.
- C. The variation in the invert elevation between adjoining ends of pipe due to eccentricity of joining surface and pipe interior surfaces shall not exceed 1/64 inch per inch of pipe diameter, or 1/4 inch maximum.

**Deleted:** A. Do not allow line and grade of pipe to vary more than 1/2 inch in 10 feet and not more than 1 inch variance from true line at any location.

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### 3.3 PRESSURE TEST

- A. Air Test: Per pipe manufacturer's recommendation.
- B. Hydrostatic test:
  1. Provide 225 psi test pressure for 2 hours unless specified otherwise.
  2. Provide air release taps at pipeline's highest elevations and expel all air before the test. Insert permanent plugs after test has been completed.

~~3. No piping installation will be acceptable until the leakage is non-detectable for projects less than 1300-feet long. For projects longer than 1300-feet long, leakage must be less than the amount allowed by industry standards for the type of pipe material being tested or if no standard prevails than the number of gallons per hour as determined by the formula:~~

**Deleted:** 3. No piping installation will be acceptable until the leakage is less than the amount allowed by industry standards for the type of pipe material being tested or if no standard prevails than the number of gallons per hour as determined by the formula:

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$$Q = \frac{LD * \sqrt{P}}{148,000}$$

Where

Q = allowable leakage, in gallons per hour.

L = length of pipe under test in feet.

D = nominal diameter of pipe in inches.

P = average test pressure, in pounds per square inch (gage).

C. Locate and repair defective joints and retest until the leakage rate is less than allowable.

D. Repair any noticeable leakage even if total leakage is less than allowable.

### 3.4 OBSTRUCTION AND DEFLECTION TEST

A. Obstructions: Maximum protuberance is 1 inch.

B. Deflections:

1. Do not use mechanical pulling equipment when pulling mandrels through pipe.

2. Maximum reduction of internal diameter in any plane measured full length of installation and not less than 30 days after installation as follows.

a. Polyvinyl chloride pipe, 7.5 percent.

b. High density polyethylene pipe, 5 percent.

c. Ductile iron pipe, 3 percent.

d. Corrugated metal pipe, 7.5 percent.

3. Recommend an alternate method of measurement if mandrel testing would cause damage to internal pipe coating.

### 3.5 INFILTRATION TEST

A. Maximum is 50 gallons per inch diameter per mile per 24 hours.

### 3.6 PIPE TESTING SCHEDULE

A. Irrigation - Gravity System:

1. Grade test: All circuits drain.

B. Irrigation – Pressure System:

1. Grade test: All circuits drain.

2. Pressure test.

3. Operational Testing:

a. Perform operational testing after hydrostatic test is complete; backfill is in place and sprinkler heads adjusted to final coverage.

b. Demonstrate system meets coverage requirements and automatic controls function properly.

c. Coverage requirements are based on operation of 1 circuit at a time.

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C. Sanitary Sewers:

1. Alignment and grade test.

2. Obstructions and deflection test on non-concrete pipes larger than 18 inches.

Deleted: 2. Obstructions and deflection test.

3. Infiltration test for gravity pipeline systems.

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4. Pressure test for pressure pipeline systems.

5. Video inspection for all mains and laterals. For lateral replacements constructed by bursting, camera in presence of ENGINEER.

Deleted: 5. Video inspection.

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D. Subdrains:

1. Grade test: All pipelines drain.

2. Obstructions and deflection test.

E. Storm Drains:

1. Alignment and grade test.

2. Obstructions and deflection test on non-concrete pipes larger than 18 inches.

Deleted: 2. Obstructions and deflection test.

3. Infiltration test for gravity pipeline systems.

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4. Pressure test for pressure pipeline systems.

5. Video inspection for all mains and laterals with slopes less than one (1) percent.

Deleted: 5. Video inspection.

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F. Potable Water System:

1. Obstruction and deflection test on non-ductile iron pipe 18 inches or greater.

Deleted: 1. Obstruction and deflection test.

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2. Disinfection (Section 33 13 00).

Deleted: 2. Pressure test.¶  
3. Disinfection (Section 33 13 00).

3. Pressure test.

END OF SECTION

**SECTION 33 11 00 AMENDED  
WATER DISTRIBUTION AND TRANSMISSION**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Water distribution and transmission system identification, valves, boxes, service connections and accessories.
- B. This section is applicable to potable and non-potable water pressure systems.

**1.2 REFERENCES**

- A. ACPA: American Concrete Pipe Association.
- B. Applicable water company requirements.
- C. AWWA C600: AWWA Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances.
- D. AWWA C605: AWWA Standard for Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.
- E. AWWA C800: AWWA Standard for Underground Service Line Valves and Fittings.
- F. AWWA M11: AWWA Manual for Steel Pipe - Design and Installation.
- G. CDA: Copper Development Association.

H. BACKFLOW AND CROSS CONNECTION PROTECTION, Supplementary Section 33 11 05.

**1.3 PERFORMANCE REQUIREMENTS**

A. Depth of Cover:

1. 60 inches minimum to top of pipe, service line, or as indicated in local building code. 72 inches maximum unless ENGINEER authorizes otherwise.

2. If less cover, provide additional protection to withstand frost and external loads.

B. Remove any section of pipe already placed that is found to be defective or damaged. Relay or replace without additional cost to OWNER.

**Deleted:** 1. 48 inches minimum to top of pipe, service line, or as indicated in local building code. 72 inches maximum unless ENGINEER authorizes otherwise.

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**1.4 SUBMITTALS**

- A. Product Data: Submit manufacturer's technical product data and installation instructions.
- B. Commissioning: Submit testing data indicated in Section 33 08 00.
- C. Record Documents: Submit documents, Section 01 78 39. Include details of underground structures, connections, thrust blocks and anchors. Show interface and spatial relationship between piping and adjacent structures.
- D. Operating and Maintenance: Submit data, Section 01 78 23. Include maintenance data, parts lists, product data, and shop drawings.

**1.5 SITE CONDITIONS**

A. Minimize neighborhood traffic interruptions. Barricade stockpiles.

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- B. Secure acceptance of pipeline lateral tie-in work.
- C. Repair public and private facilities damaged by CONTRACTOR.
- D. Do not turn on or turn off any valve outside of the Work prior to securing ENGINEER's or water company's permission.

**PART 2 PRODUCTS**

**2.1 PIPES AND FITTINGS**

- A. Provide piping materials and factory fabricated piping products of sizes, types, pressure ratings, and capacities indicated. Use only NSF approved products in drinking water systems. All such products shall be appropriately stamped with the NSF logo.
- B. Where not indicated, provide proper selection as determined by installer and acceptable to ENGINEER to comply with installation requirements.
- C. Provide sizes and types of equipment connections for fittings of material that matches pipe material used in the piping system. Where more than one type of material or product Option is indicated, selection is installer's choice.
- D. Provide pipe fittings and accessories of same material and weight or class as pipe, with joining method indicated or recommended by manufacturer.

**2.2 VALVES**

- A. Section 33 12 16.

**2.3 VALVE BOX**

- ~~A. Buried Valves In Traffic Areas: 2 piece, cast iron, . 5 - 1/4 inch shaft, with a drop lid. Screw adjustable sleeves are not allowed.~~
- B. Buried Valves in Non-traffic Areas: Slip type of height required for the installation.
- C. Markings: On cover of valve box, cast the appropriate utility lettering.

**Deleted:** A. Buried Valves In Traffic Areas: 2 piece, cast iron, screw adjustable sleeve, 5 - 1/4 inch shaft, with a drop lid.

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**2.4 VALVE CHAMBER**

- A. General: Refer to applicable design criteria requirements explained in Laws and Regulations.
- B. Basin: Class 4000 concrete floor and walls.
- C. Steps: Plastic, cast into sidewalls greater than 4 feet deep.
- D. Top: Flat slab class 4000 concrete.
- E. Frame and Cover: Scoriated asphalt coated, heavy duty ductile iron conforming to Section 05 56 00 with flat top design and appropriate utility lettering. Shape and size as indicated.
- ~~F. Air Relief Valves: At high points in water mains where air can accumulate, provisions shall be made to remove air by means of hydrants or air relief valves. Automatic air relief valves shall not be used in situations where flooding may occur (R309-550-6(6)).~~

**2.5 MORTAR, GROUT, AND CONCRETE**

- A. Mortar: Cement, Section 04 05 16.
- B. Grout: Cement, Section 03 61 00.
- C. Concrete:
  - 1. Cast-in-place: Class 4000, Section 03 30 04.
  - 2. Precast: Class 5000, Section 03 40 00.

**2.6 TAPPING SADDLES**

- A. Provide epoxy coated ductile iron, or stainless steel saddles with stainless steel double straps.
- B. Provide tapping saddles that have a minimum rated working pressure of 300 psi, neoprene Buna N gaskets, and bronze straight threads. Tapered threads are not allowed on tapping saddles.

**Deleted:** A. Provide bronze alloy, ductile iron, or stainless steel saddles with stainless steel double straps.

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**Deleted:** B. Provide tapping saddles that have a minimum rated working pressure of 300 psi, neoprene Buna N gaskets, and bronze tapered threads.

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**2.7 SERVICE CONNECTION**

- A. Type K copper pipe; Section 33 05 03 with 200 psi compression fittings in accordance with AWWA C800. If materials used in main line are non-copper, provide a plastic nipple to separate the metals.
- B. PE Pipe, AWWA C901 pipe with 200 psi compression fittings and ratings in accordance with AWWA C800.

**Deleted:** A. Type K copper pipe; Section 33 05 03 with flare type 200 psi compression fittings in accordance with AWWA C800. If materials used in main line are non-copper, provide a plastic nipple to separate the metals.

