

SECTION 02612

HOT MIX ASPHALT

PART 1 GENERAL

1.01 SUMMARY

- A. Work to be performed under this section shall include all labor, equipment, materials and miscellaneous items necessary to furnish and install one or more courses of hot mix asphalts (HMA) constructed on a prepared surface in accordance with the Specifications or as shown on the Drawings. The finished product shall be in close conformity with the lines, grades, thickness, and typical cross sections shown on the Drawings or as established in the field.

1.02 REFERENCE STANDARDS

- A. All work is to be performed in accordance with the "Colorado Department of Transportation - Standard Specifications for Road and Bridge Construction", latest edition and as modified herein. The reference Specifications are not reproduced in their entirety.

1.03 SUBMITTALS

- A. Mix Design. Provide complete mix design by independent testing laboratory, including certifications of all material compliance. The job-mix formula for each mixture shall establish a single percentage of aggregate passing each required sieve size, a single percentage of asphalt material to be added to the aggregate, and a single temperature for the mixture at the discharge point of the plant.
 - 1. Submitted mix design shall be sealed by a Professional Engineer in the State of Colorado.
- B. Prime Coat. Certification of material.
- C. Tack Coat. Certification of material.

1.04 COORDINATION

- A. It shall be the responsibility of the Contractor under this section to coordinate this work with all other trades involved in the project. No paving work shall be started until the work of others has progressed to a point that a definable area can be paved; patching, blending, butting, etc. of work under this section will not be allowed except as required as part of the normal paving operation.

PART 2 PRODUCTS

2.01 COMPOSITION OF MIXTURE

- A. Reference Section 403.02 (further reference 401.02 through 401.06) Section 702, Section 703, and Section 704, with revisions and additions as follows:
 - 1. Use Grading SX (Ref. Section 703.04); aggregate gradation per Table 703-4.
 - 2. Superpave performance graded binder shall be PG 58-28 per Table 702-1.
 - 3. The Contractor shall prepare a quality control plan outlining the steps to be taken to minimize segregation of HBP. This plan shall be submitted to the Engineer prior to beginning the paving operations. When the Engineer determines that segregation is unacceptable, the paving shall stop and the cause of segregation corrected before paving operations will be allowed to resume.
 - 4. The Hot Mix Asphalt shall not contain reclaimed material.
 - 5. Contractor to provide to the Engineer, a job mix composition meeting this section. Submittal shall include testing results sufficient to show compliance. Testing shall be under the certification of an independent testing laboratory acceptable to the Engineer. The mix design shall have been completed within the preceding 12 months.
 - 6. Contractor may use an anti-stripping additive from the current CDOT approved list of additives.
 - a. Contractor may use an anti-stripping additive from the current CDOT approved list of additives.
 - B. The Contractor shall prepare a quality control plan outlining the steps to be taken to minimize segregation of HMA. This plan shall be submitted to the Engineer prior to beginning the paving operations. When the Engineer determines that segregation is unacceptable, the paving shall stop and the cause of segregation corrected before paving operations will be allowed to resume.

2.02 PRIME COAT

- A. Reference Section 702.02.
 - 1. Prime coat shall be MC-70 (ASTM D2026)

2.03 TACK COAT

- A. Reference Section 702.03.

1. Tack Coat to be SS-1h (ASTM D977) or CSS-1h (AASHTO M208).

2.04 PAVEMENT MARKING

- A. Reference Section 708.05
 1. Glass beads required.

PART 3 EXECUTION

- A. Reference Section 403.03 (further reference 401.07 through 401.20) and Section 407.04 through 407.08.
 1. Maximum compacted pavement depth per pass to be 3".
 2. Prime not required unless indicated on Drawings. Prepared base course or Subgrade surfaces receiving pavement courses shall be primed at Contractor's expense if the surface has deteriorated, due to traffic, weather or time lapse between surface preparation and placement of HMA, such that in the opinion of the Engineer, use of prime coat is required.
 3. Tack coat required between lifts, on all abutting old pavement surfaces and for overlays on existing pavements unless waived by Engineer. Application rate shall be 0.05 to 0.10 gallons per square yard diluted.
 - a. Dilution shall be one part tack emulsion to one part water.
 - b. All cut asphalt surfaces that are to butt new pavement sections shall be tacked with a liberal application of tack coat prior to paving.

3.01 COMPACTION

- A. The plant mix HMA shall be compacted by rolling. The number, weight and type of rollers furnished shall be that which is sufficient to obtain the required density while the mixture is in a workable condition. Compaction shall begin immediately after the mixture is placed and be continuous until the required density is obtained. When the mixture surface temperature falls below 185 degrees F, no further compaction effort will be permitted unless approved.
- B. All roller marks shall be removed with the finish rolling. Use of vibratory rollers with the vibrator on will not be permitted during surface course final rolling and will not be permitted on any rolling on bridge decks covered with waterproofing membrane.
- C. Pavement shall be compacted to a density of 92 percent to 96 percent of the maximum theoretical density, determined according to AASHTO T209. Field density determinations will be made in accordance with Colorado Procedure 44 or 81.
- D. Along forms, curbs, headers, walls and all other places not accessible to the rollers, the mixture shall be thoroughly compacted with mechanical tampers.
- E. Any mixture that becomes loose and broken, mixed with dirt, or is in any way defective, shall be immediately removed and replaced with fresh hot mixture, and

compacted to conform to the surrounding area.

3.02 SURFACE TOLERANCES

- A. Section 401.20. No skin patching will be allowed.

3.03 PAVEMENT MARKING

- A. Section 627 and as contained in the Contract Documents.

3.04 INSPECTION AND TESTING

- A. Contractor is solely responsible for Quality Control. They must take whatever means they deem necessary to assure the quality of the product.
- B. Owner will provide Quality Assurance testing. Contractor to cooperate fully with all persons engaged in testing.

3.05 DENSITY TESTING AND CONTROL

- A. See Section 3.01, Compaction, above.
- B. Field Testing. Testing for density during compaction operations to be done using nuclear density methods.
- C. Frequency of Testing. Minimum of one (1) test every 10,000 square feet, but not less than two (2) tests per City block, or as directed by Engineer.
- D. Retesting. In the event of failure to meet compaction criteria, Contractor shall recompact and/or replace defective work at direction of Engineer. All retesting to be paid for by Contractor, and to be performed by testing firm approved by the Engineer.

PART 4 MEASUREMENT AND BASIS OF PAYMENT

Where items are specifically included on the bid schedule, they will be paid for by the unit given. All other items in this section that are essential to the project but for which there are no specific pay items, will not be measured and paid for separately but shall be included in the project.

END OF SECTION

SECTION 02700

FINISHED GRADING AND RESTORATION

PART 1 GENERAL

1.01 SUMMARY

- A. This Work shall consist of finish grading, restoration of grounds and cleanup. This shall be a continuous process from project start-up to final acceptance of the Work by the Engineer.

PART 2 PRODUCTS

2.01 GENERAL CLEANUP

- A. Cleanup shall include the regrading, resurfacing, rebuilding and replacing of all surfaces on which construction took place, and rebuilding or replacing any areas disturbed by the construction. The streets or roads where disturbed shall be resurfaced by the Contractor, including both gravel and oil roads, and shall be replaced in as good or better condition than that at the start of construction. The Engineer shall be the sole judge as to whether streets, roads or property have been restored to a condition as good or better than at the start of construction.
- B. The Contractor shall, at all times, keep property on which Work is in progress free from accumulation of waste material or rubbish caused by employees or caused by the Work, and he shall carry on a constant program to maintain Work area, structure sites, right-of-ways and the surface of streets and roads in a condition satisfactory to the appropriate authority, grantor of the right-of-way, and the Engineer.
- C. Preliminary cleanup shall commence as soon as the construction site is occupied by the Contractor (including his employees, supplies, materials or equipment) and shall be a continuous process, if necessary, in order that the site of the Work shall have an appearance and/or utility equal to or better than the start of the Work.
- D. Upon completion of the Work, the Contractor shall remove all remaining rubbish, tools, equipment, scaffolds and surplus materials from the job and leave the Work area clean and free of debris.

PART 3 EXECUTION

3.01 GENERAL

- A. All driveways, retaining walls, concrete flatwork, drainage ditches, trees, shrubs, and other miscellaneous items shall be returned to as good as or better than original conditions, if they are damaged by Work.

3.02 LANDSCAPING

- A. See Plans for reseeding requirements. Decorative Landscaping is not applicable.

PART 4 MEASUREMENT AND BASIS FOR PAYMENT

Clean-up and restoration shall not be measured and paid for as a separate bid item but shall be considered a part of the project.

END OF SECTION

SECTION 02780

UNIT AND FLAGSTONE PAVERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Clay Unit Pavers
- B. Flagstone Pavers

1.02 RELATED SECTIONS

- A. Section 03300 – Cast in Place Concrete.

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 1. C33, Standard Specification for Concrete Aggregates.
 2. C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 3. C140, Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
 4. C144, Standard Specification for Aggregate for Masonry Mortar.
 5. ASTM C 902 - Standard Specification for Pedestrian and Light Traffic Paving Brick.
 6. C936, Standard Specification for Solid Concrete Interlocking Paving Units.
 7. C979, Standard Specification for Pigments for Integrally Colored Concrete.
 8. ASTM C 1272 - Standard Specification for Heavy Vehicular Paving Brick.
 9. C1645, Standard Test Method for Freeze-thaw and De-icing Salt Durability of Solid Concrete Interlocking Paving Units.
 10. D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,000 ft-lbf/ft³ (600 kN-m/m³)).
 11. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 12. D2940, Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports.
- B. Interlocking Concrete Pavement Institute (ICPI):
 1. ICPI Tech Spec Technical Bulletins
- C. American Society of Civil Engineers (ASCE)
 1. ASCE 58-16 Structural Design of Interlocking Concrete Pavement for Municipal Streets and Roadways

- D. US Green Building Council (USGBC)
 - 1. Leadership in Energy and Environmental Design (LEED) version 4.]
- E. Americans with Disabilities Act (ADA) regulations, latest edition.

