SECTION 622
REST AREAS AND BUILDINGS

DESCRIPTION

622.01 This work consists of the construction of various facilities in rest areas and other areas in accordance with these specifications and in conformity to the lines, grades, dimensions and details shown on the plans or established.

When information shown on the plans are of general arrangements only, the Engineer will establish exact locations, measurements, levels, etc., at the site to adapt the work to suit actual conditions.

MATERIALS

622.02 All materials used in the construction shall conform to the requirements of Section 717 and to the details shown on the plans or established.

622.03 Shop Drawings and Descriptive Brochures. At the preconstruction conference, the Contractor shall submit to the Department five copies of shop drawings or descriptive brochures for all materials and equipment to be incorporated in the work for review by the Engineer.

All work for which shop drawings or descriptive brochures are required must be performed in accordance with such drawings, and work on the item shall not be started until review of said drawings.

All shop drawings or descriptive brochures must be complete in every respect, numbered consecutively, have the name of the project printed thereon, and each transmittal must be accompanied by a letter directing the Engineer's attention to any changes from the plans.

After shop drawings and descriptive brochures have been reviewed, any portion of the work covered by the shop drawings which modify the plans shall be rejected as soon as such modification is discovered unless said modification has been specifically pointed out to the Engineer review.

The review of such shop drawings and descriptive brochures will be general in character and shall not relieve the Contractor from responsibility for their accuracy or for proper fitting and construction of the work, or from the necessity of furnishing any materials and workmanship required by the Contract which may not be indicated on shop drawings when reviewed.

622.04 Construction Material. Structure excavation and structure backfill shall conform to the requirements of Section 206. Treated timber shall conform to the requirements of Section 508. Concrete shall be Class "B" and conform to the requirements of Section 601. Reinforcing steel and fabric shall conform to the requirements of Section 602.

CONSTRUCTION REQUIREMENTS

622.05 Services of Factory Representative. It is important that the Department be protected as far as possible against the discontinuance of the make of equipment to be purchased, and that repair parts and the services of expert factory representatives be available if desired. Under these conditions the Contractor shall not furnish equipment made by firms in the hands of receivers.

622.06 Maintenance Manuals. The Contractor shall furnish to the Engineer five copies of instructions for the operation, lubrication and maintenance for all major items of equipment. The Contractor shall assemble all literature into five coordinated manuals with additional information describing the combined operation of field assembled units, including as-built wiring diagrams. Manuals shall also contain the names, addresses of the manufacturer, and the local representative who stocks or furnishes repair parts for all items of equipment. All five manuals shall be turned over to the Engineer for review and distribution to the Department. Manuals shall include but not be limited to the above information for the following equipment: Furnace, water heater, well pump, exhaust fan, incinerators, timer, septic tank, emergency battery charger, and area luminaires.

622.07 Temporary Heat. All heating and electrical service required during construction for the satisfactory prosecution of the work shall be furnished by the Contractor. Heating units must be of approved types, and equipment and surroundings shall be kept in a clean and safe condition. Open fires will not be permitted.

622.08 Temporary Utilities.

(a) *Water for Construction Purposes.* The Contractor may use water pumped by the permanent well pump and equipment, if approved by the Engineer. The Contractor shall provide potable water for construction purposes at his expense. If temporary pumps are approved, all sanitary precautions necessary to prevent contamination of the well shall be taken.

(b) *Electrical.* The Contractor shall furnish at his expense, all electrical power required for construction.

622.09 Barricades. When required, the Contractor shall barricade the entrance ramp to the rest area during construction with standard barricades. The barricades will not be paid for separately but shall be included in the work.

622.10 Masonry Work.

(a) *Installation of Masonry.* Concrete masonry units shall be placed in face shell mortar bedding with complete coverage of face shells. Extruded mortar shall be struck. After the mortar has stiffened somewhat, all joints shall be tooled with a rounded tool having a diameter slightly larger than the thickness of the joint. Mortar joints shall average $^{3}/_{8}$ inch in thickness. Blocks shall be placed in accordance with local standard masonry practice. Reinforcement and wall ties shall be installed as indicated on the plans.

Standard shapes of concrete masonry units such as radius, corner, jamb blocks, control joint blocks, bond course units and square end blocks, shall be furnished as required by the Contract.

Structural glazed tile in toilets shall be placed with white mortar. Mortar joints shall not exceed ¼ inch in thickness. All joints shall be tooled.

The Contractor shall furnish cap courses, base courses, coverings, bull-nosed corners and any special units which are necessary to complete a first class job. Special shapes of tile required are shown on the plans.

When cutting of tile is necessary, it shall be done with a special saw as recommended by the manufacturer. Chipped, warped or defective tiles will be rejected.

All face brick shall be placed with joints about $^{3}/_{8}$ inch thick. Joints shall be concave tooled joints.

Brick will be rejected if the edges and corners of finished faces have chippage exceeding the following maximum sizes: Edges $^{5}/_{16}$ inch (measured in from edge) and corners, ½ inch (measured in from edge), or for any other structural or color defect.

Each brick shall be placed in a full bed of mortar and shall be shoved in place. The Engineer may remove brick already placed to assure himself that all joints are full. If he finds joints that are not completely filled, he can order brick removed until he is assured that the joints of all remaining brick are completely filled.

All face surfaces of the face brick work shall be kept clean. After joints are struck, the surface shall be carefully cleaned.

The faces and angles of all walls shall be carefully plumbed and all work carried up true and even, laying all walls to lines.

(b) *Precautions and Protection.* All work and materials shall be protected from the weather. Stored masonry units shall be stockpiled on planks to prevent contact with the ground.

(c) *Masonry Work in Cold Weather.* Masonry shall not be placed when the surrounding air temperature is 40 °F or less, except when the masonry work is housed in a temporary manner, suitable to the Engineer, and the inside air temperature is kept within 40 °F to 80 °F for a period of 24 hours after the masonry is placed. Mortar for masonry work during cold weather shall have a minimum temperature of 50 °F and a maximum temperature of 100 °F at the time it is applied to the masonry. This temperature shall be provided by heating the mixing water or the aggregate or both if necessary. Masonry materials shall

also be heated, if necessary, to provide at least a minimum temperature of 40 °F at the time they are placed.

(d) *Cleaning.* After completion, all masonry units shall be thoroughly cleaned according to the masonry manufacturer's recommendations. The Contractor shall protect adjacent work from damage during the cleaning operations.

Cleaning shall start at the top and be continued down until such work is completed. All pointing will be inspected and the Contractor shall completely point up all voids.

622.11 Metal Specialties. Metal stalls or compartments for toilet rooms and mirrors shall be of the type and style specified and shall be installed as shown on the plans.

622.12 Sanitary Napkin Disposal. Sanitary napkin dispenser and disposal for Women's Rest Rooms shall be installed as shown on the plans and in accordance with the manufacturer's recommendations.

622.13 Comfort Station and Sanitary Station Signs. Comfort Station and Sanitary Station Signs shall be installed in the size and location shown on the plans.

622.14 Doors, Frames and Windows. Doors, frames, windows and door hardware shall be installed as shown on plans.

All door frames shall have floor anchors installed to set flush with the finished floors. Two rubber door silencers shall be installed for strike jambs of each door. At least three masonry "T" anchors shall be installed at each jamb that is adjacent to masonry work.

622.15 Ceramic Tile.

(a) *General.* The work required under this heading shall include all labor, material, equipment and services necessary for the furnishing and setting of all tile as shown on the plans and as specified herein. The floor slab shall be clean and free of oily or waxy films.

(b) *Installation of Ceramic Floor Tile.*

1. Mortar Setting Bed. A mortar setting bed shall be applied over the floor slab to give a true and even setting bed. This mortar shall be composed of one part portland cement, six parts sand.
2. Setting Floor Tile. Floor tile shall be set by troweling a skim coat of neat portland cement mortar on the setting bed and immediately floating the tile into place. Joint width shall not exceed $^{1}/_{16}$ inch.
3. Grouting. All joints in ceramic floor tile shall be grouted full with a grout mixture and application as recommended by the tile manufacturer immediately after a suitable area of tile has been set. A $^{1}/_{8}$ inch bronze

edging strip shall be provided under the metal thresholds where the ceramic floor tile terminates at the door.

4. Defective Tiles. All tiles chipped, broken, stained or otherwise imperfect, shall be considered defective, and shall not be set; any such defective tiles set shall be removed and replaced with approved tiles at the Contractor's expense.
5. Cleaning. Upon completion of the work, all tile shall be thoroughly cleaned, and left free from stains, scum, discoloration and in an acceptable condition.

622.16 Roofing, Flashing and Roof Insulation. The work required under this heading shall include all labor, material, equipment and services necessary for the proper furnishing and installing of all roofing, flashing and insulation materials as shown on the plans.

(a) *Flashing at Flues, Breather Vents, Vents, Roof Drains and Emergency Light Conduit.* Flashings at sewer vent and roof drain shall be at least 2 feet square lead flanges soldered to lead sleeves of sufficient diameter to fit the pipe involved, placed over the last layer of felt and sealed in place with two plies of felt, hot mopped in place. The specified roofing shall be applied over this. At the vent, the lead sleeve shall be folded over the top of the 4 inch soil pipe. At the roof drain, the lead sleeve or flange shall be securely clamped in place to make a watertight joint. Other means of flashing may be used if approved. Flashing at emergency light and breather vents shall be as detailed on the plans or directed.

All flashing shall be installed before roofing operations begin.

(b) *Roofing Construction (Shingle Roofing).* Shingles as shown on the plans shall be applied over two layers of 15 pound asphalt felt in straight courses. Shingles shall be doubled at all eaves, and butts of first-course shingles shall project 1½ inch beyond the first sheathing board. Spacing between adjacent shingles (joints) shall be ¼ inch. Joints in any one course shall be separated at least 1½ inches from joints in adjacent courses and joints in alternate courses shall not be in direct alignment. Exposure of shingles shall be 4½ inches for 16 inch shingle, 5 inches for 18 inch shingle and 7 inches for 24 inch shingle.

(c) *Roofing Construction (Membrane Roofing).* Membrane roofing shall be installed as follows:

Starting at one side of the roof install one layer of 30 pound Per 100 square feet base sheet side lapped 2 inches and end lapped 4 inches. Nail and tin cap the base sheet to the deck with large-headed roofing nails through 1½ inch diameter tin disks, 18 inch on centers. Over the base sheet in the same direction, install three layers of 15 pound per 100 square feet asphalt felt, solid mopped to the base sheet with 25 pound per 100 square feet of specification asphalt. Felt sheets shall be lapped 24 inch over preceding sheet and solid-mopped full with 25 pound per 100 square feet of specification asphalt. All starter courses shall be

enveloped in order to prevent drippage if low-melting-point material is being used. After flashing has been installed at all vertical projections, the entire surface shall be given a 60 pound per 100 square feet pour coat of specification asphalt into which, while asphalt is hot, the Contractor shall embed 400 pound per 100 square feet. of clean gravel. Damp gravel is permissible. In cold weather, instead of applying roof three ply solid, the 15 pound per 100 square feet asphalt felts may be installed on a two and one application provided the entire roof is mopped at the end of each day's work. Where roofs pond water, the asphalt felt shall be coated at the end of the day's work.

The bitumen used shall not be heated above 425 °F. In order to get 25 pound Per 100 square feet between plies, a 40 ounce cotton mop when full and out of the mop bucket should not cover more area than a 3 foot wide swath 9 feet long.

(d) *Caulking.* This work shall include all labor, materials, equipment and tools necessary for the proper gun or knife applied caulking wherever indicated and in all following locations:
(1) Exterior joints between all metal and masonry.
(2) Joints between roof and aluminum flashing.
(3) Interior joints between hollow metal frames and wall tile.

Mixing of the caulking shall be in strict accordance with the manufacturer's instructions. Working times listed by the manufacturer shall not be exceeded.

Sealant application shall be as directed by the manufacturer, taking particular care to prepare the joints as directed. Metal surfaces to be sealed shall be bright metal clean before sealing. Window and door frames shall be cleaned before sealing. It is imperative that paint shall not remain on the surfaces to be sealed. Any joint showing sealant applied over paint will be cause for rejection of that complete joint.

622.17 Carpentry. The work under this heading shall include all labor, materials, equipment and services necessary for the proper completion of all rough and finish carpentry.

(a) *Ceiling Panel Installation.* Ceiling panels shall be fastened to gypsum board back up by use of adhesive and in accordance with the manufacturer's instructions. Each and every joint shall be concealed with colored aluminum mouldings. Adhesive shall be applied over the entire back surface of each panel.

(b) *Preservation Treatment.* All wood blocking under gravel stops and wood nailers shall be treated timber.

622.18 Interior Insulation. This work shall include all labor, materials, equipment and Services necessary for and reasonably incidental to the proper completion of all insulating work.

Insulation for cavity walls shall be installed in the cavity after all excess mortar is cleaned from the face of the interior wall. Ties and insulation shall be pressed firmly together so that ties hold the insulation in place and insure that the adjacent boards are butted tightly together. Cut ends shall be squared so that all joints will be tight. Asphalt emulsion shall be used if necessary, to hold insulation against inner wall.

Insulation to be applied to underside of roof shall be secured by using suitable fasteners common to the industry and recommended by the insulation manufacturer.

622.19 Glass and Glazing. This work shall include the furnishing of all labor, materials, equipment and services necessary for and reasonably incidental to the proper completion of all glass and glazing work.

(a) *Installation.* All glass shall be set in the best possible manner with polished side out and in such a way that there will be an equal bearing the entire width of each pane.

All putty shall be left smooth and free from marks and other defects and shall be painted. Putty shall be an approved type suitable for glazing.

(b) *Cleaning and Replacing.* Glass broken or damaged before completion of the building operations shall be replaced with glass of like kind and quality without cost to the Department. Upon completion of all construction work and approval of glazing, labels shall be removed and glass shall be cleaned.

622.20 Trash Receptacles. This work shall include furnishing of all labor, materials, equipment and services necessary for the proper installation of trash receptacles.

Receptacles with anchor shall be installed at locations shown on the plans.

622.21 Painting and Special Coating Application. This work shall include the furnishing of all labor, materials, equipment, and services necessary for the proper completion of painting and finishing of all unfinished metal throughout the interior and exterior of the building and the information center. It also includes the application of special coatings on concrete tables, benches and underside and edges of roof.

Colors and finishes shall be as specified on the plans. Sample panels to show proposed finish and color shall be prepared by the Contractor and approved by the Engineer before the painting work or special coating work is begun.

(a) *Paint Application.* Paint shall not be applied to wet surfaces. Exterior surfaces shall not be painted during rain or snow, or when temperature is below 40 °F, or when conditions are not conducive to acceptable painting.

All joints in plywood shall be sealed before paint is applied. Paint shall be spread evenly and smoothly without runs and sags.

All metal surfaces shall be thoroughly cleaned of rust and shall be thoroughly washed with non flammable solvent to remove any dirt or grease before applying paint.

Before painting or application of special coatings, all hardware, accessories, plates, lighting fixtures and similar items shall be removed, and protection of such items shall be provided. Only skilled mechanics shall be used for removing and connecting the above items.

(b) *Paint and Special Coating Schedule.*

1. Interior Metal. This metal is defined as, but not limited to, all hollow metal frames, doors and grills. Ductwork, electrical devices and conduit, stainless steel items and plumbing fixtures and devices shall not be painted.
   A. One field coat primer (omit this coat on previously primed surfaces).
   B. Two coats enamel, flat finish, color to match interior walls.

2. Exterior Non-Galvanized Metal. This metal is defined as, but not limited to, all exterior metal including structural steel, but not including finish hardware, vent stacks, and metal soffits.
   A. One field coat primer (omit this coat on previously primed surfaces).
   B. Two coats house paint, flat finish, color to match stain used on Redwood.

3. Concrete Benches, Tables, Table Supports and Table Slabs. Two coats of sealant. Application shall be in accordance with the manufacturer's directions.

4. Exterior Wood.
   A. Facing and fascia on buildings and information center shall be stained as scheduled on the plans.
   B. Plywood soffit on buildings and information center shall have one coat white prime and two coats semi-gloss white enamel.
   C. Information display board posts shall be stained the same as facing and fascia and the bulletin board shall have one coat white prime and two coats white paint, flat finish.