**2.8 ACCESSORIES**

- A. Bolts, Nuts, Washers: Steel, Section 05 05 23.
- B. Anchorages: Provide anchorages for tees, wyes, crosses, plugs, caps, bends, valves, and hydrants. After installation, apply full coat of asphalt or other acceptable corrosion-retarding material to surfaces of ferrous anchorages.
- C. Corporation Stops: All bronze with straight threads and saddle. Corp stop valve shall be a full port ball valve.
- D. Hydrant and Valve: Dry barrel, Section 33 12 19.
- E. Water Meter and Valve: Section 33 12 19.
- F. Grease: Non-oxide food grade required where contact with potable water is possible. Non-Oxide poly-fm for all exposed buried metal surfaces for bolts, nuts, washers, and restraints.
- G. Polyethylene Sheet: 8 mil thick.
- H. Joint Restraints: All Joint Restraint methods shall be approved by ENGINEER prior to installation.

**Deleted:** C. Corporation Stops: All bronze with tapered threads.

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**Deleted:** F. Grease: Non-oxide.

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**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. Verify Trench Excavation is ready to receive work, and dimensions, and elevations are as indicated.

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B. Commencing installation means acceptance of existing conditions.

**3.2 PREPARATION**

A. Excavation, Section 31 23 16. Hand trim to required elevations. Correct over excavations.

B. Remove stones or other hard material in accordance to manufacturer requirements that may damage the pipe during embedment or impede backfilling or compaction.

**Deleted:** B. Remove stones or other hard matter that could damage pipe embedment or impede backfilling or compaction.

C. Examine areas and conditions under which materials and products are to be installed. Do not proceed with system installation until unsatisfactory conditions have been corrected in manner acceptable to system installer.

D. Clearly identify and promptly set aside defective or damaged pipe.

E. Use pipe cutting tool acceptable to pipe manufacturer.

**3.3 LOCATING POTABLE WATER PIPE**

A. Comply with Utah Administrative Rules for Public Drinking Water Systems as found in R309-550. As a minimum locate potable water pipe at least 18 inches vertical and 10 feet horizontal edge to edge between water and sewer lines. Place water lines above sewer line.

**Deleted:** A. Comply with Utah Drinking Water Act. As a minimum locate potable water pipe at least 18 inches vertical and 10 feet horizontal edge to edge between water and sewer lines. Place water lines above sewer line.

B. Where potable water pipe crosses under gravity-flow sewer lines, fully encase the sewer pipe in concrete for a distance at least 10 feet each side of the crossing.

- 1. Do not locate any joint in the water line within 36 inches of the crossing.
- 2. Encase water line if it is within 24 inches of a sewer force main or inverted syphon.
- 3. Encase sewer main joints in concrete if joints are horizontally closer than 36 inches to the water line.

C. Do not put potable water lines in the same Trench with sewer lines, storm drains or electric wires.

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**3.4 INSTALLATION - PIPE AND FITTING**

B. Steel Pipe: AWWA M11.

C. Ductile Iron Pipe: AWWA C600.

D. Copper Tube: CDA "Copper Tube Handbook".

E. Polyethylene Pipe: For 3 inches and smaller pipe follow AWWA C901. Install all other sizes per manufacturer's installation instructions.

F. Polyvinyl Chloride Pipe: AWWA C605.

G. Concrete Pipe: ACPA "Concrete Pipe Handbook".

**3.5 INSTALLATION – CONCRETE THRUST BLOCKS**

A. Do not make hydrostatic tests of Section 33 08 00 until thrust block concrete has cured for at least 5 days.

B. Provide thrust blocks on all plugs, caps, tees, hydrants and vertical or horizontal bends.

**Deleted:** H. Wedges: Install metal wedges on all metal pipe systems.

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- C. Provide stainless steel or epoxy coated steel tie rods and clamps or shackles to restrain thrust.
- D. Unless otherwise indicated or directed by ENGINEER, place the base and bearing sides of thrust blocking directly against undisturbed earth.
- E. Sides of thrust blocking not subject to thrust may be placed against forms. Place thrust blocking so the fitting joints will be accessible for repair.

### **3.6 JOINT RESTRAINTS - WITH OR WITHOUT THRUST BLOCKS**

- A. Joint restraints shall be installed within 60 ft of all valves 8 inches and smaller.
- B. Joint restraints shall be installed with all valves larger than 8 inches for the distance approved by the ENGINEER.
- C. Joint restrains shall be installed for the distance approved by the ENGINEER where concrete thrust blocks exceed 3 cubic yards as designed, vertical bends, where soil is disturbed, or undisturbed soil bearing capacity is less than 1000 pounds per square foot.

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### **3.7 INSTALLATION - VALVES AND VALVE BOXES**

- A. Valves:
  1. Ensure all parts are in working order.
  2. Set location of valves outside of sidewalk limits, Driveway Approaches and other pedestrian or vehicular interference.
  3. Install plumb with stems pointing up.
  4. Grease all exposed bolts and nuts then apply polyethylene sheet and tape wrap.
- B. Valve Boxes:
  1. Set over valve nut so operator's key is plumb with clearance in valve box when opening and closing the valve.
  2. Adjust box to finish grade.
  3. Clean all dirt or foreign material out of box.

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### **3.8 INSTALLATION - TAPS**

- A. Apply for and pay for applicable permits from water company for the indicated size and location of tap to water main. Comply with all connection requirements of water company.
- B. Make all service taps with a tapping machine acceptable to the water company. Use teflon tape on all taps unless indicated otherwise.
- C. The minimum distance between taps is 24 inches, with a 5 degree stagger. Do not make service taps within 24 inches of the end of pipe. Install taps at 60 degrees from vertical, or authorized by ENGINEER.
- D. Service saddles are required on all taps except, 3/4 inch or 1" taps to new ductile iron pipe
- E. Grease all exposed bolts and nuts then apply polyethylene sheet and tape wrap.

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**3.9 INSTALLATION – SERVICE LINES**

A. Replacing Existing Water Service Line:

1. Follow AWWA C800, Utah Devision of Drinking Water Rules and Regulations (R309), and International Building Code requirements.

Deleted: 3.8 . INSTALLATION – SERVICE LINES¶

Deleted: 1. Follow AWWA C800, Utah public drinking water regulations and Utah plumbing code requirements.

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2. When replacing water service lines, replace old service lines with type K copper pipe, Section 33 05 03 or PE AWWA C901 pipe for service lines less than three inches.

Deleted: 2. When replacing water service lines, replace non-copper pipe with type K copper pipe, Section 33 05 03.

3. Sevice taps shall be more than 24 inches from nearest joint or existing tap unless a greater distance is required by pipe manufacturer.

B. Looping Existing Water Service:

1. Minimum pipe diameter 1 inch.

Deleted: 1. Minimum pipe diameter 3/4 inch.

2. Pinching tools are not allowed for repair work on existing copper services. Use liquid nitrogen to spot freeze the line.

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3. Soldered joints or connections not allowed.

Deleted: 2. Pinching tools used to close and open service lines may be used only if allowed by ENGINEER. When service line pinches cannot be returned to previous shape or flow, remove and replace damaged portion of pipe.

4. For copper to iron connections use a brass pack joint compression coupling with joint locking device.

5. For copper- to- copper connections use a brass compressions fittings. Flared end fittings are not allowed.

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Deleted: 5. For copper- to- copper connections use a brass flare coupling.

6. Follow details shown in the Drawings.

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C. Meter Box: Install meter boxes back of the curb, outside of sidewalks and Driveway Approaches and outside of other pedestrian and vehicular interference.

**3.10 INSTALLATION – WATER MAIN LOOP (SYPHON)**

Deleted: 3.9 . INSTALLATION – WATER MAIN LOOP (SYPHON)¶

A. Existing water mains may not match standard size. Excavate to obtain actual pipe diameter and match size.

B. Do not shutdown pipeline until couplings and fittings are on site. Coordinate shutdown with water company.

C. Connections to steel or transite pipe requires transition couplings or sleeves with transition gaskets.

D. Grease all exposed bolts and nuts then apply polyethylene sheet and tape wrap

E. Provide thrust blocks except where joints are welded. Follow details shown on the Drawings.

**3.11 DISINFECTION**

Deleted: 3.10 . DISINFECTION¶

A. Section 33 13 00.

B. After disinfection, legally dispose of disinfection water.

**3.12 BACKFILLING**

Deleted: 3.11 . BACKFILLING¶

A. Prior to Backfilling:

1. Secure ENGINEER’s acceptance of brass wedge installations and concrete thrust block installations.

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2. For pressure pipe testing follow Section 33 08 00 requirements and for disinfection follow Section 33 13 00 requirements.

B. Trenches: Section 33 05 20.

C. Landscapes: Section 31 23 23.

**3.13 SURFACING RESTORATION**

Deleted: 3.12 SURFACING RESTORATION

A. Roadway Trenches and Patches: Section 33 05 25.

B. Landscapes: Section 32 92 00 or Section 32 93 13 as applicable.

END OF SECTION

## **SECTION 33 11 05 SUPPLEMENTARY BACKFLOW AND CROSS CONNECTION CONTROL**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Permanent backflow and cross connection protection requirements for irrigation, commercial and industrial, and residential systems.
- B. Temporary backflow and cross connection protection requirements for construction, and other temporary uses.

#### **1.2 REFERENCES**

- A. American Society of Mechanical Engineers (ASME) A112.1.2: 2004 Air Gaps in Plumbing Systems
- B. American Society of Sanitary Engineers (ASSE) 1001-2008: Performance Requirements for Atmospheric Type Vacuum Breakers
- C. ASSE 1011: Performance Requirements for Hose Connection Vacuum Breakers
- D. ASSE 1013: Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers
- E. ASSE 1015: Performance Requirements for Double Check Backflow Prevention Assemblies and Double Check Fire Protection Backflow Prevention Assemblies
- F. ASSE 1020: Performance Requirements for Pressure Vacuum Breaker Assembly
- G. ASSE 1024: Performance Requirements for Dual Check Backflow Preventers
- H. ASSE 1056: Performance Requirements for Spill Resistant Vacuum Breaker
- I. Foundation of Cross Connection Control and Hydraulic Research: Manual of Cross Connection Control.
- J. International Plumbing Code, 2006 as amended by Utah Administrative Rules R156-56.