1.04 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Cleaning methods.
- C. Verification Samples: For each product and finish specified, two full-size samples representing actual products, colors and textures.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: All primary products specified in this section will be supplied by a single manufacturer with a minimum of ten years of experience.
- B. Installer Qualifications: All products listed in this section are to be installed by a single installer with a minimum of five years demonstrated experience in installing products of the same type and scope as specified.
- C. Mock-Up: Provide a completely assembled, typical wall areas installed with related accessories, in composite configurations designed to fulfill the performance criteria, and representative of the design as shown on the Drawings.
 - 1. Install a 10'x10' minimum mock-up in a location as directed by the Engineer or Architect.
 - 2. Do not proceed with remaining work until workmanship is approved by the Engineer or Architect.
 - 3. This area will be used as the standard by which the work will be judged.
 - 4. Subject to acceptance by the Owner and Engineer or Architect, mock-up may be retained as part of the finished work.
 - 5. If mock-up is not retained, remove and properly dispose of mock-up.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations and industry standards.
- B. Store materials in manufacturer's original sealed, labeled packaging until ready for installation and in accordance with manufacturer's instructions. Protect from damage.

1.07 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.08 WARRANTY

- A. Manufacturer's Standard Material Warranty: At project closeout, provide to Owner or Owners Representative an executed copy of the manufacturer's standard limited warranty against manufacturing defect, outlining its terms, conditions, and exclusions from coverage.

PART 2 PRODUCTS

2.01 CLAY UNIT PAVERS

- ~~A. Pedestrian/Light Vehicular Pavers: Nominal 4 inch x 8 inch brick pavers with wirecut surface texture as manufactured by Endicott Clay Products Co., which is located at: 57120 707th Rd.; Endicott, NE 68350; Tel: (402) 729-3315; Fax: (402) 729-5804; Email: request info (endicott@endicott.com); Web: www.endicott.com.~~

- ~~1. Actual Product Size: 4 x 8 x 2-1/4 inches (102 x 203 x 57 mm).~~
- ~~2. Color: Medium Ironspot No. 46.~~
- ~~3. Pattern: Per Drawings, Manufacturer supplied spacers; including perimeter spacers.~~

- B. Heavy Vehicular Pavers: Nominal 4 inch x 8 inch brick pavers with wirecut surface texture as manufactured by Endicott Clay Products Co., which is located at: 57120 707th Rd.; Endicott, NE 68350; Tel: (402) 729-3315; Fax: (402) 729-5804; Email: request info (endicott@endicott.com); Web: www.endicott.com.

- 1. Actual Product Size: 4 x 8 x 2-5/8 inches (102 x 203 x 67 mm).
- 2. Color: Medium Ironspot No. 46.
- 3. Pattern: Per Drawings, Manufacturer supplied spacers; including perimeter spacers.

- C. Permeable Pavers: Nominal 4 inch x 8 inch brick pavers with wirecut surface texture as manufactured by Endicott Clay Products Co., which is located at: 57120 707th Rd.; Endicott, NE 68350; Tel: (402) 729-3315;

Fax: (402) 729-5804; Email: request info (endicott@endicott.com); Web: www.endicott.com.

1. Actual Product Size: 4 x 8 x 2-5/8 inches (102 x 203 x 67 mm) with relieved edge tips of lugs x 6.
2. Color: Medium Ironspot No. 46.
3. Pattern: Per Drawings

2.02 CONCRETE UNIT PAVERS

- A. Drivable Grass® Plantable Concrete System: Nominal 24 inch x 24 inch concrete units as manufactured by GeoSolutions, which is located at: 725 SE 59th Street; Oklahoma City, OK 73129; Tel: (405) 702-4444.

1. Actual Product Size: 24 x 24 x 1-1/2 inches.
2. Color: Buff/Tan.
3. Pattern: Per Drawings.

2.03 STONE UNIT PAVERS

- A. Granite: Manufactured by Coldspring, 17482 Granite West Road, Cold Spring, MN 56320, (320) 685-4703.

1. Color:
 - a. Masabi Black: 3-1/4 Thick Depth by 4 inch Wide by 8 inch Long, snapped edges, Diamond 10 finish top, sawn bottom, 1/4 inch maximum joint.
 - b. Sierra White: 3-1/4 inch Thick by 4 inch Wide by 8 inch Long, snapped edges, thermal finish top, sawn bottom, 1/4 inch maximum joint.

2.04 FLAGSTONE PAVERS

- A. Granite: Manufactured by Coldspring, 17482 Granite West Road, Cold Spring, MN 56320, (320) 685-4703.

1. Color:
 - a. Carnelian: 3-1/4 inch Thick by 8 inch Wide by 24 inch Long, snapped edges, Diamond 10 finish top, sawn bottom, 1/4 inch maximum joint.
 - b. Masabi Black: 3-1/4 Thick Depth by 8 inch Wide by 24 inch Long, snapped edges, Diamond 10 finish top, sawn bottom, 1/4 inch maximum joint.

- B. Sandstone: Manufactured by Lyons Sandstone, 2493 CR 37 E, Lyons, CO 80540, (303)823-5659

1. Color: Buff and Rose, as per Drawings.
2. Actual Product Size: 2-1/2 inch Depth (widths and lengths vary per Drawings).

2.05 BEDDING AND JOINT SAND

- A. Provide bedding and joint sand as follows:
1. Washed, clean, non-plastic, free from deleterious or foreign matter, symmetrically shaped, natural or manufactured from crushed rock.
 2. Do not use limestone screenings, stone dust, or sand for the bedding sand material that does not conform to the grading requirements of ASTM C33.
 3. Do not use mason sand or sand conforming to ASTM C144 for the bedding sand.
 4. Where concrete pavers are subject to vehicular traffic, utilize sands that are as hard as practically available.
 5. Sieve according to ASTM C136.
 6. Bedding Sand Material Requirements: Conform to the grading requirements of ASTM C33 with modifications shown in Table 1.

Table 1
Grading Requirements for Bedding Sand
ASTM C33

Sieve Size	Percent Passing
3/8 in.(9.5 mm)	100
No. 4 (4.75 mm)	95 to 100
No. 8 (2.36 mm)	80 to 100
No. 16 (1.18 mm)	50 to 85
No. 30 (0.600 mm)	25 to 60
No. 50 (0.300 mm)	5 to 30
No. 100 (0.150 mm)	0 to 10
No. 200 (0.075 mm)	0 to 1

7. Joint Sand Material Requirements: Conform to the grading requirements of ASTM C144 shown with modifications in Table 2.

Table 2
Grading Requirements for Joint Sand

ASTM C144 Natural Sand		ASTM C144 Manufactured Sand
Sieve Size	Percent Passing	Percent Passing
No. 4 (4.75 mm)	100	100
No. 8 (2.36 mm)	95 to 100	95 to 100
No. 16 (1.18 mm)	70 to 100	70 to 100
No. 30 (0.600 mm)	40 to 75	40 to 100
No. 50 (0.300 mm)	10 to 35	20 to 40
No. 100 (0.150 mm)	2 to 15	10 to 25
No. 200 (0.075 mm)	0 to 1	0 to 5

PART 3 EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. Prepare substrates using the methods recommended by the manufacturer for achieving best result for the substrates under project conditions.
- B. Do not proceed with installation until substrates have been prepared using the methods recommended by the manufacturer and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.
- C. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

3.02 INSTALLATION

- A. Install pavers in accordance with Americans with Disabilities Act (ADA) regulations, manufacturer's instructions and in proper relationship with adjacent construction.

3.03 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 02810

IRRIGATION SYSTEM

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: Landscape irrigation system as shown on the drawings for complete coverage to landscape areas. Furnish design for layout, pipe sizing, valving and head types and locations to meet specified criteria. Report any discrepancies and or modifications to the Landscape Architect or Engineer.
- B. Related Sections:
 - a. Section 02830 – Trees, Shrubs, Grasses and Perennials

1.02 SUBMITTALS:

- A. Product Data:
 - a. Submit manufacturer's technical data and installation instructions for the landscape irrigation system and control system for all deviations from the proposed sprinkler design.
- B. Operating and Maintenance Data:
 - a. Provide instructions covering full operation, care, winterization and maintenance of system, controls and manufacturer's parts catalog.
 - b. Include schedule showing length of time each valve is to be open to provide determined amount of water and precipitation rate per control valve, verified by field tests.
 - c. Instruct Owner's designated maintenance personnel in proper operation of system, including adjusting of sprinkler heads and winterizing procedures.
- C. Project Record As-Built Drawings:
 - a. Submit record as-built drawing information prepared by a qualified drafter on site plan furnished by Landscape Architect. Show locations of main connection, pressure lines at 100' intervals, all valves, drip line blowout valves, changes in zoning, changes in numerical sequence at control valves, other items required by Landscape Architect. Dimension to nearest foot from suitable permanent reference points.

1.03 QUALITY ASSURANCE:

- A. Provide each element of landscape irrigation system produced by the manufacturer, including heads, valves, piping circuits, controls and accessories.

- B. Installer must be an experienced firm specializing in irrigation systems with not less than 5 years experience in this specialty and having successfully completed not less than 5 projects of scope similar to that of the Project.

1.04 MAINTENANCE:

A. Extra Materials:

a. Deliver to Owner the following items:

- i. Two sets of special tools for disassembly and adjustment of each type of head and valve.
- ii. Two heads of each type of sprinkler.

1.05 WARRANTY:

- A. Trees planted as part of the project shall have a two-year warranty. This warranty period start date shall be at the completion of the of landscape establishment period. Once the period begins, the Contractor will be notified if any of the trees or shrubs planted as part of this project die. The Contractor shall replace and establish any dead trees or shrubs identified during this period in accordance with this specification.
- B. The Contractor is responsible for proper watering of plantings during the establishment period. The Contractor has the option to install temporary irrigation at no additional cost to the project.

PART 2 - PRODUCTS

2.01 MANUFACTURES:

- A. Provide system as manufactured by Rainbird, Rain Master or as specified in schedules.

2.02 MATERIALS:

A. Pressure Pipe:

- a. PVC Plastic Pipe, ASTM D2242, SDR 21, Class 200 PVC 1120
- b. Drip Tubing (downstream from control valves):
- c. Polyethylene Pipe for drip tubing.

B. Pipe Sleeves:

- a. PVC Plastic Pipe, ASTM D2241, Type PVC 1120-1220, Schedule 80.
- b. Provide sleeves minimum 2 pipe sizes larger than line carried. Provide sleeves below all paved, gravel areas as indicated on drawings.

C. Pipe Fittings:

- a. As recommended by the Manufacturer.

D. Valves:

- a. Manufacturer's standard, of type and size indicated, and as follows:
 - i. Automatic Control Valves: Globe valves with self-cleaning scrubber with stainless steel screen, operated by low-power solenoid, normally closed, manual flow adjustment and bleed nut.

E. Hose Bibs: Manual shut-off hose bibs.

F. Valve boxes:

- a. Manufacturer's standard plastic type, with cover. Furnish sizes and types suited to job conditions.