622.22 Plumbing and Drainage. This work shall include the furnishing, installation, and testing of a system of plumbing and drainage as herein described, and as shown on the plans, including such minor details not specifically mentioned or shown as may be necessary to complete the system for successful operation.

Also included in this work is the construction of the sewer line which shall connect the building to the septic tank or treatment facility.

Fixtures specified shall be of one make or type throughout the work.

All work, materials and manner of placing materials shall be in strict accordance with the latest requirements of the Colorado Technical Plumbing Code.

(a) *Data and Measurements.* Data contained in these specifications and shown on the plans are of general arrangement only. The Engineer shall determine exact locations, measurements, levels, etc., at the site and adapt the work to suit actual conditions.

(b) *Well Pump.* The well pump shall be as scheduled on plans.

The wells shall be equipped with a well seal and a liquid level control relay to stop the pump if the well water falls below a safe level. All related fittings, piping and electrical work for proper operation of the well is also included in this item.

(c) *Drinking Fountains.* Drinking fountains shall be the style and type called for on the plans.

(d) *Plumbing Installation.* All fixtures and plumbing items shall be installed according to the manufacturer's recommendations complete with all necessary accessories and trimmings. All water supply connections shall have stops or shut off valves to facilitate maintenance. All waste connections shall be trapped and vented. Stops or shut off valves shall be so installed as to be readily accessible in the utility room.

Immediately after fixtures are set, they shall be covered, and this cover shall not be removed until the building is prepared for occupancy. In addition, the Contractor shall furnish and install such guards and boxing as may be required to protect fixtures against damage by any other craft.

The Contractor shall clean all fixtures with acceptable cleaning compounds before final acceptance of the work.

The Contractor shall install all piping in such a manner as to allow complete drainage of the piping system. This requirement shall be met by pitching all lines to low points where valves or capped nipples in threaded tees shall be installed to drain the lines. These fittings, which are required specifically for draining the various lines, are not shown on the plans, since the number required and their locations must be determined by the field conditions encountered, and are considered subsidiary to the work.

(e) *Testing Interior Drainage and Vent System.* The waste drainage and vent system inside the building shall be tested and proved gastight and watertight prior to covering or concealment. The rough work shall be tested as a whole unit (that is: as a whole stack or riser).

Testing shall be conducted using water as the media under a hydrostatic head of not less than 10 feet above the highest joint being tested. If the vertical distance is less than 50 feet to the top of the highest vent above the roof, the entire stack-riser shall be tested by filling to the top of the highest vent. Other media may be used in lieu of water with the approval of the Engineer.

Testing shall be continuous for at least 30 minutes duration for each separate test. At end of this time interval, there shall not be more than ¾ inch drop in water level or not more than $^{1}/_{16}$ inch drop in mercury level.

If lines prove tight, concealment of rough work may begin. If repairs are required, retesting shall be conducted as often as necessary until lines are proved gastight and watertight to the satisfaction of the Engineer.

(f) *Testing Water Piping System.* Upon completion of a section or of the entire hot and cold water piping systems, they shall be tested hydrostatically to a pressure of at least 50 percent in excess of the maximum pressure to which the pipe will ordinarily be subjected, but not less than 100 pounds per square inch. Test shall not be less than two hours. Any leaks or defective pipe disclosed by the tests shall be repaired or replaced and the tests repeated until all piping shows tight.

All water for tests shall be furnished and disposed of by the Contractor at his expense. Piping shall not be insulated or concealed until it has been tested to the satisfaction of the Engineer.

(g) *Fixtures Substitution.* When substitutions for specified fixtures are requested, the Contractor shall submit a portfolio containing illustrations and complete descriptions of the fixtures for approval. Portfolios shall state the make and weight of the proposed fixtures, shall clearly indicate the materials of which the fixtures are made, and shall otherwise clearly describe in detail the fixtures proposed to be substituted.

(h) *Air Chambers.* Each water supply riser and fixture connection at all flush valves and lavatories shall terminate with an air chamber of diameter equal to the supply pipe and so located as to prevent water hammer. Approved shock absorbers may be substituted for air chambers.

(i) *Trenching and Backfilling for Water Lines and Sewer Lines.* The Contractor shall perform all excavation and backfilling in accordance with Section 206.

Trenches shall be only of sufficient width to provide a free working space and shall not be more than the outside diameter of the pipe bells plus 24 inches. They shall be dewatered and kept free from standing water until all joints are complete, the pipe tested, and the trench backfilled.

Backfilling around tanks may be puddled-in provided the tanks are first filled with water.

(j) *Sterilization of Water Systems.* The completed piping system including the piping from the well shall be sterilized in accordance with the regulations of the Department of Public Health and Environment, State of Colorado and as follows: Prior to final acceptance, the entire water system shall be thoroughly flushed. After flushing, chlorine or chlorine compound shall be introduced into the

system. The dosage shall be sufficient to give an initial residual chlorine mass fraction of 50 ppm. Samples shall be collected from various taps and fixtures throughout the systems during the introduction of the chlorine to assure uniform distribution. After a 24-hour contact period, all traces of the heavily chlorinated water shall be flushed from the systems. After flushing is complete, the Contractor shall, at his expense, provide evidence of the effectiveness of the disinfection by filing with the Engineer, laboratory reports of bacteriological tests on samples taken from the system. The number and the locations for taking samples shall be as specified by the Engineer. Should other than satisfactory results be obtained, the above disinfection process shall be repeated until satisfactory tests are obtained.

(k) *Cleaning and Adjusting.* At the completion of the work and prior to final acceptance, all parts of the work installed under this specification, all equipment, fixtures, pipe, valves and fittings shall be thoroughly cleaned of grease, oils, metal cuttings, sludge, etc., which may have accumulated by operation of installing these systems, of testing, or from other causes. Stoppage or discoloration or other damage to parts of the building, its finish or furnishing, due to failure of the Contractor performing the plumbing work to properly clean the piping system, shall be repaired at the Contractor's expense.

622.23 Heating and Ventilation. This work shall include furnishing and installing all units and duct work as set forth in the heating plans and installing the minor items necessary to complete the work outlined below:

The Contractor shall provide and install all other items, such as wiring, thermostats, sheet metal work, etc., that are necessary for a complete and operating system.

(a) *General.* All exhaust fans, duct work, outlets, inlets, thermostats, grills, vents, electrical wiring, plumbing, etc., shall be new. Standard products of manufacturers regularly engaged in production of such equipment shall be as shown in the manufacturer's latest catalogue.

(b) *Wall Heater, Exhaust Fans, Furnace and Duct Installation.* Wall heaters, exhaust fans, furnace and duct work shall be installed as shown on the mechanical plans. The fresh air duct shall be provided with a close fitting damper to vary the volume, or completely shut off the fresh air supply. For normal operation the fresh air damper should be adjusted to take in a maximum of 20 percent fresh air with the remainder being recirculated to the furnace through the return air grills. The fresh air duct shall run between the joists from the intake grill to above the furnace, and down to the return air plenum. A return air grill shall be installed in the return air plenum to pass recirculated air to blower. Both fresh air duct and return air grill shall be installed so that all return air will pass through the furnace filters. The fresh air damper shall be manually operated.

622.24 Electrical Work. All electrical wiring shall be installed in conformance with the National Electrical Code and the National Electrical Safety Code.

These specifications and plans cover the furnishing and installation of a system of electric wiring and conduit and box work as hereinafter described and as indicated on the plans of the building, and outdoor lighting including such minor details not specifically mentioned or shown as may be necessary to complete the system for a complete turnkey operation.

The Contractor shall, at the preconstruction conference or within 14 days after award of Contract, submit to the Engineer a complete list of electrical materials he proposes to furnish and install on the Contract. Five copies of the list, including manufacturer and catalogue numbers of devices and fixtures, shall be furnished in accordance with subsection 622.03.

(a) *Symbols.* Items of equipment and materials are indicated on the plans in accordance with the legend of symbols shown on the plans.

(b) *Conduit.* All conduit shall be installed in conformance with the National Electrical Code.

All conduit runs shown are diagrammatic. Exact locations will be determined in the field.

(c) *Position of Outlets.* Outlets shall be located as shown on the plans or as directed.

(d) *Conductors.* Conductors shall conform to the requirements of the National Electrical Code.

(e) *Thermostat.* A separate thermostat shall control the furnace so that the furnace or wall heaters will operate when the temperature drops to the thermostat setting.

A separate thermostat shall operate the emergency light to signal when the temperature in the building drops to a set temperature. Line voltage wiring complete in conduit shall be provided for this system.

(f) *Emergency Light.* Low voltage wiring, not in conduit, shall be provided for this circuit to the emergency battery charger.

(g) *Emergency Battery Charger.* The emergency light shall signal power failure and/or temperature drop in the building to below a preset temperature. Power failure or temperature drop below set temperature shall cause emergency battery charger to energize the emergency light. Upon correction of the emergency condition the battery charger shall turn off emergency light and keep the batteries charged automatically by use of line current.

(h) *Photoelectric Control.* Photoelectric cells shall be located and mounted as indicated on the plans.

(i) *Disconnect Switches.* The Contractor shall furnish and install disconnect switches for means of disconnecting appliances at the location shown on the plans.

(j) *Circuit Breakers.* All electrical devices shall be protected by circuit breakers located in the main breaker panel. The circuit breakers shall be in accordance with the National Electrical Code.

(k) *Grounding.* All equipment and conduit shall be grounded in accordance with the National Electrical Code requirements.

Code color shall be adhered to for all ground conductors and ground continuity shall be positive throughout the entire project.

(l) *Incoming Service.* The Contractor shall furnish, install and connect the incoming service cable from the local utility company service pole to the building. This cable shall be as specified under conductors and shall be buried at the location shown on the plans. Details of the connections to the local utility company poles are not shown on the plans. The Contractor shall furnish and install all material and equipment required to make these connections in conformance with utility company recommendations. Materials required to make these connections shall be considered subsidiary to the electrical systems.

(m) *Installation.* Where sizes are not indicated or shown on the plans for junction boxes, a 4 inch square galvanized junction box with blank cover shall be used.

Mounting heights above finished floor shall be as indicated below, unless otherwise shown on the plans or indicated in these specifications. All mounting heights shall be verified by the Engineer.

Switches	48 inches
Convenience outlets	48 inches
Panel to center	54 inches
Lighting fixtures -	as shown on the plans

622.25 Sanitary Sewer, Septic Tank, Leaching Field, Sewage Lift Station and Sanitary Station. This work shall include all labor, materials, equipment and services necessary for the installation of a sewer system including septic tank, leaching field and associated sewage piping as required for the comfort station, trailer pad and the trailer sanitary station, as shown on the plans and described as follows:

A sewage system shall be constructed, as shown on the plans or as directed, for each building.

A precast septic tank shall be installed for each trailer sanitary station and trailer pad as shown on the plans. Each septic tank shall be vented.

The septic tank required for the building may be cast-in-place or may be a precast unit or precast units in tandem of the capacity indicated on the plans.

Treatment plant and polishing tank or pond required for the building shall be installed as shown on the plans, or as directed.

Sewage lift station and wet well shall be installed as shown on the plans.

Leaching fields shall be constructed to the dimensions and details shown on the plans or as directed.

622.26 Flagpole. Flagpole shall be of the type and style specified and shall be installed as shown on the plans.

METHOD OF MEASUREMENT

622.27 The quantities to be measured under this Section will be the actual number of pay units, completed and accepted, of the various pay items which appear in the bid schedule, comprising the rest area, or other buildings.

All electrical work for the building including service from meter pole, shall be included as part of the building that appears in the bid schedule.

All electrical work for the information center shall be included as part of the information center.

Area lighting will be measured and paid for as luminaires, light standards and wiring in accordance with Section 613.

Shade shelter item shall include table and benches.

Septic tank, sewage lift station or treatment plants shall include the related mechanical devices and fittings and the sewer piping from the tank to the leaching field, wet well polishing tank or polishing pond. Sewage lift station shall also include the wet well.

Sewer piping, fittings, devices, etc., from the septic tank, treatment plant or sewer to the building, sanitary stations or trailer pad shall be included as part of the building, sanitary station or trailer pad.

Sewer piping from sewage lift station to point of discharge will be measured and paid for in accordance with in Section 619.

Polishing tanks or polishing ponds shall include all related pipe and fittings.

Sewage leaching field shall include all work associated with the leaching field. Measurement will be based on the square yards of leaching field trench excavated or linear foot of perforated pipe installed.

Trailer sanitary station shall include the water tower, hatch with cover, vacuum breaker, related fittings, sewer pipe to septic tank and water line connections.

Storage tank shall include all controls, fittings and piping from the tank to the building and, unless otherwise stipulated, shall also include all controls, fittings and piping from the water source to the storage tank.

Trailer pad shall include water service valve and riser, electrical pedestal, intercom connection, and sewer pipe to septic tank.

Drinking fountains except for those on or in the buildings will be measured by the units installed and accepted.

Well pump shall include the pitless adapter, seal, electric controls, and all related pipe and fittings.

Flagpole shall include halyard, swivels, cleats, ornamental ball and base.

BASIS OF PAYMENT

622.28 The accepted quantities will be paid for at the contract unit price for the various items listed below that appear in the bid schedule.

Payment will be made under:

Pay Item	**Pay Unit**
Information Sign Board	Each
Information Center	Each
Shade Shelter	Each
Table	Each
Trash Receptacles	Each
Drinking Fountain	Each
Trailer Pad	Each
Well Pump	Each
Sewage Lift Station	Each
Comfort Station	Each
Trailer Sanitary Station	Each
Leaching Field	Square Yard
Leaching Field	Linear Foot
Septic Tank (____Gal.)	Each
Storage Tank (____Gal.)	Each
Sewage Treatment Plant (____Gal.)	Each
Polishing Tank (____Gal.)	Each
Scale Pit and Approach Slabs	Each
Flagpole	Each
_____Building	Each

SECTION 623
IRRIGATION SYSTEM

DESCRIPTION

623.01 This work consists of furnishing and constructing an irrigation system in accordance with these specifications and in conformity with the lines and grades shown on the plans or established.

MATERIALS

623.02 General. All materials and equipment incorporated into the irrigation system shall be new and of recognized standard quality. In the case of computer software or hard coded instructions, the latest available version from the manufacturer is required. All materials shall be of a standard line from a name brand manufacturer, or must be approved.

623.03 Backflow Preventer. Pressure vacuum breakers shall be the pressure type with a bronze body and a machined valve seat. Reduced pressure-type backflow preventers shall include two check valves, a relief valve, two gate or ball valves, and test cocks for field testing. Vacuum breakers and reduced pressure-type backflow preventers shall meet the requirements in the Colorado Department of Health, Cross Connection Manual, and shall have a non-shock cold water rating of at least 150 psi.

623.04 Automatic Controllers. The automatic controller shall be an electro-mechanical or microprocessor based/microelectronic solid state type capable of operating in an automatic or manual mode. The controller shall have a minimum of six stations. Each station shall be programmed to operate for 1 to 99 minutes, or 0.1 to 9.9 hours. The controller shall have two independent programs with three automatic starts per day for each program. Each station on the controller shall be assigned to either or both programs. The controller shall be capable of watering any day or sequence of days on a six or seven day cycle.

The controller shall operate on a minimum of 117 volts AC power input. Controller electrical output shall be capable of 26.5 volts AC at 1.5 amps. The controller shall have a reset circuit breaker (1.5 amps holding and 2.5 amps break) to protect it from power overload.

Primary surge protection for 117 volt lines and valve (24 volt) output surge protection shall be installed to protect the controller.

The automatic controller shall be grounded using two $^{5}/_{8}$ inch x 8 foot copper clad grounding rods driven into the soil. A #10 AWG bare copper wire shall be used to connect the ground rods to the automatic controllers protective grounding circuit. The resistance of the ground shall not exceed 5 ohms.

The controller enclosure (including satellite controllers) shall be of a vandal and weather-resistant nature, manufactured entirely of metal or steel mill-treated with

zinc for rust resistance. The main housing shall have louvers in the upper and lower body to allow for crossflow ventilation.

623.05 Remote Control. Remote control shall consist of an FM, AM, UHF, or VHF radio transmitter/receiver pair with a minimum range of one mile in congested areas, and shall include battery charger and replacement battery. The receiver shall plug into a receptacle installed in the enclosure or panel of the automatic controller. Remote control shall be capable of turning on/off any station in any order. Remote control shall comply with all applicable FCC rules and regulations.