#### **1.3 DEFINITIONS**

- A. Air Gap: The unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe or faucet supplying water to a tank, plumbing fixture or other device and the flood level rim of such vessel in accordance with ASME A1121.2 and FCCCHR.
- B. Approved: Accepted by the water division manager or his designated agent as meeting an applicable referenced specification stated or cited in this section, or as suitable for the proposed use.
- C. Assembly: A combination of mechanical valves and/or atmosphere utilized to prevent backflow. They are required to be testable and repairable.
- D. Auxiliary Water Supply: Any water supply on or available to the premises other than the City's approved public water supply. These auxiliary waters may include water

- from another purveyor's public potable water supply or any natural sources such as a well, spring, river, stream, etc.
- E. Backflow: The flow of water or other liquids, mixtures or substances into the distributing pipes of a potable water supply system from any source or sources other than its intended source.
  - F. Back Siphonage: The flow of water or other liquids, mixtures or substances into the distribution pipes of a potable water supply system from any source other than its intended source caused by the reduction of pressure in the potable water supply system.
  - G. Backflow Preventer: A device, assembly, or means designed to prevent back siphonage.
  - H. Contamination: The impairment of a potable water System by the introduction or admission of any foreign substance that degrades the water quality and creates a health hazard.
  - I. Cross Connection: A connection or potential connection between any part of a potable water system and any other environment containing other substances in a manner that, under any circumstances, would allow such substances to enter the potable water system. Other substances may be gases, liquids, or solids, such as chemicals, waste products, steam, water from another source (potable or nonpotable), or any matter that may change the color or add odor to the water.
  - J. Cross Connection Control by Containment: The installation of an approved backflow prevention device or assembly at the water service connection to any customer's premises where it is physically and economically infeasible to find and permanently eliminate or control all actual or potential cross connections within the customer's water system; or, it means the installation of an approved backflow prevention device or assembly on the service line leading to and supplying a portion of a customer's water system where there are actual or potential cross connections which cannot be effectively eliminated or controlled at the point of cross connection.
  - K. Cross Connections, Controlled: A connection between a potable water system and a non-potable water system with an approved backflow prevention device or assembly properly installed that will continuously afford the protection commensurate with the degree of hazard.
  - L. Degree of Hazard: The risk or potential risk to the public health and the adverse effect of the possible pollution or contamination of the potable water system.
  - M. Device: A combination of mechanical valves and/or atmosphere to prevent backflow. They are not required to be testable or even repairable.
  - N. Double Check Valve Assembly: An assembly of two (2) independently operating internally loaded check valves with two tightly closing shutoff valves on each side of the check valves, plus appropriately located test cocks for the testing of each check valve.
  - O. Hazard Assessment: A regular inspection of facilities, either public system or customer system, to ascertain the degree of hazard posed to the public system and the general public as a whole.

- P. Health Hazard: The degree of hazard which under any condition, device or practice in the water distributing system and its operation may create, or in the judgment of the water division manager or his designated agent may create a danger to the health and well being of the water consumer. An example of a health hazard is a structural defect, including cross connections, in a water supply system.
- Q. Industrial Fluids System: Any system containing a fluid or solution which may be chemically, biologically or otherwise contaminated or polluted in a form or concentration such as would constitute a health, system, pollutional or plumbing hazard if introduced into an approved water system.
- R. Nonpotable Water: Water which is not safe for human consumption or which is of questionable potability.
- S. Plumbing Hazard: A plumbing type cross connection in a consumer's potable water system that has not been properly protected by a vacuum breaker, air gap separation or backflow prevention device or assembly. Unprotected plumbing type cross connections are considered to be a health hazard.
- T. Pollution: The presence of any foreign substance (organic, inorganic, or biological) in water which tends to degrade its quality so as to constitute a hazard or to impair the usefulness or quality of the water to a degree which does not create an actual hazard to the public health but which does adversely and unreasonably affect such waters for domestic use.
- U. Pollutional Hazard: An actual or potential threat to the physical properties of the water system or to the safety of the public or the consumer's potable water system but which would constitute a nuisance or be aesthetically objectionable or could cause damage to the system or its appurtenances, but would not be dangerous to health.
- V. Potable Water: Any water which, according to recognized standards is safe for human consumption.
- W. Reduced Pressure Principle Assembly: An assembly of two (2) independently acting check valves with a hydraulically operated mechanically independent differential relief valve between the two (2) check valves, tightly closing shutoff valves on either side of the check valves, plus appropriately located test cocks for the testing of the check and relief valves.
- X. System Hazard: An actual or potential threat of severe damage to the physical properties of the public potable water system or of a pollution or contamination which would have a protracted effect on the quality of the potable water in the system.
- Y. Used Water: Any water supplied by the water division from a public potable water system to a consumers water system after it has passed through the point of delivery and is no longer under the sanitary control of the water division.
- Z. Water Service Connections: The terminal end of a service connection from the public potable water system; i.e. where the water division loses jurisdiction and sanitary control over the water at its point of delivery to the customer's water system. If a meter is installed at the end of the service connection, then the service connection shall mean the downstream end of the meter. "Service connection" also includes water service connection from a fire hydrant and all other temporary or emergency

water service connections from the public potable water system, including fire suppression systems, rather public or private.

#### **1.4 SUBMITTALS**

- A. Back Flow Prevention Assembly or Device Manufacturer Documentation.
- B. Certified Inspection Test Results within 5 work days of test if it fails and within 30 days if device passes.
- C. Documentation of date of installation, tests, repairs, overhauls, and replacements.

#### **1.5 QUALITY ASSURANCE**

- A. Proof of certification of backflow technician performing test.
- B. Installation by licensed plumber.

#### **1.6 ACCEPTANCE**

- A. Site inspection by City Backflow Inspector prior to turning water on to the facility.
- B. Initial test shall be completed within 10 days of first use.
- C. Passing test completed by Certified Backflow Technician.
- D. Acceptance by City Backflow Inspector.

### **PART 2 PRODUCTS**

#### **2.1. REDUCED PRESSURE PRINCIPLE ASSEMBLY**

- A. Compliant with ASSE 1013.
- B. Completely compliant with laboratory and field performance specifications of the FCCC&HR.
- C. Recognized as approved by Utah Division of Drinking Water.

#### **2.2 ATOMOSPHERIC VACUUM BREAKER**

- A. Compliant with ASSE 1001.
- B. Completely compliant with laboratory and field performance specifications of the FCCC&HR.
- C. Recognized as approved by Utah Division of Drinking Water.

#### **2.3 PRESSURE VACUUM BREAKER ASSEMBLY**

- A. Compliant with ASSE 1015.
- B. Completely compliant with laboratory and field performance specifications of the FCCC&HR.
- C. Recognized as approved by Utah Division of Drinking Water.

#### **2.3 SPILL RESISTANT PRESSURE VACUUM BREAKER ASSEMBLY**

- A. Compliant with ASSE 1056.
- B. Completely compliant with laboratory and field performance specifications of the FCCC&HR.
- C. Recognized as approved by Utah Division of Drinking Water.

**2.4 DOUBLE CHECK VALVE ASSEMBLY**

- A. Compliant with ASSE 1020 or ASSE 1056.
- B. Completely compliant with laboratory and field performance specifications of the FCCC&HR.
- C. Recognized as approved by Utah Division of Drinking Water.

**2.5 HOSE CONNECTION VACUUM BREAKER**

- A. Compliant with ASSE 1011
- B. Completely compliant with laboratory and field performance specifications of the FCCC&HR.
- C. Recognized as approved by Utah Division of Drinking Water.

**2.6 AIR GAP**

- A. Compliant with ASME A112.1.2.

**PART 3 EXECUTION****3.1 REDUCED PRESSURE PRINCIPLE ASSEMBLY**

- A. Used for Health and non-health hazards and against back siphonage and back pressure backflow conditions.
- B. Protect from freezing and vandalism where applicable.
- C. Bottom of the assembly shall be a minimum of 12 inches above the ground or floor.
- D. Body of the assembly shall have a minimum of 12 inches clearance from any wall, ceiling, and obstacle and shall be readily accessible for testing, repair, and/or maintenance.
- E. Relief port waste drain line shall be sized to accommodate full relief port discharge and any other discharging fixtures going to this drain. Drain line shall be free draining.
- F. Assembly shall not be installed in pits.
- G. This assembly is not allowed for connection to any waste disposal line including sanitary sewer, storm drains, or vents.
- H. Install horizontally unless assembly is listed as approved by Utah Division of Drinking Water for vertical assembly.

**3.2 DOUBLE CHECK VALVE ASSEMBLY**

- A. Used for non-health hazards only and back siphonage and/or back pressure backflow conditions.
- B. Protect from freezing and vandalism where applicable.
- C. Bottom of the assembly shall be a minimum of 12 inches above the ground or floor.
- D. Body of the assembly shall have a minimum of 12 inches clearance from any wall, ceiling, and obstacle and shall be readily accessible for testing, repair, and/or maintenance.

- E. Assembly may be installed in a pit, but must have 12 inches of clearance on all sides.
- F. Install horizontally unless assembly is listed as approved by Utah Division of Drinking Water for vertical assembly.

### **3.3 PRESSURE VACUUM BREAKER ASSEMBLY**

- A. Used for high health and non-health hazards and back siphonage conditions only.  
This assembly is not allowed for back pressure conditions.
- B. Protect from freezing and vandalism where applicable.
- C. Bottom of the assembly shall be a minimum of 12 inches above the highest downstream point of use.
- D. Body of the assembly shall be easily accessible for testing, repair, and maintenance.
- E. This assembly shall not be installed in a pit or underground under any condition.
- F. Install assembly vertical only.