G. Sprinkler Heads:

- a. Manufacturer's standard unit designed to provide uniform coverage over entire area of spray shown on drawings at available water pressure.

H. Drip Emitters:

- a. Rainbird Xeribug Drip Emitters or as approved by the City Parks & Recreation Dept.

I. Drainage Backfill:

- a. Cleaned gravel or crushed stone, graded from 3" maximum to 0.75" minimum size.

J. Backflow Prevention:

- a. Per City Water Department Standards and Specifications.

K. Irrigation Controller:

- a. Provide Rain Master RME Eagle-i 24 Station Controller or as approved by the City Parks & Recreation Dept, with the following included options:
 - i. Rain Master communications card (iCentral) to provide connectivity to the Internet.
 - ii. Rain Master Weather Station for direct ET measurements
 - iii. Rain Master Flow sensor or other flow sensor device.
 - iv. Built-in remote control capability for compatibility with all Rain Master remote control systems.

- v. Connectivity for any one of the following: rain, freeze, or moisture sensor device. The enabling of this device can be performed on a per program basis.
 - vi. Built-in remote control capability with Irritrol Pro Max Remote.
 - vii. Rain Master “EGP-SPED” vandal and weather resistant extended size stainless steel enclosure with station screw terminals and “EG-T” expanded heavy-duty surge lightning protection.
- L. Control Wiring: No. 12 or heavier for common wire and No. 14 or heavier for zone wire direct burial insulated copper wire AWG, UL approved and sized as recommended by controller manufacturer. Provide connectors, accessories as required. Provide with color coded insulation to differentiate function and circuit. Furnish wiring diagrams showing color coding:
- a. White – common
 - b. Red - zone wire
 - c. Black – spare
- B. Supply 4 spare wires from controller to terminal valve boxes on each end of irrigation run.

PART 3 – EXECUTION

3.01 EXAMINATION:

- A. Refer to Section 01040 for examination of substrate and job conditions. Verify size and location of pipe sleeves at paving, connections to water service and coordination with other site work.

3.02 PREPARATION:

- A. Furnish sleeves to Installers of paving and walks for piping or control wiring that crosses exterior walks or paving. Direct such installers to assure correct locations and elevations.
- B. Furnish at least 2 pipe sizes larger than pipe to be accommodated. If sleeves are missing, install them by boring or jacking. Resort to cutting only where acceptable to Owner

3.02 LAYOUT:

- A. Design Pressures: Based on static pressures at site.
- B. Drip Emitters: Design location is approximate. Make minor adjustments as necessary to avoid plantings and other obstructions.
- C. Contact Landscape Architect 16 working hours in advance and request inspection of layout and staking. Architect will observe layout and indicate any

changes as needed. Observation does not relieve Installer of coverage problems due to improper placement of heads after staking.

3.03 TRENCHING:

- A. Excavate straight and true with bottom uniformly sloped to low points. Provide 6" minimum clearance horizontally between lines. Do not place parallel lines over one another or place lateral and pressure lines in same trench except where acceptable to Landscape Architect.
- B. Trench Depth: Excavate trenches to a depth of 3" below invert of pipe, unless otherwise indicated.
- C. Minimum Cover: Provide 18" minimum over top of installed pressure piping and control wiring and 12" minimum over lateral piping.

3.04 INSTALLATION:

A. General:

- a. Unless otherwise indicated, comply with requirements of the applicable plumbing code.

B. Control Valves:

- a. Install in valve box, arranged for easy adjustment and removal. Provide union on upstream and downstream side of valve.
- b. Adjust automatic control valves to provide flow rate of rated operating pressure required for each sprinkler zone.
- c. Install one valve per valve box, arranged for easy adjustment and removal. Adjust valves to provide flow rate of rated operating pressure required for each lateral.

C. Valve Boxes and Covers:

- a. Install one box and cover for all valves installed. Place top even with finish grade.

D. Piping: PVC Mainline and Poly Laterals in sleeving (under paving and gravel).

- a. Lay pipe on solid sub-base, uniformly sloped without humps or depressions.
- b. Install plastic pipe in dry weather when temperature is above 40 F. in strict accordance with manufacturer's recommendations.
- c. Allow joints to cure at least 24 hours at temperature above 40 F. before testing, unless otherwise recommended by manufacturer.

- E. Ring-Tite PVC: Prepare ends by beveling and verify that rings are in place. Apply lubricant to clean surfaces and follow manufacturer's recommendations.
- F. Sprinkler Heads:
 - a. Flush circuit lines with full head of water and install heads after hydrostatic test is completed.

3.05 BACKFILLING:

- A. Do not backfill in freezing weather or leave trenches open for more than 28 hours. Leave trench backfill slightly mounded to allow for settlement. Keep the site cleaned of excess or waste materials as backfilling progresses.
- B. Carefully backfill with approved excavated materials free of rock and debris. Place and compact as specified in Section 02200 including compacted densities.
- C. Hand place the first 6" of backfill or to top of pipe and walk the trench bottom to secure the position to the pipe and wire.
- D. Deposit and compact remainder in layers as specified in Section 02200.
- E. Repair any backfill settlement occurring during the warranty period, including any replacement or repair of sod, plant material, parking surface or structure.

3.06 CONTROL WIRING:

- A. Bury control wiring between controller and electric valves in sprinkler main line trenches or in separate trenches.
- B. Make electrical connection at valve to allow for pigtail so solenoid can be removed from valve with sufficient slack to allow ends to be pulled 12" above ground for examination and cleaning.
- C. Bundle 24 volt wires at 15' to 20' intervals and lay with mainline pipe below and to one side of the trench.
- D. Provide an expansion loop at every valve and every 100' formed by wrapping wire at least eight times around a 0.75" pipe and withdrawing pipe.
- E. Make splices and connections in accordance with NEC. Run 1 spare wire, as previously indicated, from controller along full length of main (pressure) lines.
- F. Install as per manufacturer's instructions or detail. Connect remote control valves to controller in numerical sequence as shown on the drawings.
- G. Final electrical connections are the responsibility of a licensed Electrical Contractor.

3.07 TESTING:

A. General:

- a. Notify Landscape Architect in writing not less than 16 working hours in advance of when testing will be conducted. Conduct tests in the presence of the Landscape Architect.
- b. Before sprinkler heads are set, thoroughly flush the lines to remove all foreign matter.
- c. Flush from dead end fittings for a minimum of five minutes under a full head of pressure.

B. Hydrostatic Test:

- a. Test water piping and valves, after backfilling trenches, except leave joints exposed, to a hydrostatic pressure of not less than the working pressure, unless otherwise indicated. Piping may be tested in sections to expedite the work. Remove and repair piping, connections, valves which do not pass the hydrostatic testing. Piping must hold pressure not less than 3 hours and pressure supply lines not less than 48 hours.

C. Operational Testing:

- a. Perform operational testing after hydrostatic testing is completed, backfill is in place, and sprinkler heads adjusted to final position.
- b. Demonstrate to the Architect that system meets coverage requirements and that automatic controls function properly.
- c. Coverage requirements are based on operation of one zone at a time.

3.08 ADJUSTMENT:

- A. After completion of grading, carefully adjust sprinkler heads so they will be flush with or not more than 0.5" above grade.
- B. Flush and adjust all sprinkler heads for optimum performance and to prevent overspray onto walks and roadways.
- C. If it is determined that adjustments in the irrigation equipment will provide proper and more adequate coverage, make such adjustments prior to final acceptance at direction of Architect. Adjustments may also include changes in nozzle sizes and degrees of arc as required.
- D. Correct areas which do not conform to designed operation requirements due to unauthorized changes or poor installation practices.

3.09 WINTERIZATION:

- A. Installer shall winterize by draining the complete system at the conclusion of the first sprinkling season within 3 days of notification by the Owner. Drain by using compressed air or similar method. Re-open, operate and adjust system malfunctions accordingly during April or May of next season as requested by the Owner.

END OF SECTION

SECTION 02830

TREES, SHRUBS, GRASSES AND PERENNIALS

PART 1 - GENERAL

1.01 SUMMARY:

A. Section Includes:

- a. Landscape development work as shown on the drawings and in schedules.

B. Related Sections:

- a. Section 02810 – Irrigation System

1.02 SUBMITTALS:

A. Maintenance Instructions:

- a. Submit 2 copies of typewritten instructions recommending procedures to be established by the Owner for the maintenance of landscape work for one full year. Submit prior to completion of planting for review by Landscape Architect.

1.03 QUALITY ASSURANCE:

- A. Work of this Section shall be performed by a single firm specializing in landscape work having not less than 5 years successful experience in landscape projects of similar scope to this one.

B. Source Quality Control:

- a. Ship landscape materials with certificates of inspection as required by governmental authorities. Comply with governing regulations applicable to landscape materials.
- b. Trees, Shrubs, Grasses and Perennials: Provide trees, shrubs, grasses and perennials grown in a local Colorado nursery in accordance with good horticultural practice. Provide healthy, vigorous stock grown under climatic conditions similar to conditions in the locality of the project and free of disease, insects, eggs, larvae, and defects such as knots, sun-scald, injuries, abrasions, or disfigurement.

C. Plant Material Inspection;

- a. Landscape Architect and City of Glenwood Springs shall inspect plant materials when delivered to project site. Damaged, diseased or defective plant material will be rejected and shall be removed from project site. Rejected plant material will be replaced, at the expense of the Contractor, with healthy, vigorous stock.

1.04 PROJECT / SITE CONDITIONS:

- A. Utilities: Prior to the start of the work, the Contractor shall verify the location of all utilities, structures, and facilities. Any conflict between existing structures, utilities, and other facilities shall be called to the Engineer's attention before proceeding with the work.
- B. Excavation: When conditions are detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstruction, notify Landscape Architect before planting.
- C. Coordinate with landscape irrigation system work. Exercise special care to avoid damage to irrigation system.
- D. Plant trees, shrubs, grasses and perennials during normal seasons for such work in location of project.