623.06 Control Wiring 24 Volt. Connection between automatic controller and automatic control valves, flow sensors and moisture sensors shall be made with direct burial copper, 600 volt, UF, UL approved wire. Minimum wire size shall be #14 AWG. One wire shall be provided for each valve. Wires shall be color coded according to the basic plant materials irrigated by the lateral. Wire colors shall be:

Wire Color	Plant Materials
Black	master (power)
Purple	spares
Green	turf
Brown	tree
Yellow	perennials
Red	shrubs
White	“common” or ground wire

623.07 Sprinkler Heads. The sprinkler head shall be of the pop-up spray and pop-up rotor internal drive type. All sprinkler heads shall be capable of accepting a check valve where head elevation varies more than 5 feet within a control zone.

(a) *Pop-up Sprays.* The pop-up spray head body, stem, and screen shall be constructed of heavy duty plastic. Spray heads shall have the following components:

(1) A soft pressure-activated wiper seal for cleaning debris from the pop-up stem as it retracts into the case to prevent stem and nozzle from sticking in the up position.

(2) A matched precipitation rate brass or plastic nozzle with an adjusting screw capable of regulating the radius and flow.

(3) A screen to protect it from clogging and a strong stainless steel retract spring for positive pop-down.

(4) A threaded cap that will allow easy removal of the screen and all other internal components from the top without removing the body from the ground.

Minimum pop-up height for turf heads shall be 4 inches. Spray head pop-up height for turf in roadway medians shall be at least 6 inches, and shrub, flower, and ground cover spray heads shall be at least 12 inches.

(b) *Rotor Heads.* The pop-up rotor heads shall be an internal drive type, with heavy duty plastic housings and non-corrosive internal components. The rotor head shall have a soft pressure-activated wiper seal for cleaning debris from the pop-up stem as it retracts into the case, to prevent the stem and nozzle from sticking in the up position. The rotor head shall have a screen to protect it from clogging and a strong stainless steel retracting spring for positive pop-down. Minimum pop-up height for rotor heads shall be 3 inches. The rotor head shall have a fully adjustable arc or full circle capabilities and an adjustable break-up pin capable of reducing the radius up to 25 percent.

623.08 Flow Sensor. The flow sensor shall be an in-line type and shall transmit an electronic pulse through conductors to a compatible automatic controller with interface unit for subsequent transmission to a compatible central computer.

623.09 Drip Emitters. The drip emitter shall be of the pressure compensating type with flow rates of 0.5, 1, or 2 gallons per hour plus or minus a 10 percent deviation at 10 to 40 psi. The emitter shall be constructed of durable plastic with a barbed inlet, and the outlet shall be capable of a watertight connection compatible with the polyethylene capillary tubing. Emitters shall be of the self-flushing type and capable of clog-free operation with a 150 mesh strainer. Emitters shall be multi-outlet (six outlets) and shall be installed on the polyethylene drip lateral line. The ends of the capillary tubing shall be installed on 6 inch plastic stakes with debris caps on the end of the tubing.

623.10 Plastic Pipe and Fittings. All pipe shall be identified with the following indelible markings: manufacturer's name, nominal pipe size, schedule or class of pipe, pressure rating in pounds per square inch, date of extrusion, and NSF seal of approval.

(a) Mainline Pipe. Mainline pipe shall be Class 200 PVC manufactured from virgin polyvinyl chloride (PVC) compound in accordance with ASTM D 1784 and D 2466, cell classification 12454-B, Type I, Grade I. Pipe sizes 3 inches and smaller shall be of the solvent weld type, and sizes larger than 3 inches shall have rubber gasketed fittings. Fittings shall be standard weight schedule 40 injection molded PVC conforming to ASTM D 1784 and D 2466, cell classification 12454-B. Threaded nipples shall be schedule 80 PVC with molded threads conforming to ASTM D 2464. Threaded fittings shall be kept to a minimum. Cement and cleaner for solvent weld pipe and fittings shall conform to ASTM D 2564.

(b) *Lateral Line Pipe.* Lateral line pipe shall be 80 pound NSF polyethylene manufactured from virgin material in conformance with ASTM D 2239 and designated as PE 2306 or PE 3408. Pipe size shall not exceed 2 inches. Fittings shall be injected-molded schedule 40 PVC conforming to ASTM D 2609, cell classification 12454-B. Pipe shall be clamped onto the fitting using 100 percent stainless steel screw clamps (two clamps on 1½ inch and 2 inch pipe).

(c) *Drip Lateral Line Pipe and Capillary Tubing.* Drip lateral line pipe and capillary tubing shall be made of linear low density, UV resistant polyethylene with a pressure rating of 50 psi.

(d) *Swing Joint Assembly.* Swing joints shall be premanufactured with full rotation capacity. Swing joints shall consist of threaded fittings combined with elastomer seals and solvent weld or threaded fittings when attaching to supply line, valve, or sprinkler head. The swing joint assembly shall consist of injection molded schedule 40 PVC conforming to ASTM D 1784 and D 2466, cell classification 12454-B, Type I, Grade I.

(e) *Detectable Underground Marking Tape.* The Contractor shall provide utility line marking tape for installation above all mainline pipe which does not have control wire placed in the same trench.

623.11 Valves.

(a) *Automatic Control Valves.* The automatic control valve shall be a normally closed 24-volt AC, 60 cycle solenoid actuated globe or angle pattern, diaphragm type valve. The valve body and bonnet shall be heavy duty glass filled nylon or brass and internal components (not including diaphragm and seat disc) shall be non-corrosive brass, bronze, stainless steel, or a combination thereof. Control valve diaphragms shall be of a one-piece molded reinforced fabric. Control valve shall have a non-shock cold water rating of at least 150 psi.

Control valves shall function manually (without electrical power) by means of an internal bleeder device on the bonnet assembly. Control valves 1 inch or greater shall have manual flow control capacity. Control valves shall be constructed so that the bonnet assembly and all operating parts can be removed without disturbing the valve body. Valve closure time (measured in actual seat disc movement time) shall be at least 0.5 second.

(b) *Quick-Coupler Valves.* The quick-coupler valve shall have a two-piece brass body, a non-shock cold water rating of at least 150 psi, and 1 inch female pipe threads at the base. The quick-coupler valve shall be designed to permit operation with a special connecting device (lug type coupler) designed for this purpose. The quick-coupler shall be provided with a rubber-like vinyl hinged locking cover. Quick-coupler keys and hose swivels shall be compatible with the quick-coupler valves furnished. Hose swivels shall be of all brass construction designed to rotate freely.

(c) *Drip Pressure Reducing Valve.* The drip pressure reducing valve shall be of the non-adjustable, pre-set type, consisting of a two-piece body molded from sturdy long lasting plastic. The internal spring shall be of stainless steel. Each pressure reducing valve shall have a minimum flow range of 0.5 gallons per minute with a regulated outlet pressure of 20 to 35 psi, with an inlet pressure range of 35 to 100 psi.

(d) *Mainline Pressure Reducing Valve.* Valves 2 inches or smaller shall be of the diaphragm spring cage construction type with a bronze body, renewable stainless steel seat, and stainless steel integral strainer. Valves larger than 2 inches shall be the balanced piston type with a ductile-iron, or cast iron body.

(e) *Manual Drain Valves.* The manual drain valve shall be constructed of heavy duty cast bronze and machined brass. The drain valve shall be a rising stem globe valve with a non-shock cold water rating of at least 150 psi. The drain valve shall have a reverse flow capability, removable bonnet, and cast bronze cross handle.

(f) *Mainline Isolation Valves.* Mainline isolation valves ¾ inch through 3 inches shall be full port ball valves with a bronze body and have a stainless steel ball and teflon seat. The valves shall have a blow-out proof stem and be rated at a minimum of 400 psi, WOG. Mainline isolation valves larger than 3 inches in size shall be resilient seated gate valves with a cast iron body and have a 2 inch square nut operator. All isolation valves shall be rated at 200 psi differential pressure.

623.12 Valve Box. The valve box, cover and necessary extensions shall be as shown on the plans, and shall be manufactured or molded, virgin plastic materials conforming to ASTM D 638 and D 648. Box extensions shall be used as necessary to completely expose the remote control valve and shall seat in place under the valve box. Valve box lids shall be imprinted "Irrigation Control Valve."

623.13 Strainer. Strainer shall be a wye pattern type with a polypropylene body. The strainer shall contain a 150 mesh stainless steel screen accessed by removing a threaded non-corrosive cap. Strainer shall be flushed via a ball valve located on the strainer.

CONSTRUCTION REQUIREMENTS

623.14 General. Irrigation systems shall be installed in conformity with applicable local codes. Information on the plans shows general locations only. The Contractor shall establish exact locations of all irrigation equipment to fit field conditions, and locations will be approved by the Engineer prior to start of construction. Contractor shall maintain and protect the approved staking layout. Prior to purchase of any irrigation equipment, the Contractor shall submit a list of suppliers and specification sheets for all irrigation components. This submittal must be approved by the Engineer before any equipment purchase is made. At the submittal stage, all changes in equipment shall be brought to the attention of the Engineer.

623.15 Site Review. At least 14 days prior to the start of irrigation work on the project a preconstruction conference shall be held. During irrigation installation, monthly meetings shall be held. Those in attendance shall be a representative of the Contractor's staff, the Landscape and Irrigation Subcontractors, the Engineer, and a CDOT Landscape Architect. A written description of work methods, and time schedules and milestone dates shall be presented. The Contractor shall notify the Engineer prior to mainline pressure testing, coverage tests, and final review. The Contractor shall provide two radio transceivers with necessary personnel or remote-control devices to operate automatic controllers during coverage tests and final review.

623.16 Excavation and Backfill. Excavation and backfill shall conform to the requirements of Section 206 and subsection 703.08(b) (Class 2 Structure Backfill), except that compaction of backfill outside of the roadway prism may be done by water flooding, with the approval of the Engineer. The Contractor shall maintain bottoms of trenches flat to permit all piping to be supported on an even grade. Where lines occur under paved areas, dimensions shall be considered to be below the subgrade. All mainline pipe shall be bedded in sand to allow a minimum of 2 inches of sand on all sides. Rock larger than 1 inch shall not be placed in the backfill material.

Where it is necessary to excavate adjacent to existing trees or shrubs, the Contractor shall use all possible care to avoid injury to the plant root system.

623.17 Pipe Installation. Minimum cover for irrigation pipe shall be as follows:

Mainline Pipes	24 inches below finished grade
Lateral Pipes	18 inches below finished grade
Pipe under roadways	30 inches below subgrade finished grade
Irrigation sleeving	30 inches below finished grade
Drip lines	8 inches below soil grade

All pipes under roadways shall be encased in a steel pipe sleeve which shall be jacked or placed in a hole bored under present roadways, or in a steel or plastic pipe sleeve placed by trenching on new construction. At least 4 inches of clearance shall be provided between lines and at least 4 feet of clearance between lines of other trades. Parallel pipes shall not be installed directly over any other line. Manual drain valves shall be installed at all low points in the mainline. Minimum grade of pipe to drains shall be 3 inches per 100 feet. Plastic threaded fittings shall be assembled using teflon tape applied to male pipe threads only. Threaded fittings shall be kept to a minimum. The Contractor shall tape all open ends of the pipe during installation to prevent entry of any foreign matter into the system.

623.18 Kick Blocks. Concrete kick blocks shall be installed when the following conditions occur on 4 inch or greater mainline pressure pipe:

(1) 22 degree or greater change in pipe direction.
(2) Change in pipe size.
(3) Dead ends in pipes.

623.19 Wiring. All 24-volt wire to automatic control valves and flow sensor wiring shall be installed at a minimum depth of 28 inches below finished grade. Power source wire shall conform to subsection 715.07.

Wiring shall be installed at the side of and under mainline whenever possible. When more than one wire is placed in a trench, the Contractor shall tape wires together with electrical tape at intervals of 15 feet or less. A 24 inch coiled expansion loop shall be provided every 300 feet along wire run, before controller enclosure, at each connection, and at directional changes. Each automatic controller shall have its own

separate ground wire, colored green. Wiring between automatic controller and automatic control valves or sensors shall be continuous. At locations where splicing is approved by the Engineer, moisture proof splices shall be made in a valve box. Two extra wires shall be installed along the entire mainline pipe from each automatic controller to the last automatic control valve. Wire splices shall be compatible in effectiveness to wire coating. All wire under roadways shall be encased in a separate steel or plastic conduit.

Wires not following the mainline shall be installed using open trench excavation. Wiring shall not be installed using a vibratory plow.

Tubing shall be installed to an even grade in an open trench. Flush valve assemblies shall be installed at all ends of the drip lateral lines.

Prior to backfilling, all capillary drip lines shall be staked with an approved staple, 6 feet on center.

623.20 Drip Systems. Drip lateral lines and capillary tubing shall be installed after 5 gallon and larger plant materials are in place and finished grade is established. The Contractor shall tape all open ends of pipe during installation to prevent entry of debris into the system. All pipe shall be cut with a knife or blade type pipe cutter to prevent entry of pipe debris into the system; a saw shall not be used.

Tubing shall be installed to an even grade in an open trench. Flush valve assemblies shall be installed at all ends of the drip lateral lines.

Prior to backfilling, all drip lines shall be staked with an approved staple, 6 feet on centers.

623.21 Valve Boxes. All valve boxes shall be installed flush with the finished grade. A “branding iron” type of tool shall be used to imprint the automatic control valve number (letters and numbers 2 inches high) on the valve box lid. Valve numbering system shall be as indicated on the plans. Geotextile filter fabric shall be placed under valve box and extend a minimum of 4 inches beyond bottom rim of valve box. Valves shall be grouped so that three or four valves are located together. Valves shall not be installed in low areas subject to standing water.

623.22 System Flushing. After all irrigation pipelines and valves are in place and connected, and prior to installation of irrigation sprinklers, rotary heads, etc., the Contractor shall thoroughly flush all lines with water at system operating pressure.

623.23 Pressure and Coverage Tests, and Adjustments. After installation of valves, pipe, and fittings, mainlines shall be inspected for leaks after a minimum 90 psi static pressure (or point-of-connection static pressure if higher) has been maintained for four hours in a hydro static test. Mainline pipes shall not be buried until completion of the test. If the system does not pass the test, the Contractor shall detect and correct problems until the system reaches the acceptable test standard. This test shall be passed prior to payment for the pipe.

Gasketed pipe shall be tested using a volumetric (make up water) test and leak rates supplied by the pipe manufacturer and commonly accepted in the industry.

The Contractor shall perform coverage tests in the presence of the Engineer, after the irrigation system is completed and prior to any planting, seeding or sodding to assure that all irrigated areas are watered completely and uniformly. The Contractor shall make all necessary adjustments to provide required coverage as directed.

Drip lateral and emitter coverage tests shall be performed after planting and before backfilling of lateral lines and emitters.

623.24 Inspections. Inspections by the Engineer or the Engineer's representative can be made at any point during construction. Milestone progress dates shall be established at the preconstruction meeting and 72-hour notice shall be given by the Contractor when a milestone event is approaching.

623.25 Irrigation As-built Plans. The Contractor shall dimension from two permanent reference points, building corners, sidewalk corners, road intersections or any permanent structures, the location of the following items:

(1) Routing of irrigation mainline.
(2) All drip and sprinkler automatic control valves.
(3) Quick coupling valves, isolation gate valves, and manual drain valves.
(4) Other related equipment as directed.

The Contractor shall provide an accurately detailed irrigation as-built layout of the irrigation system at the same scale as the design plans and on 24 inch by 36 inch waterproof medium within 90 days after installation is complete and before notice of substantial landscape completion as defined in subsection 214.04. An in-progress as-built plan shall be kept on the construction site at all times and available for impromptu review by the Engineer or the Engineer's representative.

Provision of the final as-built plan is a condition for final acceptance and release of retainage.

All changes in the irrigation system layout, including lateral layout, shall also be indicated on irrigation as-built plans.

The Contractor shall provide finalized as-built plans to the Engineer at the time of Final Landscape Acceptance.