### **3.4 SPILL RESISTANT PRESSURE VACUUM BREAKER ASSEMBLY**

- A. Used for high health and non-health hazards and back siphonage conditions only.  
This assembly is not allowed for back pressure conditions.
- B. Protect from freezing and vandalism where applicable.
- C. Bottom of the assembly shall be a minimum of 12 inches above the highest downstream point of use.
- D. Body of the assembly shall be easily accessible for testing, repair, and maintenance.
- E. This assembly shall not be installed in a pit or underground under any condition.
- F. Install assembly vertical only.

### **3.5 ATMOSPHERIC VACUUM BREAKER**

- A. Used for high health and non-health hazards and back siphonage conditions only.  
This assembly is not allowed for back pressure conditions.
- B. Protect from freezing and vandalism where applicable.
- C. Bottom of the assembly shall be a minimum of 6 inches above the highest downstream point of use.
- D. Install on downstream (discharge) side of any valves.
- D. Body of the assembly shall be easily accessible for testing, repair, and maintenance.
- E. This assembly shall not be installed in a pit or underground under any condition.
- F. Install assembly vertical only.
- G. This assembly shall NOT be installed where it may be subjected to continuous pressures for more than 12 consecutive hours.

### **3.6 AIR GAP**

- A. Used for high health and non-health hazards.
- B. Air gap shall be one (1) inch or two times (2x) the diameter of the incoming pipe measured ten (10) diameters from the termination of the pipe, WHICHEVER is greater.

- C. Air gap is measured from the flood rim of the receptacle or vat and the termination of the end of the water line.
- D. Where air gap is within two (2) pipe diameters (horizontal measurement) of a wall or vertical surface, increase the air gap by the greater of 1.5 inches or three (3) times the incoming pipe diameter.

### **3.7 HOSE BIB VACUUM BREAKER**

- A. Used for non-health hazards only and back siphonage conditions only. This assembly is not allowed for high hazard and/or back pressure conditions.
- B. Install with the anti-removal locking device engaged.

END OF SECTION

## SECTION 33 12 16 AMENDED WATER VALVES

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Gate, butterfly, plug, check, pressure reducing, pressure relief, control valves and their installation.
- B. Related work includes but is not limited to,
  - 1. Excavation, Section 31 23 16.
  - 2. Trench backfill, Section 33 05 20 .
  - 3. Landscape restoration, Section 32 92 00 or Section 32 93 13.
  - 4. Pavement restoration, Section 33 05 25.

#### 1.2 REFERENCES

- A. AWWA C111: American National Standard for Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
- B. AWWA C504: AWWA Standard for Rubber-Seated Butterfly Valves.
- C. AWWA C508: AWWA Standard for Swing-Check Valves for Waterworks Service, 2 In. Through 24 In. NPS.
- D. AWWA C509: AWWA Standard for Resilient-Seated Gate Valves for Water and Sewerage Systems.
- E. AWWA C550: AWWA Standard for Protective Interior Coatings for Valves and Hydrants.
- F. AWWA C600: AWWA Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances.
- G. AWWA C515, Reduced Wall, Resilient-Seated Gate Valves for Water Supply Service.

#### 1.3 SUBMITTALS

- A. Provide technical information as required for evaluating the quality of the valve. As a minimum include dimensions, weights, materials lists and operation charts.

### PART 2 PRODUCTS

#### 2.1 VALVES - GENERAL

- A. Underground:
  - 1. Less than 3 inches: Screwed ends.
  - 2. 3 inches and larger: Flanged or mechanical joint ends as specified. Non-rising stem. Two inches square operating nut. Low alloy steel bolts, AWWA C111.
- B. Submerged or Above Sewage or Water:

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1. Valve body bolts per manufacturer's recommendations.
  2. For joining valve to piping system use stainless steel nuts and bolts, Section 05 05 23.
- C. Below an Operating Deck: Provide shaft extension from the valve to deck level.
- D. Above Ground: Non-rising stems equipped with a hand wheel.
- E. Manually Operated Valves Over 6 feet Above Operating Level: Provide chain operated handles.
- F. Clearance: Install so that handles clear all obstruction when moved from open to closed.

G. Rated Working Pressure: 250 psi unless indicated.

H. Coating: Interior, AWWA C550. Exterior per manufacturer's recommendation.

**Deleted:** G. Rated Working Pressure: 150 psi unless indicated.

**Deleted:** ¶

## 2.2 GATE VALVES

A. Material: Cast iron body, bronze mounted. Furnish valves smaller than 12 inches that conform to the requirements of AWWA C509, non-rising stem design with "O" ring seals. Valves 12 inches and larger shall be Butterfly Valves.

- B. Operating Direction: Open counterclockwise.
- C. Buried Valves: Flanged, mechanical joint, or as indicated.

**Deleted:** A. Material: Cast iron body, bronze mounted. Furnish valves 3 inches through 48 inches that conform to the requirements of AWWA C509, non-rising stem design with "O" ring seals.

**Deleted:** ¶

## 2.3 BUTTERFLY VALVES

- A. Material: Cast iron body, bronze mounted. Furnish valves 3 inches through 48 inches that conform to the requirements of AWWA C504.
- B. Body Type: Short body or long body at CONTRACTOR's option or short body valves only where the disc will not interfere with adjacent fittings.
- C. Wafer Valves: Subject to approval.

## 2.4 ECCENTRIC PLUG VALVES

- A. Material: Cast iron body, bronze mounted, non-lubricated, eccentric, quarter-turn type with resilient face plugs, ductile iron discs with upper and lower shafts integral.
- B. Markings: Indicate open and close position.
- C. Port Areas: At least 82 percent of full pipe area.
- D. Resilient Seat Seals: Buna N, field replaceable.

## 2.5 CHECK VALVES

- A. Material: AWWA C508.
- B. Valves 2-1/2 inches in Size and Smaller: 200 psi working pressure Y-pattern, bronze, regrinding, swing check valve with screwed ends.
- C. Valves 3 inches in Size and Larger: Iron body, bronze mounted, flanged end, swing valves with stainless steel hinge pins.
- D. Outside Weight and Lever: Required.

**2.6 PRESSURE REDUCING VALVES - SERVICE LINE**

- A. Operation: Capable of reducing a varying higher upstream pressure to an adjustable constant lower downstream pressure.
- B. Spring and nylon reinforced diaphragm type construction.
- C. Equip with Y-strainer upstream of valve.

**2.7 PRESSURE REDUCING VALVES - MAIN LINE**

- A. Operation: Capable of maintaining an adjustable constant downstream pressure regardless of upstream pressure.
- B. Type: Hydraulically operated using a direct-acting, spring-loaded, normally open, pilot valve controlled diaphragm.
- C. Provide a single removable seat and a resilient disc. No "O" ring type discs permitted. No external packing glands permitted. No pistons operating the main valve or pilot controls permitted.
- D. Equip with Y-strainers on the pilot controls, variable closing and opening speed controls and a valve position indicator.
- E. Rating: 250 psi working pressure with flanged connections.
- F. Include an upstream and downstream pressure gage capable of accurately measuring system pressures.

**2.8 PRESSURE RELIEF VALVES**

- A. Operation: Maintain a constant upstream pressure by passing or relieving excess pressure.
- B. Closed Valves: Drip-tight.
- C. Type: Hydraulically operated, pilot control using a diaphragm with a single removable seat and resilient disc.
- D. Pilot Controls: Direct acting, adjustable between 20 and 200 psi, springloaded diaphragm valve.
- E. Rating: 250 psi working pressure with flanged connections.

**2.9 CONTROL VALVE**

- A. Types: Diaphragm actuated, single seated, composition disc, hydraulically operated globe valve.
- B. Pilot Controls: Externally mounted, four-way, solenoid pilot valve with self cleaning strainers and diaphragm type check valves.
- C. Equip with a limit switch for pump control.
- D. Equip with a built-in lift check valve to prevent flow reversal.
- E. Rating: 250 psi working pressure with flanged connections.
- F. Solenoids and the Limit Switch: Supplied with operating voltage as indicated.

**PART 3 EXECUTION****3.1 INSTALLATION**

- A. Flush all lines before valve installation.
- B. In ductile iron water mains install valves, AWWA C600.
- C. Install butterfly valve shafts vertical in Vault boxes and horizontal otherwise.
- D. Valves isolating construction from existing system shall only be operated by OWNER. Any deviation from this will be treated as a Class B Misdemeanor.

END OF SECTION

## **SECTION 33 12 19 AMENDED HYDRANTS**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Dry-barrel fire hydrants, valves, piping and accessories.

#### **1.2 REFERENCES**

- A. AWWA C110: American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In., for Water and Other Liquids.
- B. AWWA C111: American National Standard for Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
- C. AWWA C209: AWWA Standard for Cold-Applied Tape Coatings for the Exterior of Special Section, Connections, and Fittings for Steel Water Pipelines.
- D. AWWA C210: AWWA Standard for Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.
- E. AWWA C213: AWWA Standard for Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel water Pipelines.
- F. AWWA C214: AWWA Standard for Tape Coating Systems for the Exterior of Steel Water Pipelines.
- G. AWWA C502: AWWA Standard for Dry-Barrel Fire Hydrants.
- H. AWWA M17: AWWA Manual for Installation, Operation, and Maintenance of Fire Hydrants.

#### **1.3 PRODUCT HANDLING**

- A. Package fire hydrants, gate valves, and valve boxes for protection against dirt and damage during shipment and storage.
- B. Do not plug drain hole.

#### **1.4 SUBMITTALS**

- A. Product Data: Manufacturer's technical product data and installation instructions.
- B. Shop Drawings: Show interface and spatial relationship between piping and adjacent structures.
- C. Field Quality Control Reports: For system commissioning.

#### **1.5 JOB CONDITIONS**

- A. Notify appropriate fire department as soon as hydrant is removed or placed in service.