1.05 HANDLING, SHIPPING AND STORAGE:

- A. Plants shall not be dug at the nursery or approved source until the Contractor is ready to transport them from their original locations to the site of the work or acceptable storage location. Evidence of inadequate protection following digging, carelessness while in transit, or improper handling or storage, shall be cause for rejection. Upon arrival at the temporary storage location or the site of the work, plants shall be inspected for proper shipping procedures. Should the roots be dried out, large branches be broken, balls of earth be broken or loosened, or areas of bark be torn, the Engineer will reject the injured plant. When a plant has been rejected, the plant shall be removed and replaced with one of the required size and quality at the contractor's expense.
- B. Unless specific authorization is obtained from the Engineer, plants shall not remain on the site of work longer than three days prior to being planted. Plants that are not planted immediately shall be protected from drying out, freezing, or other damage due to inclement weather.
- C. Both the duration and method of storage of plant materials shall be subject to the approval of the Engineer. Exercise care in handling plant materials to avoid damage or stress. Do not lift or handle container plants by tops, stems or trunks at any time. Do not bind or handle plants with wire or rope at any time.

PART 2 - PRODUCTS

2.01 TOPSOIL:

- A. Provide new topsoil which is fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter, and free of stumps, rocks, gravel, roadbase and other extraneous or toxic matter harmful to plant growth.
- B. Plant Backfill:

- a. For backfill at trees and shrubs, use a soil mixture containing one (1) part compost to four and one half (4.5) parts topsoil.

C. Soil Amendments:

- a. Compost: Provide compost from local nursery.

2.02 PLANT MATERIALS:

- A. Provide plant materials true to name and variety established by the American Joint Committee on Horticultural Nomenclature "Standardized Plant Names", Second Edition, 1942.
- B. Quality: Provide trees, shrubs, and other plants complying with the recommendations and requirements of ANSI Z60.1 "Standard for Nursery Stock" and of not less than indicated sizes, balled and burlapped or container grown, unless otherwise indicated of specified.
- C. Deciduous Shrubs: Provide shrubs of the height shown or listed and with not less than the minimum number of canes required by ANSI Z60.1 for the type and height of shrub required.

2.03 OTHER LANDSCAPE MATERIALS:

A. Bark Mulch:

- a. New material shall be shredded red cedar bark mulch.

PART 3 – EXECUTION

3.01 PREPARATION:

- A. Layout individual tree and shrub locations and areas for multiple plantings. Stake locations and outline areas and secure Landscape Architect's and City of Glenwood Springs acceptance before start of planting work. Make minor adjustments as may be requested.
- B. Before mixing, clean topsoil of roots, plants, sod, stones, clay lumps and other extraneous materials harmful or toxic to plant growth.
- C. Mix soil amendments at rates specified.
- D. Mix soil amendments by suitable means to assure complete mixing and uniform texture using proportions for each use.
- E. Preparation for Other Plantings:
 - a. For pit and trench type plant backfill, mix soil and soil amendments prior to backfilling, and stockpile at the site.

F. Excavation for Trees, Shrubs, Grasses and Perennials:

- a. Excavate pits and trenches with vertical sides and with bottom of excavation slightly raised at center to provide property drainage. Loosen subsoil in bottom of excavation.
- b. For balled and burlap or container grown stock, excavate as specified on the drawings.
- c. Dispose of unacceptable subsoil removed from landscape excavations.
- d. Where rubble fill is encountered, prepare planting pits properly by removal of rubble or other acceptable methods.

G. Use prepared plant backfill mix for setting and filling all plants. Allow a 3" settling layer of planting soil mixture.

3.02 PLANTING:

A. Planting Trees and Shrubs:

- a. Set balled and burlap (B&B) stock on layer of compacted planting soil mixture, plumb and in center of pit or trench with top of ball 2" above adjacent finish landscape grades and no deeper than it was in the nursery. When set, place additional backfill mixture and eliminate voids and air pockets. When excavation is 2/3 full, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing final layer of backfill.
- b. Remove wire basket and burlap from sides of balls; retain on bottom.
- c. Planting Container Grown Stock:
- d. Set container grown stock as specified for ball and burlap except remove from container. Do not damage root balls.
- e. Dish top of backfill to allow for mulching.
- f. Mulch pits, trenches and planted areas with specified mulch. Finish level with adjacent grades.

B. Pruning:

- a. Remove dead wood and branches from trees and shrubs in accordance with standard horticultural practice.

3.03 OTHER LANDSCAPE MATERIAL:

A. Mulching:

- a. Spread mulch to a depth of 3”.

3.04 MAINTENANCE AND WARRANTY:

- A. Trees planted as part of the project shall have a two-year warranty. This warranty period start date shall be at the completion of the of landscape establishment period. Once the period begins, the Contractor will be notified if any of the trees planted as part of this project die. The Contractor shall replace and establish any dead trees identified during this period in accordance with this specification.
- B. The contractor is responsible for proper watering of plantings during the establishment period. The Contractor has the option to install temporary irrigation at no additional cost to the project.
- C. The Contractor shall warrant trees and shrubs against defects including death and unsatisfactory growth, except for defects resulting from abuse or damage by others, or unusual phenomena or incidents which are beyond Contractor’s control. Replace at optimum planting time.

3.05 CLEANUP AND PROTECTION:

- A. During landscape work, store materials and equipment where directed. Protect landscape work and materials from damage due to landscape operations, operations by other contractors and trades and trespassers. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged landscape work as directed.

3.06 INSPECTION AND ACCEPTANCE:

- A. When landscape work is completed, including maintenance, the Landscape Architect and the City of Glenwood Springs will make an inspection to determine acceptability.
- B. Where inspected landscape work does not comply with the requirements, replace rejected work and continue specified maintenance until re-inspected by the Landscape Architect and the City of Glenwood Springs and found to be acceptable. Remove rejected materials promptly from the project site.
- C. Replace warranty items at one time and within 10 working days of notification.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes. Work to be completed under this section shall include all labor, equipment, plant and materials necessary to furnish and install all poured-in-place concrete, together with all miscellaneous and appurtenant items, as shown on the Plans and as specified herein.

1.02 REFERENCES

- A. Except as modified or supplemented herein, all Work shall conform to the following standards, latest edition. Refer to standards for detailed requirements.
1. ACI 318 - Building Code Requirement for Reinforced Concrete.
 2. ACI 301 - Specifications for Structural Concrete for Buildings.
 3. ACI 305 - Recommended Practice for Hot Weather Concreting.
 4. ACI 306 - Recommended Practice for Cold Weather Concreting.
 5. ACI 347 - Recommended Practice for Concrete Formwork.
 6. ACI 350 - Code Requirements for Environmental Engineering Concrete Structures.
 7. Publication SP-2, ACI Manual for Concrete Inspection.
 8. ASTM A 615 - Standard Specifications for Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
 9. ASTM A 185 - Specifications for Welded Steel Fabric for Concrete Reinforcement.
 10. ASTM C 618 - Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete.

1.03 SUBMITTALS

The following shall be submitted to and approved by the Engineer prior to beginning any concrete work.

- A. Lab Design Mix. Prior to the start of Work, Contractor to submit a statement of the proportions for the concrete mixture. Statement to include:
1. Location & identification of aggregate source.
 2. Batch quantities for one (1) cubic yard of concrete, including:
 - a. Weight of fine aggregate in a saturated surface dry condition.
 - b. Weight of coarse aggregate in a saturated surface dry condition.
 - c. Weight or number of 94 pound bags of cement
 - d. Weight or gallons of water.
 - e. Amount and description (including manufacturer, specific product name, and number) of all admixtures.
 3. Test results on trial batch concrete made from the proposed mix design, including:
 - a. Cement factor in bags per cubic yard based on yield tests.
 - b. Water-cement ratio.
 - c. Percent of entrained air.
 - d. Consistency in inches of slump.
 - e. At least three 28-day compressive strength tests.
 4. Brand, type and place of manufacture of cement.
 5. Aggregate test results for grading, deleterious substances and physical properties using test procedures developed by ACI. Aggregate shall be free of substances that are deleteriously reactive with the alkali's in the cement in an amount sufficient to cause excessive expansion of the concrete. Acceptable aggregate shall be based on satisfactory evidence furnished by the Contractor that the aggregate is free from such materials. This evidence shall include service records of concrete of comparable properties under similar conditions of exposure and certified records of tests by a testing laboratory that meets the requirements of ASTM C 1077. Tests shall be made in accordance with ASTM C 1260. Prior to approval of mixture design, the Contractor shall submit written certification that the aggregate does not have a history of D-Cracking and that the aggregate is approved by a state Department of Transportation specifically addressing susceptibility to D-Cracking. If the aggregate is not approved by a state agency, the aggregates may be approved provided the aggregate is tested in accordance with ASTM C 666 and receives a durability factor of 95 percent or greater.
- B. Reinforcing Steel. Product data sheet and statement of manufacturer's compliance with applicable standards.
- C. Construction Joint Location. Where not indicated on the Plans the contractor shall provide a plan indicating the proposed location of all construction joints in slabs and walls for all fluid containing tanks. The contractor shall refer to "Section 3.03 – Construction, control, and Expansion Joints" for a detailed description of joint placement and construction within structures. Construction Joint submittals are not required for structures other than fluid containing tanks.

1.04 RECORD OF THE WORK

- A. Contractor to keep a record of time, date and location of each concrete pour and submit these records to the Engineer.

1.05 NOTICE OF INTENTION TO POUR

- A. Contractor shall notify the Engineer at least 48 hours before an intended cast-in-place concrete pour. No structural cast-in-place concrete shall be poured until all reinforcing, forms and foundation soils have been inspected by the Engineer.

1.06 PROTECTION OF THE WORK

- A. Contractor to be responsible for protection of all Work prior to acceptance. In place concrete shall not be subjected to loadings or stress prematurely.

1.07 STORAGE OF MATERIALS

- A. Cement and aggregate shall be stored in such a manner as to prevent deterioration or intrusion of foreign matter. Any material which has deteriorated or which has been damaged shall not be used for concrete.
- B. All reinforcing steel shall be stored in a dry location and protected from excessive accumulation of rust or scale.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Cement. All cement shall be Portland Cement Type II or V conforming to "Standard Specifications for Portland Cement" (ASTM C 150) or Type MS or HS conforming to "Standard Performance Specification for Hydraulic Cement" (ASTM C 1157). The same brand cement for all exposed cast-in-place concrete shall be used. Flyash conforming to ASTM C618 may be substituted for a portion of the cement; type and amount to be approved at time of mix design submittal.
- B. Stone Aggregate. Fine and course aggregate shall conform to "Specifications for Concrete Aggregates" (ASTM C33-61T). Fine aggregates shall be clean, hard, natural and free from all foreign matter. Course aggregate shall be sound, crushed rock or gravel, free from adherent coating, organic water or injurious amounts of flat or friable pieces.
- C. Water. Water used in mixing shall be potable, cleaned and free from deleterious amounts of oil, acids, alkalis and organic material.
- D. Admixtures. "Protex" as manufactured by Protex Industries, Inc. and conforming to Specifications of Air-Entraining Admixtures for Concrete (ASTM C260) is an approved air-entraining admixture. Other admixtures for retarding or accelerating concrete may be used in strict accordance with manufacturer's recommendations and ASTM Specifications upon approval of the Engineer.