623.26 Maintenance Manuals and Training. Prior to Final Landscape Acceptance, the Contractor shall provide two individually bound maintenance manuals to the Department for the irrigation system, and shall train the owner's maintenance personnel in the proper operation of all irrigation equipment, including winterization procedures. Each manual shall contain the following:

(1) Index sheet, stating irrigation contractor's name, address, telephone number and name of person to contact.
(2) Duration of equipment or component warranty and warranty form.
(3) Equipment list providing the following for each item:
    (i) Manufacturer's name
    (ii) Make and model number
    (iii) Name and address of manufacturer's local authorized distributor
    (iv) Spare parts list in detail
    (v) Detailed operating and maintenance instructions for major equipment
(4) Descriptions of all installed materials and systems in sufficient detail to permit maintenance personnel to understand, operate, and maintain the equipment.

A blueline print of the as-built plans shall be provided, showing the area covered by that automatic controller. The area of coverage of each automatic control valve shall be identified using a distinctly different pastel color, drawn over the entire area of coverage.

Following approval of charts by the Engineer, they shall be hermetically sealed between two layers of plastic sheet, each 20 mils thick.

623.27 Warranty. The Contractor shall warranty the irrigation system for the duration of the Landscape Establishment period specified in subsection 214.04. To ensure proper operation of the system, the Contractor shall perform, as required, warranty activities including, but not limited to the following:

(1) Inspection of the system and correction of system leaks, improperly operating valves, clogged emitters, malfunctioning automatic controllers and other components
(2) Maintaining optimum sprinkler coverage
(3) Adjusting sprinkler head elevations relative to finish grade

In an emergency the Contractor shall correct all deficiencies within 24 hours of notification by the Engineer. The Contractor shall perform irrigation system inspections at least once per week and after each mowing. The Contractor shall make corrections as necessary to ensure proper operation. The Contractor shall document each inspection in writing and submit it to the Engineer.

623.28 Final Landscape Acceptance. Before final landscape acceptance is granted, the Contractor shall perform an overall operation and pressure test and confirm the irrigation system is correctly functioning. This includes two weeks on "Flow" to be verified by the CDOT "Central Computer". The Contractor shall inspect every sprinkler and as necessary, raise or lower those sprinklers which are no longer at the proper elevation relative to the finish grade as shown in the plans. The Contractor shall complete Spring start-up (pressurization) and repair all damage to the irrigation system.

623.29 Cleanup. Upon completion of the work, the Contractor shall restore ground surfaces to required elevations and remove excess materials, debris, and equipment from the site.

623.30 Keys and Repair Components. Three keys shall be furnished for manual operation of valves. When valves require different kinds of keys, three keys of each kind shall be furnished. Keys shall be of adequate length and made of non-corrosive metal.

The following sprinkler components shall be furnished for system repair:

(1) Two Automatic Control Valves
(2) Two Manual Drain Valves
(3) Four of Each Type of Sprinkler Specified
(4) Two Valve Boxes
(5) Two Mainline Isolation Valves
(6) Two Quick Coupler Valves

623.31 Irrigation Scheduling. The Contractor shall submit recommendations for the project's initial irrigation operating schedule for optimum plant establishment to the Engineer.

METHOD OF MEASUREMENT

623.32 Automatic controller will be measured by the number of units of each size installed and accepted, including concrete pad, conduit, bolts, enclosure, ground wire, and all other items necessary to complete the work as shown on the plans.

Drip emitters will be measured by the number of multi-outlet emitters and shall include the capillary tubing, tubing stakes, enclosure box, and debris caps. Each drip emitter shall have six outlets.

Emitter valve assemblies will be measured by the number of units of each size installed.

Vacuum breakers, backflow preventers, strainers, and all other valves of the various types and sizes, including fittings, valve boxes, copper risers, and sleeves, will be measured by the number of units installed and accepted.

Quick couplers, sprinkler of the various types and sizes including risers, check valves, swing joints and fittings, will be measured by the number of units installed and accepted.

Plastic and copper pipe will be measured by the linear foot installed and will include the cost of the detectable underground marking tape.

Power source wire and 24 volt wire will be measured by the linear foot installed.

Water meter pay item includes all appurtenant fittings, valves, meter pit, and related equipment.

BASIS OF PAYMENT

623.33 The accepted quantities will be paid for at the contract unit price for the various items below that appear in the bid schedule.

Payment will be made under:

Pay Item	Pay Unit
Shrubbery Spray & Flood Irrigator	Each
_____Inch Pop-up Spray Sprinkler	Each
_____Inch Pop-up Rotary Sprinkler	Each
_____Inch Above Ground Rotary Sprinkler	Each
_____Inch Above Ground Spray	Each
Hose Swivel	Each
Hose Bib	Each
_____Inch Copper Pipe	Linear Foot
_____Inch Plastic Pipe	Linear Foot
_____Inch Hose	Linear Foot
_____Inch Valve Box	Each
_____Inch Backflow Preventer	Each
_____Inch Pressure Reducing Valve	Each
_____Inch Drain Valve	Each
_____Inch Automatic Drain Valve	Each
_____Inch Manual Control Valve	Each
_____Inch Automatic Control Valve	Each
Power Source Wire	Linear Foot
_____Inch Quick-Coupler Valve	Each
_____Inch Gate Valve	Each
_____Inch Mainline Isolation Valve	Each
_____Inch Water Meter	Each
_____Inch Station Automatic Controller	Each
_____Inch Station Satellite Controller	Each
Control Wire, 24 Volt	Linear Foot
_____Inch Strainer	Each
Automatic Controller Transmitter/Receiver Unit	Each
Drip Emitter	Each
Emitter Valve Assembly	Each
_____Inch Flush Unit	Each

Water lines will be paid for as provided in Section 619.

Kick blocks, unions, fittings, filter fabric, valve access sleeves, valve boxes, piping and wire inside boxes, keys, and aggregate for valves will not be paid for separately but shall be included in the work.

Structure excavation and backfill including compaction and water will not be paid for separately, but shall be included in the work.

Concrete pad, bolts, enclosure, ground wire, and all other items necessary to complete the work shall be included in the price of the automatic controller.

Capillary tubing, tubing stakes, enclosure box and debris caps shall be included in the price of the drip emitter.

System flushing and adjustment, pressure and coverage tests, maintenance manuals, and training will not be paid for separately but shall be included in the price of the work.

The backflow preventer enclosure and pad will not be paid for separately, but shall be included in the work.

Detectable Underground Marking Tape will not be paid for separately, but shall be included in the work.

Advisor Message Receiver pagers and hand held two-way radios will not be paid for separately, but shall be included in the work.

Warranty work will not be measured and paid for separately, but shall be included in the work.

SECTION 624
CORROSION RESISTANT CULVERTS

DESCRIPTION

624.01 This work consists of furnishing and installing corrosion resistant culvert pipe in accordance with these specifications and in conformity with the lines and grades shown on the plans or established.

MATERIALS

624.02 Materials shall meet the requirements in the Contract and in the following subsections.

Abbreviation	Description	Subsection
CSP	Corrugated Steel Pipe	707.02
Bit. Co. CSP	Bituminous Coated Corrugated Steel Pipe	707.03
A.F. Bo. CSP	Aramid Fiber Bonded Corrugated Steel Pipe	707.03
CAP	Corrugated Aluminum Pipe	707.06
PCSP- both sides	Precoated Corrugated Steel Pipe coated on both sides with 10 mils minimum	707.10
RCP	Reinforced Concrete Pipe, Type I, II, or V Cement	706.02
NRCP	Nonreinforced Concrete Pipe, Type I, II, or V Cement	706.01
PVC	Polyvinyl Chloride	712.13
PE	Polyethylene	712.13

All precoated sheet steel for PCSP culvert shall be tested by the manufacturer for coating holidays and certified to be free of defects. The coating will be visually inspected by the Engineer during construction and all damage found shall be repaired in an approved manner.

Connecting bands shall receive the same corrosion protection as the pipe with which they are used. Coatings conforming to the requirements of Sections 706 and 707 will be permitted as applicable. End sections, connecting bands, and pipe extensions shall be of similar metal, or of non-metallic material, to avoid galvanic corrosion.

When the plans specify culvert to resist a corrosive condition indicated by a corrosion resistance number, the Contractor will be permitted to furnish any pipe allowed under that specific corrosion resistance number in Table 624-1. The Contractor shall state at the preconstruction conference the type of culvert intended to be furnished.

Table 624-1

Corrosion Resistance Number*	CR1	CR2	CR3	CR4	CR5	CR6
Corrosion Condition Description*	Mild	Mild	Mild	Moderate	Severe	Extreme
Corrosion Condition Inside or Outside Pipe	Outside Only	Inside Only	Both	Both	Both	Both
Type of Pipe						
CSP	NO	NO	NO	NO	NO	NO
Bit. Co. CSP	YES[1]	NO	NO	NO	NO	NO
A.F. Bo. CSP	YES	YES	YES	YES	YES	YES
CAP	YES[2]	YES[2]	YES[2]	YES[2]	YES	NO
PCSP - both sides	YES	YES	YES	NO	NO	NO
RCP or NRCP, Type I Cement	YES	YES	YES	NO	NO	NO
RCP or NRCP, Type II Cement	YES	YES	YES	YES	NO[3]	NO
RCP or NRCP, Type V Cement	YES	YES	YES	YES	YES	YES
PVC	YES	YES	YES	YES	YES	YES
PE	YES	YES	YES	YES	YES	YES

* As determined by the Department.

[1] Coated Steel Structural Plate Pipe of equal or greater diameter, conforming to Section 510, may be substituted for Bit. Co. CSP at no additional cost to the project.

[2] Aluminum Alloy Structural Plate Pipe of equal or greater diameter, conforming to Section 510, may be substituted for CAP at no additional cost to the project.

[3] RCP or NRCP made with Type II cement having maximums of 5 percent C_3A and 25 percent (C_4AF+2C_3A) may be used for corrosion condition CR-5 if approved by the Engineer.

CONSTRUCTION REQUIREMENTS

624.03 Installation shall conform to the requirements of Section 603 or Section 510 as applicable.

Joining and installation of plastic pipe shall conform to ASTM D 2321 and the manufacturer's recommendations.

METHOD OF MEASUREMENT

624.04 Corrosion resistant culvert pipe will not be measured but will be the net length of pipe called for on the plans, except when field changes are ordered or when there are errors on the plans. In case of exceptions, the quantity to be measured shall be the actual net length of conduit measured along the bottom centerline of the installed pipe. The net length shall include end sections when required.

BASIS OF PAYMENT

624.05 The accepted quantities of corrosion resistant culvert pipe will be paid for at the contract unit price per linear foot for the specified size and corrosion resistance number.

Payment will be made under:

Pay Item	Pay Unit
_____Inch Culvert Pipe (CR__)	Linear Foot

Structure excavation and structure backfill will be measured and paid for in accordance with Section 206.

SECTION 625
CONSTRUCTION SURVEYING

DESCRIPTION

625.01 This work consists of the construction surveying, calculating, and staking necessary for the construction of all elements of the project. The work shall be done under the supervision of a Professional Land Surveyor (PLS) or Professional Engineer (PE) who is experienced and competent in road and bridge construction surveying and licensed in the State of Colorado.

Locating, preserving, referencing, installing and restoring land monuments such as Primary Control monuments from which the Right of Way or any land boundary will be calculated, described or monumented, Public Land Survey System (PLSS) monuments, General Land Office (GLO) monuments, Bureau of Land Management (BLM) monuments, Mineral Survey (MS) monuments, Right of Way (ROW) monuments, property boundary monuments, easement monuments, and other monuments that are required by law or regulation to be established by a PLS, and the determination of any land boundary, shall be done in accordance with Section 629, under the supervision of a Professional Land Surveyor (PLS) who is experienced and competent in Right of Way and boundary surveying and licensed in the State of Colorado.

The PLS or PE shall be available to review work, resolve problems, and make decisions in a timely manner.

Unless specified otherwise in the Contract, all survey procedures shall be in conformance with the CDOT Survey Manual.

MATERIALS AND EQUIPMENT

625.02 The Contractor shall furnish all personnel, survey equipment, safety equipment, materials, and traffic control necessary to perform the required construction surveying and staking. All surveying equipment, including Electronic Distance Meters (EDM), total stations, theodolites, levels, rods, tapes, tripods, tribrachs, and Global Positioning System (GPS) receivers and equipment, shall be checked and calibrated in accordance with the CDOT Survey Manual, Chapter 6, Section 6.1.10, and documented in the survey records prior to the start of work and every six months thereafter.

EDM and total stations shall be checked and calibrated on a National Oceanic and Atmospheric Administration/ National Geodetic Survey (NOAA / NGS) calibrated baseline in accordance with the CDOT Survey Manual, Chapter 2, Section 2.1 and 2.2, and documented in the survey records prior to the start of work and every six months thereafter.

GPS receivers and equipment shall be checked and calibrated on a NOAA / NGS calibrated baseline in accordance with the CDOT Survey Manual Chapter 3, Section 3.3, and documented in the survey records prior to the start of work and every six months thereafter.

Levels shall be checked and calibrated in accordance with the CDOT Survey Manual, Chapter 6, Section 6.4.5, and Chapter 5, Section 5.9.12, and documented in the survey records prior to the start of any level circuit.

If any survey equipment is found to be functioning outside the manufacturer's specified tolerance, certification from an approved repair facility showing that the instruments have been repaired, properly adjusted, or both if necessary shall be included in the survey records and submitted to the Engineer before being used.

Traffic control shall be in accordance with Section 630.

CONSTRUCTION REQUIREMENTS

625.03 General. The Department will establish Primary horizontal and vertical control for the project. All available information defining the extent of that control is provided on the plans in accordance with the CDOT Survey Manual Chapter 6, Section 6.1.11 and 6.1.16, or is available from the Engineer.

A Presurvey Conference – Construction Survey shall be held in accordance with the CDOT Survey Manual Chapter 6, Section 6.1.6, prior to performing any surveying work under this section. The Engineer, Region Survey Coordinator (or designee), Contractor's Superintendent, Contractor's Surveyor (PLS or PE) and Party Chief shall attend. A Presurvey Conference – Construction Survey Form shall be included in accordance with the CDOT Survey Manual Chapter 6, Appendix 6.A.4. A surveying work schedule shall be submitted to the Engineer for review prior to the conference.

625.04 Contractor Surveying. The Contractor shall perform all construction surveying and staking that is necessary for construction of the project. Construction surveying and staking shall be based on the Primary Control established by the Department. Bid items which require stakes to be set by the Contractor's Surveyor (PLS or PE) are shown on the Survey Tabulation Sheet of the plans in accordance with the CDOT Survey Manual Chapter 6, Section 6.1.7.

The Contractor shall check all Department established Primary horizontal and vertical control points in accordance with the CDOT Survey manual Chapter 6, Section 6.1.13, and verify and document in the survey records their horizontal accuracy tolerance in accordance with the CDOT Survey Manual Chapter 5, Section 5.5, and their vertical accuracy tolerance in accordance with the CDOT Survey Manual Chapter 6, Section 6.4.3 and Chapter 5, Section 5.8.6, for a CDOT Class A - Primary Survey prior to using them for construction surveying control.

625.05 Staking. Acceptable staking placement intervals for the various construction survey items are described in the CDOT Survey Manual Chapter 6. Staking placement intervals specified on the Survey Tabulation Sheet have precedence over those in the CDOT Survey Manual. Stationing shall be established in the field on centerline or an approved offset.

625.06 Accuracy and Tolerances. Horizontal and vertical accuracy tolerances for Secondary Control surveys and monuments, and for each construction item being staked shall be as specified in the Contract or in the CDOT Survey Manual Chapter 6. If a discrepancy should occur, the higher degree of accuracy or the more restrictive tolerance shall apply.

Horizontal accuracy tolerances for Primary Control surveys and monuments shall be as specified in the CDOT Survey Manual Chapter 5, Section 5.5. Vertical accuracy tolerances for Primary Control surveys and monuments shall be as specified in the CDOT Survey Manual Chapter 6, Section 6.4, and Chapter 5, Section 5.8.6.

Horizontal accuracy tolerances for Secondary Control surveys and monuments shall be as specified in the CDOT Survey Manual Chapter 6, Section 6.2.4. Vertical accuracy tolerances for Secondary control surveys, monuments, and/or Secondary benchmarks shall be as specified in the CDOT Survey Manual Chapter 6, Section 6.2.7.