**PART 2 PRODUCTS**

**2.1 DRY-BARREL FIRE HYDRANT**

A. Cast iron compression type, AWWA C502, opening against pressure and closing with pressure, base valve design, 250 psi working pressure, with 1/4 inch diameter minimum tapping and bronze plug in standpipe.

**Deleted:** A. Cast iron compression type, AWWA C502, opening against pressure and closing with pressure, base valve design, 150 psi working pressure, with 1/4 inch diameter minimum tapping and bronze plug in standpipe.

**Deleted:** ¶

- 1. Size: 5-1/4 inch valve opening.
- 2. Direction to Open Hydrant: Counterclockwise.
- 3. Size and Shape of Operating and Cap Nuts: Pentagon. 1-1/2 inch point to flat.
- 4. Hose Nozzles: Two 2-1/2 inch National Standard Thread, cap, gasket and chain.
- 5. Pumper Nozzle: One 4-1/2 inch National Standard Thread, cap, gasket and chain.

6. Depth of Burial: 60 inches or consistent with main depth.

**Deleted:** 6. Depth of Burial: 48 inches or consistent with main depth.

**Deleted:** ¶

7. Connection to Main: 6 inches flanges or mechanical joint.

8. Pressure: 250 psi working pressure and 300 psi hydrostatic pressure.

**Deleted:** 8. Pressure: 150 psi working pressure and 300 psi hydrostatic pressure.

**Deleted:** ¶

9. Inlet Bottom Connection: 6 inches mechanical joint or flanged in accordance with AWWA C110 and AWWA C111, designed to allow separation at the sidewalk level when hydrant is sheared off.

10. Automatic Drain: Opens as the hydrant is closed.

11. Hydrant Flag: Solid metal flag installed on 2.5 inch nozzle. Available from the City of Logan Water Division.

12. Hydrant Brands Allowed:

- a. Clow Medallion
- b. Mueller Super Centurion
- c. East Jordan Iron Works (EJIW) 5BR250 - WATERMASTER
- d. No Equals allowed.

**2.2 PIPE AND FITTINGS**

- A. Ductile iron, Section 33 05 05. Standard drilling, AWWA C110.
- B. PVC, Section 33 05 07.
- C. Steel, Section 33 05 09. Standard drilling, 150 lb.
- D. Spool, Schedule 40 steel, epoxy lined, exterior wrapped with minimum 60 mil thick tape wrap, AWWA C210 or C213 and C209 or C214 with two welded in place 150 lb. steel ANSI B 16.5 slip on flanges.

**2.3 VALVES**

- A. Gate valve. Section 33 12 19.
- B. If indicated, furnish an auxiliary 6 inch diameter valve with end connections as required.

**2.4 ACCESSORIES**

- A. Bolts, Nuts, Washers: Stainless steel, Section 05 05 23.

- B. Anchorages: Provide anchorages for tees, wyes, crosses, plugs, caps, bends, valves, and hydrants. After installation, apply full coat of asphalt or other acceptable corrosion-retarding material to surfaces of ferrous anchorages.
- C. Thrust Blocks: Cast-in-plac concrete, Class 2000 minimum, Section 03 30 04.
- D. Valve Box, Valve Chamber: Section 33 12 19.

**PART 3 EXECUTION**

**3.1 PREPARATION**

- A. Excavation, Section 31 23 16.

**3.2 INSTALLATION**

- A. Install hydrants, valves, and valve boxes as indicated and located in accordance with AWWA M17. Hydrants shall not be connected to or located within 10 feet of a sanitary sewer or storm drain.

B. Install so bottom of hydrant base flange is between 4 inches and 8 inches above final grade.

**Deleted:** B. Install so bottom of hydrant base flange is even with or less than 4 inches above grade.

- C. Point 4-1/2" pumper nozzle to face the street.

**Deleted:** ¶

- D. Drain holes at base of hydrant to remain clear with a minimum of 1 cubic yard of clean Sewer Rock (Section 32 11 23) placed around hydrant base and drain. Place sheet plastic over gravel to prevent silting.

E. Grease coat and cover with approved 8 mil polyethylene bag for unprotected ductile iron and steel parts.

**Deleted:** E. Coal tar and tape wrap steel pipe.

- F. Grease all buried nuts and bolts and wrap with 8 mil polyethylene sheet and tape.

G. Install thrust blocks, Section 33 11 00.

**Deleted:** G. Install thrust blocks, Section 33 12 19.

**Deleted:** ¶

**3.3 BACKFILLING**

- A. Secure water company permission to commence backfilling operation.
- B. Trenches, Section 33 05 20.
- C. Structures and landscaping, Section 31 23 23.
- D. Pavements, Section 32 05 10.

**3.4 PAINT**

- A. Paint buried portion of hydrant with two coats of coal tar enamel or asphalt.
- B. Paint hydrant barrel and caps with one coat primer and final coat per water company paint standards.

**3.5 FIELD QUALITY CONTROL**

- A. Commissioning, Section 33 08 00.
- B. Disinfection, Section 33 13 00.

END OF SECTION

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## SECTION 33 12 33 AMENDED WATER METER

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Water meters, service connections, materials.
- B. Related work includes but is not limited to,
  - 1. Excavation, Section 31 23 16.
  - 2. Trench backfill, Section 33 05 20 .
  - 3. Landscape restoration, Section 32 92 00 or Section 32 93 13.
  - 4. Pavement restoration, Section 33 05 25.

#### 1.2 REFERENCES

- A. AWWA C704: AWWA Standard for Cold-Water Meters - Propeller Type for Main Line Applications.
- B. AWWA C800: AWWA Standard for Underground Service Line Valves and Fittings.

#### 1.3 SUBMITTALS

- A. Manufacturer's test records on the range and accuracy of the meter being furnished.
- B. Equipment material diagram and parts schematic.

### PART 2 PRODUCTS

#### 2.1 METERS FOR SYSTEM PIPING

A. Provided by OWNER unless indicated otherwise.

#### 2.2 METERS FOR SERVICE PIPING

A. Provided by OWNER unless indicated otherwise.

#### 2.3 SERVICE LINE, VALVES, AND FITTINGS

- A. Service Pipe: Provide copper pipe, Section 33 05 03 or polyethylene pipe, (Section 33 05 06). The service pipe between the main and the meter and to a point not less than 1 foot from the public way side of the property line cannot exceed the meter size.
- B. Service Valves and Fittings: AWWA C800.
- C. Meter Setters: Brass, with angle fittings, saddle nuts and gaskets.
- D. Corporation Stops and Angle Valves: Invert key design.
- E. Bypasses: Not allowed on any service installation without approval of ENGINEER.

#### 2.4 METER BOXES

A. Meters to 1 inch service: 21-inch inside diameter by 60-inch minimum deep white HDPE or precast concrete meter box when installed in normal park strip with Type A or Type B curb and gutter. For all other Curb and Gutter Types, HDPE meter barrels

**Deleted:** A. Materials and Construction: AWWA C704

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**Deleted:** 1. Cast iron bodies with 175 psi working pressure flanged connections.¶  
 2. Built-in straightening vanes.¶  
 3. Working pressure 150 psi.¶  
 4. Polyethylene plastic propeller.¶  
 5. Stainless steel shaft with stainless steel ball bearings, lubricated by means of a single pressure fitting.¶  
 B. Accuracy: Plus or minus 2 percent of scale for velocities over 1 foot per second.¶  
 C. Totalizer: Six digits reading in units indicated.¶

**Deleted:** A. Meters to 1" Service: Plastic or asphalt-dipped corrugated metal. Fiber meter boxes are not acceptable. Provide a meter box with frame and cover of sufficient strength to withstand loadings in vehicular traffic areas without breaking.

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shall not be used. Provide meter box with frame and cover from D&L Supply, Model L2240-15 to receive 2-inch Neptune meter antenna.

B. Meters 1-1/2" and Larger: Reinforced concrete with a minimum clearance of 12" from each side of meter plumbing. Provide frame and cover from D&L Supply, Model B5019-03 to receive 2" Neptune meter antenna.

**Deleted:** B. Meters 1-1/2" and Larger: Reinforced concrete with a minimum clearance of 12" from each side of meter plumbing.

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## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- A. Install meter box, meter setters, valves, etc. at indicated locations. If not indicated, install in street right-of-way parking strip or at a location approved by ENGINEER.
- B. Install meter setters level and horizontal. Provide suitable pipe lengths to prevent stress.
- C. Do not operate any of the utility agency's main line valves. Contact agency if valves are to be operated. If required by water utility agency notify affected water users, Section 01 31 13.
- D. OWNER Supplied Meters: Installed by CONTRACTOR unless indicated otherwise.

END OF SECTION

## SECTION 33 13 00 AMENDED DISINFECTION

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Disinfection of potable water system.
- B. Test and report results.

#### 1.2 REFERENCES

- A. AWWA A100: AWWA Standard for Water Wells.
- B. AWWA B300: AWWA Standard for Hypochlorites.
- C. AWWA B301: AWWA Standard for Liquid Chlorine.
- D. AWWA C651: AWWA Standard for Disinfecting Water Mains.
- E. AWWA C652: AWWA Standard for Disinfection of Water-Storage Facilities.
- F. State of Utah: Public Drinking Water Regulations, Part 2, Section 12.

#### 1.3 DEFINITIONS

- A. Disinfectant Residual: The quantity of disinfectant in treated water.
- B. ppm: Parts per million.

#### 1.4 SUBMITTALS

- A. CONTRACTOR's evidence of experience in disinfection.
- B. Bacteriological laboratory's evidence of certification if laboratory is not OWNER's laboratory.

C. City of Logan Disinfection Report: 3 copies containing:

1. Date issued.
2. Project name and location.
3. Treatment contractor's name, address and phone number.
4. Type and form of disinfectant used.
5. Time and date of disinfectant injection started.
6. Time and date of disinfectant injection completed.
7. Test locations.
8. Initial and follow-up disinfectant residuals in ppm for each outlet tested.
9. Time and date of flushing start.
10. Time and date of flushing completion.
11. Disinfectant residual after flushing in ppm for each outlet tested.
12. Flush water disposal location and acceptance by local agency.

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D. City of Logan Bacteriological Report: 3 copies including:

1. Date issued.

Deleted: D. Bacteriological Report: 3 copies including:

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2. Project name and location.
3. Laboratory's name, certification number, address, and phone number.
4. Time and date of water Sample collection.
5. Name of person collecting Samples.
6. Test locations.
7. Time and date of laboratory test start.
8. Coliform bacteria test results for each outlet tested.
9. Certification that water conforms or fails to conform to bacterial standards of State of Utah public drinking water regulations.
10. Bacteriologist's signature.

#### **1.5 QUALITY ASSURANCE**

- A. Bacteriological Laboratory: Certified by State of Utah if laboratory is other than OWNER's laboratory.

#### **1.6 PRODUCT HANDLING**

- A. Store and protect disinfectant in accordance with manufacturer's recommendations to protect against damage or contamination. Do not use unsuitable disinfectant.
- B. Follow all instruction labeling for safe handling and storage of disinfectant materials.

#### **1.7 REGULATORY REQUIREMENTS**

- A. Conform to State of Utah public drinking water regulations.

### **PART 2 PRODUCTS**

#### **2.1 DISINFECTANT**

- A. Liquid Chlorine: AWWA B301 with chlorine 99.5 percent pure by volume.
- B. Sodium Hypochlorite: AWWA B300 with not less than 100 grams per liter available chlorine.
- C. Calcium Hypochlorite: AWWA B300 with 65 to 70 percent available chlorine by weight in granular form.
- D. Powder, tablet, or gas according to manufacturer's specification.

#### **2.2 ALKALI**

- A. Caustic Soda or Soda Ash.

#### **2.3 ACID**

- A. Hydrochloric (Muriatic) type.

**PART 3 EXECUTION**

**3.1 PREPARATION**

- A. Provide necessary signs, barricades, and notices to prevent accidental exposure to disinfecting materials, consuming disinfecting water, or disturbing the system being disinfected.
- B. Make sure the potable water system is complete, clean, and that the system to be disinfected is not connected to the existing system.

**3.2 DISINFECTION OF WATER LINES**

- ~~A. Use one method defined under AWWA C651 that is acceptable to ENGINEER. Fill pipe line to required residuals.~~
- ~~B. Starting at outlet closest to water source, bleed water from each outlet until chlorine residual reaches outlet. Repeat process at each outlet throughout system.~~
- ~~C. Flush the chlorinated water from the main through hydrants or if a hydrant does not exist, install a tap sufficient in size to provide a 2.5 feet per second flushing velocity in the line. Show that the chlorine concentration in the water leaving the main is no higher than that generally prevailing in the system or is acceptable for domestic use.~~
- ~~D. Collect bacteriological water sample at end of line to be tested. If sample fails bacteriological test, flush system and retest.~~
- ~~E. If flushing does not produce a passing bacteriological test disperse disinfectant throughout system to obtain 10 to 25 ppm of free chlorine residual. Maintain residual for 24-hours.~~
- ~~F. Flush the chlorinated water from the main until chlorine measurements show the concentration in the water leaving the main is no higher than that generally prevailing in the system or is acceptable for domestic use.~~
- ~~G. After a negative bacteriological sample is obtained, let the system relax for 24 hours. Flush thirty (30) seconds and collect a subsequent bacteriological sample for testing. If the subsequent test is negative then water line is acceptable.~~
- ~~H. Pressure testing per Section 33 08 00.~~

**Deleted:** A. Use one method defined under AWWA C651 that is acceptable to ENGINEER.

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**Deleted:** B. After pressure testing per Section 33 08 00, flush system through hydrants or if a hydrant does not exist, install a tap of sufficient size to provide 2.5 feet per second flushing velocity in the line.¶

**Deleted:** D

**Deleted:** Collect a bacteriological water sample at end of line to be tested. If sample fails bacteriological test, flush system and retest. Continue flushing and retesting until a good sample is obtained.¶

**Deleted:** E. If flushing does not produce a passing bacteriological test disperse disinfectant throughout system to obtain 10 to 25 ppm of free chlorine residual.¶

**Deleted:** F. Flush the chlorinated water from the main until chlorine measurements show the concentration in the water leaving the main is no higher than that generally prevailing in the system or is acceptable for domestic use.¶

**Deleted:** G. After a negative bacteriological sample is obtained, let the system relax for 24 hours. Flush and collect a subsequent bacteriological sample for testing. If the subsequent test is negative then water line is acceptable.

**3.3 DISINFECTION OF CULINARY WELLS**

- A. Use one method defined under AWWA A100 that is acceptable to ENGINEER.
- B. Do not start disinfection until well is thoroughly cleaned.
- C. Use a disinfecting solution containing a minimum of 50 ppm residual chlorine.
- D. Flush system after disinfection.

**3.4 DISINFECTION OF WATER STORAGE RESERVOIRS**

- A. Use one method defined under AWWA C652 that is acceptable to the ENGINEER.
- B. Do not start disinfection until water storage tank is thoroughly cleaned.
- C. Provide and use necessary safety equipment for workers in contact with disinfectant or gasses.

D. Flush system after disinfection.

### 3.5 FIELD QUALITY CONTROL

A. Bacteriological Test:

1. Collect Samples for testing no sooner than 16 hours after system flushing.
2. Analyze water samples per State of Utah requirements.
3. If bacteriological test proves water quality to be unacceptable, repeat system treatment.
4. Do not place water systems into service until a negative bacteriological test is made. Provide a copy of the negative bacteriological test to ENGINEER.

B. Disposal of Disinfectant:

1. Legally dispose of disinfecting water and ensure no chlorine buildup or damage to the environment.
2. Dechlorinate any water discharged prior to discharge to the storm water system or natural water bodies. Discharge to the sanitary sewer system is not allowed without approval of the ENGINEER and LOGAN CITY ENVIRONMENTAL DEPARTMENT.

END OF SECTION

## SECTION 33 31 00 AMENDED SANITARY SEWERAGE SYSTEMS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Gravity sanitary sewerage systems.
- B. Pressure systems are indicated in Section 33 11 00.

#### 1.2 REFERENCES

- A. ASTM C 478: Standard Specification for Precast Reinforced Concrete Manhole Section.
- B. ASTM C 891: Standard Practice for Installation of Underground Precast Concrete Utility Structures.
- C. ASTM C 923: Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.

#### 1.3 PERFORMANCE REQUIREMENTS

A. Vertical Cover: Unless indicated otherwise, 3 feet minimum for laterals and 4 feet when subjected to light construction equipment loads.

**Deleted:** A. Vertical Cover: Unless indicated otherwise, 2 feet minimum for laterals and 4 feet when subjected to light construction equipment loads.

- B. Remove any section of pipe already placed that is found to be out of alignment tolerance indicated, defective, or damaged. Relay or replace at no additional cost to OWNER.

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#### 1.4 PROJECT CONDITIONS

- A. Minimize neighborhood traffic interruptions. Barricade stockpiles.
- B. Provide access to adjacent properties for local traffic and pedestrians, Section 01 31 13.
- C. Repair public and private facilities damaged by CONTRACTOR.
- D. Prior to Backfilling: Commission pipeline per Section 33 08 00. Provide sizes and types of equipment connections and fittings which match pipe materials when pressure testing system.

#### 1.5 ACCEPTANCE

- A. Each sanitary sewer system component must pass applicable requirements in Section 33 08 00.

### PART 2 PRODUCTS

#### 2.1 PIPING AND FITTINGS

- A. Provide piping materials and factory fabricated piping products of sizes, types, and classes indicated.
- B. Where not indicated, provide proper selection acceptable to ENGINEER to comply with installation requirements.

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C. Provide pipe fittings and accessories of same material and weight or class as pipe, with joining method indicated or recommended by manufacturer.

**2.2 MORTAR, GROUT AND CONCRETE**

A. Mortar: Cement, Section 04 05 16.

B. Grout: Cement based shrinkage resistant grout, Section 03 61 00

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C. Concrete:

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- 1. Cast-in-place: Class 4000, Section 03 30 04.
- 2. Precast: Class 5000, Section 03 40 00.

**2.3 MANHOLES**

A. Basin: Precast concrete, ASTM C 478.

B. Steps: None.

C. Top: Concentric cone. Concentric flat slab concrete deck allowed only with ENGINEER's permission.

D. Frame and Cover: 30 inch, similar to D&L Supply Model A-1181 or approved equal; Section 05 56 00 with flat top design meeting load rating HS-20 with pick hole, air vents, and labeled "SEWER".

Deleted: D. Frame and Cover: Scoriated, asphalt coated, heavy duty, ductile iron; Section 05 56 00 with flat top design meetin load rating H-20 and appropriate utility lettering. Shape, size and lifting device as indicated.

E. Pipe Connectors: Resilient, ASTM C 923. Sand mortar grout pipe connectios.

F. Joints in Sections: Bituminous mastic gasket-type sealant unless indicated otherwise.

**2.4 LATERAL CONNECTIONS 6-INCHES OR SMALLER**

A. Existing Sewer Mains: Use ROMAC, no equivalent, round hole sewer tapping saddle with two stainless steel straps.

B. New Sewer Mains: Use preformed wye of same materials as sewer main located at 45 degrees above centerline. This also applies to new subdivisions.

**2.5 LATERAL CONNECTIONS LARGER THAN 6-INCHES**

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A. Existing and new sewer mains: Manholes are required for all laterals larger than 6-inches.

**PART 3 EXECUTION**

**3.1 PREPARATION**

A. Verify Trench Excavation is ready to receive work, and dimensions, and elevations are as indicated.

B. Hand trim Excavations to required elevations. Backfill over excavations and compact, Section 31 23 26.

Deleted: B. Hand trim Excavations to required elevations. Backfill over excavations and compact, Section 33 23 26.

C. Examine areas and conditions under which materials and products are to be installed. Do not proceed with system installation until unsatisfactory conditions have been corrected in manner acceptable to system installer.

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D. Clearly identify and promptly set aside defective or damaged pipe.

E. Use pipe cutting tool acceptable to pipe manufacturer.

**3.2 INSTALLATION - PIPE AND FITTINGS**

A. Place bell or groove end facing upstream.

B. Install gaskets per manufacturer's recommendations.

C. Plug leakproof such pipeline branches, stubs or other open ends which are not to be immediately connected.

D. Clean interior of pipe of dirt and debris as work progresses.

E. Meet line and grade tolerance specified in Section 33 08 00.

**3.3 INSTALLATION - MANHOLES**

A. Form bottom of Excavation clean and smooth to correct elevation.

B. Place structures in location indicated.

C. Install precast units, ASTM C 891.

D. Provide elevations and pipe inverts for inlets and outlets indicated. Form inverts of channels smooth with a semi-circular cross section. Bends and turns shall be a smooth long-radius curve with the point of curvature beginning at the inlet of the pipe and ending within 12

**Deleted:** D. Provide elevations and pipe inverts for inlets and outlets indicated.

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E. When structures occur in pavements, mount frame and cover 1/2 inch below finished surface, elsewhere set 3 inches above finished grade. Provide asphalt compacted tight to the frame of the manhole lid.

**Deleted:** E. When structures occur in Pavements, mount frame and cover 1/2 inch below finished surface, elsewhere set 3 inches above finished grade. Provide.

F. Where three or more pipes enter a manhole or where one or more of the pipes are 12 inches or larger, install a 60 inch inside diameter manhole; all others install a 48 inch manhole.

**3.4 ABANDONED UTILITIES**

A. Plug and cap with concrete all open ends of abandoned underground utilities which are to remain in place.

B. Provide closure to withstand hydrostatic or earth pressure which may result after ends of abandoned utilities have been closed.

**3.5 TAP CONNECTIONS - 6 INCHES AND SMALLER**

A. Field cutting into new piping will not be permitted unless written permission is obtained from ENGINEER. Laterals shall be installed into new piping using wyes or tees with rubber ring type gaskets.

**Deleted:** A. Field cutting into new or existing piping will not be permitted unless written permission is obtained from ENGINEER.

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B. Existing pipes shall be tapped using a round hole tap and a ROMAC stainless steel, with two stainless steel straps, sanitary sewer tapping saddle.

**Deleted:** B. Make connections to existing pipe and underground structures, so connections will conform as nearly as practicable to requirements specified for new work.

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C. For taps into existing underground structures, cut opening into unit sufficiently large to allow installation of KOR-N-SEAL Manhole boot. Cut ends of connection passing through pipe or structure wall to conform to shape of and parallel with inside wall, unless otherwise indicated. Grout connection to provide smooth transition inlet into pipe.

**Deleted:** C. Use commercially manufactured wyes for branch connections. Spring wyes into existing line and encase entire wye, plus 6 inches overlap, with not less than 6 inches of concrete.

D. For taps into existing 24 inches or larger piping, or to underground structures, cut opening into unit sufficiently large to allow 3 inches of concrete to be packed around entering connection. Cut ends of connection passing through pipe or structure wall to conform to shape of and parallel with inside wall, unless otherwise indicated. Grout connection to provide smooth transition inlet into pipe.

**3.6 TAP CONNECTIONS - LARGER THAN 6 INCHES**

A. Not allowed. Provide a Manhole structure.

**3.7 JOINTS**

A. Join pipe per manufacturer's recommendation or as indicated.

B. Joining Pipe of Different Sizes: At Manholes only.

C. Use neoprene couplings with stainless steel bands to make connections between dissimilar pipe, or where standard pipeline joints are impractical.

**3.8 BACKFILLING**

A. Prior to Backfilling: Commission pipeline, Section 33 08 00. Provide sizes and types of equipment connections and fittings which match pipe materials when pressure testing system.

B. Trenches: Section 33 05 20.

C. Structures: Section 31 23 23.

D. Landscapes, Section 32 91 19.

Deleted: C. Structures or Landscapes: Section 31 23 23.

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**3.9 CLEANING**

A. Remove debris, concrete, or other extraneous material which accumulates in existing pipes or structures.

B. Clean all pipelines after testing. Do not flush sand, gravel, concrete, debris or other materials into existing piping system.

**3.10 SURFACE RESTORATIONS**

A. Provide temporary paved surfaces where Trenches pass through roadways, Driveways, or sidewalks.

B. Restore paved surfaces, Section 33 05 25.

C. Finish landscaped surfaces:

1. With grass, Section 32 92 00 or

2. Other ground cover, Section 32 93 13.

END OF SECTION

## **SECTION 33 41 00 AMENDED STORM DRAINAGE SYSTEMS**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Gravity systems such as irrigation, sub-drains, and storm drains.
- B. Pressure systems are indicated in Section 33 12 19.

#### **1.2 REFERENCES**

- A. ASTM C 478: Standard Specification for Precast Reinforced Concrete Manhole Section.
- B. ASTM C 891: Standard Practice for Installation of Underground Precast Concrete Utility Structures.
- C. ASTM C 923: Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.

#### **1.3 PERFORMANCE REQUIREMENTS**

- A. Vertical Cover: 2 feet minimum or as indicated.
- B. Remove any section of pipe already placed that is found to be out of alignment tolerance indicated, defective, or damaged. Relay or replace without additional cost to OWNER.

#### **1.4 PROJECT CONDITIONS**

- A. Minimize neighborhood traffic interruptions. Barricade stockpiles.
- B. Provide access to adjacent properties for local traffic and pedestrians, Section 01 31 13.
- C. Repair public and private facilities damaged by CONTRACTOR.
- D. Prior to Backfilling: Commission pipeline per Section 33 08 00. Provide sizes and types of equipment connections and fittings which match pipe materials when pressure testing system.

#### **1.5 ACCEPTANCE**

- A. Each storm drain system component must pass applicable requirements in Section 33 08 00.

### **PART 2 PRODUCTS**

#### **2.1 PIPING AND FITTINGS**

- A. Provide piping materials and factory fabricated piping products of sizes, types, and classes indicated.
- B. Where not indicated, provide proper selection acceptable to ENGINEER to comply with installation requirements.

- C. Provide pipe fittings and accessories of same material and weight or class as pipe, with joining method indicated or recommended by manufacturer.

## **2.2 IN-PLANE WALL DRAINAGE**

- A. Drainage Core: Manufacturer's standard three-dimensional non-biodegradable, plastic designed to effectively conduct water to foundation drainage system.
- B. Filter Fabric: Manufacturer's standard non-woven geotextile fabric of polypropylene or polyester fibers, or combination.

## **2.3 SUB DRAIN FILL MATERIALS**

- A. Sewer Rock, Section 32 11 23 and geotextile, Section 31 05 19.

## **2.4 MORTAR, GROUT AND CONCRETE**

- A. Mortar: Cement, Section 04 05 16.
- B. Grout: Cement, Section 03 61 00.
- C Concrete:
  - 1. Cast-in-place: Class 4000, Section 03 30 04.
  - 2. Precast: Class 5000, Section 03 40 00.

## **2.5 CLEANOUTS AND MANHOLES**

- A. Basin: Concrete floor with cast in place concrete walls or ASTM C 478 precast requirements.
- B. Steps: None.
- C. Top: Concentric cone. Concentric flat slab concrete deck allowed only with ENGINEER's permission.
- D. Frame and Cover: Asphalt coated, heavy duty, ductile iron; Section 05 56 00 with flat top design meeting load rating H-20 and appropriate utility lettering. Shape, size and lifting device as indicated.
- E. Pipe Connectors:
  - 1. Precast Bases: Resilient, ASTM C 923. Sand mortar grout pipe connections.
  - 2. Cast in Place or Connections to Existing Manhole with Plastic Pipe: Use rubber Manhole adapter gasket for precast sections. Grout; Section 03 61 00 for cast in place sections.
- F. Joints in Sections: Bituminous mastic coating unless indicated otherwise.

## **2.6 INLETS AND CATCH BASINS**

- A. Basin: Concrete floor and walls.
- B. Frame and Grate:
  - 1. Asphalt coated, heavy duty, cast iron: Section 05 56 00. Shape and size as indicated.
  - 2. Galvanized, heavy duty, steel: Sections 05 12 00 and 05 05 10. Shape and size as indicated.
- C. Pipe Connectors: Resilient, ASTM C 923. Sand mortar grout.

**2.7 OUTFALLS**

- A. Cast-in-place or precast concrete with reinforced headwall, apron, and tapered sides. Provide riprap, Section 31 37 00, if indicated.

**2.8 DRAIN PIPE JOINT SCREENS**

- A. Heavy mesh burlap, coal-tar saturated felt, 18 to 14 mesh copper screening or synthetic drainage fabric.
- B. Plastic or corrosion resistant metal bands.

**PART 3 EXECUTION****3.1 PREPARATION**

- A. Verify Trench Excavation is ready to receive work, and dimensions, and elevations are as indicated.

~~B. Hand-trim Excavations to required elevations. Backfill over excavations and compact, Section 31 23 26.~~

- C. Remove stones larger than 2 inches or other hard matter that could damage pipe or impede backfilling or compaction.
- D. Examine areas and conditions under which materials and products are to be installed. Do not proceed with system installation until unsatisfactory conditions have been corrected in manner acceptable to system installer.
- E. Clearly identify and promptly set aside defective or damaged pipe.
- F. Use pipe cutting tool acceptable to pipe manufacturer.

**Deleted:** B. Hand-trim Excavations to required elevations. Backfill over excavations and compact, Section 33 05 05.

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**3.2 INSTALLATION - PIPE AND FITTINGS**

- A. Place bell or groove end facing upstream.
- B. Install gaskets per manufacturer's recommendations.
- C. Plug pipeline branches, stubs or other open ends which are not to be immediately connected.
- D. Clean interior of pipe of dirt and debris as work progresses.
- E. Insulate dissimilar metals from direct contact with each other using neoprene gaskets or asphalt coatings.
- F. Meet line and grade tolerance specified in Section 33 08 00.

**3.3 INSTALLATION - CLEANOUTS AND MANHOLES**

- A. Form bottom of Excavation clean and smooth to correct elevation.
- B. Place structures in location indicated.
- C. Install precast units, ASTM C 891.
- D. Provide elevations and pipe inverts for inlets and outlets indicated.
- E. Where structures occur in Pavements, mount frame and cover 1/2 inch below finished surface, elsewhere set 3 inches above finished grade. Provide a concrete Cover Collar between the frame and asphalt Pavement.

**3.4 INSTALLATION - INLETS OR CATCH BASINS**

- A. Form bottom of Excavation clean and smooth to correct elevation.
- B. Construct with all connecting piping and appurtenances in their final position.
- C. Cut all piping parallel to interior surface wall. Grout connection to provide smooth transition inlet into pipe.

**3.5 INSTALLATION - SUB DRAIN SYSTEMS**

- A. Install pipe and fittings per manufacturer's instruction.
- B. Open Joint Systems: Loosely butt pipe ends. Place 12 inches wide filter fabric around pipe circumference, centered over joint.
- C. Mechanical Joint Perforated Pipe System: Place pipe with perforations facing down.
- D. Place drainage pipe on bed of Sewer Rock, Section 31 05 13.

**3.6 ABANDONED UTILITIES**

- A. Use concrete to plug and cap open ends of abandoned underground utilities that are to remain in place.
- B. Provide closures to withstand hydrostatic or earth pressure that may result after ends of abandoned utilities have been closed.

**3.7 TAP CONNECTIONS**

- A. Not allowed. Provide a cleanout or Manhole structure.

**3.8 BACKFILLING**

- A. Prior to Backfilling: Commission pipeline, Section 33 08 00. Provide sizes and types of equipment connections and fittings which match pipe materials when pressure testing system.
- B. Trenches: Section 33 05 20.

C. Structures: Section 31 23 23.

D. Landscapes: Section 32 91 19.

Deleted: C. Structures or Landscapes:  
Section 31 23 23.

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**3.9 CLEANING**

- A. Remove debris, concrete, or other extraneous material that accumulates in existing piping or structures.
- B. Clean all pipelines after testing. Do not flush sand, gravel, concrete, debris or other materials into existing piping system.

**3.10 SURFACE RESTORATION**

- A. Provide temporary paved surfaces where Trenches pass through roadways, Driveways, or sidewalks.
- B. Restore paved surfaces, Section 33 05 25.
- C. Finish landscaped surfaces as applicable.
  - 1. With grass; Section 32 92 00 or
  - 2. Other ground cover; Section 32 93 13.

END OF SECTION

## **SECTION 33 47 00 AMENDED PONDS**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Clearing pond site and disposal of debris and unsuitable material.
- B. Materials for dikes.

#### **1.2 REFERENCES**

- A. ASTM D 3282: Standard Practice for Classification of Soils and Soil- Aggregate Mixtures for Highway Construction Purposes.

#### **1.3 SUBMITTALS**

- A. Laboratory analysis and control testing reports of fill to be used in dikes.
- B. Sample of geosynthetics to be installed.
- C. Quality assurance test results within 24 hour of completed test results.

#### **1.4 PERFORMANCE**

- A. Protection: Do not contaminate Embankment materials with debris or unsuitable material. Protect existing improvements, trees, structures or other items from damage during construction.
- B. Dust Control: Refer to Section 01 57 00. Prevent dust being a nuisance to the neighborhood, and concurrent performance of separate work.

#### **1.5 QUALITY ASSURANCE**

- A. Perform density tests to assure compacted backfills comply.
- B. Do not interrupt surface drainage systems at site without ENGINEER's approval.
- C. Control erosion during construction and correct any damage caused by runoff.

### **PART 2 PRODUCTS**

#### **2.1 BACKFILL SOILS**

- A. Section 31 23 16, over-excavation fill.
- B. Section 31 05 13, common fill.
- C. Section 32 11 23, crushed aggregate base.
- D. Section 31 05 15, cement treated fill.
- E. Impermeable Embankment: A-4, or A-6 material, ASTM D 3282, with a plasticity index of at least 10, and a coefficient of permeability less than  $7 \times 10^{-6}$  cm/sec.
- F. Obtain approval of the material to be supplied prior to beginning construction.

#### **2.2 GEOSYNTHETIC MATERIALS**

- A. Impermeable, nonbiodegradable sheet material that is inert to soil chemicals, resistant to molds, mildew, acids and alkalis, and within a pH range of 3 to 12.

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## PART 3 EXECUTION

### 3.1 CONSTRUCTION

- A. Remove and stockpile all topsoil material for later placement on the outer dike surfaces.
- B. Excavation: Section 31 23 16. Level areas where dikes are to be constructed.
- C. Subgrade: Scarify the top 12 inches and compact to 92 percent minimum, Standard Proctor Density, Section 31 23 26.
- D. Embankments: Place Embankment materials in lifts consistent with the compaction equipment used. Compact backfill soils to a Standard Proctor of 95 percent or greater. Do not construct Embankment with frozen or unapproved material.
- E. Shape dikes to the slopes indicated.

**Deleted:** C. Subgrade: Scarify the top 12 inches and compact Subgrade soils to a Standard Proctor Density of 92 percent or greater, Section 33 05 05.

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### 3.2 TOLERANCES

- A. Dike Surface: 1 inch plus or minus from true grade.
- B. Dike Width: 3 inches plus or minus from design dimension.
- C. Dike Alignment: 6 inches plus or minus from true line.

### 3.3 FINISHING

- A. After dikes have been constructed to the lines and grades indicated, spread topsoil on dikes and grade to uniform slope.
- B. Dispose of excess or unsuitable materials and smooth grade all affected areas.
- C. Leave site free of debris.

END OF SECTION

## **SECTION 33 71 73 AMENDED ELECTRICAL UTILITY SERVICES**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

A. Under ground and above ground electrical service systems.

#### **1.2 REFERENCES**

A. NFPA 70: National Electrical Code.

B. UL: Underwriters' Laboratories Inc.

#### **1.3 RELATED WORK**

A. Inspect, splice, and test continuity for all special telemetry cables prior to backfilling Trenches.

B. Related work includes but is not limited to,

1. Excavation, Section 31 23 16.

2. Trench backfill, Section 33 05 20 .

3. Landscape restoration, Section 32 92 00 or Section 32 93 13.

4. Pavement restoration, Section 33 05 25.

#### **1.4 PERFORMANCE REQUIREMENTS**

A. Conform to.

1. NFPA 70.

2. Electrical authority having jurisdiction.

### **PART 2 PRODUCTS**

#### **2.1 COMPONENTS**

A. Conduit: Section 26 05 33.

B. Concrete: Class 3000 minimum, Section 03 30 05 with No. 67 aggregate or larger and dye additive to give permanent red color.

C. Conductors: Section 26 05 13 and as indicated.

D. Cable Lugs: Suitable for application.

E. Duct Spacers: Fabricated plastic, UL approved.

F. Meter Sockets: Provide meter sockets which comply with requirements of power utility company.

G. Metering: Size metering to capacity of main switch or buss as applicable.

#### **2.2 BACKFILL**

A. Sand fill, Section 31 05 13.

B. Crushed aggregate base, Section 32 11 23.

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**PART 3 EXECUTION****3.1 PREPARATION**

- A. Coordinate utility locations, Section 01 31 13.
- B. Excavate, Section 31 23 16.

**3.2 INSTALLATION**

- A. Provide adaptation from conduit to PVC duct.
- B. Slope service to drainage point.
- C. Terminate service conduit in main panel and transformer with grounding bushings.  
Make suitable ground connection from bushing to distribution center ground bus.

D. Install on undisturbed soil where possible. Backfill and compact, Section 31 23 26.

**Deleted:** D. Install on undisturbed soil where possible. Backfill and compact, Section 33 05 20.

**3.3 DUCTBANK**

- A. Place concrete so that voids around ducts are filled.
- B. Provide minimum concrete thickness between ducts of 2 inches.
- C. Adjust final slopes on site to coordinate with existing utilities.
- D. Install drain assembly with saddle cutouts for each conduit. Tape drain assembly to each conduit to prevent entrance of concrete. Band drain assembly with 1/2 inch stainless steel straps to conduit assembly to prevent mechanical displacement.  
Connect to piping drain.
- E. After installation, clean and swab ducts.
- F. Install galvanized steel pull wires in spare ducts. Cap spare ducts.

**Deleted:** ¶

**3.4 DIRECT BURIAL**

- A. Level Trench with 3 inches minimum layer of sand. Cover conductors with 6 inches layer of sand. Provide physical protection acceptable to electrical authority having jurisdiction.

**3.5 SERVICE INSTALLATION**

- A. Provide ductbank from property line or supply authority's pole to transformer or building as required.
- B. Coordinate with utility company to install conductor from source to meter. Coordinate Trenching, supplying and placing of sand and backfilling with power utility company.

END OF SECTION

- B. Treated or Untreated Base Course: Lot size is one day's production. Sub-lot size is 500 tons.
1. ENGINEER is not obligated to accept changes in Target after any material is delivered to site.
  2. Lot is acceptable if gradation test deviations are within pay factor 1.00 limits. At ENGINEER's discretion, a Lot with a sub-lot test deviation greater than pay factor 0.70 limits may stay in place at 50 percent cost.

3. Suitability of Source: Meet Table 2 properties. A reduction in aggregate class will be accepted providing any costs for difference in excavation, backfill, and alternate design for CBR does not increase the Contract Price.