- E. Form Material. For unexposed concrete surfaces, forms may be undressed lumber free from excessive knots. For exposed surfaces, use wood or metal forms as required to give finish as specified.
- F. Reinforcing Steel. Reinforcing steel shall be deformed bars conforming to "Standard Specifications for Deformed and Plain Billet Steel Bars for Concrete Reinforcement" (ASTM A615) and shall be Grade 60.
- G. Waterstop. Waterstop shall be SikaSwell S-2 as manufactured by Sika Corporation or approved equal. Waterstop shall be bentonite-free.
- H. Epoxy Sealer for Construction Joints. Epoxy sealer shall be SikaGuard 62 as manufactured by Sika Corporation or approved equal.

PART 3 EXECUTION

3.01 CONCRETE MIX

- A. Proportions. Concrete is to be proportioned according to laboratory designed mixes using the type of aggregate, maximum water/cement (W/C) ratio, maximum aggregate size, minimum of twenty-eight (28) day ultimate compressive strength, and entrained air as follows:

<u>Mix No.</u>	<u>Location</u>	<u>W/C Ratio</u>	<u>Aggregate (Size No.)</u>	<u>Strength (psi)</u>	<u>Entrained Air (%)</u>
1	Walls, Footings, Structural Slabs	0.53	67	4000	NR
2	Basins	0.45	67	4000	5 to 7
3	Curb, Gutter, Exterior Flatwork	0.45	67	4500	5 to 7
4	Interior Flatwork	0.53	67	4000	NR

- B. Air Entrainment. An air-entraining agent shall be added to all stone concrete so as to entrain 5%-7% by volume. Air-entraining agents shall be in strict accordance with the recommendations of the manufacturer and the testing laboratory for the design mix to assure strength requirements are being fully met or exceeded.
- C. Mixing of Materials. The concrete shall be mixed until there is a uniform distribution of the materials and shall be discharged completely before the mixer is recharged. For job-mixed concrete, the mixer shall be rotated at the speed recommended by the manufacturer.
 - 1. For stone concrete, mixing shall continue for at least one minute after all materials are in the mixer. Ready mixed concrete shall be mixed and delivered in accordance with "Standard Specifications for Ready Mixed Concrete" (ASTM C94-69).

2. Sufficient time shall be allowed for proper mixing of the concrete to provide uniformity throughout the batch. Long delays in concrete placement shall be avoided and any concrete that has not been placed within 90 minutes after water has been added to the mix shall be rejected. The 90 minute time limit may be extended to 120 minutes if no water is added after 90 minutes and the concrete temperature prior to placement is less than 90 F. Over wet mixes shall be rejected and shall not be corrected by the addition of either aggregate or cement to the mixer. Mix not less than ten minutes in transit mix trucks after addition of the mixing water.
- D. Consistency. Slumps shall be minimum, consistent with placing requirements. Slump test shall be made in accordance with "Slump Test for Consistency of Portland Cement Concrete" (ASTM C143-58). Unless written approval is obtained from the Engineer, the maximum slump shall be four (4") inches.

3.02 CONCRETE FORMS

- A. Forms shall conform to the shape, lines, grades and dimensions of the concrete as detailed on the Plans. All forms for exposed finished surfaces shall be built with the material needed to produce the form, texture and design specified in Concrete Finishes of this section.
- B. Design of Forms. Forms shall be sufficiently tight to prevent leakage of mortar and shall be properly braced or tied together so as to maintain the desired position. The formwork shall be designed for the loads outlined in Part 3, Section 102 of "Recommended Practice for Concrete Form Work" (ACI 347). The forms shall be oiled for ease of removal of forms after setting of concrete.
- C. Form Ties and Incidentals. All form ties shall be bolts and rods (adjustable for tightening) arranged so that no metal is within 3/4" of surface after removal of forms. No ties through exposed concrete will be allowed. Ties for water/wastewater structures (tanks, basins, channels etc.) shall be furnished with water resistant washers and cones, as manufactured by SYMONS, or approved equal. Ordinary wire ties will be allowed on building foundations with the specific approval of the Engineer. Set forms for all required anchors, bolt inserts, slots, sleeves, supports, etc., furnished under portions of this Specification and installed under this section.
- D. Removal of Forms. Forms shall not be disturbed until concrete has hardened sufficiently to permit their removal with safety. The removal of the forms shall be carried out in such a manner as to insure the safety of the structure. Unless otherwise permitted by the Engineer, forms shall not be removed until 24 hours after pouring.

3.03 CONSTRUCTION, CONTROL, AND EXPANSION JOINTS

Expansion, construction, and control joints shall be constructed in accordance with the Plans, and the specifications found in this section.

- A. Expansion joints - Unless otherwise indicated on the Plans, install one-half inch (½”) thick asphalt impregnated flexible foam expansion joint filler (ASTM D1751) wherever concrete slabs abut buildings or footings or as shown on the plan details. All expansion joint filler shall extend full depth of the slab.
- B. Control joints – control joints shall be placed in all non-fluid containing slabs-on-grade, and shall not be spaced more than 20 feet on center, or forming an area greater than 400 sq.ft. Control joints shall be sawn or trowel cut into concrete slab a maximum of 12 hours after the concrete has been placed.
- C. Construction joints – construction joints shall be constructed in accordance with the Plans and placed at a maximum spacing provided in the following table:

Fluid filled Tank - Walls	50 ft on-center maximum parallel spacing
Fluid filled Tank - Slabs	50 ft on-center maximum parallel spacing
Non-fluid containing structures - Walls	50 ft on-center maximum parallel spacing
Non-fluid containing structures - Slabs	Construction joints shall be spaced in accordance to the latest ACI & IBC codes. Re: section 3.03, part B – Control joints.

3.04 CONCRETE PLACEMENT

- A. Preparation for Placing. Before placing concrete, all equipment for mixing and transporting concrete shall be cleaned and all debris and ice shall be removed from places to be occupied by concrete. Forms shall be properly treated and all reinforcement cleaned of ice and other coatings. Water shall be removed from place of deposit before concrete is placed.
- B. Conveying. Concrete shall be conveyed from the mixer to the place of final deposit by methods, which will prevent the separation or loss of the materials. Equipment for chuting, pumping, or pneumatically conveying concrete shall be of such size and design as to ensure a practically continuous flow of concrete at the delivery and without separation of the materials.
- C. Other Trades. Install by way of example, anchor bolts, reinforcing steel, pipe and conduit openings and sleeves, bearing plates, and knockouts as provided by other trades and as required by other trades. Provide minimum 7 days notice to Engineer, Owner, or other trades prior to requiring materials or detailing information. Installation to meet location, dimension and alignment requirements of other trades.

- D. Depositing. Concrete shall be deposited as nearly as practicable in its final position to avoid segregation due to re-handling or flowing. The concreting shall be carried on at such a rate that the concrete is at all times plastic and flows readily into the space between the bars. No concrete that has been partially hardened or been contaminated by foreign matter shall be deposited on the Work, nor shall re-tempered concrete be used. When concreting is once started, it shall be carried on as a continuous operation until the placing of the panel or section is completed. Place concrete in approximately horizontal layers avoiding displacement of reinforcement above fresh concrete and formation of seams and planes of weakness in sections. When construction joints are necessary, they shall be located as specified in this section under Construction Joints. For bonding fresh concrete, roughen and clean exposed surface and brush with neat cement grout. Place new concrete before grout takes initial set.
- E. Compaction. Place concrete in layers not over 24" deep; compact each layer by mechanical internal vibrating equipment supplemented by hand spading, rodding, tamping, as directed. Vibrators shall not be used to transport concrete inside forms. Limit vibration duration to the time necessary to produce satisfactory consolidation without causing objectionable segregation. Do not insert vibrator into lower courses that have begun to set.
- F. Weather Conditions. Unless adequate protection is provided and the Engineer's approval is obtained, concrete shall not be placed during rain, sleet, or snow. When the mean temperature falls below 40°F for 3 successive days, concreting shall conform to "Recommended Practice for Cold Weather Conditions: (ACI 306 R-78). Concrete placed in hot weather shall meet the standards of "Recommended Practice for Hot Weather Concreting (ACI 305R-77). Concrete is not to be placed under water. A suitable means shall be provided for lowering the water level below surfaces upon which concrete is to be placed. This may require excavating approximately 12 inches below the bottom of the concrete surface and refilling with gravel and compacting. The groundwater shall not be allowed to rise to the bottom of the concrete until 24 hours after the concrete has been completed. Water shall not be allowed to fall upon or run across the concrete during this period.
- G. Protection and Curing. Concrete protection and curing shall be in conformance with ACI 308-71. Immediately after placing or finishing, concrete surfaces not covered by forms shall be protected from loss of surface moisture. All concrete shall be kept in a moist condition for at least five (5) days after placement. Curing compounds may be used upon approval of the Engineer.

3.05 SLABS ON GRADE

- A. All slabs on grade shall be poured directly on prepared gravel sub grade where shown on the Plans. Construction joints shall be placed such that no section of slab is greater than 20 feet on a side. Finishes, Expansion & Control Joints & Protection shall be as specified under other sections of this section.
- B. Minimum six-inch (6") of screened crushed rock shall be installed under the entire slab unless otherwise directed by the Engineer. The grading requirements as per Section 02222 for the aggregate course shall apply.