625.07 Responsibility and Inspection. Supervision and coordination of construction surveying and staking is the Contractor's responsibility. The Engineer may inspect the Contractor's surveying, however such inspection will not relieve the Contractor of any responsibility for accuracy or completeness of work. The Contractor shall check the work to verify the accuracy and include documentation of this check in the Survey Records. All Contractor surveying inaccuracies, errors, or omissions shall be corrected at the Contractor's expense. Engineer's inspection or the Contractor's corrections shall not entitle the Contractor to additional payment or contract time extension.

625.08 Reset Monuments and Stakes. Primary and Secondary Control monuments, benchmarks, and other significant stakes that are damaged, destroyed, or made inaccessible by the progress of construction shall be replaced, transferred or reestablished at the Contractor's expense in accordance with the CDOT Survey Manual Chapter 6, Section 6.2.

A supplemental or amended Project Control Diagram shall be submitted to the Engineer and the Region Survey Coordinator for any replaced, transferred or re-established Primary Control monuments in accordance with the CDOT Survey Manual Chapter 6, Section 6.2.3.

Locating, preserving, referencing, installing and restoring land monuments such as Primary Control monuments from which the Right of Way or any land boundary will be calculated, described or monumented, PLSS monuments, GLO monuments, BLM monuments, MS monuments, ROW monuments, property boundary monuments, easement monuments, and other monuments that are required by law or regulation to be established by a PLS, shall be done in accordance with Section 629, under the supervision of a PLS who is experienced and competent in Right of Way and boundary surveying and licensed in the State of Colorado.

625.09 Changes. All changes in lines and grades required by field conditions and all discrepancies in grades, alignment, location or dimensions detected by the Contractor shall be immediately submitted to the Engineer in writing. No changes in given data or plans will be allowed unless approved by the Engineer in writing. All changes shall be documented in the survey records.

625.10 Pay Quantities Measurements. The Engineer will perform all interim and final measurements deemed necessary by the Department to determine contract pay quantities. The Contractor shall establish and maintain Primary and Secondary Control points and stationing as required for these measurements.

625.11 Survey Records. Survey records shall be completed as the work is done. Field survey notes for construction surveying and checking by the Contractor shall be recorded in survey records in conformance with the format given in the CDOT Survey Manual Chapter 6, Section 6.1.15. Survey fieldbooks shall be indexed in accordance with the Survey Manual Chapter 2, Section 2.4.14.

All survey records generated shall be the property of the Department and shall be available to the Engineer for inspection or reproduction at all times. All survey records shall be transmitted to the Engineer for inclusion into the project records before final project acceptance. All survey records shall be stamped with the seal of, and signed by, the responsible PLS or PE identified in subsection 625.01.

If an electronic format is used it shall contain the same information and format as required in the Survey Manual Chapter 6, Section 6.1.15, for written documentation, a printout shall be signed and sealed by the PLS or PE in responsible charge identified in subsection 625.01, and shall be submitted to the Engineer on a CD ROM compact disc, or other acceptable medium which contains the stakeout data and the raw data from the actual placement of stakes.

Initial staking for major structures (overhead signs, concrete box culverts, bridges, and all other structures assigned a structure number) shall be done in accordance with the CDOT Survey Manual Chapter 6, Section 6.9, from two independent setups. An independent check shall be made by the Contractor and shown in the survey records for all bridge structures.

METHOD OF MEASUREMENT

625.12 Construction surveying will not be measured but will be paid for on a lump sum basis.

BASIS OF PAYMENT

625.13 Payment for construction surveying will be the contract lump sum bid and will be full compensation for all surveying work necessary to complete the project as shown on the plans, to include all resetting of stakes, marks, monuments Secondary and Primary Control points, and preparing supplemental or amended Project Control Diagrams.

Construction surveying required by plan force account or by additional work beyond the scope of the original Contract will be paid for at a negotiated rate not to exceed the rate established in Section 105. That rate shall also apply to reductions in construction surveying as impacted by reductions or deletions to the original contract work. Any survey work not performed to the contract requirements shall be subject to price reduction or rejection.

Partial payment for construction surveying, as determined by the Engineer, will be made as the work progresses. The Contractor shall submit a schedule of estimated contractor construction surveying time as required on the Survey Tabulation Sheet before the first partial payment is made. Copies of the Survey Records for all completed survey work shall be submitted to the Engineer prior to payment of the monthly estimate.

Before final payment is made, the following two items shall be completed, bear the seal and signature of the responsible PLS or PE identified in subsection 625.01, and have copies submitted to the Engineer for review:

(1) All survey records
(2) Supplemental or amended Project Control Diagram (a copy of which shall be submitted to the Region Survey Coordinator)

Payment will be made under:

Pay Item	**Pay Unit**
Construction Surveying	Lump Sum

Traffic control for construction surveying will be measured and paid for in accordance with Section 630.

SECTION 626
MOBILIZATION

DESCRIPTION

626.01 This work consists of the mobilization of personnel, equipment and supplies at the project site in preparation for work on the project. This item shall also include the establishment of the Contractor's offices, buildings and other necessary facilities, and all other costs incurred or labor and operations which must be performed prior to beginning the other items under the Contract.

BASIS OF PAYMENT

626.02 Partial payments for mobilization will be made once each month as the work progresses. These partial payments will be made as follows:

(1) When 5 percent of the original contract amount is earned, 25 percent of the amount bid for mobilization, or 2½ percent of the original contract amount, whichever is less, will be paid.
(2) When 10 percent of the original contract amount is earned, 50 percent of the amount bid for mobilization, or 5 percent of the original contract amount, whichever is less, will be paid.
(3) When 25 percent of the original contract amount is earned, 60 percent of the amount bid for mobilization, or 6 percent of the original contract amount, whichever is less, will be paid.
(4) When 50 percent of the original contract amount is earned, 100 percent of the amount bid for mobilization, or 10 percent of the original contract amount, whichever is less, will be paid.
(5) Upon completion of all work on the project, payment on any amount bid for mobilization in excess of 10 percent of the original contract amount, will be paid.
(6) The total sum of all payments shall not exceed the original contract amount bid for the item, regardless of the fact that the Contractor may have, for any reason, shut down the work on the project or moved equipment away from the project and then back again.

For the purpose of this Section the term "original contract amount" as used above shall mean the amount bid for the construction items in the Contract not including the amount bid for mobilization. Payments for materials on hand, as described in subsection 109.07, will not be included as a percent of original contract amount earned until said materials on hand have been incorporated into the work and accepted and paid for as contract items.

These payments shall be independent of partial payments as defined in subsection 109.06. Payment will be full compensation for all work necessary to complete the item.

Payment will be made under:

Pay Item	Pay Unit
Mobilization	Lump Sum

Nothing herein shall be construed to limit or preclude partial payments for other items as provided for by the Contract.

SECTION 627
PAVEMENT MARKING

DESCRIPTION

627.01 This work consists of furnishing and applying pavement marking, and furnishing, installing, and removing temporary pavement marking in accordance with these specifications, the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD), the Colorado supplement thereto, and in conformity to the lines, dimensions, patterns, locations and details shown on the plans or established.

MATERIALS

627.02 Materials shall conform to the requirements of the following subsections:

Paint	708.05
Glass Beads	713.08
Epoxy Pavement Marking Material	713.17
Thermoplastic Marking Material	713.12
Pavement Primer	708.07
Preformed Plastic Pavement Marking Material	713.13
Pavement Marking Tape	713.15
Pavement Marking Tape (Removable)	713.16
Raised Pavement Marker	713.18
Preformed Thermoplastic Pavement Marking Material	713.14
Methyl Methacrylate Pavement Marking Material	713.19

CONSTRUCTION REQUIREMENTS

627.03 General. All pavement markings shall be placed in accordance with the following requirements. When the term "full compliance" is used, it means the pavement markings shall meet the requirements of Standard Plan S-627-1.

(a) *Pavement Marking Plan.* When pavement marking location details are not provided in the Contract, the Contractor shall submit a layout of existing conditions to the Engineer for approval or modification. This layout is to be used as the final pavement marking plan.

(b) *Roadways Closed to Traffic During Construction.* Full compliance pavement markings shall be in place on all roadways prior to opening to traffic.

(c) *Roadways Constructed Under Traffic.* Full compliance final pavement markings shall be placed within two weeks after final surfacing is completed. Full compliance pavement markings shall also be placed on any roadways opened to traffic when the project pavement work is discontinued for more than two weeks.

(d) Temporary pavement markings and control points for the installation of those pavement markings for roadways that are being constructed under traffic shall be as follows:

1. When one roadway of a normally physically divided highway is closed, and a crossover is constructed, full compliance pavement markings shall be placed along the tapers and through the median crossovers to the twoway traffic section. Pavement markings through the twoway traffic section shall be as shown on the plans.

   All temporary paved roadways shall have full compliance pavement markings before they are open for traffic.

   Markings applied to a final surface shall not leave a scar that conflicts with permanent markings.

2. The following criteria apply to all construction on roadways open to traffic other than (d)1. above.

   Control points, 4 inch by 1 foot marks at 40 foot intervals, are guide markers for the installation of temporary markings, full compliance markings, or both and shall not be used as a substitute for temporary markings.

   All temporary broken line pavement markings shall be installed daily and shall be at least 4 feet long with a maximum gap of 36 feet.

   Temporary edge lines are not required unless specified on the plans. Control points for edge lines shall not be established unless full compliance final edge lines are to be placed the same day.

   Temporary centerline pavement markings for nopassing zones shall be full compliance and shall be placed daily.

   Temporary pavement stencils (school, railroad, etc.) are not required unless detailed on the plans.

   Temporary pavement markings shall be installed according to the manufacturer's recommendations in such a way that the markings adequately follow the desired alignment.

(e) Control points, temporary pavement markings and Contractor pavement marking plans will not be paid for separately but shall be included in the work unless otherwise noted on the plans.

627.04 Pavement Marking with Paint. Striping shall be done when the air and pavement temperatures are at least 40 °F. The pavement surface and weather conditions shall be conducive to satisfactory results.

Equipment shall be capable of painting a reasonably clean-edged stripe of the designated width ± ¼ inch and shall have a bead dispenser directly behind, synchronized with the paint applicator. For centerlines and lane lines, an automatic skip control shall be used that will paint a stripe with a gap as shown on the plans. Machines having multiple applicators shall be used for centerlines with "no passing zones." In areas where machines are not practical, suitable hand-operated equipment shall be used. Stripes shall be protected until dry.

Paint and beads shall be applied within the following limits:

	Application Rate or Coverage Per Gallon of Paint	
	Minimum	**Maximum**
Paint:	100 sq. ft.	110 sq. ft.
Beads:	5 lbs. 13 oz.	6 lbs. 3 oz.

627.05 Epoxy Pavement Marking. The epoxy pavement marking compound shall be applied with equipment that will precisely meter the two components in the ratio given in subsection 713.17(a). The equipment shall automatically shut off or warn the operator if one component is not being mixed. The equipment shall produce the required amount of heat at the mixing head and gun tip to provide and maintain the temperatures specified.

Before mixing, the individual components A and B shall each be heated to a temperature of 80 to 140 °F. After mixing, the application temperature for the combined material at the gun tip shall be 80 to 140 °F. The 140 °F upper limit is the maximum temperature under any circumstances.

Both pavement and air temperatures shall be at least 50 °F at the time of epoxy pavement marking application.

The surface areas of new portland cement concrete pavement and decks that are to receive markings shall be sandblasted prior to placement of the epoxy pavement marking. The amount of sandblasting shall be sufficient to remove all dirt, laitance, and curing compound residue.

The surface areas of new asphalt pavement, existing asphalt pavement, and existing concrete pavement that are to receive markings shall be cleaned with a high pressure air blast to remove loose material prior to placement of the epoxy pavement marking. Should any pavement become dirty, from tracked mud etc. as determined by the Engineer, it shall be cleaned prior to the placement of the epoxy pavement marking.

When recommended by the epoxy manufacturer, a high pressure water blast integrated into the gun carriage shall be used to clean the pavement surface prior to epoxy pavement marking application. The water blast shall be followed by a high pressure air blast to remove all residual water, leaving only a damp surface.

Epoxy pavement marking shall be applied to the road surface according to the epoxy manufacturer's recommended methods at 15 mils minimum thickness. Glass beads shall be applied into the epoxy pavement marking by means of a pressurized bead applicator at a rate of ¼ pound per square foot, 25 pounds per gallon minimum.

Epoxy pavement marking and beads shall be applied within the following limits:

	Application Rate or Coverage Per Gallon of Epoxy Pavement Marking	
	Minimum	**Maximum**
15 mil Marking:	100 sq. ft.	110 sq. ft.
Beads:	25 lbs.	

627.06 Thermoplastic Pavement Marking.

(a) *Equipment-General.* The material shall be applied to the pavement by an extrusion method wherein one side of the shaping die is the pavement and the other three sides are contained by, or are part of suitable equipment for heating, mixing, and controlling the flow of the material.

The equipment shall be constructed to provide continuous mixing and agitation of the material. Conveying parts of the equipment between the main material reservoir and the shaping die shall be so constructed as to prevent accumulation and clogging. All parts of the equipment which come in contact with the material shall be easily accessible and exposable for cleaning and maintenance.

All mixing and conveying parts up to and including the shaping die, shall maintain the material at the plastic temperature.

The equipment shall be so constructed as to assure continuous uniformity in the dimensions of the stripe. The applicator shall provide a means for cleanly cutting off square stripe ends and shall provide a method of applying "skip" lines. The use of pans, aprons or similar appliances which the die overruns will not be permitted under this specification.

Beads for the surface of the completed stripe shall be applied by an automatic bead dispenser attached to the applicator in such manner that the beads are dispensed almost instantly upon the completed line. The bead dispenser shall be equipped with an automatic cutoff control synchronized with the cutoff of the thermoplastic material.

The equipment shall be so constructed as to provide for varying die widths to produce varying widths of traffic markings.

The equipment shall be so designed to permit agitation of the material to prevent scorching, discoloration or excessive high temperatures of any part of the material.

A special kettle shall be provided for melting and heating the composition. The kettle shall be equipped with an automatic thermostatic control device so that heating can be done by controlled heat transfer liquid rather than direct flame.

The applicator and kettle shall be so equipped and arranged as to satisfy the requirements of the National Fire Underwriters.

The equipment shall be so equipped as to permit preheating of the pavement immediately prior to application of the material.

The applicator shall be mobile and maneuverable to the extent that straight lines can be followed and normal curves can be made in a true arc.

(b) *Types of Equipment.*

1. Portable Applicator. The portable applicator shall be a device typically used for painting cross-walk lines, stop bars, short lane lines and short center lines. The applicator shall be easily maneuverable and capable of being propelled by the operator.

2. Mobile Applicator. The mobile applicator shall contain equipment to provide for automatic installation of skip lines in any combination of line and skip up to 40 feet. The mobile applicator shall be moved in conjunction with the melting and heating kettles in such a manner as to provide continuous highway operation of the kettles and the mobile applicator as an integral unit.

3. Epoxy Primer Equipment. The epoxy primer application shall be accomplished using equipment having the following features:

   A. The main storage tank shall be equipped with a visible gauge which will allow the Engineer to readily ascertain the rate of application.

   B. The main storage tank shall be equipped with a heating device which will maintain the epoxy at a constant efficient temperature.

   C. The spray nozzle and epoxy spray shall be protected from the action of wind to insure placement where needed.

4. Cleaning Equipment. Equipment must be provided to insure removal of laitance, dust, debris, paint and other foreign matter from the road surface immediately prior to the installation of the composition, or immediately prior to the application of primer.

(c) *Application.* The stripe shall be applied to the pavement either to the right or left of the application unit, dependent upon roadway lane being used. The unit shall not occupy more than one lane of roadway while operating.

The finished lines shall have well defined edges and be free of waviness. All of the equipment necessary to the preheating and application of the material shall be so designed that the temperature of the material can be controlled within the limits necessary to its pourability for good application.

At the time of installation of thermoplastic materials, the pavement shall be clean, dry, and free of laitance, oil, dirt, grease, paint or other foreign contaminants. Pavement and ambient temperatures shall be at least 50 °F.

An epoxy resin primer conforming to subsection 708.07 shall be applied to all pavement surfaces prior to the application of the thermoplastic pavement marking.

The marking material shall not be applied until the epoxy resin primer reaches the tacky stage, approximately 15 minutes under normal conditions. An infrared heating device may be employed to shorten the curing time of the epoxy.

To insure the best possible adhesion, the marking material as specified, shall be installed at the manufacturer's recommended temperature.

The minimum thickness of thermoplastic lines as viewed from a lateral cross section shall not be less than $^{3}/_{32}$ inch at the edges, or less than $^{1}/_{8}$ inch at the center. Measurements shall be taken as an average throughout any 36 inch section of the line. The material, when formed into traffic stripes, must be readily renewable by placing an overlay of new material directly over an old line of compatible material. Such new material shall bond itself to the old line in such a manner that no splitting or separation takes place.

Glass beads shall be applied to the thermoplastic pavement marking at a rate of 10 pounds per 100 square feet, minimum.

627.07 Methyl Methacrylate Pavement Marking. Methyl methacrylate pavement marking shall be installed in accordance with manufacturer's recommendations. The Contractor shall use installation equipment, materials, equipment technicians and operators recommended by the manufacturer.

Methyl methacrylate pavement markings shall be applied to the road surface according to the manufacturer's recommended methods at 60 mil minimum thickness. Glass beads shall be applied using a double drop bead application system. The first bead applicator shall apply glass beads at the rate of 3.2 pounds per square yard (10 pounds per gallon) minimum, and 1.9 pounds per square yard (6 pounds per gallon) minimum for the second bead applicator.

Methyl methacrylate pavement marking and beads shall be applied within the following limits:

Application Rate or Coverage
Gallon of Methyl Methacrylate Pavement Marking

	Minimum	Maximum
Methyl Methacrylate Pavement Marking:	26 sq. ft.	28 sq. ft.
First Bead Applicator:	10 lbs	—
Second Bead Applicator:	6 lbs	—

627.08 Preformed Plastic Pavement Marking. This retroreflective preformed plastic strip shall be suitable for application on asphaltic or portland cement concrete pavement. The strip shall be applied at the locations called for on the plans or as directed.

If recommended by the manufacturer, an epoxy resin primer conforming to subsection 708.07 shall be applied to all pavement surfaces prior to the application of the preformed plastic pavement marking.

The surface of the pavement shall be clean, free of loose foreign material, dry and have no moisture for a minimum of 48 hours prior to application of the markings.

The surface areas of new portland cement concrete pavement and decks that are to receive marking shall be sandblasted prior to placement of primer and marking material. The amount of sandblasting shall be sufficient to remove all dirt, laitance and curing compound residue.

The air temperature shall be at least 60 °F.

When the marking strip is applied to newly overlaid hot mix asphalt, it shall be applied immediately after breakdown rolling. The rolling shall then continue to insure complete inlay of the marking strip and to obtain the required density of the pavement.

The marking strip as applied shall be in good appearance, free of cracks and the edges shall be true and straight.

627.09 Preformed Thermoplastic Pavement Marking. The markings shall consist of a resilient white or yellow thermoplastic product with glass beads uniformly distributed throughout the entire cross sectional area. Legends and symbols shall be capable of being affixed to bituminous pavements by heating.

The markings shall conform to pavement contours, breaks and faults through the action of traffic at normal pavement temperatures. The material shall have resealing characteristics with the capability of fusing with itself and previously applied thermoplastic markings under normal use.

The preformed thermoplastic markings shall be packaged in a protective plastic film with cardboard stiffeners where necessary to prevent damage in transit. The carton in which the material is packed shall be clearly labeled for ease of identification.

(a) *Application.* Application temperature shall be as recommended by the manufacturer. The pavement and air temperature shall be as recommended by the manufacturer at the time of application. The materials shall be applied using a heating method recommended by the manufacturer. The Contractor shall provide the Engineer a copy of the manufacturer's installation recommendations prior to beginning the work. The pavement shall be clean, dry and free from debris. The preformed thermoplastic markings may be installed on top of existing thermoplastic markings after all loose material has been removed. The preformed thermoplastic markings shall not be installed on top of existing preformed plastic pavement markings without first removing the existing markings to a depth that insures removal of the adhesive backing of the preformed plastic. It shall not be installed on top of pavement marking paint without first removing the paint.

(b) *Equipment.* The Contractor shall use a heating method specifically recommended by the manufacturer for the installation of preformed thermoplastic markings.

627.10 Pavement Marking Tape. Retroreflective tape shall be suitable for temporary use on asphaltic or portland cement concrete pavements. The tape shall be applied at the locations shown on the plans or as directed. The tape shall conform to subsection 713.15.

The surface to which the tape is applied shall be clean, dry and free of dirt, oils and grease. The tape shall be pressed down immediately after application, until it adheres properly and conforms to the surface. Temporary marking tape sections longer than 1 foot shall be removed before placement of the final pavement course. All tape shall be removed on sections where tape conflicts with revised traffic lanes prior to opening of new lanes to traffic.

Pavement marking tape (removable) shall be installed in accordance with the manufacturer's recommendations, and maintained throughout the required construction phase at no additional cost to the Department.

627.11 Raised Pavement Markers. Raised pavement markers (temporary) shall be installed on center lines, edge lines, and lane lines where specified in the Contract. Single markers shall be installed at 5 foot intervals for solid lines. A group of four markers at 3 foot spacings and at 40 foot intervals shall be installed for skip lines.

Markers supplementing lines shall be installed at the spacing shown on the plans. Raised pavement markers (temporary) shall be installed in accordance with the manufacturer's recommendations, and shall be maintained throughout the required construction phase at the Contractor's expense.

METHOD OF MEASUREMENT

627.12 The types of pavement marking described herein will be measured by the following units, complete in place and accepted.

(a) Pavement marking paint, epoxy pavement marking, and methyl methacrylate pavement marking will be measured by the number of gallons used including glass beads. Material used in excess of coverage limit prescribed will not be measured.

(b) Thermoplastic pavement marking, preformed thermoplastic pavement marking, and preformed plastic pavement marking will be measured by the square foot. The unmarked spaces between markings will not be included in the overall measurement.

(c) The amount of pavement marking tape to be measured will be the linear feet of the specified width tape applied. Gaps in marking will not be measured for payment.

(d) Raised pavement marker (temporary) will be measured as a unit in place and shall include all adhesive necessary for installation. Removal of the raised pavement marker shall be included in the work.

(e) Pavement word and symbol markings, transverse and longitudinal crosswalk lines, and stop lines will not be measured, but shall be the quantities, in square feet, designated in the Contract; except measurements will be made for revisions requested by the Engineer. The unmarked spaces within these markings will not be included in the measurement.

BASIS OF PAYMENT

627.13 The accepted quantities will be paid for at the contract price per unit of measurement for each of the pay items listed below that appear in the bid schedule.

Payment will be made under:

Pay Item	**Pay Unit**
Pavement Marking Paint	Gallon
Epoxy Pavement Marking	Gallon
Methyl Methacrylate Pavement Marking	Gallon
Thermoplastic Pavement Marking	Square Foot
Preformed Plastic Pavement Marking (___mils)	Square Foot
____Inch Pavement Marking Tape	Linear Foot
Pavement Marking Tape (Removable)Linear	Linear Foot
Raised Pavement Marker (Temporary)	Each
Pavement Marking Paint (Word-Symbol)	Square Foot
Pavement Marking Paint (Xwalk-Stop Line)	Square Foot

Pay Item (continued)	Pay Unit (continued)
Thermoplastic Pavement Marking (Word-Symbol)	Square Foot
Thermoplastic Pavement Marking (Xwalk-Stop Line)	Square Foot
Preformed Thermoplastic Pavement Marking	Square Foot
Preformed Plastic Pavement Marking 60 mil (Word-Symbol)	Square Foot
Preformed Thermoplastic Pavement Marking (Word-Symbol)	Square Foot
Preformed Thermoplastic Pavement Marking (Xwalk-Stop Line)	Square Foot

Sandblasting will be measured and paid for in accordance with Section 202.

Glass beads and cleaning with high pressure water blast or air blast shall be included in the cost of the work.

SECTION 629
SURVEY MONUMENTATION

DESCRIPTION

629.01 This work consists of locating, preserving, referencing, installing and restoring land monuments, such as Primary Control monuments from which the Right of Way or any land boundary will be calculated, described or monumented, Public Land Survey System (PLSS) monuments, General Land Office (GLO) monuments, Bureau of Land Management (BLM) monuments, Mineral Survey (MS) monuments, Right of Way (ROW) monuments, property boundary monuments, easement monuments, and other monuments that are required by law or regulation to be established and recorded by a Professional Land Surveyor (PLS), along with installing or adjusting Monument Boxes as listed on the Survey Tabulation Sheet or as shown on the plans.

All such monuments included in this section shall be established in accordance with the applicable and most recent editions of the Department of Interior's Manual of Surveying Instructions (BLM Manual), Colorado Revised Statutes (CRS), Colorado State Board of Licensure for Professional Engineers and Land Surveyors (State Board) Rules and Policies, the Memorandum of Understanding (MOU) with the State Board and CDOT, and the CDOT Survey Manual, under the supervision of a PLS who is experienced and competent in Right of Way and boundary surveying and licensed in the State of Colorado.

The PLS shall be available to review work, resolve problems, and make decisions in a timely manner.

Unless specified otherwise in the contract, all survey procedures shall be in conformance with the CDOT Survey Manual.

MATERIALS AND EQUIPMENT

629.02 The Contractor shall furnish all personnel, survey equipment, safety equipment, materials, and traffic control necessary to perform the required monumentation and related surveying.

Monuments and monument boxes will be furnished by the Department. The various types of monuments and monument boxes shall be constructed according to the details shown on Standard Plan M-629-1. The Contractor shall furnish all labor, survey tools, equipment, incidental materials such as but not limited to concrete, grout, asphalt caulk, glue, epoxy, nails, stakes, lath, and replacement monuments of the variety not included on the Standard Plan M-629-1.

All surveying equipment, including Electronic Distance Meters (EDM), total stations, theodolites, levels, rods, tapes, tripods, tribrachs, and Global Positioning System (GPS) receivers and equipment, shall be checked and calibrated in accordance with the Colorado Department of Transportation (CDOT) Survey Manual, Chapter 6,

Section 6.1.10, and documented in the survey records prior to the start of work and every six months thereafter.

EDM and total stations shall be checked and calibrated on a National Oceanic and Atmospheric Administration/ National Geodetic Survey (NOAA / NGS) calibrated baseline in accordance with the CDOT Survey Manual, Chapter 2, Section 2.1 and 2.2, and documented in the survey records prior to the start of work and every six months thereafter.

GPS receivers and equipment shall be checked and calibrated on a NOAA / NGS calibrated baseline in accordance with the CDOT Survey Manual, Chapter 3, Section 3.3, and documented in the survey records prior to the start of work and every six months thereafter.

Levels shall be checked and calibrated in accordance with the CDOT Survey Manual, Chapter 6, Section 6.4.5, and Chapter 5, Section 5.9.12, and documented in the survey records prior to the start of any level circuit.

If any survey equipment is found to be functioning outside the manufacturer's specified tolerance, certification from an approved repair facility showing that the instruments have been repaired, properly adjusted, or both if needed shall be included in the survey records and submitted to the Engineer before being used.

Traffic control shall be in accordance with Section 630.

CONSTRUCTION REQUIREMENTS

629.03 General. The Department will establish Primary horizontal and vertical control for the project. All available information defining the extent of that control is provided on the plans in accordance with the CDOT Survey Manual Chapter 6, Section 6.1.11 and 6.1.16, or is available from the Engineer.

A Presurvey Conference – Construction Survey shall be held in accordance with the CDOT Survey Manual Chapter 6, Section 6.1.6, prior to performing any surveying work under this section. The Engineer, Region Survey Coordinator and Plans Coordinator (or designee), Contractor's Superintendent, Contractor's Surveyor (PLS) and Party Chief shall attend. A Presurvey Conference – Construction Survey Form shall be included in accordance with the CDOT Survey Manual Chapter 6, Appendix 6.A.4. A surveying work schedule shall be submitted to the Engineer for review prior to the presurvey conference.

The Contractor shall check all Department-established Primary horizontal and vertical control points in accordance with the CDOT Survey manual Chapter 6, Section 6.1.13, and verify and document in the survey records their horizontal accuracy tolerance in accordance with the CDOT Survey Manual Chapter 5, Section 5.5, and their vertical accuracy tolerance in accordance with the CDOT Survey Manual Chapter 6, Section 6.4.3 and Chapter 5, Section 5.8.6, for a CDOT Class A - Primary Survey prior to using them for monumentation surveying control.

Survey records shall be completed as the work is done. Field survey notes for monumentation, surveying and checking by the Contractor shall be recorded in survey records in conformance with the format given in the CDOT Survey Manual Chapter 6, Section 6.1.15. Survey fieldbooks shall be indexed in accordance with the Survey Manual Chapter 2, Section 2.4.14.

All survey records generated shall be the property of the Department and shall be available to the Engineer for inspection or reproduction at all times. All survey records shall be transmitted to the Engineer for inclusion into the project records before final project acceptance. All survey records shall be stamped with the seal of, and signed by, the responsible PLS identified in subsection 629.01.

If an electronic format is used it shall contain the same information and format as required in the Survey Manual Chapter 6, Section 6.1.15, for written documentation, a printout shall be signed and sealed by the PLS in responsible charge of establishing the monuments as identified in subsection 629.01, and shall be submitted to the Engineer on a CD ROM compact disc, or other acceptable medium which contains the stakeout data and the raw data from the actual placement of the monuments.

Survey records shall include the requirements specified in the CDOT Survey Manual Chapter 6, Section 6.3, and Chapter 5, Section 5.11.9 and 5.11.10, for any PLSS monument, GLO monument, BLM monument, or MS monument on the project.

Copies of any new Monument Records filed by the PLS with the State Board of Registration in accordance with the CDOT Survey Manual Chapter 6, Section 6.3.5, and Chapter 5, Section 5.11.9, shall be submitted to the Engineer prior to filing.

629.04 Locating Monuments. This work consists of field locating all survey monumentation which is in place as a result of a Government (Federal, State, County or Municipal) survey or resurvey as shown on original PLSS, GLO, BLM, or MS plats, notes, or other survey monumentation documented in the public record in accordance with the CDOT Survey Manual Chapter 6, Section 6.3.

A diligent search of construction zones and project limits shall be performed by the PLS in accordance with the Survey Manual Chapter 5, Section 5.11.9, to locate any survey monumentation of the public record. An electronic magnetic field sensor or locator shall be used in this search. The responsible PLS shall document the search, and time spent searching, in the survey records using a narrative form. The survey records shall include the procedures used to make the diligent search, a description of each monument searched for, and the actions taken to reference and preserve the location of the monument in accordance with subsection 629.05.

629.05 Preserving and Referencing Monuments. This work consists of field surveying, establishing, installing, and making measurements to reference monuments that will facilitate the installation of a replacement monument in the event the construction activity disturbs a monument of the public record as listed in subsection 629.04.

Referencing of monuments for possible replacement requires the use of correct replacement methods so the stated precision of the monument in question is not degraded.

When a construction activity is planned which will disturb an existing PLSS, GLO, B.L.M., or MS monument, the monument shall be referenced and the survey records shall include the information required in subsection 629.03, and the monument shall be upgraded by the PLS and a new Monument Record filed with the State Board in accordance with the Survey Manual Chapter 5, Section 5.11.9 and Section 5.11.10, when the following conditions are met:

(1) No boundary survey was done for the project.
(2) A Monument Record has been filed with the State Board and there are no Monument Records which indicate conflicting locations.
(3) The existing monument does not meet the physical standards set by the State Board.

A new monument record shall be filed with the State Board in accordance with Title 38 CRS and State Board Rules and Polices, a disclaimer should be written on the new Monument Record stating "the new monument was set in the same location as described by the previous monument record".

When conflicting evidence of the location of an existing PLSS, GLO, BLM, or MS monument is encountered and construction activity is planned which will alter the evidence, the monument shall be referenced and the survey records shall include the information required in subsection 629.03. A minimum of two CDOT permanent reference monuments shall be established in accordance with the CDOT Survey Manual, Chapter 5, Section 5.11.9, and Section 5.11.10, to reference the location of all existing found monuments. Reference monuments must meet the required physical standards of the actual monument for the type of monument being referenced. These references shall be set when all of the following conditions are met:

(1) No boundary survey was done for the project.
(2) No monument record or conflicting monument records are filed with the State Board.

The reference monuments shall be set and stamped in accordance with Title 38 CRS and State Board Rules and Polices, a new monument record should be marked "Other" for "Type of Monument" and a full explanation given on the monument record as to why the presumed monument was not upgraded, the monument record shall be filed with the State Board in accordance with Title 38 CRS.

Copies of all new Monument Records filed by the PLS with the State Board shall be submitted to the Engineer prior to filing.

The equipment used in referencing or replacing the monument shall be able to produce the stated accuracies as specified by the owner of the monument. For example, the Colorado High Accuracy Reference Network (HARN) and CDOT HARN

Densification (HARND) monuments shall be referenced or replaced using Dual Frequency survey grade GPS equipment in accordance with the procedures set forth under the most recent Policy of the National Ocean Service Regarding the Incorporation of Geodetic Data of Other Organizations into the National Geodetic Survey Data Base, standards of accuracy are given in the Standards and Specifications for Geodetic Control Networks and Geometric Geodetic Accuracy Standards and Specifications for using GPS Relative Positioning Techniques (as amended).

National Geodetic Survey (NGS), U.S. Coast and Geodetic (USCG), and U.S. Geological Survey (USGS) benchmarks shall be referenced by setting a minimum of 3 temporary benchmarks in accordance with the procedures set forth under the most recent edition of the NGS Benchmark Reset Procedures. The temporary benchmarks shall be set outside the construction area so a permanent monument can be reset upon completion of the construction.

Referencing, moving, or replacing a federal or local government agency monument shall be done in accordance with the CDOT Survey manual Chapter 6, Section 6.2.9, and Chapter 5, Section 5.11.10. Prior to referencing, moving or replacing the monument the NGS State Geodetic Advisor and the CDOT Region Survey Coordinator is to be notified, contact information is available in the CDOT Survey Manual Chapter 1, Section 1.2.5.

Survey records for referencing, moving, or replacing a federal or local government agency monument shall include documentation of the work in accordance with subsection 629.03. The survey records shall be submitted to the Engineer, for review by the Region Survey Coordinator, before payment is made and shall include the following:

(1) Description of the original monument and two sets of close up photographs.
(2) Two sets of labeled color photographs showing a close up of the replaced monument, and a view of the monument looking toward the horizon in each of the cardinal directions.
(3) A complete description of the reference monuments and replacement monument with a “to-reach” description.
(4) A signed and sealed statement by the responsible PLS that states the replacement monument’s positional tolerance has not been degraded. The documentation shall conform to the owner of the monument’s specifications which control the work.

629.06 Installing Monuments. This survey work consists of installing Primary Control monuments, benchmarks, ROW monuments, property boundary monuments, easement monuments, PLSS, GLO, BLM, or MS monuments, and other monuments included on the plans. The work shall include determining the location of the monuments, installing the monuments, and verifying the positional accuracy of the monument is correct.

A Primary Control survey, when not furnished by the Department, shall be performed in accordance with the CDOT Survey Manual Chapter 5, meeting the horizontal and

vertical accuracy tolerances for a CDOT Class A - Primary Survey. A Project Control Diagram shall be submitted to the Engineer and the Region Survey Coordinator for all new Primary Control monuments and surveys in accordance with the CDOT Survey Manual Chapter 5, Section 5.10.

Vertical accuracy tolerances for Primary Control monuments and surveys shall be as specified in the CDOT Survey Manual Chapter 6, Section 6.4.3 and Chapter 5, Section 5.8.6.

Unless stated otherwise in the contract, if construction activity disturbs a Primary Control monument (or benchmark) a new Primary Control monument (or benchmark) shall be installed by the Contractor in accordance with the CDOT Survey Manual, Chapter 6, Section 6.2. Primary Control monuments shall be set so they are intervisible from at least two adjacent Primary Control monuments and shall not exceed 0.2 mile between adjacent intervisible Primary Control monuments. Primary Control monuments set by the Contractor shall not conflict with construction activities. The Primary Control survey shall consist of a closed loop network and have adequate redundancy, precision, and accuracy to prove that all the monuments included in the network are within the horizontal and vertical accuracy tolerance as specified in the CDOT Survey Manual Chapter 5, Section 5.5 for a CDOT Class A - Primary Survey.

Survey records shall include documentation of Primary Control monuments and survey in accordance with subsection 629.03. A supplemental or amended Project Control Diagram shall be submitted to the Engineer and the Region Survey Coordinator for all replaced, transferred or re-established Primary Control monuments in accordance with the CDOT Survey Manual Chapter 6, Section 6.2.3.

ROW monuments, property boundary monuments, and easement monuments shall be installed in accordance with the CDOT Survey Manual Chapter 6, Section 6.3, and Chapter 5, Section 5.11, meeting the horizontal accuracy tolerances as specified in the CDOT Survey Manual Chapter 5, Section 5.5 for a CDOT Class B - Secondary Survey using the Primary Control monuments and the data on the Control and Monumentation sheet of the ROW plans.

Additional Secondary Control monuments may be required to be set in accordance with the CDOT Survey manual Chapter 5, Section 5.6.8, meeting the horizontal accuracy tolerance specified in the CDOT Survey Manual Chapter 5, Section 5.5 for a CDOT Class B Secondary Survey, before the ROW monuments are installed.

The procedures used to set ROW monuments shall include an independent check of the installation in accordance with the CDOT Survey Manual Chapter 5, Section 5.11.5 and Section 5.11.6. Survey records shall include documentation of the survey preformed to establish the monuments in accordance with subsection 629.03. The independent check shall be documented in the survey records and the field measured differences calculated or reduced to show the work is within the specified horizontal accuracy tolerance.

PLSS, GLO, BLM, or MS monuments shall be installed in accordance with the CDOT Survey Manual Chapter 6, Section 6.3 and Chapter 5, Section 5.11, meeting the horizontal accuracy tolerance specified in the CDOT Survey Manual Chapter 5, Section 5.5 for a CDOT Class B Secondary Survey using the Primary Control monuments and the data on the Control and Monumentation sheet of the ROW plans. The procedures used to set PLSS, GLO, BLM, or MS monuments shall include an independent check of the installation in accordance with the CDOT Survey Manual Chapter 5, Section 5.11.5 and Section 5.11.6. Survey records shall include documentation of the survey preformed to establish the monuments in accordance with subsection 629.03. The independent check shall be documented in the survey records and the field measured differences calculated or reduced to show the work is within the specified horizontal accuracy tolerance.

The installation of ROW, property boundary, easement, PLSS, GLO, BLM, or MS monuments installed at a different location than the data shown on the Monumentation sheet of the ROW plans shall be submitted to the Engineer and the Region Survey Coordinator along with the monuments description and horizontal data in order that the new monument can be revised on the Land Survey Control Diagram and ROW plan sheets.

Copies of all new Monument Records filed by the PLS with the State Board for the installation of new PLSS, GLO, BLM, or MS monuments shall be submitted to the Engineer prior to filing.

629.07 Monument Box. This survey work shall consist of installing or adjusting monument boxes included on the plans. When it is necessary to set a monument within a monument box in accordance with Title 38 CRS and State Board Rules and Policies, the work shall be done in accordance with Standard Plan M-629-1. If the monument meets the physical standard as stated by the State Board and is situated within the finished roadway, a monument box shall be installed as shown on Standard Plan M-629-1. When an existing monument box, due to construction, will no longer meet the physical standard set by the State Board, the box shall be replaced or adjusted to meet those standards.

METHOD OF MEASUREMENT

629.08 Survey Monuments, Monument Boxes, and Adjust Monument Boxes will be measured by the actual number of the various types installed and accepted by the Engineer. Measurement for locating survey monuments will be by the hour as approved by the Engineer.

BASIS OF PAYMENT

629.09 The accepted quantities will be paid for at the contract unit price for each of the pay items listed below that appear in the bid schedule.

No payments will be made before the proposed work schedule is submitted.

Legible signed and sealed copies of survey records in accordance with subsection 629.03 shall be submitted on a monthly basis to the Engineer for completed work before payment is made for that pay item.

Before final payment is made, the following three items shall be completed, bear the seal and signature of the responsible PLS identified in subsection 629.01, and have copies submitted to the Engineer for review prior to being deposited with the county in accordance with Title 38 CRS, Property – Real and Personal, State Board Rules and Policies, MOU, and the CDOT Survey Manual:

(1) All survey records
(2) The ROW Plans
(3) The Project Control Diagram (new, supplemental or amended)

The Presurvey Conference – Construction Surveys, equipment calibrations, and survey records will not be paid for separately but shall be included in the work.

Payment will be made under:

Pay Item	**Pay Unit**
Locate Monuments	Hour
Survey Monument (Type)	Each
Monument Box	Each
Adjust Monument Box	Each

Traffic control for monumentation and related surveying will be measured and paid for in accordance with Section 630.

SECTION 630
CONSTRUCTION ZONE TRAFFIC CONTROL

DESCRIPTION

630.01 This work consists of furnishing, installing, moving, maintaining and removing temporary traffic signs, advance warning arrow panels, flashing beacon (portable), barricades, channelizing devices, delineators, temporary traffic signals, masking and unmasking existing signs in construction zones, and concrete barriers as required by the Manual on Uniform Traffic Control Devices for Streets and Highways and the Colorado Supplement thereto, in accordance Contract. Devices shall comply with NCHRP 350 criteria requirement. When a device is not in use, the Contractor may remove it from the project for the period it is not needed. Devices temporarily not in use shall, as a minimum, be removed from the shoulder area. Moving will include devices removed from the project and later returned to use.

This work also includes Traffic Control Management, flagging and pilot car operation.

MATERIALS

630.02 Signs and Barricades. Construction traffic sign and barricade materials shall conform to the applicable portions of Section 614 with the following exception: Sign panels may be fabricated from plywood, aluminum, steel, or other suitable materials provided they are stable and durable enough to meet the other requirements of Section 614. Material that the Engineer determines is inadequate to produce the desired results, shall not be used.

Reflective sheeting shall conform to the requirements of subsection 713.04.

Retroreflective sheeting shall be one of the types specified for the particular application in Table 630-1.

Retroreflective sheeting for all signs requiring an orange or yellow background shall be fluorescent.

Table 630-1
RETROREFLECTIVE SHEETING TYPES

Sheeting	**Type III**	**Type VI**	**Fluorescent** [1]
Application	Work Zone	Work Zone	Work Zone
All Orange Construction Signs (Including Roll-up Signs)			X
Barricades (Temporary)	X		
Vertical Panels	X		
Flaggers Stop/Slow (May include flashing light approved under SHRP product # 3016)	X		X
Drums [2]	X		
Non orange Fixed support signs with prefix "W"	X		X
Special warning signs			X
STOP sign (R 1-1) YIELD sign (R1-2) WRONG WAY sign (R5-1a) DO NOT ENTER sign (R5-1) EXIT sign (E5-1a)	X		
DETOUR sign (M4-9) or (M4-10)			X
All other fixed support signs [3]	X		X
All other signs which use is limited to working hours only	X	X	X

[1] Fluorescent sheeting shall be of a type that is on the Colorado Approved Products List.
[2] Drum sheeting shall be manufactured for flexible devices.
[3] Fixed support signs are defined as all signs that must remain in use outside of working hours. They shall be mounted in accordance with Standard Plan S-630-1, Note 12, unless otherwise approved.

The Contractor shall provide sign panel legend for standard signs in accordance with "Standard Highway Signs" published by the FHWA and the Colorado Supplement thereto, and sign panel legend for special signs in accordance with the detailed sign layouts provided by the Engineer.

630.03 Electronic Advance Warning Signs. Advance warning flashing or sequencing arrow panels shall be furnished of a size as required by project conditions and shall meet the following requirements:

Type	Minimum Size	Minimum Number of Panel Lamps	Minimum Legibility Distance
A	24"x48"	12	½ mile
B	30"x60"	13	¾ mile
C	48"x96"	15	1 mile

The panel face shall be rectangular in shape, solid construction and shall be finished nonreflective black. The panels shall be mounted on a vehicle, trailer, or other suitable support. Vehicle-mounted panels shall be provided with remote controls.

Arrow panels shall have the capability of the following mode selection: left arrow or chevron, right arrow or chevron, left and right arrow, and caution. The caution mode consists of four or more lamps, arranged in a pattern which will not indicate a direction.

Arrow panels shall include an automatic photocell sensor type signal lamp dimmer with manual override and shall be capable of minimum 50 percent dimming from rated lamp voltage.

630.04 Temporary Traffic Signals. Temporary traffic signals must meet the physical display and operational requirements of conventional traffic signals. A minimum of two signal faces shall be provided for each approach and each signal face shall consist of three 12 inch sections. At railroad grade crossing locations, one signal face with three 8 inch sections shall be visible from each rail approach. The traffic signal controllers shall conform to the requirements of subsection 614.08(b) and shall be capable of two-phase operation, or more if specified on the plans, with all-red timing intervals.

The Contractor shall submit a list of equipment proposed to be used. The equipment shall be identified by trade name, size and number. Material deemed inadequate by the Engineer shall not be used.

630.05 Traffic Cones. Traffic cones shall not be used outside of working hours unattended. The minimum cone height shall be 28 inches. However, when they are used on freeways, at night time, or when specified in the Contract, the minimum height shall be 36 inches.

When traffic cones are used during night time they shall be reflectorized. The reflectorized material shall be selected from the Colorado Approved Products List and shall have a smooth, sealed outer surface that will display the same approximate color day and night. Reflectorization of cones shall be provided by a white band at least 6 inches wide placed no more than 3 to 4 inches from the top, and an additional white band, 4 inches wide, placed a minimum of 2 inches below the 6 inch band.

Tubular markers shall be 3 to 3½ inches in diameter, shall be 36 inches ±½ inch in height, predominantly orange in color, and shall be reflectorized.

630.06 Channelizing Device (Fixed). Channelizing Device (Fixed) shall be 36 inches ±½ inch in height and 3 to 3½ inches in width for the surface facing traffic. The shape of the device is immaterial as long as it can accommodate the striping pattern and functions as described below. Reflectorization shall be alternating 4 to 6 inches wide orange and white stripes slanting downward at a 45 degree angle toward the side to which traffic will pass. The striping shall start at the top and extend downward at least 32 inches. Reflective sheeting shall be Type III. These devices shall be manufactured of flexible high-impact resistant material, shall be physically attached to the pavement, and shall be capable of returning to a vertical position after impact by a vehicle.

The brand name and model of the Channelizing Device (Fixed) shall be submitted to the Engineer for approval before use.

630.07 Concrete Barrier (Temporary). Concrete Barrier (Temporary) shall conform to Precast Type 7 Concrete Barrier as detailed in Standard Plan M-606-14. Undamaged and unpainted sections of Concrete Barrier (Temporary) with stabilization pins as shown on the plans, may be used as Guard Rail Type 7 (Precast-Portable), when approved.

630.08 General. All traffic control devices shall be provided with all components necessary to comprise a complete installation.

Work zone devices that do not meet NCHRP 350 requirements shall not be used.

The flashing beacon (portable) shall include all work and material necessary to complete the item. The beacon head, lens, signal lamp, flasher and electrical boxes and fittings shall conform to permanent flashing beacon requirements. The post or mounting method shall conform to construction traffic control materials.

Portable devices that requires weight to prevent overturning shall be weighted with appropriate sized sand bags.

Traffic control devices that are damaged, weathered, worn, or otherwise determined to be unacceptable, shall be replaced at the Contractor's expense.

Delineator (Type) (Temporary) shall conform to Delineator (Type) described in Section 612. Undamaged Delineator (Type) (Temporary), when approved, may be used as Delineator (Type).

CONSTRUCTION REQUIREMENTS

630.09 Traffic Control Plan. The Contractor shall control traffic in accordance with the Traffic Control Plan (TCP), as shown in the Contract. To implement the TCP, the Contractor shall develop and submit a Method for Handling Traffic (MHT) for each different phase of construction which shows the Contractor's proposed construction phasing and proposed traffic control devices consistent with the TCP. If at any time the Contractor desires to change the MHT, it shall be considered a different phase requiring a new MHT.

Any major revision to the Traffic Control Plan (TCP) as determined by the Engineer must be authorized by a contract modification order.

Each proposed MHT shall be approved in writing by the Engineer before the corresponding phase of construction will be allowed to begin. The initial MHT shall be submitted at the preconstruction conference.

The proposed MHT shall include as a minimum the following:

(1) A detailed diagram which shows the location of all traffic control devices, including advance construction signs and speed limit signs; method, length and time duration for lane closures; and location of flaggers and time duration of the flagging operation. Lane closures shall be kept to a minimum in both length and duration, and cause a minimum of interference to the traveling public, consistent with the work being performed.

(2) A tabulation of all traffic control devices shown in the detailed diagram including, but not limited to: construction signs; vertical panels; vertical panels with light; Type 1 and Type 2 barricades; Type 3 barricades; cones, drum channelizing devices; concrete barrier (temporary); advance warning flashing or sequencing arrow panels. Traffic control devices may be used for more than one operation or phase. However, all devices required for any particular phase must be detailed and tabulated for each phase.

(3) The Contractor shall furnish supporting references from documents such as the MUTCD, Standard Plans, etc. for any devices incorporated into the MHT which are not included in the TCP provided by the Contract.

(4) An access maintenance plan for all properties requiring access during construction. This plan shall also indicate the areas where equipment will be stored, vehicles parked, and construction signs and materials stored, if within the project limits. The Contractor shall ingress and egress the project at existing access points, including median crossings, shown on the plans, unless otherwise approved.

(5) A plan for maintaining and controlling pedestrian, bicycle, and other non-vehicular traffic.

(6) A plan for emergency vehicle access.

(7) The Contractor shall provide verification by field survey that the vertical clearances for structures in all areas covered by a proposed MHT meet or exceed the minimum clearances shown in Table 630-2. If the vertical clearance is less than what is shown for the particular condition in Table 630-2, the Contractor shall identify the location where this clearance cannot be met, and provide an appropriate signing plan. If the existing vertical clearance is already less than what is shown in Table 630-2, the Contractor shall identify the location, but a signing plan will be required only if the clearance is to be reduced further. This information shall be included in the MHT and shall be submitted to the Engineer for approval a minimum of five days before the MHT is implemented.

(8) The Contractor shall provide verification by field survey that the total driving lane plus shoulder in all areas covered by a proposed MHT is at least 17 feet. If this width cannot be maintained, the Contractor shall identify the location where this clearance cannot be met, and provide an appropriate signing plan. If the existing

width is already less than 17 feet, the Contractor shall identify the location, but a signing plan will be required only if the width is to be reduced further. This information shall be included in the MHT and shall be submitted to the Engineer for approval a minimum of five days before the MHT is implemented.

Table 630-2
VERTICAL CLEARANCES TO STRUCTURES

	Highway Underpasses	Railway Underpasses	Overhead Wires
Local Rural Roads Local Urban Streets Rural Collectors	14 Feet	23 Feet[2]	[3]
Urban Collectors Rural Arterial Urban Arterial	16 Feet[1]	23 Feet[2]	[3]

1 Vertical clearance to sign trusses and pedestrian overpasses shall be 17 feet
2 Measured from top of rail to bottom of highway structure. All railway clearances are subject to the individual railroad's approval.
3 Communication and power lines of:
0 to 750 volts 18 Feet
750 to 22,000 volts 20 Feet
22,000 to 50,000 volts 22 Feet
For voltages over 50,000 volts, increase clearance ½ inch for each 1000 volts over 50,000.

630.10 Traffic Control Management. The Contractor shall designate an individual, other than the superintendent, to be the Traffic Control Supervisor. The Traffic Control Supervisor shall be certified as a worksite traffic supervisor by either the American Traffic Safety Services Association (ATSSA) or the Colorado Contractors Association (CCA), and shall have a current Department flaggers certificate. A copy of the Traffic Control Supervisor's certifications shall be provided to the Engineer at the preconstruction conference.

The Traffic Control Supervisor's duties shall include:
(1) Preparing, revising, and implementing each required Method of Handling Traffic in accordance with the Traffic Control Plan.
(2) Directly supervising project flaggers.
(3) Coordinating all traffic control operations, including those of subcontractors and suppliers.
(4) Coordinating project activities with appropriate police and fire control agencies.
(5) Preparing a traffic control diary on every calendar day traffic control devices are in use. This diary shall be submitted to the Engineer daily and become a part of the Department's project records. The diary shall include the following information as a minimum:

(i) Date
(ii) For Traffic Control Inspection, the time of the inspection
(iii) Project number
(iv) Traffic Control Supervisor's name
(v) Description of traffic control operations (lane closures, shoulder closures, pilot car operations, detours, etc.) including location, setup and takedown time, and approved Method of Handling Traffic (MHT) number
(vi) Types and quantities of traffic control devices used in accordance with the approved MHT
(vii) List of flaggers and uniformed traffic control (UTC) used, including start time, stop time, and number of flagging hours and UTC hours used
(viii) Traffic control problems (traffic accidents; damaged, missing or dirty devices, etc.) and corrective action taken

(6) Inspecting traffic control devices on every calendar day that traffic control devices are in use, masked, or turned away from traffic. These inspections shall include at least one night inspection per week. The TCS or another representative who is certified as a work site traffic supervisor shall perform these inspections.
(7) Insuring that traffic control devices are functioning as required.
(8) Overseeing all requirements covered by the Contract which contribute to the convenience, safety and orderly movement of traffic. Have an up-to-date copy of the MUTCD and applicable standards and specifications available at all times on the project.
(9) Attending all project scheduling meetings.
(10) Supervising the cleaning and maintenance of all traffic control devices.

A certified worksite traffic supervisor shall provide Traffic Control Management (TCM) on a 24-hour-per-day basis. The Traffic Control Supervisor (TCS) or another representative who is certified as a work site traffic supervisor shall be available and reasonably accessible to the job site on every working day, on call at all times, and available upon the Engineer's request at other than normal working hours. During non-work periods, the TCS or another representative shall respond to the job site within 45 minutes. When another representative responds, the TCS or another representative who is certified as a work site traffic supervisor shall arrive at the job site within two hours after notification. The Contractor shall maintain a 24-hour telephone number at which the TCS can be contacted. The TCS shall not act as a flagger except in an emergency or in relief for short periods of time.

630.11 Temporary Masking Signs. Sign legend or portions thereof that conflict with the construction signing or Traffic Control Plan shall be completely covered by the Contractor so that none of the covered sign or legend is visible to traffic.

If the whole sign is to be covered, it shall be covered with a nontransparent material that covers the entire face of the sign.

If partial legend is to be covered, it shall be with a material furnished with reflective sheeting conforming to Section 713 and shall be the same color as the masked panel.

All covering materials shall be plywood, hard-board, sheet metal, aluminum, or reinforced plastic, and shall be durable enough to resist deterioration due to weathering and atmospheric conditions for the duration of the project. Examples are aluminum at least 0.040 inch thick, and plywood at least $^{3}/_{8}$ inch thick. Adhesives, glues, tapes, or mechanical fasteners that mar the face of the panel to be masked shall not be used.

630.12 General. Portable construction traffic signs shall be removed when not required. Permanently mounted construction traffic signs shall be masked or turned away from traffic when not required. When work is suspended, or the project is in free time, and there is no condition requiring traffic control devices or construction traffic signs, all of the construction traffic signs shall be masked or turned away from traffic. If this condition is to exist for more than 30 days, all construction traffic signs shall be removed. When storing portable signs or supports within the project they shall be removed beyond the clear zone and shall not be visible to traffic. All storage areas shall be approved. When masking is used, it shall be done in accordance with subsection 630.11.

The construction traffic signs for reduced speed limit signs and double fines signs shall be placed, or unmasked, no sooner than four hours prior to the start of work activities. The time when the double fine signing is to be placed or unmasked and location of the reduced speed limit signs and double fine signs shall be as shown on the plans or as directed by the Engineer.

Double fine signing shall be removed or masked as soon as work activities are completed. Work activities are defined as all construction and maintenance activities where workers are present in the clear zone, or there are existing hazards in the travel way, shoulders, or clear zones. Hazards include but are not limited to workers, equipment, drop offs, lane closures, temporary guardrail, and other objects, both in the roadway and the adjacent roadside, that may affect the traveling public.

The retroreflective surfaces of all signs and other traffic control devices shall be cleaned as frequently as necessary to preserve their legibility and retroreflectivity. However, all devices shall be cleaned a minimum of once every two weeks.

Vertical panels fabricated with vehicle wheel rims, and steel drum channelizing devices shall not be used.

Channelizing device (Fixed) shall be attached to the pavement in accordance with the manufacturer's recommendations. Anchoring methods or devices which penetrate the surface of the permanent pavement will not be permitted. Upon removal of the device the roadway surface shall be cleaned, patched, or both as approved by the Engineer.

630.13 Flagging and Pilot Car Operation. Flagging and pilot car operation shall be performed as described in the latest edition of part VI of the MUTCD as adopted by CDOT.

All traffic control personnel shall wear safety apparel and hardhats meeting the requirements of the latest version of the ISEA "American National Standard for High-Visibility Safety Apparel and Headwear". Safety apparel shall be labeled as meeting the standard performance for Class 2 or Class 3 risk exposure. The apparel and hardhat background material color shall be either fluorescent orange-red or fluorescent yellow-green as defined in the standard. The retroreflective material shall be either orange, yellow, white, silver, yellow-green, or a fluorescent version of these colors, and shall be visible at a minimum distance of 1,000 feet.

Night time flagging stations shall be illuminated with flood lights unless otherwise approved and shall not be paid for separately.

(a) The Contractor shall provide all flagging through the project necessary to assure proper safety to traffic. All flagging personnel shall have completed the Department's minimum training requirements for flaggers within two years prior to starting work on the project.

(b) Reimbursement for flagging shall be limited to the following areas:

(1) The entire construction area under contract and for a distance of 500 feet outside the project limits or approach to project; except that if the project consists of two or more sections, the limits will apply to each section individually.

(2) Those areas beyond the above-described limits where the Engineer determines the use of flaggers are necessary to provide adequate warning to traffic.

(3) A detour provided on the plans or approved by the Engineer for by-passing all or any portion of the construction irrespective of whether the detour termini are within the project limits.

(c) The cost of all flagging for haul routes from the Contractor's materials sources to the limits of the project shall be at the Contractor's expense.

(d) The authorized duties of flaggers consist of directing the traveling public and the construction traffic that affects the traveling public within the project limits.

METHOD OF MEASUREMENT

630.14 Quantities to be measured for construction traffic control devices shall be the number of units of the various sizes and descriptions listed below.

Construction Traffic Signs:

Panel Size A:	Up to 9 square feet including Type 1 and Type 2 Barricades.
Panel Size B:	Over 9 to 16 square feet
Panel Size C:	Over 16 square feet
Special:	As shown on the plans

The total number of traffic control devices of each type on the schedule and approved subsequent modified schedules shall be the maximum number approved for payment.

Traffic channelizing devices consisting of vertical panels, traffic cones, or drum channelizing devices will be measured by the unit. Concrete barriers will be measured by the linear foot. Barricades will be measured by the number used. Barricade warning lights shall be furnished as a part of this item when required by the Traffic Control Plan (TCP). Advance Warning Flashing or Sequencing Arrow Panels will be measured by the unit according to size.

The flashing beacon (portable) will be measured as a unit complete in place. Sign panel will be paid for under the appropriate item.

The quantity to be measured for Traffic Control Management will be the number of authorized 24-hour days of active TCM performed by the TCS or another representative certified as a work site traffic supervisor. Payment will be made for one day of Traffic Control Management regardless of the number of TCSs required to adequately control the work. An authorized 24-hour day of active TCM will be every calendar day on which active traffic control occurs in accordance with an approved MHT. This includes activities such as flagging operations, pilot car operations, and setting up or removal of construction zones, shoulder closures, lane closures or detours. Traffic control devices that are left in place during non-working hours, including configurations such as lane closures, temporary channelization or detours, are not considered active traffic control.

The quantity to be measured for Traffic Control Inspection will be the number of authorized 24-hour days of traffic control inspection (TCI) performed by the TCS or another representative certified as a work site traffic supervisor. An authorized 24-hour day of TCI shall be every calendar day that traffic control devices as shown in the MHT are in use, masked, or turned away from traffic on the project, and the only traffic control activity is the inspection of traffic control devices.

Resetting, repairing, or replacing traffic control devices is considered maintenance of the devices. Cleaning and maintaining of traffic control devices are not considered traffic control activities subsidiary to the Traffic Control Management, Traffic Control Inspection or flagging pay items.

Payment will be made for either Traffic Control Management or Traffic Control Inspection for every calendar day that traffic control devices as shown in the MHT are in use, masked, or turned away from traffic on the project. Payment will not be made for both items for the same calendar day. Work on a night shift that begins before midnight and ends after midnight will be considered as occurring on the calendar day on which the shift ends.

The quantity to be measured for flagging will be the total number of actual flagging hours that are used as authorized in accordance with an approved MHT. Payment will not be made for time spent by flaggers to set up and take down construction traffic

control devices. The quantity to be measured for pilot car operation will be the total number of hours that pilot car operation is used as authorized. Hours of flagging and hours of pilot car operation in excess of those authorized shall be at the Contractor's expense.

BASIS OF PAYMENT

630.15 Payment for the individual traffic control devices necessary to complete the work shall be full compensation for furnishing, erecting, cleaning, maintaining, resetting, repairing, replacing, moving, removing, and disposing of the construction traffic control devices. All construction traffic control devices that are not permanently incorporated into the project will remain the property of the Contractor.

Construction traffic control devices, as determined by the project Traffic Control Plan (TCP), will be paid for as follows: 50 percent of the accepted amount upon first utilization, an additional 40 percent of the accepted amount when 75 percent of the original contract amount has been earned, and the final 10 percent when the project has been completed in accordance with subsection 105.20, exclusive of any maintenance periods.

The accepted quantities will be paid for at the contract unit price for each of the pay items listed below that appear in the bid schedule.

Payment will be made under:

Pay Item	**Pay Unit**
Construction Traffic Sign (Panel Size___)	Each
Construction Traffic Sign (Special)	Square Foot
Vertical Panel	Each
Vertical Panel (With Light) (Flashing)	Each
Vertical Panel (With Light) (Steady Burn)	Each
Advance Warning Flashing or Sequencing Arrow Panel (____Type)	Each
Drum Channelizing Device	Each
Traffic Cone	Each
Tubular Marker	Each
Channelizing Device (Fixed)	Each
Concrete Barrier (Temporary)	Linear Foot
Delineator (Type__) (Temporary)	Each
Barricade (Type___) (Temporary)	Each
Traffic Control Management	Day
Traffic Control Inspection	Day
Flagging	Hour
Pilot Car Operation	Hour
Flashing Beacon (Portable)	Each
Traffic Signal (Temporary)	Lump Sum
Traffic Control Management	Day
Traffic Control Inspection	Day

Pay Item (continued)	Pay Unit (continued)
Flagging	Hour
Pilot Car Operation	Hour

The Contractor shall agree to quantities for the following items on a weekly basis when signing the CDOT Form 7 – Weekly Report of Miscellaneous Pay Items:

Construction Traffic Sign (Special) is a project specific sign indicated on the Schedule of Construction Traffic Control Devices.

When Traffic Control Management and Traffic Control Inspection are not pay items, Traffic Control Management will not be paid for separately, but shall be included in the work.

Flagger hand devices will not be measured and paid for separately, but shall be included in the work.

Cost of electrical power, including batteries, for all temporary lighting or warning devices shown on the TCP will not be paid for separately but will be considered subsidiary to the item.

Temporary masking signs, including the covering materials and fastening devices, will not be measured and paid for separately but shall be included in the work.

The Contractor may provide larger construction traffic signs than those shown on the plans, if approved; however, payment will be made for the panel size designated.

If the Contractor fails to complete construction within the approved contract time, Payment will not be made for the use of Section 630 pay items for the period of time after expiration of the approved contract time. These items shall be provided at the Contractor's expense.

Cleaning and patching of the roadway after removal of the Channelizing Device (Fixed) will not be paid for separately, but shall be included in the work.

Placement, unmasking, removal and masking of reduced speed limit signs and double fines signs, will not be measured and paid for separately but shall be included in the work