3.06 CONCRETE FINISHES

- A. Patching. Patching shall be done on all concrete surfaces immediately after stripping forms; all exposed surfaces shall have fins and other projections carefully removed, offsets leveled, and voids saturated with water and patched to a true and even surface with a wood float. Patch all holes left by the removal of the form ties or bolts. Patching material shall be a stiff mixture of sand and cement, the color of which matches the concrete being patched. Any major area of faulty or honey-combed concrete shall be completely removed and patched at the direction of the Engineer. For water/wastewater structures (tanks, basins, etc.), surface voids larger than ¼" diameter shall be patched.
- B. Floor slabs. All concrete slabs shall be screened to levels or grades indicated and float finished monolithically completely free from humps or pits. Slabs shall not show surface deviation in excess of one-quarter inch (1/4") when tested with a 10 ft. straightedge. Before the finish has set, the surface cement film shall be removed with a fine brush in order to have a fine-grained, smooth but sanded texture.
- C. Rubbed finish. All exposed concrete surfaces for water/wastewater structures (tanks, basins, etc.), shall have a rubbed finish. After removal of forms, rubbing of all exterior surfaces shall be started as soon as its condition will permit. Immediately before starting this Work, the concrete shall be kept thoroughly saturated with water. Sufficient time shall have elapsed before the wetting down to allow the mortar used in the pointing to thoroughly set. Surfaces to be finished shall be rubbed with a medium course carborundum stone, using a small amount of mortar on its face. The mortar shall be composed of cement and fine sand mixed in the same proportions as the concrete being finished. Rubbing shall be continued until all form marks, projections and irregularities have been removed, all voids filled and a uniform surface has been obtained. The paste produced by this rubbing shall be left in place.
- D. After all concrete above the surface being treated has been cast, the final finish shall be obtained by rubbing with a fine carborundum stone and water. This rubbing shall be continued until the entire surface is of a smooth texture and uniform color.
- E. After the final rubbing is completed and the surface has dried, it shall be rubbed with burlap to remove loose powder and objectionable marks.
- F. Chamfer. All exposed exterior corners shall receive 3/4" chamfer.

3.07 REINFORCING

- A. Placing Reinforcement. Reinforcing steel, at the time concrete is placed, shall be free from scale, rust or other coatings that will destroy or reduce bond. Reinforcement shall be accurately placed as shown on the Plans and shall be adequately secured in position by concrete or metal chairs and spacers.

- B. Reinforcing shall be furnished in the full lengths indicated on the Plans unless otherwise authorized by the Engineer. Splicing of bars, except where shown on the Plans or specified, shall not be permitted without written approval by the Engineer. Reinforcement placed in any member shall be inspected before any concrete is placed and the Engineer shall be notified 24 hours in advance before any concrete placement.
- C. The placing, fastening, splicing and supporting of reinforcing steel and welded wire fabric shall be in accordance with the Plans and the latest edition of the CRSI "Recommended Practice for Placing Reinforcing Bars" and in accordance with ACI 318-05. Bars shall be placed around all corners to splice steel in adjacent walls, footers and slabs (such detailing may not be shown on Plans).
- D. Concrete Protection & Reinforcement. Where not otherwise indicated on the Plans, the minimum thickness of concrete over the reinforcement shall be as follows:
 - 1. Concrete deposited against earth: 3"
 - 2. Slabs and walls not exposed to weather or earth: 1"
 - 3. All other concrete placed in forms:
 - For bars larger than #5: 2"
 - For bars #5 or smaller: 1-1/2"
 - 4. Sanitary Structures: 2"
- E. Bearing Plates, anchor bolts, etc. Place all bearing plates, anchor bolts, reinforcing rods and other structural items furnished by other trades. Contractor to provide 7-day notice to all such trades prior to affected pour. Installation to be within tolerances required by other trades.

3.08 FIELD QUALITY CONTROL

- A. Concrete Tests. 6" x 12" (or 4" x 8") cylinders shall be taken at the point of placing in the forms, shall be job cured and tested in accordance with ASTM Standards by the Engineer. For each strength of concrete used, one set of four (4) cylinders for each day's pour, but not less than one (1) set of cylinders for each 50 cubic yards poured shall be taken. Two (2) cylinders at twenty-eight (28) days shall be tested to determine strength. One cylinder at seven (7) days, and one cylinder at fifty six (56) days may be tested as indicators at the direction of the Engineer. In addition, when in the opinion of the Engineer there is a possibility of the surrounding air temperature falling below 40° F; additional specimens to be cured under job conditions may be required.
- B. Enforcement of Strength Requirements. Should the strengths shown by the test specimens fall below the specified values, the Engineer shall have the right to require changes in proportions to apply on the remainder of the Work.

- C. If concrete fails to meet the strength requirements of this specification, the Engineer may order the Contractor to have a testing laboratory, acceptable to the Engineer, take and test core samples of questionable concrete. The Engineer may order all low-strength concrete removed and replaced if core strengths are below specified strengths. All costs connected with concrete coring and removal and replacement of low-strength concrete shall be borne by the Contractor.
 - 1. Contractor shall repair all core holes at his expense.
- D. Slump Tests. Engineer to conduct slump tests on each day's pour and on individual trucks whenever concrete consistency varies. Test failure shall be grounds for rejection of individual or batch loads.
- E. Air Content. Engineer to conduct air tests on each day's pour and on individual trucks as determined by the Engineer. Test failure shall be grounds for rejection of entire batch until satisfactory tests are obtained.

3.09 CONCRETE REPAIR

- A. Concrete Repair. In the event there are leaks as determined by the testing program as specified on the drawings, Contractor shall make repairs as necessary to satisfy the requirements of the program. Acceptable products are Sika and Xypex type and installation methods as recommended by the manufacturer for the specific application. Product and method of installation as selected by the Contractor shall be submitted to the Engineer for approval.

PART 4 MEASUREMENT AND BASIS OF PAYMENT

Where items are specifically included on the bid schedule, they will be paid for by the unit given. All other items in this section that are essential to the project but for which there are no specific pay items, will not be measured and paid for separately but shall be included in the project.

END OF SECTION

SECTION 03500

STRUCTURAL PRECAST CONCRETE

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes. This section covers Prestressed or Precast concrete member construction, including product design not shown on contract drawings, manufacture, transportation, erection, and other related items such as anchorage, bearing pads, storage and protection of precast concrete.
- B. General Requirements. Prestressed concrete members shall be furnished and installed complete with all embedments, accessories and special construction specified and shown on the Drawings.

1.02 REFERENCES

- A. Requirements of Regulatory Agencies. All local codes plus the following specifications, standards and codes are a part of these specifications:
 - 1. ACI 318 – Building Code Requirements for Structural Concrete.
 - 2. AWS D1.1—Structural Welding Code— Steel.
 - 3. AWS D1.4—Structural Welding Code— Reinforcing Steel.
 - 4. CRSI—Manual of Standard Practice

1.03 SUBMITTALS

- A. Shop drawings
 - 1. Erection drawings
 - a. Member piece marks and completely dimensioned size and shape of each member.
 - b. Plans and/or elevations locating and defining all products furnished by manufacturer.
 - c. Sections and details showing connections, cast-in items and their relation to the structure.
 - d. Relationship to adjacent material.
 - e. Joints and openings between members and between members and structure.
 - f. Description of all loose, cast-in and field hardware.
 - g. Field installed anchor location drawings.
 - h. Erection sequences, when required to satisfy stability, and handling requirements.
 - i. All dead, live and other applicable loads used in the design.

2. Production drawings
 - a. Elevation view of each member.
 - b. Sections and details to indicate quantities and position of reinforcing steel, anchors, inserts, etc.
 - c. Handling devices.
 - d. Dimensions and finishes.
 - e. Prestress for strand.
 - f. Concrete strengths.
 - g. Estimated cambers.
 - h. Methods for storage and transportation.
- B. Product design criteria:
 1. Loadings for design:
 - a. Initial handling and erection stress limits.
 - b. All dead and live loads as specified on the contract drawings.
 - c. All other loads specified for member, where applicable.
 - d. Provide continuous unistrut embedded into bottom of all precast double tee stems. Hold back 12 inches from each end of double tee stem. Design load shall be 500 pound concentrated load as part of collateral dead load, not in addition. Unistrut shall be hot dipped galvanized.
 2. As directed on the contract drawings, design calculations of products shall be performed by a registered engineer experienced in precast, prestressed concrete design and submitted for approval with production drawings.
 3. Design shall be in accordance with applicable codes, ACI 318 or AASHTO Standard Specifications for Highway Bridges.
- C. Permissible design deviations:
 1. Design deviations will be permitted only after the architect/engineer's written approval of the manufacturer's proposed design supported by complete design calculations and drawings.
 2. Design deviations shall provide an installation equivalent to the basic intent without incurring additional cost to the owner.
- D. Test reports: Reports of tests on concrete and other materials upon request.

1.04 QUALITY ASSURANCE

- A. Manufacturer qualifications: The precast concrete manufacturing plant shall be certified by the Precast/Prestressed Concrete Institute Plant Certification Program. Manufacturer shall be certified at the time of bidding.
- B. Erector qualifications: Regularly engaged in the erection of precast structural concrete similar to the requirements of this project.

- C. Welder qualifications: In accordance with AWS D1.1.
- D. Testing: In general compliance with testing provisions in MNL-116, *Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products*.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and handling:
 - 1. Precast concrete members shall be lifted and supported during manufacturing, stockpiling, transporting and erection operations only at the lifting or supporting points, as shown on the shop drawings, and with suitable lifting devices. Lifting inserts shall have a minimum safety factor of 4. Reusable lifting hardware and rigging shall have a minimum safety factor of 5.
 - 2. Transportation, site handling, and erection shall be performed with acceptable equipment and methods, and by qualified personnel.
- B. Storage:
 - 1. Store all units off ground.
 - 2. Place stored units so that identification marks are discernible.
 - 3. Separate stacked members by battens across full width of each bearing point.
 - 4. Stack so that lifting devices are accessible and undamaged.
 - 5. Do not use upper member of stacked tier as storage area for shorter member or heavy equipment.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Portland cement: ASTM C 150 – Type I or III
- B. Other cementitious materials:
 - 1. Fly ash or natural pozzolans: ASTM C 618.
 - 2. Ground granulated blast furnace slag: ASTM C 989.
 - 3. Silica fume: ASTM C 1240.

- C. Admixtures:
 - 1. Air-entraining admixtures: ASTM C 260.
 - 2. Water reducing, retarding, accelerating, high range water reducing admixtures: ASTM C 494 or C 1017.
 - 3. Calcium chloride or admixtures containing chlorides shall not be used.
- D. Aggregates: ASTM C 33 or C 330
- E. Water: Potable (see ACI 318)
- F. Reinforcing Steel
 - 1. Bars
 - a. Deformed billet-steel: ASTM A 615.
 - b. Deformed low-alloy steel: ASTM A 706.
 - c. Galvanized reinforcing bars: ASTM A 767.
 - d. Epoxy coated reinforcing bars: ASTM A 775.
 - 2. Wire
 - a. Plain: ASTM A 82.
 - b. Deformed: ASTM A 496.
 - 3. Welded wire reinforcement
 - a. Welded plain steel: ASTM A 185.
 - b. Welded deformed steel: ASTM A 497.
 - 4. Coatings
 - a. Epoxy bars: ASTM A 775.
 - b. Galvanized bars: ASTM A 767.
 - c. Epoxy welded wire reinforcement: ASTM A 884.
- G. Strand: Uncoated, 7-wire strand: ASTM A 416 – Grade 250 or 270
- H. Anchors and inserts
 - 1. Materials:
 - a. Structural steel: ASTM A 36.
 - b. Malleable iron castings: ASTM A 47.
 - c. Stainless steel: ASTM A 666, Type 304.
 - d. Carbon steel plate: ASTM A 283.
 - e. Bolts: ASTM A 307 or A 325.
 - f. Welded headed studs: ASTM A 108.
 - g. Deformed bar anchors: ASTM A 496 or A 706.

2. Finish
 - a. Shop primer: Manufacturer's standards.
 - b. Hot dipped galvanized: ASTM A 123.
 - c. Zinc-rich coating: DOD-P-21035, self curing, one component, sacrificial.
 - d. Cadmium coating: ASTM B 766.
- I. Grout
 1. Cement grout: Portland cement, sand, and water sufficient for placement and hydration.
 2. Non-shrink grout: Premixed, packaged ferrous or non-ferrous aggregate shrink-resistant grout.
 3. Epoxy-resin grout: Two-component mineral-filled epoxy-resin: ASTM C 881 or FS MMM-A-001993.
- J. Bearing pads:
 1. Chloroprene (Neoprene): Conform to Division II, Sect. 18 of AASHTO Standard Specifications for Highway Bridges.
 2. Random oriented fiber reinforced: Shall support a compressive stress of 3000 psi with no cracking, splitting or delaminating in the internal portions of the pad.
 3. Duck layer reinforced: Conform to Division II, Sect. 18.10.2 of AASHTO Standard Specifications for Highway Bridges or Military Specification MIL-C-882D.
 4. Plastic: Multimonomer plastic strips shall be non-leaching and support construction loads with no visible overall expansion.
 5. Tetrafluoroethylene (TFE): Reinforced with glass fibers and applied to stainless or structural steel plates.

2.02 MIXES

- A. 28-day compressive strength: Minimum of 5000 psi.
- B. Release strength: Minimum of 3500 psi.

2.03 MANUFACTURED UNITS

- A. Manufacturing procedures shall be in general compliance with PCI MNL-116.
- B. Manufacturing tolerances shall comply with PCI MNL-116 except as modified herein. Prestressed members will be rejected for any of the following:

1. Length and variation in excess of $\frac{1}{2}$ " ($\frac{1}{4}$ " at each end) of adjacent units or 1" maximum between the longest and shortest units.
2. Edges varying from a straight line more than $\frac{3}{16}$ " and from parallel within a maximum between the longest and shortest units.
3. Edges not straight and parallel.
4. Deviation from design camber, differential camber between adjacent members of the same design, or warp or camber which cannot be controlled by the fastening system between members.
5. Improperly placed accessories or blockouts.
6. Unsatisfactory surface finish.
7. Exposure of wire mesh, reinforcing steel, or prestressing strand, except where cut off at the ends.
8. Honeycomb.
9. Fractures, cracks, chips or spalls which cannot be repaired to the satisfaction of the Engineer.
10. Irregularities resulting from damaged forms.

C. Finishes:

1. Standard underside: Resulting from casting against approved forms using good industry practice in cleaning of forms, design of concrete mix, placing and curing. Small surface holes caused by air bubbles, normal color variations, normal form joint marks, and minor chips and spalls shall be tolerated, but no major or unsightly imperfections, honeycomb, or other defects shall be permitted.
2. Standard top: Result of vibrating screed and additional hand finishing at projections. Normal color variations, minor indentations, minor chips and spalls shall be permitted. No major imperfections honeycomb, or defects shall be permitted.
3. Vertical ends:
 - a. When exposed to view, strands shall be recessed a minimum of 2 in., the holes filled with grout and the ends of the member shall receive sacked finish.
 - b. When not exposed to view, protruding ends of prestressing strand shall be cut off flush with the concrete and coated or finished to prevent rusting.

- D. Openings: Primarily on thin sections, the manufacturer shall provide for those openings 10 in. round or square or larger as shown on the structural drawings.

Other openings shall be located and field drilled or cut by the trade requiring them after the precast, prestressed concrete products have been erected. Openings shall be approved by the architect/engineer before drilling or cutting.

- E. Patching: Shall be acceptable providing the structural adequacy of the product and the appearance are not impaired.
- F. All plates, inserts and other accessories as detailed or required by the contract drawings are required to be embedded in the members at the time of manufacture. All embedded items shall be accurately positioned and shall be rigidly held in position during concrete placement. It is essential that bearing plates be installed in exact and true position.
- G. Each member shall have shop markings, painted or labeled at a place not be finally exposed, to indicate location and position in the structure in accordance with the manufacturer's layout drawings.
- H. Concrete shall be cured by continuous surface saturation or inundation, exposure to steam or saturated air in a tightly closed room or chamber, or other method acceptable to the Engineer. Moist curing shall be maintained for at least seven days when Type I cement is used, or 48 hours when Type III cement is used. The minimum steam curing period shall be 18 hours for either type of cement.

PART 3 EXECUTION

3.01 ERECTION

- A. General contractor shall be responsible for providing suitable access to the building, proper drainage and firm, level bearing for the hauling and erection equipment to operate under their own power.
- B. General contractor shall be responsible for:
 - 1. Providing true, level bearing surfaces on all field placed bearing walls and other field placed supporting members.
 - 2. Placement and accurate alignment of anchor bolts, plates or dowels in column footings, grade beams and other field placed supporting members.
 - 3. All shoring required for composite beams and slabs.
- C. Installation of precast, prestressed concrete shall be performed by the manufacturer or a competent erector. Members shall be lifted by means of suitable lifting devices at points provided by the manufacturer. Temporary shoring and bracing, if necessary, shall comply with manufacturer's recommendations.

- D. Prestressed concrete members shall be handled carefully in a manner which will cause no damage, and shall be kept from contact with adjacent concrete members. Members shall be stored off the ground on timber skids and leveled to avoid twisting or introduction of other undesirable stresses. Members shall not be moved from the fabricator's yard until completion of specified curing period.
- E. Prestressed concrete members shall be set in position in accordance with the manufacturer's approved layout and the Drawings. Members shall rest solidly upon the supports without rocking.
- F. Members in final position shall be loaded as necessary so that adjacent top edges are even and the joints welded as indicated on the Drawings. Loading shall be acceptable to the Engineer. After all joints have been welded and leveling loads removed, the member shall be anchored to the supports as indicated on the Drawings.

3.02 WELDING

- A. Welding shall be done by qualified welders possessing valid certificates under the qualification procedures of the American Welding Society. Care shall be exercised to avoid overheating and cracking the concrete adjacent to the anchorage plates. All members damaged during welding shall be removed and replaced with new undamaged members by and at the expense of the Contractor.

3.03 FIELD CUTTING

- A. Holes, within the manufacturer's limitations and not requiring cutting of prestressing strands, shall be cut in the field by the erector in accordance with the manufacturer's standard recommendations. Holes requiring cutting of prestressing strands shall be made during manufacture; prestressing strands shall not be cut in the field.
- B. All cutting of concrete sections shall be done with suitable concrete saws or core drilling equipment in a manner that will provide smooth, even cut surfaces.
- C. All lifting loops shall be cut off flush with the top surface of the member before any covering materials are placed.

3.04 JOINTS

- A. The underside of joints that will be permanently exposed to view after the work has been completed shall be caulked.

3.05 ATTACHMENTS

- A. Subject to approval of the architect/engineer, precast, prestressed concrete products may be drilled or "shot" provided no contact is made with the prestressing steel. Should spalling occur, the repair of the spall shall be the responsibility of the trade doing the drilling or the shooting.

3.06 FIELD QUALITY CONTROL

- A. Final inspection and acceptance of erected precast, prestressed concrete shall be made by the architect/engineer within a reasonable time after the work is completed.

PART 4 MEASUREMENT AND BASIS OF PAYMENT

Where items are specifically included on the bid schedule, they will be paid for by the unit given. All other items in this section that are essential to the project but for which there are no specific pay items, will not be measured and paid for separately but shall be included in the project.

END OF SECTION

SECTION 04200

MASONRY

PART 1 GENERAL

1.01 SUMMARY

- A. Work to be completed under this section shall include all labor, equipment, plant, and materials necessary to furnish and install all masonry units, together with all miscellaneous and appurtenant items required for installation and/or furnished by other trades, as shown on the Plans and as specified herein.

1.02 REFERENCE STANDARDS

- A. ASTM C476 - Standard Specification for Mortar and Grout for Reinforced Masonry.
- B. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.
- C. ASTM C144 - Standard Specification for Aggregates for Masonry Mortar.
- D. ASTM C55 - Standard Specification for Concrete Building Brick.
- E. International Masonry Industry, All-weather Council, "Recommended Practices and Guide Specification for Cold Weather Masonry Construction".

1.03 SUBMITTALS

- A. Descriptive literature and catalogue cuts on masonry units, reinforcing steel and insulation.

1.04 PROTECTION OF WORK

- A. Contractor responsible for protection of all work prior to acceptance. Exposed insulation or cells shall be covered to prevent moisture or dirt intrusion.

1.05 STORAGE OF MATERIALS

- A. Materials shall be stored in a dry place and in a manner to prevent damage or intrusion of foreign matter. Materials showing evidence of water or other damage are subject to rejection.
- B. Concrete masonry units shall be protected against wetting prior to use. During freezing weather, all masonry units shall be protected with tarpaulin or other suitable material. Concrete masonry units shall be stored under covers that will permit circulation of air and prevent excessive moisture absorption.
- C. Cement, lime and air-settling mortars shall be stored in watertight sheds with elevated floors.

- D. Reinforcement shall be protected from the elements; immediately before placing, reinforcement shall be free from loose rust, ice or other foreign coatings that will destroy or reduce the bond.
- E. Deliver packaged material in original manufacturer's containers.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS (CMU)

- A. Units shall conform to ASTM C90 specifications. All units shall be Type I. Units below grade or exposed to weather shall be Grade N. Other units may be Grade S. Crushing strength, $f'm = 1900$ psi.
- B. Units shall be in modular sizes with standard 8" width or 4" width as required. Corner units shall have square external corners.
- C. Jamb units at windows, bond beam units and other special units shall match the approved samples for the type of construction and locations designated.
- D. Units shall not contain iron spots or other substances that will strain plaster or paint.

2.02 JOINT REINFORCEMENT

- A. Steel reinforcement for use in horizontal bed joints of concrete masonry units and other locations as hereinafter specified shall be prefabricated truss design type formed of zinc-coated cold drawn steel wire conforming to ASTM A82 and A116 of Class 3 coating. Side wire shall be formed of 9 gauge rod; cross rods shall be of 9 gauge, smooth or deformed wire, butt welded to side wires in the same plane at contact points. Special formed pieces shall be provided at corners and wall intersections.
- B. Reinforcing shall be of proper widths for the wall thicknesses shown.
- C. Reinforcing shall be Standard Type Dur-O-Wall, Rewal, or approved equal.
- D. Unless otherwise noted on the plans, reinforcement in masonry walls shall be installed in the first and second bed joints above lintels, below sill at openings and below bond beams around the entire top of the perimeter walls of the building. Elsewhere, reinforcing shall be installed in bed joints at 16" vertical intervals. Side rods shall be lapped horizontally a minimum of 6". Joint reinforcement embedded in horizontal mortar joints shall have not less than 5/8" mortar coverage from the exposed face.

2.03 REINFORCING STEEL

- A. Reinforcing steel shall be deformed bars conforming to "Standard Specifications for Deformed and Plain Billet Steel Bars for Concrete Reinforcement" (ASTM A615) and shall be Grade 60.

2.04 MORTAR AND GROUT

- A. Shall conform to the property requirements of ASTM C476. Proportion the mix to meet strength and other requirements. Mortar shall be Type S minimum grout compressive strength shall be 2000 psi.
- B. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
 - 1. Pigments shall not exceed 10 percent of portland cement by weight.
 - 2. Pigments shall not exceed 5 percent of masonry cement by weight.
 - 3. Application: Use pigmented mortar for exposed mortar joints with the following units: Integral color CMUs.

2.05 PORTLAND CEMENT

- A. All cement shall be Portland Cement Type II or V conforming to "Standard Specifications for Portland Cement" (ASTM C 150).

2.06 INSULATION

- A. Loose fill insulation not permitted.
- B. Foamed-In-Place masonry insulation see Section 07214.

2.07 MASONRY CEMENT

- A. Cement shall conform to ASTM Specification C91. Cement shall be gray.

2.08 LIME

- A. Hydrated lime shall be Type S conforming to ASTM Specification C207. Quicklime shall conform to ASTM Specification C5; it shall be slaked in accordance with the manufacturer's directions.

2.09 LIME PUTTY

- A. Putty shall be a stiff mixture of lime and water. Keep putty moist until used. Putty made from quicklime shall be slaked and allowed to soak at least 24 hours before using. Putty made from Type S hydrated lime may be used immediately after mixing.

2.10 SAND

- A. Sand shall conform to ASTM Specification C144 except that sand for mortar in 1/4 inch wide joints shall pass a No. 16 sieve.

2.11 MIXING WATER

- A. Water shall be clean and potable.

2.12 COARSE AGGREGATE FOR MASONRY GROUT

- A. Aggregate shall conform to ASTM Specification C404.

PART 3 EXECUTION

3.01 MIXING MORTAR

- A. Mix all cementitious materials and sand in a mechanical batch mixer for a minimum of 5 minutes.
- B. Adjust the consistency of the mortar to the satisfaction of the mason, but add only as much water as is compatible with convenience in using the mortar.
- C. If the mortar begins to stiffen from evaporation or from absorption of a part of the mixing water, re-temper the mortar immediately by adding water and remix the mortar.
- D. All mortar shall be used within 2 1/2 hours of the initial mixing. It shall not be used after it has begun to set.

3.02 OTHER TRADES

- A. Other trades shall be consulted and provisions made such that the installation of their work is permitted in a manner to avoid butting and patching.
- B. Install, by way of example, anchor bolts, bearing plates, pipe and conduit openings and sleeves, HVAC openings and other knockouts required by other trades. Provide minimum 7-day notice to Owner, Engineer and other trades prior to requiring materials or detailing information.
- C. Build in work specified under other sections, as necessary and as the work progresses in accordance with requirements or other trades. Masonry contractor not responsible for installation of materials running within walls such as concealed conduit and piping.

3.03 LAYING MASONRY UNITS

- A. All units shall be set plumb and true to line. All units shall be laid with level horizontal joints. Units shall be laid in "running bond" unless otherwise shown.
- B. All interior masonry partitions unless otherwise shown shall terminate 1/2-inch from structural ceilings and a 1/2-inch thick by 8-inch wide expansion joint material installed thereon.

- C. Where electric conduit, outlet and switch boxes occur, units shall be ground and cut before building in service. Work shall be coordinated with electrical subcontractor. Cutting of all units exposed in finished work shall be done with an approved type of power saw. Work must also be coordinated with plumbing subcontractor where plumbing occurs in masonry partitions.
- D. Masonry units shall be reinforced horizontally with continuous joint reinforcement placed not to exceed 16" on center vertically in exterior walls and in non-load bearing partitions.
- E. Bond each course at corners in a masonry bond and at intersections with metal ties, anchors or joint reinforcement spaced as above.
- F. Partitions of all units that abut exterior walls, columns and other partitions shall be bonded in or be anchored thereto once every 16 inches in height. Where anchors are used they shall be 1/8 x 1-inch zinc coated steel anchors with ends turned up 2 inches and extending 4 inches into wall and not less than 8 inches onto partitions; or anchors may be of type to fit the slats in concrete.
- G. Interior joints of all masonry construction shall match existing. Exterior joints of all masonry construction shall be "concave".

3.04 SPECIAL REQUIREMENTS

- A. Masonry shall not be laid when the temperature of the outside air is below 40 degrees F, unless suitable means as approved by the Engineer are provided to heat materials, protect work from cold and frost and ensure that mortar will harden without freezing. (No anti-freeze ingredient shall be used in the mortar).
- B. The facing material shall be protected against staining and tops of walls kept covered with non-staining waterproof coverings when work is not in progress. When work is resumed, top surface of work shall be cleaned of all loose mortar and in drying weather thoroughly wet except for concrete masonry units.
- C. Where fresh masonry joins masonry that is partially set or totally set, clean the exposed surface of the set masonry and wet it lightly so as to obtain the best possible bond with the new work. Remove all loose brick and mortar. If it is necessary to "stop off" a horizontal run of masonry, this shall be permitted only with the Engineer's approval.
- D. All reinforced hollow unit masonry shall be built to preserve the unobstructed vertical continuity of the cells to be filled. Walls and webs forming such cells to be filled shall be full bedded in mortar to prevent leakage of grout. All head (or end) joints shall be solidly filled with mortar for a distance of the longitudinal face shells. Bond shall be provided by lapping units in successive vertical courses or by equivalent mechanical anchorage.
- E. Vertical cells to be filled shall have vertical alignment sufficient to maintain a clear, unobstructed continuous vertical cell measuring not less than 2 inches by 3 inches.

- F. All cells containing reinforcement shall be filled solidly with grout. Grout shall be poured in lifts of 8 feet maximum height. All grout shall be consolidated at time of pouring by puddling or vibrating and then reconsolidated by again puddling later, before plasticity is lost.
- G. When total grout pour exceeds 8 feet in height, the grout shall be placed in 4-foot lifts and special inspection during grout shall be required. Minimum cell dimension shall be 3 inches.
- H. When the grouting is stopped for one hour or longer, horizontal construction joints shall be formed by stopping the pour of grout 1½ -inches below the top of the uppermost unit.
- I. Steel in lintels shall be set in beds of mortar. Spaces around jambs and heads of metal door bucks and frames shall be filled solidly with mortar.
- J. Bond beams or concrete caps along the top of the walls shall be provided with the necessary and required bearing plates, anchor bolts, expansion joint filler, etc. and welds and connections of the pre-cast concrete components to the walls shall be made by the contractor under this section.
- K. All mortar smears and mortar chucks shall be cleaned from all exposed surfaces or surfaces to receive paint. Point all joints as directed by Engineer removing joint material sufficient to allow uniform joint after repair. Receive approval of finished wall.

END OF SECTION

SECTION 16521
EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
1. Exterior luminaires with lamps and ballasts.
 2. Poles and accessories.

1.3 SUBMITTALS

- A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
 2. Details of attaching luminaires and accessories.
 3. Details of installation and construction.
 4. Luminaire materials.
 5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
 - a. For indicated luminaires, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
 - b. Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
 6. Photoelectric relays.
 7. Ballasts, including energy-efficiency data.
 8. Lamps, including life, output, and energy-efficiency data.
 9. Materials, dimensions, and finishes of poles.
 10. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
 11. Anchor bolts for poles.
 12. Manufactured pole foundations.

- B. Samples for Verification: For products designated for sample submission in Exterior Lighting Device Schedule. Each sample shall include lamps and ballasts.
- C. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4 and that load imposed by luminaire has been included in design.
- D. Qualification Data: For agencies providing photometric data for lighting fixtures.
- E. Field quality-control test reports.
- F. Operation and Maintenance Data: For luminaires and poles to include in emergency, operation, and maintenance manuals.
- G. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with IEEE C2, "National Electrical Safety Code."
- E. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Package aluminum poles for shipping according to ASTM B 660.
- B. Store poles on decay-resistant-treated skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.
- C. Retain factory-applied pole wrappings on fiberglass and laminated wood poles until right before pole installation. Handle poles with web fabric straps.
- D. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.
 - 1. Warranty Period for Luminaires: Five (5) years from date of Substantial Completion.
 - 2. Warranty Period for Metal Corrosion: Five (5) years from date of Substantial Completion.
 - 3. Warranty Period for Color Retention: Five (5) years from date of Substantial Completion.
 - 4. Warranty Period for Lamps: Replace lamps and fuses that fail within twelve (12) months from date of Substantial Completion; furnish replacement lamps and fuses that fail within the second twelve (12) months from date of Substantial Completion.
 - 5. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three (3) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRES

- A. Providence Small – LED (PROV-LED) by Architectural Area Lighting, Black (BLK) color, standard post-top mount (PR3), Architectural Area Lighting, 16555 East Gale Avenue, City of Industry, CA 91745, (626)968-5666

2.2 POLES

- A. SP8703 Glenwood Springs 10' Pole by Hadco Lighting, Black black powdercoat finish, Base Details: Reference template #T01000592, Hadco Lighting, 100 Craftway P.O. Box 128, Littlestown, PA 17340-0128, (717)359-7131

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

- A. Install luminaires per manufacturer instructions.

3.2 POLE INSTALLATION

- A. Install poles per manufacturer instructions.

3.3 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain luminaire lowering devices. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION