Grounding jumper shall be attached by a 3/16 inch or larger brass bolt in the signal standard or controller pedestal and shall be run to the conduit, ground rod or bonding wire in the adjacent pull box.

Grounding jumper shall be visible after cap has been poured on foundation.

For equipment grounding jumper a No. 8 bare copper wire shall run continuously in all circuits except a No. 12 bare copper wire shall run continuously in conduits that contain only signal interconnect cable and/or loop detector cable.

O. Service

Service shall conform to the provisions in Section 86-2.11, "Service", of the Standard Specifications and these Special Provisions.

Service equipment enclosure shall be Type III-CF, as shown on the Standard Plans, ES-2F, and shall conform to the following:

1. 120 / 240 volt, 2 meter service unless otherwise shown on the plans.
2. Circuit breakers required:
    - 2 - 100 Amp 2 pole (signal main and lighting main)
    - 1 - 30 Amp 1 pole (luminaires)
    - 1 - 30 Amp 1 pole (signals)
    - 1 - 20 Amp 1 pole (illuminated street name signs)
    - 1 - 15 Amp 1 pole (luminaire photoelectric control)
    - 1 - 15 Amp 1 pole (street name sign photoelectric control)
    - 1 - 15 Amp 1 pole (for video detection cameras)
    - 1 - 20 Amp 1 pole (for each beacon, if applicable)
3. Cabinet shall be fabricated from aluminum sheeting and finish shall be anodic coating in accordance with Section 86-3.04A "Cabinet Construction".
4. Circuit breakers shall be marked with identifying labels for each circuit breaker.
5. Each service must be provided with up to 2 main circuit breakers that will disconnect ungrounded service entrance conductors. Where the "Main" circuit breaker consists of 2 circuit breakers as described, each of the circuit breakers must have a minimum interrupting capacity of 22,000 A, rms.

Service equipment enclosure for street lighting and irrigation controller shall be Type III-BF, as shown on the Standard Plans, ES-2E, and as shown on the plans.

Type V photoelectric control contactor and test switch assembly shall be installed in the service cabinet. Photoelectric control contactors shall be as follows:

1. Luminaires - 60 Amp electrically held contact
2. Street name signs - 30 Amp electrically held contact

A GFCI outlet shall be installed on the interior side of service cabinet door. and an eight (8) position terminal strip for termination of Video Cameras.
Photo Electric Control assembly shall be installed within the circuit breaker compartment of the service equipment enclosure, and accessible to the Engineer after installation of electrical meters.

Direct burial service conductors are not allowed.

The Contractor shall be responsible for contacting the power company, arranging and providing for the electrical service connection, and ensuring that adequate notice is provided to the serving electric company in advance of need. *The County of Riverside will pay all electric company fees required.*

The service equipment enclosure shall be a minimum of 15 feet from the controller cabinet, and a minimum of 10 feet from all utility poles, unless otherwise directed by the Engineer.

Service Identification

The service address shall be shown on the front upper panel of the service equipment enclosure, and the meters shall be labeled "LS3" (lighting meter) and "TC1" (signal meter) by lettering applied to the exterior of the enclosure in accordance with these special provisions, or as directed by the Engineer.

Lettering markings shall be black with a two-inch minimum size in block letter form. Markings shall be applied to a brushed aluminum, stainless steel, or other non-corroding metallic plate, as approved by the Engineer. Plate shall be white in color. All paint and markings shall conform in all respects to Federal Specification TT-E-489, latest revision, Class A, Air Drying. Said plate shall be affixed in a permanent manner by riveting or with stainless steel bolts and nuts. Bolts shall be peened after tightening. All materials used for affixing address plate shall be non-corroding. The Engineer shall approve all alternate materials and methods prior to installation.

P. Testing

Testing and Field Testing shall conform to the provisions in Section 86-2.14, "Testing", of the Standard Specifications and these Special Provisions.

Specific testing requirements for various systems and components shall be in accordance with the Special Provisions entitled to each herein.

The complete controller assembly and Battery Backup System shall be delivered to the following location or location as directed by the Engineer for testing:

Traffic Signal Shop
Riverside County Transportation Department
McKenzie Highway Operations Center
2950 Washington Street
Riverside, California 92504
Telephone (951) 955-6894

A minimum of 15 working days for operational testing and adjustment is required. An additional 15 working days period shall be allowed for retesting should the equipment fail.

The conflict monitor unit shall be tested in the field before signal turn on.

Q. Controller Assembly

Controller assembly shall conform to the provisions in Section 86-3, "Controller Assemblies", of the Standard Specifications and these Special Provisions.

Controller assembly shall be Model 170 controller assembly consisting of the additional features:

1. Model 332L controller cabinet:
   - Anodic coating for both interior and exterior finish
   - A Corbin No. 2 door lock

2. An interior fluorescent lamp with an on/off switch and a door switch that will automatically turn on the lamp when cabinet door is opened.

3. An interior thermostatically controlled, 24 volt electric fan with ball or roller bearing that has capacity rating of 100 cubic feet per minute minimum.

4. Rack mounted push buttons for manual actuation of the following:
   - 8 vehicular phases,
   - 4 pedestrian phases,
   - 4 Emergency Vehicle Preemption (EVP) phases; and,
   - 2 Railroad preemption phases.

5. Model 170E local controller unit:
   - Dual Asynchronous Communications Interface Adaptor (ACIA) capability. ACIA shall be integral to the controller unit. Horizontal printed circuit board controllers will not be accepted.
   - A Model 412F Program Module with 32K 27256 EPROM, 16K RAM, and 8K zero power RAM (memory method two, memory select four).
   - Bi Trans Systems, Inc. 233RV2.5 or latest version firmware, test program and a loopback cable.
   - If required, provide a Model 170E field master controller unit that has the same features as the 170E local controller except the firmware shall be Bi Tran Systems, Inc. No. 245 FM. It shall be mounted above the local controller unit.

6. A pullout shelf/drawer assembly made of aluminum with telescoping drawer guides for full extension installed below the local controller unit. The top shall have a non-slip plastic laminate permanently attached. The non-slip laminate shall not be attached with silicon adhesive.

7. Load Switches: Switching circuit shall be contained in a replacement module (cube type) sealed in epoxy and rated at 15 amperes load (25 Amp triac). Pin 11 on all load switch sockets shall be wired to AC. Input and output indicators shall be installed on all load switches.

   All load switch sockets shall have individual wire terminals. Printed circuit boards will not be allowed.

8. Flasher units: Switching circuit shall be contained in a replacement module (cube type) sealed in epoxy and rated at 15 amperes load (25 Amps triac).

9. Conflict monitor shall be EDI Model 2010ECL or equivalent with a red monitor assembly circuit board and capable of monitoring green, amber and red indications.

10. Loop detector sensor unit shall be Model 222:
    - Detector unit shall have delay timers adjustable from zero to a minimum of 30 seconds and extension timers adjustable from zero to a minimum of 7 seconds.
    - Delay timers shall delay calls only during display of the associated red or yellow indications. If a vehicle departs the area of detection prior to expiration of the assigned delay period, the timer shall reset and no call shall be placed upon the controller. During display of the associated green indication, detectors shall operate in the present mode and calls shall not be delayed.

11. Power Distribution Assembly shall be Model PDA-2.

12. A twelve-position interconnect terminal strip.

The contractor shall furnish the following spare equipments / components:

Description	Model	Quantity
Cabinet	332	0
Controller Unit (local)	170E	0
Controller Unit (master)	170E	0
Switch Pack	200	0
Flasher Unit	204	0
Conflict Monitor Unit	2010	0
2-Channel Loop Detector	222	0
2-Channel DC Isolator	242	0
Modem Module	400	0
Program Module	412F	0

Spare equipments or components shall be delivered to the following location or as directed by the Engineer:

Traffic Signal Shop
Riverside County Transportation Department
McKenzie Highway Operations Center
2950 Washington Street
Riverside, California 92504
Telephone (951) 955-6894

The controller unit and controller cabinet shall be manufactured and furnished by the same manufacturer to form a complete functional controller system capable of providing the traffic signal operation specified. All traffic control equipment to be furnished shall be listed on the California Department of Transportation Qualified Products List.

The controller unit and controller cabinet manufacturer or supplier shall perform operational and functional testing of the supplied controller assembly and additional supplied equipment in accordance with the State of California Department of Transportation's Transportation Electrical Equipment specifications (TEES), and a Certificate of Compliance shall be issued for each successfully tested controller assembly and additional supplied equipment.

Modify traffic signal controller assembly if necessary and provide any necessary auxiliary equipment and cabling to achieve the intended traffic signal operation as shown on the plans. The Contractor shall make all field wiring connections to the terminal blocks inside the controller cabinet.

A technician who is qualified to work on the controller assembly from the controller manufacturer or their representative shall install the program module and program the signal controller in accordance with the Engineer provided signal timing sheets, and to be present when the equipment is turned on.

R. Vehicle Signal Assemblies

Vehicle signal assemblies and auxiliary equipment shall conform to the provisions in Section 86-4, "Traffic Signal Faces and Fittings", of the Standard Specifications and these Special Provisions.

Signal sections, backplates, visors and signal mounting assemblies shall be the metal type and shall be made from the same manufacturer. The section assemblies shall be uniform in appearance and alignment.

Backplates shall be louvered. Visors shall be the "tunnel" type. Top opening of signal sections shall be sealed with neoprene gaskets.

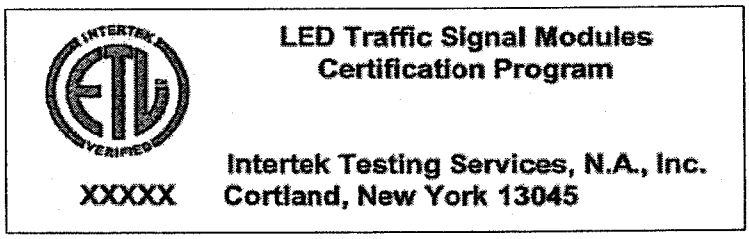
Vehicle signal indications shall be 12-inch diameter Light Emitting Diode (LED) modules in accordance with the following:

1. All circular LED modules shall comply with Institute of Transportation Engineers (ITE) Vehicle Traffic Control Signal Heads (VETCH) - LED Circular Supplement, Adopted June 27, 2005.

2. All arrow LED modules shall comply with ITE VETCH - LED Vehicle Arrow Traffic Signal Supplement, Adopted July 1, 2007.

3. All modules shall fit in existing signal housings without the use of special tools.

4. All modules shall be certified in the Intertek LED Traffic Signal Modules Certification Program and be labeled with the ETL Verified Label as follows:



5. Luminous intensity requirements of the VTCSH must be met across the entire temperature range from -40°C to + 74°C, (-40°F to +165°F).

6. The following cable colors shall be used for the AC power leads on all modules: white for common, red for the red module line, yellow for the yellow module line, and brown for the green module line.

7. The AC power leads shall exit the module via a rubber grommet strain relief, and shall be terminated with quick connect terminals with spade tab adapters. The leads shall be separate at the point at which they leave the module.

8. All external wiring used in the module shall be anti-capillary type cable to prevent the wicking of moisture to the interior of the module.

9. All power supplies shall be coated for additional moisture and thermal protection.

10. The module shall have an incandescent, non-pixilated appearance when illuminated.

11. Nominal power usage is measured at 25°C, 120 VAC. For the 8 inch modules, it shall not exceed 8 watts for Red, 8 watts for Yellow, and 8 watts for Green modules. For the 12 inch modules, it shall not exceed 10 watts for Red, 19 watts for Yellow, and 11 watts for Green modules. For the arrows, it shall not exceed 6 watts for any color.

12. All modules shall use LEDs that have been manufactured with materials that have industry acceptance as being suitable for uses in outdoor applications. At no time is the use of LEDs that utilize AlGaAs technology acceptable.

13. The external lens shall have a smooth outer surface to prevent the buildup of dirt and dust and shall be designed to minimize the potential for sun phantom signals.

14. The circular LED module lens material must be tinted . A tinted transparent film or coating is not permitted.

15. A module shall be sealed against dust and moisture intrusion, including rain and blowing rain per Mil-Std-810F Method 506.4, Procedure 1.

16. Arrow modules shall be clearly marked with the phrase "Suitable for mounting in any orientation".

17. Modules shall be repaired or replaced if the module fails to function as intended due to workmanship or material defects within warranty period.

18. Modules shall be repaired or replaced if the module exhibit luminous intensities less than the minimum specified values within 60 months of the date of delivery.

19. The Manufacturer shall clearly disclose the country in which the factory of module origin is located, the name of the company or organization that owns the factory including all of its parent companies and/or organizations, and their respective country of corporate citizenship.

S. Pedestrian Signal Assemblies

Pedestrian signals assemblies shall conform to the provisions in Section 86-4.03, "Pedestrian Signal Faces", of the Standard Specifications and these Special Provisions.

Pedestrian Signal Mounting Assemblies and Pedestrian Signal Housings shall be made from the same manufacturer and the section assemblies shall be uniform in appearance and alignment.

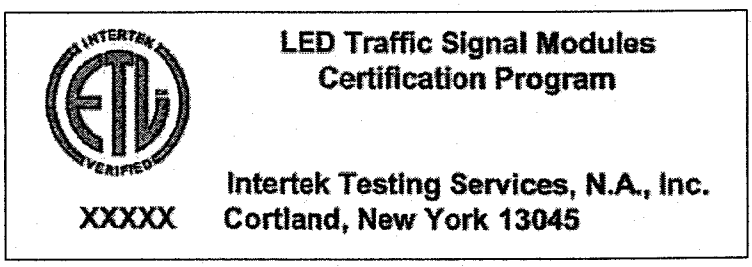
Pedestrian signals shall be provided with a polycarbonate egg crate or Z-crate screen.

Pedestrian signals shall be equipped with light emitting diode countdown pedestrian module in accordance to the following:

1. It shall comply with ITE specification: Pedestrian Traffic Control Signal Indications (PTCSI) Part 2: LED Pedestrian Traffic Signal Modules, Adopted March 19, 2004.

2. All modules shall fit in existing signal housings without the use of special tools.

3. All modules shall be certified in the Intertek LED Traffic Signal Modules Certification Program and be labeled with the ETL Verified Label as follows:



The PTCSI does not cover the countdown features of countdown pedestrian signal LED modules. The countdown features shall incorporate the following:

1. Fully compliant to NEMA TS-1, NEMA TS-2, Type 170, and Type 2070 traffic signal controller specifications.

2. The countdown portion of the pedestrian (ped) module shall have a high off-state input impedance so as not to provide a load indication to conflict monitors and interfere with the monitoring of the pedestrian signal. The input impedance of the countdown circuitry shall maintain a voltage reading above 25 VAC to the conflict monitor for up to four units connected on the same channel.

3. The countdown drive circuitry shall not be damaged when subjected to defective load switches providing a half wave signal input.

4. The countdown ped module shall have an internal conflict monitor circuit preventing any possible conflicts between the Hand, Person, and Countdown signal indications. It shall be impossible for the display to countdown during a solid Hand indication.

5. Per CA MUTCD Manual section 4E.07: "The countdown pedestrian signal shall display the number of seconds remaining until the termination of the pedestrian change interval. Countdown displays shall not be used during the walk interval or during the red clearance interval of a concurrent vehicular phase".

6. The countdown ped module shall have a micro-processor capable of recording its own time when connected to a traffic controller. It shall be capable of displaying the digits 0 through 99.

7. When power is first applied or restored to the ped module, the countdown display will be blank during the initial cycle while it records the countdown time using the walk (person) and don't walk (flashing hand) signal indications. The normal hand and person icons shall be displayed during this cycle.

8. The countdown ped module shall continuously monitor the traffic controller for any changes to the pedestrian phase time and re-program itself automatically if needed.

9. The countdown ped module shall register the time for the walk and clearance intervals individually and shall begin counting down at the beginning of the pedestrian clearance interval. The digits shall not flash during the countdown.

10. When the flashing hand becomes solid, the ped module shall display 0 for one second and then blank-out. The display shall remain dark until the beginning of the next countdown.

11. In the event of a pre-emption, the countdown ped module shall skip the remaining time, reach 0 at the same time as the flashing Hand becomes solid, and remain dark until the next cycle.

12. In the cycle following preemption call, the signal shall display the correct time and not be affected by the reduced previous cycle. The countdown shall remain synchronized with the signal indications and always reach 0 at the same time as the flashing Hand becomes solid.

13. If a pedestrian button is activated during the clearance interval, some controllers can change to a second walk cycle without a don't walk phase. The countdown module shall also be capable of consecutive walk cycles. The display digits will be blank during the second walk and countdown properly during the second flashing hand.

14. The countdown ped module shall not display an erroneous or conflicting time when subjected to defective load switches. Should there be a short power interruption during the ped clearance interval or if voltage is applied to both the hand and person simultaneously the display will go to "0" then blank.

15. The countdown ped module shall have accessible dip-switches for the user selectable options. The unit shall have a removable plug on the rear allowing easy access to control the user selectable functions. The countdown is disabled when all the switches are in the "ON" position. The unit shall be shipped from the factory with the specified default setting.

16. Switch 1 – Blank Cycle Following a Timing Change – Factory default is "OFF". When this switch is "OFF" the unit will allow the time to be displayed normally during the cycle following a truncated timing such as a preemption call. The countdown shall be capable of displaying the correct time and not affected by the previous reduced cycle. The unit will require 2 consecutive reduced cycles of identical value to validate and record a new time setting. If the timing is extended, the unit will record it immediately. In the "ON" position when a change in timing is detected the unit will blank out during the following cycle while the new cycle time is measured and recorded if confirmed.

17. Switch 2 – Disables Auto-sync Mode- Factory default setting is "OFF". When this switch is in the "OFF" position the auto-sync is enabled. When the clearance interval begins and the initial flash of the hand is not in sync with the walk signal the unit will measure the offset and reduce the duration of the first second by the value of the offset. This will ensure the countdown reached zero at the same time as the flashing hand becomes solid. In the "ON" position there is no time correction when the flashing hand is in offset with the walk signal. The duration of the first second will not be reduced and the hand will appear solid shortly before the countdown reaches zero.

18. Switch 3 – Countdown Starts with Flashing Hand Signal – Factory default setting is "ON". When this switch is "ON" the countdown begins when the hand signal is turned on. With this switch "ON" and the auto-sync mode enabled a short power interruption will have no effect on the countdown display. With switch 3 in the "OFF" position the countdown begins when the walk signal is turned off. This eliminates the effect of an offset hand signal. When switch 3 is in the "OFF" position the auto-sync switch 2 has no effect on the countdown. In this mode if the power to the walk signal is interrupted, the unit will interpret this as the start of the clearance interval and will display the countdown time for 2 seconds before the operation is cancelled. The countdown will resume with the normal ending of the walk signal.

19. Switch 4 – Stores Time Value in Memory, Immediate. Restart. - Factory default setting is "OFF". When this switch is in the "OFF" position and power is removed from the unit, the time value stored in the unit is erased. The unit will need to run a dark cycle before it can display the countdown again. In the "ON" position the countdown timing is stored in memory. Following a power interruption, the unit will restart with the stored value and not remain dark during the learning cycle. If the value is different after restart, it will be recorded and displayed correctly at the following cycle.

20. Switch 5 – All LEDs "ON", Test Mode – Factory default setting is "OFF". With this switch in the "ON" position all LEDs are turned on simultaneously. With both switches 4 and 5 in the "ON" position the LED test mode will also scan the 7 individual segments of both digits.

21. The countdown shall be disabled when all switches are placed in the "ON" position.

22. Nominal power usage for Ped Modules at 25°C (77°F), 120 VAC input shall not exceed the values shown in Table 1.

Table 1 -- Nominal Power of Pedestrian Signals

Size	Description	Wattage @ 25°C

		Hand	Person	Countdown[1]
16"x18"	Side by Side Hand & Person	8	7	N/A
16"x18"	Hand & Person Overlay with Countdown	9	7	5

[1] Wattage for the countdown is measured when the digits 18 are displayed.

23. All wiring shall meet the requirements of Section 13.02 of the VTCSH standard. Secured, color coded, 600V, 18 AWG jacketed wires, 1 meter (39 in) in length, conforming to the NFPA 70, National Electrical Code, and rated for service at +105°C, shall be provided.

24. The following color scheme shall be used for the ped module's AC power leads: Orange for the upraised hand, Blue for the walking person, and White for common. The countdown portion of the LED ped module shall be internally wired to the hand and walking person power.

25. The AC power leads shall exit the ped module via a rubber grommeted strain relief, and shall be terminated with insulated female quick connect terminals with spade / tab adapters. The leads shall be separate at the point at which they leave the ped module.

26. All external wiring utilized in the ped modules shall be anti-capillary type wire to prevent the wicking of moisture to the interior of the ped module.

27. The Hand and Person Icons shall utilize separate power supplies. On countdown products, the countdown ped module must have its own power supply but may take the incoming AC power from the hand / person AC signal lines. All power supplies shall be located inside the ped module.

28. All power supplies shall be conformally coated for additional protection.

29. Off State Voltage Decay: When the hand or person icon is switched from the On state to the Off state the terminal voltage shall decay to a value less than 10 VAC RMS in less than 100 milliseconds when driven by a maximum allowed load switch leakage current of 10 milliamps peak (7.1 milliamps AC).

30. For a minimum period of 60 months, measured at 80 to 135 VAC RMS and over the ambient temperatures of -40°C to +74°C (-40°F to +165°F), the minimum maintained luminance values for the ped modules, when measured normal to the plane of the icon surface, shall not be less than:
    - Walking Person, White: 2,200 cd/m^2
    - Upraised Hand, Portland Orange: 1,400 cd/m^2
    - Countdown Digits, Portland Orange: 1,400 cd/m^2

31. The external lens shall have a textured outer surface to reduce glare.

32. Icons that are printed on the lens shall be on the interior surfaces in order to prevent scratching and abrasion to the icons.

33. All icons and numbers shall have a uniform incandescent non-pixilated appearance.

34. All exposed components of a ped module shall be suitable for prolonged exposure to the environment, without appreciable degradation that would interfere with function or appearance. As a minimum, selected materials shall be rated for service for a period of a minimum of 60 months in a south-facing Arizona Desert installation.

35. All LEDs used to illuminate the ped module shall use material that has industry acceptance for use in outdoor applications. At no time is the use of LEDs that utilize AlGaAs technology acceptable.

36. The countdown display shall consist of two 7 segment digits as shown below. All countdown display digits shall be 9 inches in height for use in all size crosswalks in compliance with MUTCD recommendations.

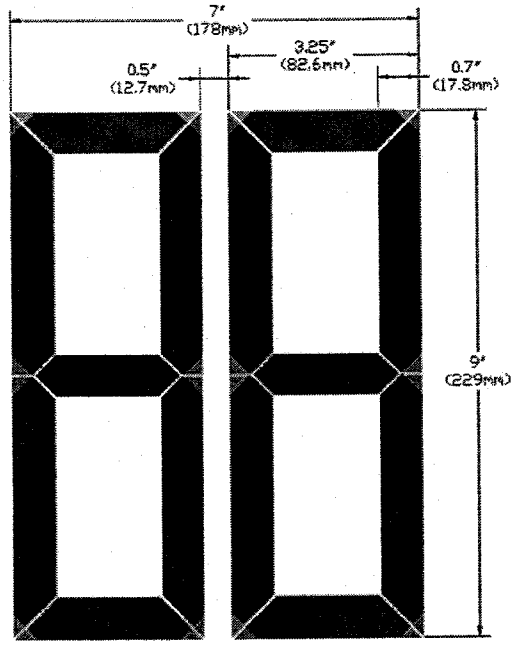


Figure 2: Countdown Display

37. Ped modules shall be repaired or replaced if the ped module fails to function as intended due to workmanship or material defects within warranty period.

38. Ped modules shall be repaired or replaced if the ped module exhibit luminous intensities less than the minimum specified values within 60 months of the date of delivery.

39. The manufacturer shall clearly disclose the country in which the factory of ped module origin is located, the name of the company or organization that owns the factory including all of its parent companies and organizations, and their respective country of corporate citizenship.

T. Pedestrian, Bicycle and Equestrian Push Buttons

Pedestrian, bicycle, and equestrian push buttons shall conform to the provisions in Section 86-5.02, "Pedestrian Push Button Assemblies", of the Standard Specifications and these Special Provisions.

Push button assembly shall be Type B per Standard Plans ES-5C.

Push button housing shall be die-cast or permanent mold cast aluminum powder coated frame with stainless steel inserts and sign screws.

Push button sign shall be white powder coat base with black heat cured ink. Right and left arrow signs shall be doubled sided.

Push button shall be Polara Engineering, Inc. model BDLM2-Y or approved equal.

Push button shall utilize solid-state Piezo switch technology, pressure activated, two-tone audible, visual LED confirmation of actuation and shall be ADA compliant.

The equestrian push buttons (EPB) shall be installed at 6 feet above finish grade or as directed by the Engineer. The Engineer shall approve the EPB placement on each pole prior to installation.

U. Detectors

Detectors shall conform to the provisions in Section 86-5, "Detectors", of the Standard Specifications and these Special Provisions.

Delay timers shall delay calls only during display of the associated red or yellow indications. If a vehicle departs the area of detection prior to expiration of the assigned delay period, the timer shall reset and no call shall be placed upon the controller. During display of the associated green indication, detectors shall operate in the present mode and calls shall not be delayed.

Inductive Loops

Detector loop configuration shall be Type E per Standard Plans ES-5B unless otherwise shown on the construction plan, in the Special Provisions, or as directed by the Engineer.

Limit Line detector loop configuration shall be modified Type E with diagonal saw cuts and wire winding conforming to Type D loop configuration.

Detector loop wire shall be Type 2.

Detector loop lead-in cable shall be Type B.

Detector loop curb terminations shall be Type A in accordance with Standard Plans ES-5D.

Loop sealant shall be the Hot-Melt Rubberized Asphalt sealant type, unless otherwise directed by the Engineer. Loop conductors and sealant shall be installed on the same day the loop slots are cut.

All detector loops shall be tested sequentially by the following methods:

- impedance (measured by megaohms)
- resistance (measured by ohms)
- inductance (measured in microhenries)

Video Detection

The contractor shall furnish and install video detection cameras (VDC), video detection processors (VDP), extension modules (EM), access module (AM), an industry standard 3-button USB mouse, a drawer mounted 17 inch LCD monitor, surge suppressors, and all necessary cabling and auxiliary equipment to make the video detection systems fully functional for the intended operation. The Contractor shall furnish a spare VDC, a spare EM, and a spare VDP to the Engineer.

All equipment supplied shall come from and qualified by the VDP supplier to ensure proper system operation.

The VDC shall attach to the top of luminaire mast arm using mounting bracket provided by manufacturer, or the backside of signal mast arm using Pelco Astrobrac with 6' extension or approved equal. The Engineer shall approve the final camera placements.

The video detection systems shall be installed by supplier factory certified installers per recommended method provided in the supplier's installation manuals. Proof of factory certification shall be provided.

Video Detection Zones:

Placement of detection zones shall be done by using the supplied USB mouse connected to the VDP. Detection zones are drawn on the video image from the video camera displayed on a video monitor using the menu and graphical interface built into the VDP. The menu shall facilitate placement of detection zones and setting of zone parameters or to view system parameters.

Detection zone setup shall not require site-specific information such as latitude, longitude, date and time to be entered into the system. No separate computer shall be required to program the detection zones.

Each detection zone shall be user definable in size and shape to suit the site and the desired vehicle detection region. A detection zone shall be approximately the width and length of one car.

A single detection zone shall be able to replace multiple inductive loops and the detection zones shall be OR'ed as the default or may be AND'ed together to indicate vehicle presence on a single phase of traffic movement.

The VDP shall provide a minimum of 24 channels of vehicle presence detection/detection zones per camera through a standard detector rack edge connector and one or more EMs.

Functional Capabilities:

System must have a single point access to multiple rack-mounted video detection units. The access device shall provide interface capabilities to enable multiple rack-mounted video detection processors to be locally and remotely accessed from a single point via one set of user interface devices.

The camera shall be able to transmit the composite video signal, with minimal signal degradation, up to 1000 feet under ideal conditions.

The EM shall be plugged into the appropriate slot in the detector rack to avoid the need of rewiring the detector rack. The extension module shall be connected to the VDP by an 8-wire cable with modular connectors.

The EM and VDP communications shall be accommodated by methods using differential signals to reject electrically coupled noise. The EM shall be available in both 2 and 4 channel configurations programmable from the VDP.

The VDP shall have video input in NTSC composite video format and shall be digitized and analyzed in real time.

The VDP shall have a nine-pin RS232 port that is multi-drop compatible for communications with an external computer. The VDP shall be able to accept new detector patterns from and send its detection patterns to an external computer through this RS-232 port. A Windows™ based software designed for local or remote connection for uploading and downloading data, and providing video capture, real-time detection indication and detection zone modification capability shall be provided with the system.

The VDP shall store up to three different detection zone patterns within the VDP memory. The VDP's memory shall be non-volatile to prevent data loss during power outages. The VDP shall

continue to operate (e.g. detect vehicles) using the existing zone configurations even when the operator is defining/modifying a zone pattern. The new zone configuration shall not go into effect until the operator saves the configuration. Each configuration can be uniquely labeled for identification and the current configuration letter is displayed on the monitor. The selection of the detection zone pattern for current use shall be done through a local menu selection or remote computer via RS-232 port. It shall be possible to activate a detection zone pattern for a camera from VDP memory and have that detection zone pattern displayed within 1 second of activation.

The VDP shall provide dynamic zone reconfiguration to enable normal detector operation of existing channels except the one where a zone is being added or modified during the setup process. The VDP shall output a constant call on any detection channel corresponding to a zone being modified.

The VDP shall detect vehicles in real time as they travel across each detector zone.

The VDP shall output a constant call for each enabled detector output channel if a loss of video signal occurs. The VDP shall output a constant call during the background learning period. The background learning period shall be not more than three minutes.

The VDP shall be capable of detecting a low-visibility condition automatically, such as fog, and place all defined detection zones in a constant call mode. The VDP shall automatically revert to normal detection mode when the low-visibility condition no longer exists. A user-selected output shall be active during the low-visibility condition that can be used to modify the controller operation if connected to the appropriate controller input modifier(s).

Detection shall be at least 98% accurate in good weather conditions and at least 96% accurate under adverse weather conditions (rain, snow, or fog). Detection accuracy is dependent upon site geometry; camera placement, camera quality and detection zone location, and these accuracy levels do not include allowances for occlusion or poor video due to camera location or quality.

Detection zone outputs shall be configurable to allow the selection of presence, pulse, extend, and delay outputs. Timing parameters of pulse, extend, and delay outputs shall be user definable between 0.1 to 25.0 seconds.

Up to six detection zones shall be capable to count the number of vehicles detected. The count value shall be internally stored for later retrieval through the RS-232 port. The data collection interval shall be user definable in periods of 5, 15, 30 or 60 minutes.

System software shall

- Utilize a dual redundant hybrid tracking algorithm to enhance vehicle presence detection and data collection.
- Include a moving shadow and occlusion rejection algorithm that is activated by selection of a drop down menu tab.
- Include a menu selectable zone type labeled "Bike" that is specifically designed to detect bicycles.
- Include a virtual QWERTY keyboard that is present when performing any labeling functions for the detection zones and cameras.
- Include the ability to copy completed zones with one mouse click, drag and drop single zones, rows of zones together and entire detection configurations.

VDP & EM Hardware:

The VDP and EM shall be specifically designed to mount in a standard NEMA TS-1, TS-2, 2070 ATC, 170 type detector rack, using the edge connector to obtain power and provide contact closure outputs. No adapters shall be required to mount the VDP or EM in a standard detector rack. Detector rack rewiring shall not be required or shall be minimized.

Both VDP and EM shall operate in a temperature range from -34°C to +74°C and a humidity range from 0% RH to 95% RH, non-condensing.

Both VDP and EM shall be powered by 12 or 24 volts DC. These modules shall automatically compensate for the different input voltages.

Both VDP and EM shall include detector output pin out compatibility with industry standard detector racks.

Both VDP and EM shall have a detector test switch on the front panel to allow the user to place calls on each channel. The test switch shall be able to place either a constant call or a momentary call depending on the position of the switch.

The VDP power consumption shall not exceed 300 milliamps at 24 VDC. The EM power consumption shall not exceed 120 milliamps at 24 VDC.

The VDP shall utilize flash memory technology to enable the loading of modified or enhanced software through the RS232 port without modifying the VDP hardware.

The VDP shall include the following on the front panel:

- A multi-drop compatible RS232 port, a 9-pin "D" subminiature connector, for serial communications with a remote computer.
- Detection indication such as LED for each channel of detection that display detector outputs in real time when the system is operational.
- One or two BNC video input connection suitable for RS170 video inputs as required. The video input shall include a switch selectable 75-ohm or high impedance termination to allow camera video to be routed to other devices, as well as input to the VDP for vehicle detection. Video must be inputted via a BNC connector on the front face of the processor. RCA type connectors/jacks for video input are not allowed. Video shall not be routed via the edge connectors of the processor.
- One BNC video output providing real time video output that can be routed to other devices. A RCA type connector/jack for video output is not allowed.

Video Detection Camera:

The camera shall be housed in a weather-tight sealed enclosure consists of the following:

1. The enclosure shall be made of 6061 anodized aluminum.

2. The enclosure shall be field rotatable to allow proper alignment between the camera and the traveled road surface.

3. The enclosure shall be equipped with a sunshield. The sunshield shall include a provision for water diversion to prevent water from flowing in the camera's field of view. The camera enclosure with sunshield shall be less than 6" diameter, less than 18" long, and shall weigh less than 6 pounds when the camera and lens are mounted inside the enclosure.

4. The enclosure shall be design so that the pan, tilt and rotation of the camera assembly can be accomplished independently without affecting the other settings.

5. The enclosure shall include a proportionally controlled Indium Tin Oxide heater design that maximizes heat transfer to the lens. The output power of the heater shall vary with temperature, to assure proper operation of the lens functions at low temperatures and prevent moisture condensation on the optical faceplate of the enclosure.

6. The glass face on the front of the enclosure shall have:
    a. An anti-reflective coating to minimize light and image reflections.
    b. A special coating to minimize the buildup of environmental debris such as dirt and water.

The camera shall produce a useable video image of the bodies of vehicles under all roadway lighting conditions, regardless of time of day. The minimum range of scene luminance over which the camera shall produce a useable video image shall be the minimum range from nighttime to daytime, but not less than the range 1.0 lux to 10,000 lux.

The imager luminance signal to noise ratio shall be more than 50 dB. In harsh backlit conditions, vehicles can be detected flawlessly with >100dB of dynamic range.

The camera shall be digital signal processor based and shall use a CCD sensing element and shall output color video with resolution of not less than 540 TV lines. The CCD imager shall have a minimum effective area of 811(h) x 508(v) pixels.

The camera shall include an electronic shutter control based upon average scene luminance and shall be equipped with an auto-iris lens that operates in tandem with the electronic shutter.

The camera shall utilize automatic white balance.

The camera shall include a variable focal length lens with variable focus that can be adjusted, without opening up the camera housing, to suit the site geometry by means of a portable interface device designed for that purpose and manufactured by the detection system supplier.

The horizontal field of view shall be adjustable from 5.4 to 50.7 degrees. This camera configuration may be used for the majority of detection approaches in order to minimize the setup time and spares required by the user. The lens shall have a 27x zoom.

The lens shall also have an auto-focus feature with a manual override to facilitate ease of setup.

The camera shall incorporate the use of preset positioning that store zoom and focus positioning information. The camera shall have the capability to recall the previously stored preset upon application of power.

The camera electronics shall include automatic gain control to produce a satisfactory image at night.

When mounted outdoors in the enclosure, the camera shall operate satisfactorily in a temperature range from -34 °C to +60 °C and a humidity range from 0% RH to 100% RH. Measurement of satisfactory video shall be based upon VDP system operation.

The camera shall be powered by120-240 VAC 50/60 Hz. Power consumption shall be 30 watts or less under all conditions.

The camera shall view approaching vehicles at a distance not to exceed 350 feet for reliable detection (height to distance ratio of 1:10). Camera placement and field of view shall be unobstructed and as noted in the installation documentation provided by the supplier.

There shall be at least 2 options for camera set up, diagnostic testing, and viewing video when it is mounted on mast arm or pole using lens adjustment module supplied by the VDP supplier:

1. Connected directly to the camera.
2. Connected to the coaxial cable from the cabinet.

The video signal shall be fully isolated from the camera enclosure and power
Cable terminations at the camera for video and power shall not require crimping tools.

No BNC or other connector shall be used for the coaxial video cable termination at the camera.

The power connection at the camera shall use connector terminations that only require the use of wire strippers and a standard screwdriver. No special crimping tools or other types of terminations shall be used.

A weather-proof protective cover shall be provided shall be provided to protect all terminations at the camera. No special tooling shall be required to remove or install the protective cap.

Cabling and Cable Connections:

The coaxial cable to be used between the camera and the VDP in the traffic cabinet shall be Belden 8281. The coax cable shall be a continuous unbroken run from the camera to the VDP. This cable shall be suitable for installation in conduit or overhead with appropriate span wire. A BNC plug connector shall be used at the cabinet end. The coaxial video cable shall be stripped and terminated at the camera and cabinet per manufacturers' instructions (no BNC or other connector shall be used at the camera). The coaxial cable, BNC connector used at the cabinet termination, and crimping tool shall be approved by the supplier of the video detection system and the manufacturer's instructions must be followed to ensure proper connection.

The power cable shall be three 16 AWG conductor cable with a minimum outside diameter of 0.325 inch and a maximum diameter of 0.490 inch. The power cable shall be terminated at the camera per manufacturers' instructions and shall only require standard wire strippers and a screw driver for installation (no special connectors or crimping tools shall be used for installation). The cabling shall comply with the National Electric Code, as well as local electrical codes. Cameras shall not acquire power from the luminaire.

A Din Rail mounted AC power panel assembly shall be supplied by the video detection manufacturer that will include a minimum of one convenience receptacle, four camera chassis ground connections, four camera AC neutral (AC-) connections, four 2 amp camera circuit breakers for hot (AC+) connections, and one AC source connection for Line, Neutral and Ground wires. A Din Rail video surge suppression protection panel assembly shall also be supplied by the video detection manufacture. One panel shall accommodate up to six EDCO surge suppressors. This equipment shall be installed, including termination of all necessary wiring, per the video detection manufacturer requirments for the intended use.

Maintenance and Support:

The supplier shall maintain an adequate inventory of parts to support maintenance and repair of the system. These parts shall be available for delivery within 30 days of placement of an acceptable order at the supplier's then current pricing and terms of sale for said parts.

The supplier shall maintain an ongoing program of technical support for the access unit and video detection system. This technical support shall be available via telephone, or via personnel sent to the installation site upon placement of an acceptable order at the supplier's then current pricing and terms of sale for on-site technical support services.

Installation or training support shall be provided by factory-authorized representative.

All product documentation shall be written in the English language.

V. Luminaries

Luminaires shall conform to the provisions in Section 86-6, "Lighting", of the Standard Specifications and these Special Provisions.

Luminaires shall be of the cutoff type and shall be 200, 250 or 400 Watt High Pressure Sodium Vapor as shown on the plans. The fixtures shall be constructed with flat lenses, integral ballasts, and detachable power unit assemblies. The power unit assemblies shall contain the ballast, starter board, capacitors, and a heavy-duty terminal block.

Each luminaire shall be furnished without the photoelectric unit receptacle.

Each luminaire shall have a 5-amp inline fuse installed inside the standard's hand hole.

LED Luminaire:

Summary

This specifications for installing LED luminaires is in addition to Section 86-6, Lighting", of the Standard Specifications.

LED Luminaire shall conform to the provision in Section 86-6.01 "LED Luminaire" of the standard Specifications and these special provisions.

Warranty

Furnish a 7-year replacement warranty from the manufacturer of the luminaires against any defects or failures. The effective date of the warranty is the date of installation. Furnish replacement luminaires within 10 days after receipt of the failed luminaire. The Department does not pay for the replacement. Deliver replacement luminaires to the following department maintenance electrical shop:

Traffic Signal Shop
Riverside County Transportation Department
McKenzie Highway Operations Center
2950 Washington Street
Riverside, California 92504
Telephone (951) 955-6894

Physical and Mechanical Requirements

The luminaire must be a single, self-contained device, not requiring job site assembly for installation. The power supply for the luminaire is integral to the unit. The weight of the luminaire must not exceed 35 lb. The maximum effective projected area when viewed from either side or either end must be 1.4 sq ft. The finish color of the decorative pole and lighting fixture is as indicated on plan.

The housing must be fabricated from materials designed to withstand a 3,000-hour salt spray test under ASTM B 117. All aluminum used in housings and brackets must be of a marine grade alloy with less than 0.2 percent copper. All exposed aluminum must be anodized.
Each refractor or lens must be made from UV-inhibited high impact plastic such as acrylic or polycarbonate or heat- and impact-resistant glass and be resistant to scratching. Polymeric materials except lenses of enclosures containing either the power supply or electronic components of the luminaire must be made of UL94VO flame retardant materials. Paint or powder coating of the housing must comply with section 86-2.16. A chromate conversion undercoating must be used underneath a thermoplastic polyester powder coat.

Each housing must be provided with a slip fitter capable of mounting on a 2-inch pipe tenon. This slip fitter must fit on mast arms with outside diameters from 1-5/8 to 2-3/8 inches. The slip fitter must be capable of being adjusted a minimum of ±5 degrees from the axis of the tenon in a minimum of five steps: +5, +2.5, 0, -2.5, -5. The clamping brackets of the slip fitter must not bottom out on the housing bosses when adjusted within the designed angular range. No part of the slip fitter mounting brackets on the luminaires must develop a permanent set in excess of 1/32 inch when the two or four 3/8-inch diameter cap screws used for mounting are tightened to 10 ft-lb. Two sets of cap screws may be furnished to allow the slip fitter to be mounted on the pipe tenon in the acceptable range without the cap screws bottoming out in the threaded holes. The cap screws and the clamping brackets must be made of corrosion resistant materials or treated to prevent galvanic reactions and be compatible with the luminaire housing and the mast arm.

The assembly and manufacturing process for the LED luminaire must be designed to ensure internal components are adequately supported to withstand mechanical shock and vibration from high winds and other sources. When tested under California Test 611, the luminaire to be mounted horizontally on the mast arm must be capable of withstanding the following cyclic loading for a minimum of 2 million cycles without failure of any luminaire part:

Cyclic Loading

Plane	Power supply	Minimum peak acceleration level
Vertical	Installed	3.0 g peak-to-peak sinusoidal loading (same as 1.5 g peak)
Horizontal[a]	Installed	1.5 g peak-to-peak sinusoidal loading (same as 0.75 g peak)

[a]Perpendicular to the direction of the mast arm

The housing must be designed to prevent the buildup of water on top of the housing. Exposed heat sink fins must be oriented to allow water to freely run off of the luminaire and carry dust and other accumulated debris away from the unit. The optical assembly of the luminaire must be protected against dust and moisture intrusion to at least an ANSI/IEC rating of IP66. The power supply enclosure must be protected to at least an ANSI/IEC rating of IP43.

Mounted luminaire indicated on plan must be furnished with an ANSI C136.41-compliant, locking type photocontrol receptacle with dimming connections and a rain tight shorting cap. The receptacle must comply with section 86-6.11A. Mounting of the locking type photocontrol receptacle to be coordinated with the decorative pole manufacturer.
When the components are mounted on a down-opening door, the door must be hinged and secured to the luminaire housing separately from the refractor or flat lens frame. The door must be secured to the housing such that accidental opening is prevented. A safety cable must mechanically connect the door to the housing.

Field wires connected to the luminaire must terminate on a barrier type terminal block secured to the housing. The terminal screws must be captive and equipped with wire grips for conductors up to no. 6. Each terminal position must be clearly identified.
The power supply must be rated for outdoor operation and have at least an ANSI/IEC rating of IP65.

The power supply must be rated for a minimum operational life equal to the minimum operational life of the luminaire or greater.

The power supply case temperature must have a self rise of 77 degrees F or less above ambient temperature in free air with no additional heat sinks.

The power supply must have 2 leads to accept standard 0-10 V(dc). The dimming control must be compatible with IEC 60929. If the control leads are open or the analog control signal is lost, the circuit must default to 100-percent power.

Conductors and terminals must be identified.

W. Sign Lighting Fixtures

Sign lighting fixtures shall conform to the provisions in Sections 86-6.8, "Sign Lighting Fixtures", of the Standard Specifications.

Sign lamp for Type 9 Standard shall be LED type.

X. Internally Illuminated Street Name Signs

Internally illuminated street name signs (IISNS) shall conform to the provisions in Section 86-6.09, "Internally Illuminated Street Name Signs", of the Standard Specifications and these Special Provisions.

The sign fixture, panels, and mounting assemblies shall be designed and constructed to prevent deformation, warp or failure when subjected to a minimum of 100 mph wind loads, as set forth in the latest AASHTO publication, "Standard Specifications for Structural Supports of Highway Signs, Luminaires, and Traffic Signals", and amendments thereto. The IISNS manufacturer shall submit a certificate of compliance conforming to the provisions in Section 6-3.05E , "Certificates of Compliance", with each lot of IISNSs delivered.

The IISNS shall be double-faced Edge-lit LED sign with white translucent diamond grade reflective border, arrows, and lettering using 12" uppercase and 9" lowercase Clearview Series 5-W fonts. The background shall be green match color no. 14109 of FED-STD-595.

The standard IISNS height shall be 2' and length shall be 6', 8' or 10' attached to the 10 feet IISNS mast arm with Pelco SE-5015 mast arm sign bracket, or approved equal, per County Standard No. 1200.

Y. Photoelectric Controls

Photoelectric controls shall conform to the provisions in Section 86-6.11, "Photoelectric Controls", of the Standard Specifications and these Special Provisions.

Photoelectric controls shall be a dual Type V for luminaires and internally illuminated street name signs conforming to the County Standard No. 1207.

Photoelectric units shall be the delay type.

Z. Emergency Vehicle Preemption System

Furnish and install complete and functioning emergency vehicle preemption (EVP) system as intended per plans, the manufacturer, and these special provisions.

The EVP system shall consist of the following equipments or components:

- Optical detector for each approach, as shown on the plans
- Rack-mounted 24-channel phase selectors for 8-phase operation
- Detector cable

The Contractor shall furnish the following spare EVP equipments or components:

- One (1) rack-mounted ~~24~~-channel phase selector
- One (1) optical detector

The EVP system shall be designed to prevent simultaneous pre-emption by two or more emergency vehicles on separate approaches to the intersection.

The Engineer shall approve EVP sequence of operation prior to timing and turn-on of each respective traffic signal.

At locations where optical detectors are not to be installed, EVP cable shall be installed for future use. The following also apply:

1. EVP cable shall be installed, without splices, between the controller cabinet and each mast arm traffic signal pole.
2. EVP cable shall be connected to the EVP rack terminals within the controller cabinet.
3. Each mast arm EVP detector mounting shall be drilled and tapped in its ultimate location. In lieu of the detector, install approved water tight UL listed electrical box. EVP cable shall be installed to terminate within the mast arm mounted electrical box. Excess cable shall be coiled within the electrical box sufficient for future installation of the EVP system.

Optical Detector

The optical detector shall be mounted on the indicated signal mast arm per County Standard No. 1202.

Each optical detector shall be waterproof unit capable of receiving optical energy from ~~a single~~ dual directions and have an adjustable turret configuration. The reception angle for each optical detector unit shall be a minimum of eight (8) degrees in all directions about the aiming axis of the unit.

Dual detectors shall utilize only one optical cable per detector.

Internal circuitry shall be solid state and electrical power shall be provide by the associated discrimination module.

Each optical detector unit shall have a minimum of a ~~½~~ 3/4 inch NPT opening used for mounting and for bringing the connecting cable into the terminal block located within the assembly. The housing shall be provided with weep holes to permit drainage of condensed moisture.

Each optical detector shall be installed, wired, and aimed as specified by the manufacturer.

Cable

Optical detector cable shall meet the requirements of IPCEA-S-61-402/NEMA WC 5, Section 7.4, 600 V Control cable, 75 degrees C, Type B, and the following:

1. The cable shall contain 3 conductors, each of which shall be AWG# 20 (7 x 28) stranded, tinned copper. Insulation of individual conductors shall be color-coded: 1-Yellow, 1-Orange, and 1-Blue.

2. The shield shall be either tinned copper braid or aluminized polyester film with a nominal 20% overlap. When film is used, an AWG# 20 (7 x 28) stranded, tinned, bare drain wire shall be placed between the insulated conductors and the shield and in contact with the conductive surface of the shield.

3. The jacket shall be marked as required by IPCEA/NEMA.

The cable run between each detector and the Traffic Controller cabinet shall be continuous without splices.

Phase Selector

Each phase selector shall be compatible and usable with a Model 170E or 2070 controller unit, and shall be mounted in the input file of a Model 332 or Model 333 JP controller cabinet.

Each phase selector shall be capable of operating at least two or more channels, each of which shall provide and independent output for each separate input.

Phase Selector shall be a four-channel, dual priority, Mulitimode encoded signal device designed for use with both infrared and GPS emitters and optical detectors.

Phase Selectors and Optical detectors shall me manufactured by a single manufacturer

Phase Selector shall recognize and discriminate among three distinct frequency rates via high priority, low priority and probe priority infrared and GPS signals.

Phase selector shall further discriminate among 254 agency ID's, 15 classes of vehicle identification codes and 10,000 individual vehicle codes per class, for more than 38 million total per priority level.

Phase selector shall be capable of operating unlimited intersections and directions.

Phase selector shall have on the front panel, USB, serial and Ethernet capabilities

Phase selector shall be capable of accepting infrared signals from LED and or strobe technologies

Phase selector shall store the following records:

Intersection name
Date and time of activity
Vehicle class and code of activating vehicle
Activating vehicle's ID number
Agency ID
Channel called
Priority of the activity
Final green activity displayed at end of call
Time spent in the final greens
Duration of the activity
Turn signal status
Relative priority level
Capability to playback up to the last 250 seconds of the 100 most recent calls

Each phase selector, when used with its associated optical detectors, shall perform as a minimum, the following:

1. Receive Class I and Class II signals.

2. Decode the signals based on optical frequency, at 9.639 Hz + or -0.119 Hz for Class I signals and 14.035 Hz + or –0.255 Hz for Class II signals.

3. Establish the validity of received signals based on optical frequency and length of time received. A signal shall be considered valid only when received for more than 0.50 second. No combination of Class I signals shall be recognized as a Class II signal regardless of the

number of signals being received, up to a maximum of 10 signals. Once a valid signal has been recognized, the effect shall be held by the module, in the event of temporary loss of signal for a minimum period of 4.0 seconds.

4. Provide an output for each channel that will result in a "low" or grounded condition of the appropriate input of a Model 170 controller unit. For a Class I signal, the output shall be a 6.25 Hz + or – 0.1 %, rectangular waveform with a 50 % duty cycle. For Class II signal, the output shall be steady.

Each phase selector shall receive power from the controller cabinet at either 12 VDC or 120 VAC.

Auxiliary inputs for each channel may enter each module through a front panel connector or by a parallel hook-up of the associated detector cables at the input location.

The phase selector shall provide an optically isolated output for each channel to the Model 170 controller unit. All outputs signals shall comply with NEMA signal level definitions and shall be compatible with the Model 170 controller assemblies' inputs.

Each phase selector shall be provided with means of preventing transients received by the detector from affecting the Model 170 controller assembly.

Each phase selector shall have a single connector board and shall occupy one slot of the input file. The front panel of each phase selector module shall have a handle to facilitate withdrawal and have the following controls and functions for each channel:

1. Range adjustments for both class I and Class II signals.

2. A 3-position, center off, momentary contact switch, one position (down) labeled for test operation of Class I signals, and one position (up) labeled for test operation of Class II signals.

3. A "signal" indication and a "call" indication each for Class I and for Class II signals. The "signal" indications denote that a signal, which is not valid, has been received; a "call" indication denotes a steady, valid signal has been received. These 2 indications may be accomplished with a single indication lamp.

In addition, the front panel shall be provided with additional connectors or ports used to perform other functions as specified by the manufacturer.

Cabinet Wiring

Wiring for a Model 332 cabinet shall conform to the following:

1. Slots 12 and 13 of input file "J" shall be wired to accept either a 2 channel or a 4 channel module.

2. Field wiring for the primary detectors, except the 24 VDC power, shall terminate on either terminal block TB-9 in the controller cabinet or on the rear of input file "J", depending on cabinet configuration. Where TB-9 is used, position assignments shall be as follows:

    a. TB-9 – 1 = Not Used
    b. TB-9 – 2 = + 24 VDC Out (Orange)
    c. TB-9 – 3 = + 24 VDC Out (Orange)
    d. TB-9 – 4 = EVA Detector (Yellow)
    e. TB-9 – 5 = EVC Detector (Yellow)
    f. TB-9 – 6 = DC Common Out (Blue)

g. TB-9 – 7 = EVB Detector (Yellow)
h. TB-9 – 8 = EVD Detector (Yellow)
i. TB-9 – 9 = DC Common Out (Blue)

Assuming TB9 – 2 and TB9 – 3 are unused on the "J" File, move wires on J11-J & J11-K (Twisted Pair) to J12-E & J13-E, respectively.

Field wiring for auxiliary detectors may terminate on terminal board TB-0 (If unused) in the controller cabinet. Use manufactures recommended wiring for these connections.

System Operation

The contractor shall demonstrate that the components of each system are compatible and will perform satisfactorily as a system. Satisfactorily performance shall be determined using the following test procedure during the functional test period:

1. Each system to be used for testing shall consist of an optical detector, an optical detector cable and a phase selector module.

2. The phase selector shall be installed in the proper input file slot of the Model 332 or 333 controller cabinet assembly.

3. Two tests shall be conducted; one using a Class I signal emitter and a distance of 1000 feet between the emitter and the detector, the other using a Class II signal emitter and a distance of 1800 feet between the emitter and the detector. Range adjustments on the phase selector shall be set to "Maximum" for each test.

4. During the tests of the Class I and Class II emitters, the proper response from the Model 170E and 2070 controller unit during the "ON" interval and there shall be no improper operation of the Model 170E or 2070 controller unit or the monitor during the "OFF" interval.

Arrange for a technician from the EVP manufacturer, to be present for the first day of the traffic signal and lighting function test to insure proper installation and functioning of the EVP equipment.

Arrange for a technician from the controller assembly manufacturer to perform any controller modifications required for the installation, or operation, of the EVP equipment.

AA. GPS Universal Time Sources

The GPS Universal Time Source shall be a McCain model M32755 or approved equal. The Engineer shall approve any alternate GPS time source prior to installation.

The GPS Universal Time Source shall incorporate a precision GPS receiver and a microprocessor to decode the time signals received from the GPS satellite network. The Universal Time Source shall interface this time signal to a model 170E controller (using Bi-Tran local software) to provide an accurate clock update to the traffic signal controller.

The GPS Universal Time Source shall meet or exceed the following criteria:

- Operate in temperatures from –30°C to +80°C.
- Receive power through 170E controller's ACIA port.
- Provide 170E controller with the time, date, and day of the week data.
- Software configured time zone and daylight savings operations.
- Support RS-232C serial data rates at 300, 600, 1200, 2400, 48000, 9600 and 19200 bps.

- Provide LED indicators for communication status to a satellite.
- Provide a weatherproof disc antenna no greater than 3" diameter x 1" height to be mounted directly to the top of the traffic signal controller cabinet.
- Provide all cabling and connectors with the correct pin assignments to interface the GPS unit to antenna and to 170E controller.

Proper gaskets or other weatherproofing materials for the antenna shall be supplied and installed to prevent water or moisture from entering the traffic signal controller cabinet.

BB. Battery Backup System

This special provision establishes the minimum requirements for a battery backup system (BBS) that shall provide power to a traffic signal system in the event of a power failure or interruption.

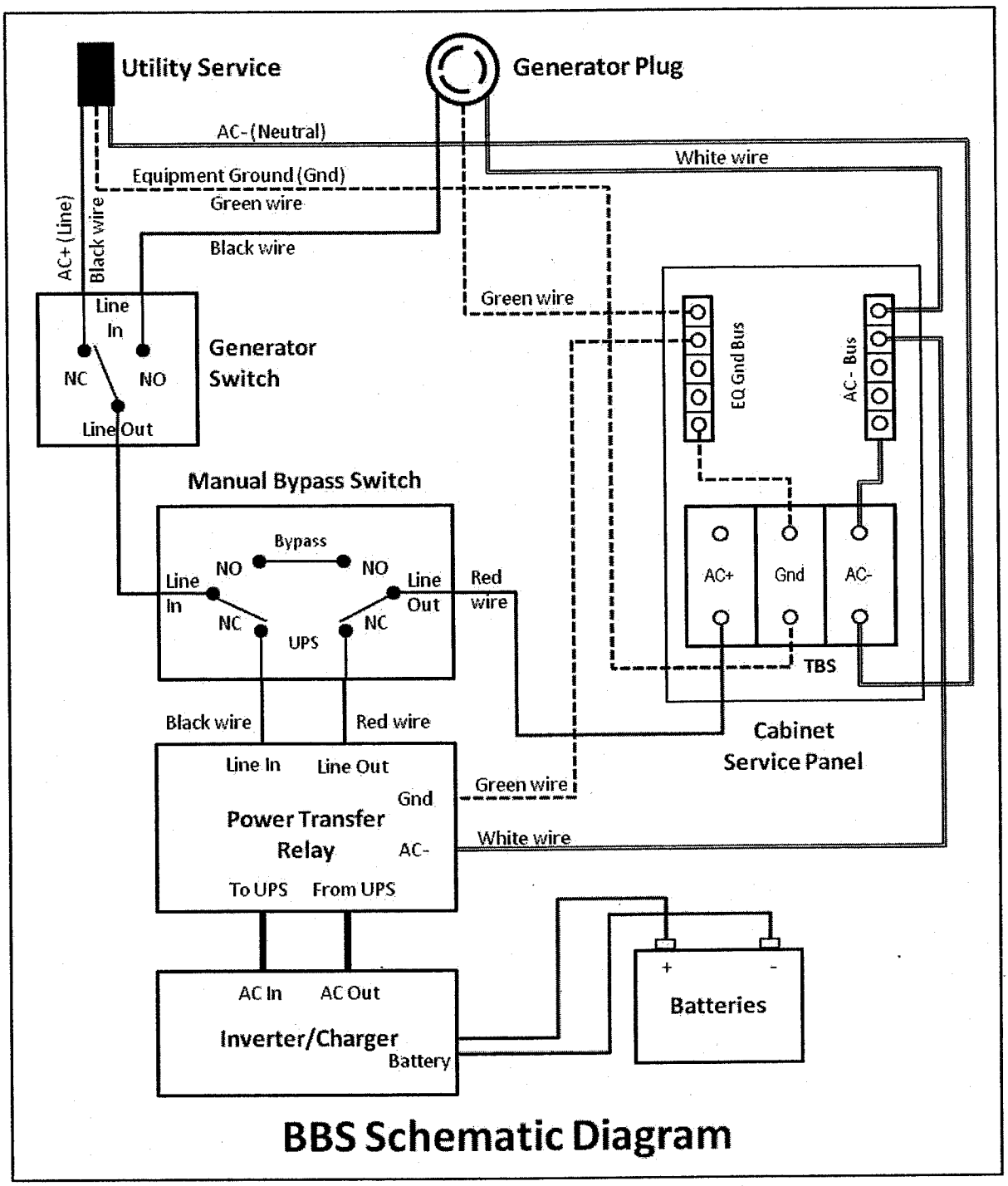
The BBS shall be designed for outdoor applications, in accordance with the current edition of Chapter 1, Section 8 requirements of Transportation Electrical Equipment Specifications (TEES).

The BBS batteries shall be external to the traffic signal controller cabinet as specified under "External Battery Cabinet Option" herein unless specified otherwise.

BBS cabinet shall be listed on the current Caltrans pre-qualified product list. The BBS shall include, but not limited to the following:

- cabinet,
- utility line/generator switch,
- inverter/charger,
- power transfer relay,
- a separate manually operated non-electronic bypass switch,
- batteries,
- all necessary hardware, shelving, and interconnect wiring.

The following figure shows BBS components interconnecting with each other and the controller cabinet to ensure interchangeability between all BBS manufacturers.

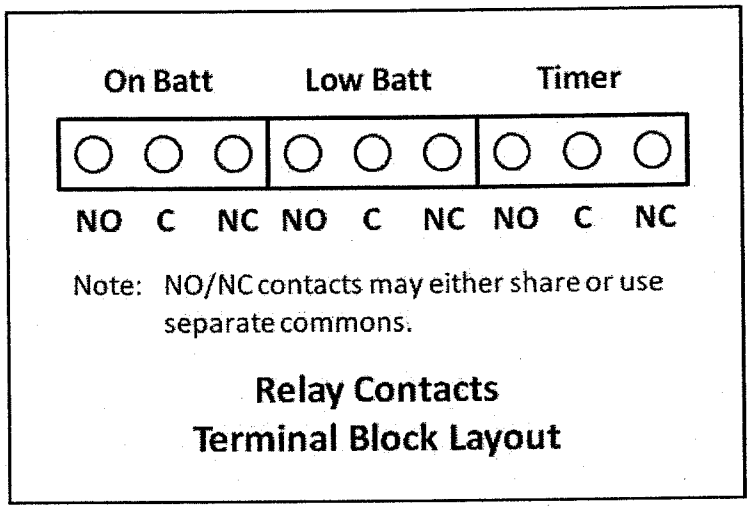


Operation

The BBS shall provide a minimum two (2) hours of full run-time operation for an intersection equipped with all LED traffic signal indications (minimum 1100W active output capacity, with 80% minimum inverter efficiency). and 2 (2) hours of flashing operation.

The maximum transfer time allowed, from disruption of normal utility line voltage to stabilized inverter line voltage from batteries, shall be 65 milliseconds. The same maximum allowable transfer time shall also apply when switching from inverter line voltage to utility line voltage.

The BBS shall provide the user with six (6)-sets of fully programmable normally open (NO) and normally closed (NC) single-pole double-throw (SPDT) dry relay contact closures, available on a panel-mounted terminal block, rated at a minimum 120V/1A, and labeled so as to identify each contact. See below figure for typical configuration.



The first set of NO and NC contact closures shall be energized whenever the unit switches to battery power. Contact shall be labeled or marked "On Batt".

The second set of NO and NC contact closures shall be energized whenever the battery approaches approximately 40% of remaining useful capacity. Contact shall be labeled or marked "Low Batt".

The third set of NO and NC contact closures shall be energized two hours after the unit switches to battery power. Contact shall be labeled or marked "Timer".

The six programmable NO and NC contact closures shall be independently configured to activate under any of the following conditions: On Battery, Low Battery, Timer, Alarm, or Fault.

Operating temperature for inverter/charger, power transfer relay and manual bypass switch shall be –37 °C to +74 °C.

Both the Power Transfer Relay and Manual Bypass Switch shall be rated at 240VAC/30 amps, minimum.

The BBS shall use a temperature-compensated battery charging system. The charging system shall compensate over a range of 2.5 – 4.0 mV/ °C per cell.

The temperature sensor shall be external to the inverter/charger unit. The temperature sensor shall come with 10' of wire.

Batteries shall not be recharged when battery temperature exceeds 50 °C ± 3 °C.

BBS shall bypass the utility line power whenever the utility line voltage is outside of the following voltage range: 100VAC to 130VAC (± 2VAC).

When utilizing battery power, the BBS output voltage shall be between 110 VAC and 125 VAC, pure sine wave output, ≤ 3% THD, 60Hz ± 3Hz.

BBS shall be compatible with NEMA and Model 332 and 333JP Cabinets, and Model 170, 390 & 2070 Controllers and cabinet components for full time operation.

In cases of low (below 100VAC) or absent utility line power, when the utility line power has been restored at above 105 VAC ± 2 VAC for more than 30 seconds, the BBS shall transfer from battery backed inverter mode back to utility line mode.

In cases of high utility line power (above 130VAC), when the utility line power has been restored at below 125VAC ± 2 VAC for more than 30 seconds, the BBS shall transfer from battery backed inverter mode back to utility line mode.

The BBS shall have an automatic tap to step up or step down the output voltage by 10 percent. The resulting output voltages shall remain within the above prescribed voltage range: 100VAC to 130VAC. This capability will extend BBS range for operating on input AC and not reverting to battery power.

BBS shall be equipped to prevent a malfunction feedback to the cabinet or from feeding back to the utility service.

In the event of inverter/charger failure, battery failure or complete battery discharge, the power transfer relay shall revert to the NC (and de-energized) state, where utility line power is connected to the cabinet.

Recharge time for the battery, from "protective low-cutoff" to 80% or more of full battery charge capacity, shall not exceed twenty (20) hours.

Mounting / Configuration

Generator Switch, Inverter/Charger, Power Transfer Relay and manually operated Bypass Switch shall fit inside a typical fully equipped traffic signal controller cabinet.

Mounting method inside the 332 and 333JP cabinet shall be shelf-mount, rack-mount or combination of either. Available rack space for front-mounted inside the 332 and 333JP cabinet is 3U or approximately 6 inches.

All interconnect wiring provided between Generator Switch, Inverter/Charger, Power Transfer Relay, Bypass Switch and Cabinet Terminal Service Block shall be no less than 9 feet of UL Style 1015 CSA TEW with the following characteristics:

- AWG Rating: 10 AWG
- Stranding: 105 strands of 10 AWG tinned copper
- Rating: 600 V, 105 °C, PVC Insulation

Relay contact wiring provided for each set of NO/NC relay contact closure terminals shall be 9 feet of UL Style 1015 CSA TEW 18 AWG wire, same ratings as above, except 16 strands of 18 AWG tinned copper.

All necessary hardware for mounting (shelf angles, rack, etc) shall be included in the **contract price paid** for the BBS, and no additional compensation will be allowed therefor.

Internal mounted battery option

(Allowed only if requested on the plans)

The controller cabinet shall be equipped with a generator twist lock flanged inlet receptable, manual transfer switch and bypass switch.

The twist lock flanged inlet receptacle shall be Hubbell 2615, NEMA L5-30P Twist Lock Flanged Male Inlet Rated for 30A/125VAC or approved equal. Receptacle shall be mounted flush to the cabinet in a weatherproof lift cover plate made of impact-resistant thermoplastic and gray in color.

The bypass switch shall transfer the load, including the UPS to the twist lock inlet receptacle. The manual transfer switch shall be wired to prevent any back feed to the utility service. Both the bypass switch and manual transfer switch shall be rack mounted independently in the controller cabinet meeting industry standards.

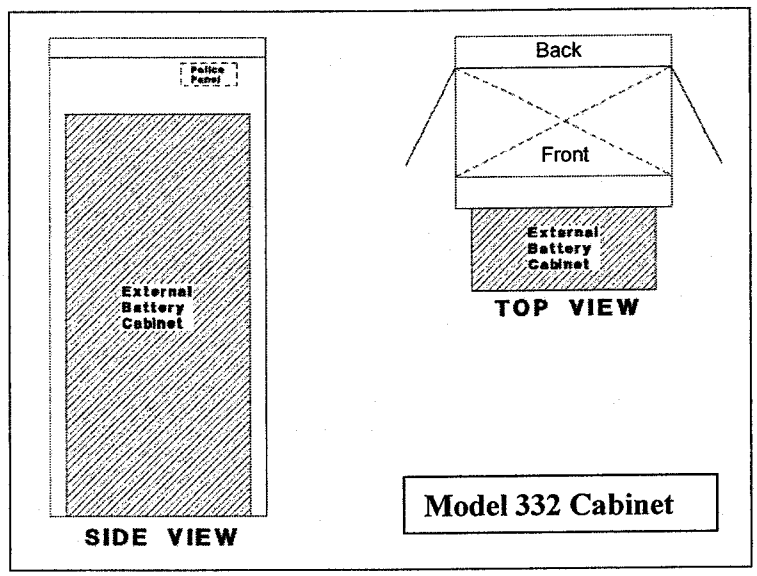
Batteries shall be mounted on swing-tray mounted below the controller shelf. A minimum of six (6) bolts/fasteners shall be used to secure swing-trays to the 332 Cabinet standard EIA 19" rack. All bolts/fasteners and washers shall meet the following requirements:

- Screw type: Pan Head Phillips machine screw
- Size and Thread pitch: 10-32
- Material: 18-8 stainless steel (Type 316 stainless steel is acceptable as an alternate)
- Washer: Use one 18-8 stainless steel flat washer under the head of each 10-32 screw; lock washers are unnecessary provided that the screws are properly tightened.

Number of screws per swivel bracket: minimum six (6) screws per swivel bracket. Screws are to be spaced evenly along bracket, with one screw near each end. Batteries may be shelf mounted in area behind controller so long as shelf and batteries do not interfere with controller unit and C1 plug.

External battery cabinet option

Batteries shall be housed in an external cabinet mounted to the side of the controller cabinet as shown in the following figure or as directed by the Engineer with a minimum of eight (8) bolts:



If BBS is installed at the back of controller cabinet, the modification shall include a minimum of 36 inches wide concrete walkway access to the BBS without encroaching outside the right-of-way. BBS shall be installed at the front of the controller cabinet (in locations where the back of the controller cabinet has limited ROW or conflicting structures and facilities and other obstructions), the BBS

cabinet shall not cover the police panel. The BBS cabinet shall also not hinder the access ramp's compliance with ADA requirements.

Four shelves shall be provided within the battery cabinet. There shall be a minimum of 12 inches clearance between shelves. Each shelf shall be a minimum of 9" X 25", and capable of supporting a minimum of 125 lbs. Batteries shall be mounted on individual shelves.

The external battery cabinet shall be NEMA 3R rated in accordance to Section 2-Housings of the Chapter 7 of TEES, for the construction of the cabinet and anodic coating finish.

The external battery cabinet shall be ventilated through the use of louvered vents, filter, and one thermostatically controlled fan in accordance to Section 2-Housings of the Chapter 7 of TEES.

External battery cabinet fan shall be AC operated from the same line output of the Manual Bypass Switch that supplies power to the controller cabinet.

The external battery cabinet shall have a door opening to the entire cabinet. The door shall be attached to the cabinet through the use of a continuous stainless steel piano hinge or four, two-bolts per leaf, hinges in accordance to Section 2-Housings of the Chapter 7 of TEES. The door shall use a three-point, roller locking mechanism and standard #2 key lock to lock the door. The door shall have a stainless steel handle.

The external cabinet shall be equipped with a generator twist lock flanged inlet receptacle, manual transfer switch and bypass switch.

The twist lock flanged inlet receptacle shall be Hubbell 2615, NEMA L5-30P, Twist Lock Flanged Male Inlet Rated for 30A/125V or approved equal. Receptacle shall be mounted flush to the cabinet in a weatherproof lift cover plate made of impact-resistant thermoplastic and gray in color.

The bypass switch shall transfer the load, including the UPS to the twist lock inlet receptacle. The manual transfer switch shall be wired to prevent any back feed to the utility service. Both the bypass switch and manual transfer switch shall be rack mounted independently in BBS cabinet meeting industry standards.

The BBS with external battery cabinet shall come with all bolts, conduits and bushings, gaskets, shelves, and hardware needed for mounting.

Maintenance, Displays, Controls and Diagnostics

The BBS shall include a 2 line by 40 character LCD display to indicate current battery charge status, input/output voltages, time and settings of various conditions. The same parameters shall be available via RS232 or USB interfaces on the face of the BBS.

The BBS shall have lightning surge protection compliant with IEEE/ANSI C.62.41.

The BBS shall be capable of accepting firmware upgrades of the non-volatile, read-only memory via serial port communications. The updates shall be accomplished by uploading the software to the BBS over the RS232 serial port located on the face of the BBS.

The BBS shall be equipped with an integral system to prevent battery from destructive discharge and overcharge.

The BBS shall be capable of performing a SELF-TEST, locally from the BBS front panel LCD, or remotely via RS232 or USB interface. The duration of the SELF-TEST shall be programmable in 1-minute increments from 1 minute to 255 minutes.

The BBS and batteries shall be easily replaced with all needed hardware and shall not require any special tools for installation.

The BBS shall include a re-settable inverter event counter to indicate the number of times the BBS was activated and the total number of hours the unit has operated on battery power, accessible via the LCD screen or remotely via RS232 or USB.

The BBS shall be equipped with an event log that stores for a minimum the last 100 events. The events shall be time and date stamped. The event log shall be retrievable vial RS232, USB or from the BBS LCD screen. The event log shall be display and print out in plain English when output the RS232 or USB ports.

Battery System

Individual battery shall be 12V, rated 105 amp-hour for 20 hours @ 77°F to 1.70 VPC, deep cycle, sealed prismatic lead-calcium based Absorbed Glass Mat/ Valve Regulated Lead Acid (AGM/VRLA) battery and shall be easily replaced and commercially available off the shelf.

The manufacturer shall certify batteries to operate over a temperature range of – 25 °C to +74 °C.

The batteries shall be provided with appropriate interconnect wiring and corrosion-resistant mounting trays and/or brackets appropriate for the cabinet into which they will be installed.

Batteries shall indicate maximum recharge data and recharging cycles.

Furnish four (4) batteries for the BBS.

Battery Harness

Battery interconnect wiring shall be via two-part modular harness:

- Part I shall be equipped with red (+) and black (-) cabling that can be permanently connected to the positive and negative posts of each battery. Each red and black pair shall be terminated into a Molex, polarized – keyed battery cable connector or equivalent. The length of the harness between batteries shall be a minimum of 12 inches.

- Part II shall be equipped with the mating Power Pole style connector for the batteries and a single, insulated Power Pole style connection to the inverter/charger unit. Harness shall be fully insulated and constructed to allow batteries to be quickly and easily connected in any order to ensure proper polarity and circuit configuration. The length of the battery interconnect harness shall be a minimum of 60 inches from the Inverter/Charger plug to the first battery in the string.

Power Pole connectors may be either one-piece or two-piece. If a two-piece connector is used, a locking pin shall be used to prevent the connectors from separating.

All battery interconnect harness wiring shall be UL Style 1015 CSA TEW or Welding Style Cable or equivalent, all of proper gauge with respect to design current and with sufficient strand count for flexibility and ease of handling.

Battery terminals shall be covered and insulated with molded boots to prevent accidental shorting.

BBS Quality Assurance

Each Battery Backup System (BBS) shall be manufactured in accordance with a manufacturer Quality Assurance (QA) program. The QA program shall include two Quality Assurance procedures:

1. Design QA - The manufacturer, or an independent testing lab hired by the manufacturer, shall perform Design Qualification Testing on new BBS system(s) offered, and when any major design change has been implemented on an existing design. A major design change is defined as any modification - material, electrical, physical, or theoretical, that changes any performance characteristics of the system, or results in a different circuit configuration. Where a dispute arises in determining if a system is a new design or if the system has had a major design change, the County will make the final determination if Design Qualification Testing is required prior to production consideration.

2. Production QA - The Production QA shall include statistically controlled routine tests to ensure minimum performance levels of BBS units built to meet this specification and a documented process of how problems are to be resolved.

QA process and test results documentation shall be kept on file for a minimum period of seven years.

Battery Backup System designs not satisfying Design QA Testing and Production QA Testing requirements shall not be labeled, advertised, or sold as conforming to this specification.

A technician whom is qualified to work on the battery backup system and employed by the battery backup system manufacturer or the manufacturer authorized distributor, shall be present at the time the equipment is turned on.

It shall be the responsibility of the Contractor to implement and fund any traffic signal controller assembly modifications required to achieve the traffic signal operation as shown on the construction plans and as required in the Special Provisions.

CC. Solar Powered Flashing Beacon System

Solar powered flashing beacon system shall conform to the provisions in Section 86, "Signals and Lighting" of the Standard Specifications, Chapter 4K, Flashing Beacons, of the CA MUTCD and these Special Provisions.

Each unit shall consist of a self-contained solar engine, dual yellow LED signal modules and signal housing, and mounting hardware such that the entire assembly mounts to the top of the pole, see County Standard No. 1209. The solar engine shall contain all electronics, batteries & solar panels. No additional cabinet is required.

Mechanical Specifications

The solar engine shall be constructed from powder coated aluminum, and shall be no greater in size than 4.75" x 15" x 32". The Solar panels shall be integrated to the solar engine. All batteries and electronics shall be mounted in the solar engine, with no external control cabinet or battery cabinet required. The solar engine shall be vented to provide cooling of the battery and electronic system. Venting shall be covered by wire mesh to prevent intrusion of insects.

The solar engine shall have the provision to mount an external device for remote activation. System must have capability to power such device. Solar engine must contain sufficient space to house third party device inside a sealed enclosure located inside the solar engine.

The overall weight of the assembly, including mounting hardware, signal housings, LED modules, and solar engine shall not exceed 75 lbs.

The solar engine shall have the provision to be tilted and oriented south with additional mounting hardware, or mounted completely flat to the ground such that mounting in any orientation will keep the solar engine level.

Mounting

The entire assembly, including solar engine, signal housing and LED module, and bracket shall be provided with hardware for mounting on to the top of a 4 1/2" diameter round pole. Mounting hardware shall be standard traffic signal mounting hardware manufactured by Pelco Products Inc. or approved equal.

Solar/Battery System

The solar engine shall include two 10-watt solar panels no larger than the footprint of the housing. The solar engine shall house two, field replaceable sealed lead acid batteries no greater than 24 Ah each. The solar panel and battery system shall be 12 Volt DC.
The solar panel shall meet the design qualification and type approval of photovoltaic modules in accordance with IEC 61215. This specification includes radiation testing, thermal testing, and mechanical testing for environmental conditions such as UV-exposure, thermal cycling, as well as degradation of maximum power output.

The solar panel shall consist of no more than two solar panels, mounted to the solar engine with an aluminum flashing.

The batteries shall be mechanically secured into the housing. A battery bracket shall enclose each battery in a manner to restrict the thermal expansion of the battery.

System shall have an auxiliary 12 VDC power output to power third party devices such as wireless radios or sensing equipment.

Signal Housing

The signal housing shall meet the equipment standard of the Institute of Transportation Engineers (ITE) Vehicle Traffic Control Signal Heads (VTCSH) Chapter 2.

The solar engine shall not overhang the signal head, so as not to restrict mounting a signal head back plate. The signal head shall be easily removable from the assembly. The bracket assembly shall be constructed such that the signal heads can be removed easily in the field without removing the solar engine. The bracket assembly shall be designed to take the torsion and bending load of the solar engine. The signal head shall not be subjected to the torsion or bending load of the solar engine.

The signal housing must be able to rotate independent from the bracket for lens alignment. The dual flashing beacons shall be mounted horizontally and the signal housing shall be black in color.

LED Signal Module

The LED signal module shall be 12", yellow and conform to the specifications of ITE Vehicle Traffic Control Signal Heads, Light Emitting Diode (LED) Circular Signal Supplement.

DD. Payment Method

See Signal and Lighting subsection O, "Service" for payment of all electric company fees required.

The contract price paid **per Lump Sum** for Signal and Lighting shall include full compensation for furnishing all labor, materials, tools, equipment, foundations, pole and mast arm mounted regulatory signs, documents, programming, testing, potholing required for utility verification prior to all conduit installation and incidents and for doing all the work specified herein, elsewhere in these Special Provisions, and plans including the complete installation of an operational traffic signal and lighting system, removing and salvaging existing traffic signal and equipments, excavation and backfilling where needed and no additional compensation shall be allowed therefor.

Appendix K

City of Riverside

Electrical Systems Specifications

PART 7

TRAFFIC SIGNALS, LIGHTING AND ELECTRICAL SYSTEMS

7-1 GENERAL

7-1.01 Description. Furnishing and installing and modifying traffic signals, highway lighting, flashing beacons and sign illumination, and payment therefore shall conform to the provisions in Section 86 "Signals, Lighting and Electrical Systems," of the State Standard Specifications and these Special Provisions (See Section 2-5 herein).

Traffic signal and lighting work is to be performed at the following locations:

Magnolia Avenue at Buchanan Street Intersection

Magnolia Avenue

7-1.04 Equipment List and Drawing. Equipment list and drawings of electrical equipment and material shall conform to the provisions in Section 86-1.04, "Equipment List and Drawings", of the State Standard Specifications and these Special Provisions. The Caltrans HC-30 form or one similar shall be submitted to the Engineer. Also, see required submittal with the bid proposal.

The controller cabinet schematic wiring diagram and intersection sketch shall be combined into one drawing, so that when the cabinet door is fully open, the drawing is oriented with the intersection. The size of the plan containing said diagram and sketch shall not exceed 30" X 42". The cabinet schematic wiring diagram shall have point-to-point designations. Detector plug, and/or slot and channel (if applicable) designations shall be marked on the intersection sketch.

The Contractor shall furnish two sets of operation and maintenance manuals for all controller units, auxiliary equipment, vehicle detector units, and control units. The maintenance manuals or combined maintenance and operation manual(s) shall be submitted at the time the controller assemblies are delivered to the signal lab located at 8095A Lincoln Avenue, Riverside, for testing or, if ordered by the Engineer, previous to delivery. The maintenance manual shall include, but need not be limited to, the following items:

(a) Specifications

(b) Design characteristics

(c) General operation theory

(d) Function of all controls

(e) Troubleshooting procedure (diagnostic routine)

(f) Block circuit diagram

(g) Geographical layout of components

(h) Schematic diagrams

(I) List of replaceable component parts with stock numbers

All equipment and material that the Contractor proposes to install shall conform to these specifications and the contract plans. A list of substitute equipment and/or materials along with a written descriptive summary, describing the functions of the components, which the Contractor proposes to install, shall be submitted along with Contractor's bid proposal. The list shall be complete as to the name of manufacturer, size, and identifying number of each item. The list shall be supplemented by such other data as may be required including reference to certified Intertek equipment. Substitution shall not be allowed for products certified or listed in the Intertek LED Traffic Signal Modules Certification Program (www.intertek-etlsemko.com/ledtraffic) or for products governed by the State of California Department of

Transportation Pre-Qualified Products List (QPL). Refer to Section 7-3 and 7-4 of these Special Provisions.

If these Special Provisions specify manufacturers' names along with the term "City approved equal", the following shall apply:

If the Contractor proposes to furnish equipment and/or material other than that specified in the Contract Special Provisions, a sample of the item(s) must be submitted to the Engineer to determine its equality. The item(s) must be reviewed prior to the beginning of construction and will not be accepted for installation unless approved by the Engineer. Judgment shall be based on intended use, maintenance, quality and interchange ability, if applicable.

In all cases, the judgment of the Engineer shall be final as to whether substitute equipment and/or materials, recommended by the Contractor, conform to the intent of these specifications and are acceptable for use.

7-1.06 Maintaining Electrical Systems. Traffic signal system shutdowns shall be limited to periods between the hours of 8:30 a.m. and 3:30 p.m., or as specified by the Engineer.

In lieu of 30" Stop Signs, 36" Stop Signs are required.

The traffic signal inspector shall be notified 72 hours prior to a traffic signal shut down.

Contact:

Mike Corona

mcorona@riversideca.gov

951-826-5695

7-2 MATERIALS AND INSTALLATION

7-2.04 Standards, Poles, Steel Pedestals and Posts. All standards shall be installed 2" above the finished surface (grade). The void between the base plate and surface shall be filled with dry packed concrete conforming to the provisions of the third paragraph of Section 86-2.03 of the Standard Specifications.

When a standard or mast arm is relocated, new nuts, bolts, cap screws and washers shall be provided by the Contractor, and shall conform to the requirements for hardware used with new standards.

All Type 1A standards shall be aluminum. Anchor bolts, bolt circle, threads, nuts and washers shall conform to the Standard Plans. Anchor bolt covers are required.

7-2.05 Conduit. Conduit shall conform to the provisions in Section 86-2.05, "Conduit" of the State Standard Specifications and these Special Provisions.

Split-bolt or set screw couplings are not allowed.

Loop stub-outs shall be Schedule 40 PVC or better. All other conduit shall be Type 1 rigid steel, as specified in the Standard Specifications, unless otherwise indicated on plans.

In lieu of installing conduit by jacking or drilling, as provided for in Section 86-2.05C, "INSTALLATION" of the State Standard Specifications, conduit shall be placed in paved roadways by the trenching method in accordance to the provisions of said Section 86-2.05C, except that 376 pounds of cement per cubic yard will be used in lieu of the 564 specified. A minimum of 12" shall be maintained over top of conduit. Conduit shall be type 1.

Insulated bonding bushings will be required on metal conduit.

After conductors have been installed, the ends of conduits terminating in pullboxes and controller cabinets shall be sealed with an approved type of sealing compound.

The Contractor shall be responsible for modifying (includes directing spray away from cabinet, if necessary), and repairing existing sprinkler system(s) in the parkway, if said systems interfere with conduit and appurtenant installations. The property owner(s) shall be notified of these alterations and requested to test the facility before the Engineer will accept this work.

7-2.06 Pullboxes. Pull boxes shall conform to the provisions in Section 86-2.06, "Pull Boxes" of the State Standard Specifications and these Special Provisions.

Pull boxes shall be No. 6 unless otherwise indicated on plans. All pull boxes shall be precast of reinforced Portland cement concrete (PCC).

Any pull box in which four (4) or more conduits terminate shall be # 6 or larger.

All pull boxes to be installed shall be surrounded by a 6" wide x 3 1/2" to 4" deep concrete pour, excepting those placed within improved PCC or asphalt concrete sidewalk area.

Pull boxes not protected by PCC or asphalt concrete curb or located at any point in medians or subjected to vehicular traffic shall be State of California, Department of Transportation traffic pull box (Type T) and installed per ES-8.

Non-traffic bearing pull box lids for No. 3 ½ and No. 5 shall be PCC. Composite reinforced fiber lids shall be used for No. 6 pull boxes. Composite reinforced fiber lids are subject to City approval.

All new pull box covers shall be marked "Traffic Signal", or "Street Light".

The Contractor shall grout any existing pull boxes that are to remain in place and are not grouted with material specified in Section 86-2.06 of the State Standard Specifications. The Contractor shall excavate within the pull box, to proper depth prior to grouting.

7-2.08 Conductors, Cable, and Wiring. Conductors and wiring shall conform to the provisions in Section 86-2.08, "Conductors and Cables" and Section 86-2.09, "Wiring" of the State Standard Specifications and these Special Provisions.

In lieu of individual conductors for vehicle and pedestrian signals and pedestrian push buttons, signal cable shall be installed and shall conform to the provisions of Section 86-2.08D, "Signal Cable" of the State Standard Specifications. Installation shall be as follows:

1. A 12-conductor cable shall be installed from the cabinet to each pole unless otherwise indicated on the plan(s).
2. A 3-conductor cable (pedestrian push button) shall also be installed from the cabinet to each pole. An additional 3-conductor cable must be provided if two pedestrian push buttons are located on the same pole.
3. No splices will be allowed for the installation of the conductors for Items 1 and 2 above.
4. Each conductor and cable shall be identified in the controller cabinet.
5. Other required cables, detectors and interconnect, and conductors for luminaires, I.I.S.N.S., vehicle preemption and signal service shall be installed as indicated in the Conductor Schedule.
6. Conductor identification for signal phasing shall be as directed in the field by the Traffic Engineer or his representative.

The second paragraph in Section 86-2.08, "Conductors and Cables" of the State Standard Specifications is amended to read:

The Contractor shall be responsible to install the number of conductors and/or cable(s) needed to operate the electrical system(s). Omissions in the conductor schedule or unnumbered conduit runs shall not

constitute "Extra Work". This also pertains to conductors for future phases indicated on the plan(s) for installation.

Conductors for each inductive detector loop shall be Type 2.

If a "C" shaped compression connector is used for splicing, the conductors shall also be soldered.

Splicing for signal modifications as specified in Subsection 86-2.09D, "Splicing and Terminations," of the State Standard Specifications will not be allowed unless otherwise indicated on the contract plan(s).

For splicing commons, the ends of the conductors shall be crimped and soldered to secure connections.

The minimum insulation thickness, at any point, for USE, RHH or RHW wire shall be 1.0mm for conductor sizes No, 14 to No. 10, inclusive, and 1.3 mm for No. 8 to No. 2, inclusive. The minimum insulation thickness, at any point, for Type THW and TW wires shall be 0.69 mm for conductor sizes No. 14 to No. 10, inclusive, 1.02mm for No. 8 and 1.37mm for No. 6 to No. 2 inclusive.

Service conductors for traffic signal systems shall be No. 6 AWG, unless otherwise noted on plan. All service conductors shall be continuous between controller and service point, and no splices will be allowed.

Wire for multiple street lighting systems shall be rated for 600-volt operation and shall have black polyvinyl chloride insulation.

Signal Interconnect Cable. Signal Interconnect Cable (SIC) shall be in accordance with the provisions of Section 86-2.08E, "Signal Interconnect Cable (SIC)", of the State Standard Specifications except that conductors shall be 19 gauge AWG solid twisted pairs; the grounding conductor is not required. A sample of SIC and splicing material to be used shall be submitted to the Engineer prior to installation

Unless otherwise indicated on the plan(s), six pair interconnect is required.

Notice shall be given, 48 hours in advance, to the City prior to any splicing. All final splicing shall be done in the presence of the Engineer or his representative.

Fused Splice Connectors. Fused splice connectors as specified in Section 86-2.09F, "Fused Splice Connectors", of the State Standard Specifications will be required; the fuse shall be rated at 10 amperes.

7-2.10 Bonding and Grounding. Bonding and grounding shall conform to the provisions in Section 86-2.10, "Bonding and Grounding", of the State Standard Specifications and these Special Provisions.

Equipment grounding conductors will not be required in conduit containing loop lead-in cables only.

7-2.11 Service. Service shall conform to the provisions in Section 86-2.11, "Service", of the State Standard Specifications and these Special Provisions.

The contractor shall be responsible to furnish a TV1 signal mount for all 1A service mounts. This shall be delivered to the signal maintenance shop at 8095A Lincoln Avenue, Riverside, CA for fabrication.

New signal service shall be installed by the Contractor in accordance to the appropriate Std. Dwg.; contact the City Public Works Department, 951-782-5688, at least four weeks in advance for processing the request for service connection(s).

THE CITY WILL FURNISH ALL CIRCUIT BREAKERS AND HOUSING FOR ALL CITY CONTRACTS.

7-2.14 Testing. Testing shall conform to the provisions in Section 86-2.14, "Testing", of the State Standard Specifications and these Special Provisions.

The cabinet and controller and related equipment, including a battery back-up system shall be delivered to the signal maintenance shop at 8095A Lincoln Avenue, Riverside, CA for testing 20 working days prior to installation in the field.

No testing of the cabinet or equipment will start until all of the equipment is delivered to the signal maintenance shop.

7-2.16 Painting. Painting shall conform to the provisions in Section 86-2.16, "Painting", of the State Standard Specifications and these Special Provisions.

For controller cabinet, see Sec. 7-3 of these Special Provisions.

7-3 CONTROLLER UNITS, CABINETS AND AUXILIARY EQUIPMENT

7-3.01 Solid State Traffic Actuated Controllers. Solid-state traffic actuated controller units, cabinets, and auxiliary equipment shall conform to the provisions in Section 86-3, "Controller Assemblies", of the State Standard Specifications and these Special Provisions.

When the plan sheets and/or Special Provisions call for special functions, features, future detector loops, or additional future phasing, all necessary cabinet wiring, connecting cables, support bases, phase timing modules, signal load units, circuitry, and other necessary equipment shall be provided to perform the future phasing, detections, and special functions and features.

MODEL 170ATC-CF CONTROLLER ASSEMBLY

The cabinet, Model 332, shall be in accordance with the provisions of Section 86-3.04of the State Standard Specifications and these Special Provisions. The controller assembly shall be a McCain 170ATC-CF or approved equal.

The Type 170ATC-CF controller assembly shall consist of a Model 170ATC-CF controller unit, completely wired Model 332 controller cabinet, Model 222 solid state output inductive loop detector sensor units (See Sec. 7-6 of this PART 7), Model 242 isolators, and Model 210 conflict monitor. Model 400 Modem, flasher units, and other equipment required to provide a complete control system shall be furnished and installed. The 332 cabinet shall incorporate a PDA2 power distribution assembly. The software program shall be Bi Trans Systems, Inc. No. 750 or the latest version thereof.

If the contract plan(s) indicates 2 ea. Model 170ATC-CF controller units to be housed in 1 ea. 332 cabinet, one unit shall serve as the master control for coordinated traffic operations between signalized intersections. The cabinet shall be completely wired including all appurtenances for this operation. All ports for system communications, including telephone, shall be provided. The system master unit shall have 4 ports.

On the PDA2 power assembly, wire termination on the backside of T1, T2 and T4 terminal blocks shall be soldered connections. Crimp terminals fastened with screws will be rejected.

Crimp terminals on connecting cables between input files and input panel terminal blocks shall be crimped and soldered.

All output files shall be completely wired to monitor RED failure.

For load switches, Pin 11 on all load switch sockets shall be wired to AC-. Individual indicator lamps shall be provided to monitor inputs and outputs.

All load switch sockets shall have individual wire terminals; printed circuit boards will not be allowed.

Monitoring device channels 9 and 10 shall be wired in order that Ped. Yellow monitoring or unterminated wires may be selected by a connector assembly.

The input file shall be wired to accept the pre-empt module required for vehicle pre-emption specified elsewhere in these Special Provisions. Also, see "Vehicle Pre-emption" else wherein this section for other cabinet requirements(s). Green monitoring harnesses for 3M brand opticom modules will be factory installed.

Cabinet finish (interior and exterior) shall be anodic coating as specified in Section 86-3.04A, "Cabinet Construction", of the State Standard Specifications.

The cabinet features shall include push buttons for manual actuation of all vehicular and pedestrian phases. The buttons shall be mounted on the front door panel and enclosed in a suitable metal housing. The cabinet shall also be provided with a fluorescent lamp for interior lighting. Said lamp shall be

mounted on the fan plenum and illuminate both front and rear of the cabinet. Light switches shall be provided for both doors.

The controller cabinet shall be equipped with a document drawer/shelf.

Two (2) complete manuals and four (4) complete cabinet wiring diagrams shall be supplied.

The 170ATC-CF controller shall contain a menu driven LCD front panel, five serial ports (one Ethernet 10/100 port, and a USB 2.0 full speed device), Motorola MCF5282CVM66, 32-bit MCU, CPU clock speed of 66MHz, Onboard temperature sensor to give an approximate around the board temperature reading, front panel serial communication port, operating temperature shall range between -40° C to 85° C.

Attention is directed to "TESTING" included elsewhere in these special provisions.

Turn On

The Contractor shall arrange to have a signal technician, qualified to work on the controller and employed by the controller/equipment manufacturer or its representative, present at the time the controller/equipment is turned on. This includes when an existing traffic signal system is modified.

Standards (poles) shall not be placed on foundations until five (5) working days before scheduled turn on.

No Traffic Signal System shall be turned on until all equipment and signage are installed.

The intersection must be cleaned and swept completely prior to the traffic signal turn-on. Clean up includes but is not limited to:

Signal poles, signal mast arms, signal heads, signal head visors, signal head lenses, traffic safety lights, controller cabinet, battery back-up cabinet, signs, side walks, curbs, gutters, intersection within 150m (500') in all directions, etc.

Vehicle Pre-emption. Vehicle pre-emption shall conform to the applicable provision of the Standard Specifications and these Special Provisions. New vehicle pre-emption shall be 100% compatible with existing City of Riverside vehicle pre-emption equipment.

The pre-emption system shall be able to identify certain designated vehicles as high priority (emergency types such as fire, police, etc.) and low priority (transit types) via a transmitted optical signal and process for activation of the appropriate phase green or hold a displayed phase green. Pre-set codes in the systems processor (phase selector) shall recognize each vehicle's priority and its class (fire, bus, etc.). The system shall operate on a first come, first served basis except that high priority vehicles shall take precedence over low priority vehicles.

Vehicle Pre-emption equipment/component parts shall be warranted by the manufacturer in a documented system-protection plan for the first five (5) years from the date of shipment from the manufacturer. Furthermore, said equipment shall be covered for an additional five (5) years of maintenance, repair or replacement at a fixed charge for a total of ten (10) years of product protection coverage.

A complete intersection vehicle pre-emption system shall be installed at the intersection(s) as indicated on the contract plan(s) and shall consist of optical detectors (signal receiver(s) mounted on the indicated signal poles' mast arm (the exact position to be determined in the field.); an encoded phase selector within the controller cabinet to activate the phase green; and all cabinet and field wiring to provide an operating system.

The optical detector shall be housed in a weatherproof high impact non-corrosive fabricated material; mounting hardware shall also be non-corrosive. Said detector shall incorporate a built-in terminal strip for wire connections.

The optical detector shall have an adjustable responsive range up to 2,500 feet from a discrete optical light source; said discrete light source shall be identified for the proper preemption. Operating ambient temperature range shall be –30 degrees C to +60 degrees C. To achieve optimum operation, the appropriate detector to receive the required optical inputs and electrical outputs (to phase selector) shall be as recommended by the manufacturer.

The phase selector unit provided shall be for the Model 170E, 170ATC-CF or a N.E.M.A. controller as indicated on the plan(s). Installation shall not cause cabinet modification or disrupt normal traffic signal operation unless a valid transmittal is received from an optical detector. The phase selector shall be a two-channel device and provide the following functions and features:

Functions:

Only one priority control output (phase green) shall be active at a time.

High priority signals shall override low priority signals in the same channel or from channel to channel.

The unit shall have three (3) levels of discriminating the signal.

All valid signals shall be logged and stored in non-volatile memory; data shall be maintained when power is removed. The following information shall be stored:

a. Class

b. Code

c. Priority

d. Direction

e. Call duration

f. Final greens at end of call

g. Duration of final greens displayed

h. Time call ended (real time)

I. If vehicle passed through intersection

Features:

A port (RS 232 interface) for remote communication via modem.

A test switch for each channel.

A pilot light and call status indicator lights.

Error diagnostic capabilities.

The detector cable shall be a shielded, 3-conductor 20-gage cable with a drain wire and shall conform to the detector and selector manufacturer's recommendation.

7-3.02 Battery Backup System. Battery Back-up System shall conform to the applicable provisions in Section 86-3.02, "Battery Backup System", of the State Standard Specifications and these Special Provisions. New Battery Back-up System shall be 100% compatible with existing City of Riverside Battery Back-up equipment.

The Battery Back-up System (BBS) shall be a Dimension Model ADI-24M11-WBE or a Clary Corporation SP1250PD-N (Plus) Traffic UPS or "City approved equal". The BBS must provide a battery back-up/uninterruptible power system and shall consist of three (3) major components: the Electronics Module, the Power Interface Module with automatic transfer circuitry for generator input, and the Battery System consisting of 6 Outpost OPB-1241, or approved equal batteries. The system must be capable of operating in two (2) modes: Flash mode (red LEDs) and full normal operation mode (all LED indications). System shall include a timing circuit allowing automatic switching from full operation to all red flash at a selectable time interval. The BBS shall have two (2), continuously conditioned, 5- 15 receptacles for connecting the controller and other sensitive equipment.

If these Special Provisions specify manufacturers' names along with the term "City approved equal", the following shall apply:

If the Contractor proposes to furnish equipment and/or material other than that specified in the Contract Special Provisions, a sample of the item(s) must be submitted to the Engineer to determine its equality. The item(s) must be reviewed prior to the beginning of construction and will not be accepted for installation unless approved by the Engineer. Judgment shall be based on intended use, maintenance, quality and interchange ability, if applicable.

In all cases, the judgment of the Engineer shall be final as to whether substitute equipment and/or materials, recommended by the Contractor, conform to the intent of these specifications and are acceptable for use.

This specification establishes the minimum requirements for a complete emergency battery backup system for use with Light Emitting Diode (LED) Traffic Signal Modules. The BBS shall include, but not be limited to the following: Inverter/Charger, Power Transfer Relay, batteries, a separate manually operated non-electronic Bypass Switch (See Figure 1 – BBS Block Diagram) and all necessary hardware and interconnect wiring. The BBS shall provide reliable emergency power to a traffic signal system (Vehicle and Pedestrian Traffic) in the event of a power failure or interruption.

The BBS shall be capable of providing power for full run-time operation for an "LED-only" intersection (all colors: red, yellow, green and pedestrian heads) or flashing mode operation for an intersection using Red LED's.

The BBS shall be designed for outdoor applications, in accordance with the Caltrans Transportation Electrical Equipment Specifications (TEES), dated August 16, 2002, Chapter 1, Section 8 requirements.

Operation

BBS shall be compatible with Caltrans Model 332 or 333JP Cabinets, Model 170E Controllers, Model 170ATC-CF, or Model 2070 Controllers and cabinet components for full time operation.

The BBS shall provide a minimum two (2) hours of full run-time operation for an "LED-only" intersection (minimum 700W/1000VA active output capacity, with 80% minimum inverter efficiency). The BBS shall have at least 4000 watts of peak power.

The maximum transfer time allowed, from disruption of normal utility line voltage to stabilized inverter line voltage from batteries, shall be 65 milliseconds. The same maximum allowable transfer time shall also apply when switching from inverter line voltage to utility line voltage.

The BBS DC system voltage shall be 24, or 72 Vdc.

The BBS shall provide the user with 3-sets of normally open (NO) and normally closed (NC) single-pole double-throw (SPDT) dry relay contact closures, available on a panel-mounted terminal block, rated at a minimum 120V/1A, and labeled so as to identify each contact. For typical configuration, see Figure 3(b).

The BBS shall provide the user with 3-sets of normally open (NO) and normally closed (NC) single-pole double-throw (SPDT) dry relay contact closures, available on a panel-mounted terminal block, rated at a minimum 120V/1A, and labeled so as to identify each contact. For typical configuration, see Figure 3(b).

The first set of NO and NC contact closures shall be energized whenever the unit switches to battery power. Contact shall be labeled or marked "On Batt."

The second set of NO and NC contact closures shall be energized whenever the battery approaches approximately 40% of remaining useful capacity. Contact shall be labeled or marked "Low Batt."

The third set of NO and NC contact closures shall be energized two hours after the unit switches to battery power. Contact shall be labeled or marked "Timer."

Operating temperature for both the inverter/charger, power transfer relay and manual bypass switch shall be –37 °C to +74 °C.

Both the Power Transfer Relay and Manual Bypass Switch shall be rated at 240VAC/30 amps, minimum.

The BBS shall use a temperature-compensated battery charging system. The charging system shall compensate over a range of 2.5 – 4.0 mV/ °C per cell.

The temperature sensor shall be external to the inverter/charger unit. The temperature sensor shall come with 3 meters (9'10") of wire.

Batteries shall not be recharged when battery temperature exceeds 50 °C ± 3 °C.

BBS shall bypass the utility line power whenever the utility line voltage is outside of the following voltage range: 100VAC to 130VAC (± 2VAC).

When utilizing battery power, the BBS output voltage shall be between 110 VAC and 125 VAC, pure sine wave output, = 3% THD, 60Hz ± 3Hz.

BBS shall be compatible with Caltrans Model 332A Cabinets, Model 170ATC-CF Controllers, Model 2070 Controllers and cabinet components for full time operation.

In cases of low (below 98VAC) or absent utility line power, when the utility line power has been restored at above 105 VAC ± 2 VAC for more than 30 seconds, the BBS shall transfer from battery backed inverter mode back to utility line mode.

In cases of high utility line power (above 132VAC), when the utility line power has been restored at below 125VAC ± 2 VAC for more than 30 seconds, the BBS shall transfer from battery backed inverter mode back to utility line mode.

BBS shall be equipped to prevent a malfunction feedback to the cabinet or from feeding back to the utility service.

BBS shall have lighting surge protection compliant with IEEE/ANSI C.62.41.

BBS shall be equipped with an integral system to prevent the battery from destructive discharge and overcharge.

In the event of inverter/charger failure, battery failure or complete battery discharge, the power transfer relay shall revert to the NC (and de-energized) state, where utility line power is connected to the cabinet.

Recharge time for the battery, from "protective low-cutoff" to 80% or more of full battery charge capacity, shall not exceed twenty (20) hours.

The Battery Backup System must be able to shutdown to protect against internal damage in the event of an overload at its output.

Mounting / Configuration

General

Inverter/Charger Unit shall be shelf-mounted or rack-mounted.

Power Transfer Relay and Manual Bypass Switch shall be mounted on the 332 cabinet standard Electronic Industries Association (EIA) rail.

All interconnect wiring shall be provided between Power Transfer Relay, Bypass Switch and Cabinet Terminal Service Block and shall be no less than 3 meters (9'10") of UL Style 1015 CSA TEW with the following characteristics:

1. AWG Rating: 10 AWG

2. Stranding: 105 strands of 30 AWG tinned copper

3. Rating: 600 V, 105 °C, PVC Insulation

Relay contact wiring provided for each set of NO/NC relay contact closure terminals shall be 3 meters (9'10") of UL Style 1015 CSA TEW 18 AWG wire, same ratings as above, except 16 strands of 30 AWG tinned copper.

All necessary hardware for mounting (shelf angles, rack, etc) shall be included in the bid price of the BBS. A minimum of 6 bolts/fasteners shall be used to secure swing-trays to the 332 or 333JP Cabinet standard EIA 19" (482.6mm) rack. All bolts/fasteners and washers shall meet the following requirements:

1. Screw type: Pan Head Phillips machine screw
2. Size and Thread pitch: 10-32
3. Material: 18-8 stainless steel (Type 316 stainless steel is acceptable as an alternate.)
4. Washer: Use one flat washer (18-8 stainless steel) under the head of each 10-32 screw (provided that the screws are properly tightened, lock washers are unnecessary.) Number of screws per hinge bracket: Minimum of six (6) screws per hinge bracket spaced evenly along bracket, with one screw near each end.

External Cabinet

Inverter/Charger, Power Transfer Relay and manually operated Bypass Switch shall fit inside a typical fully equipped Caltrans Model 332 or 333JP Cabinet that includes one Model 170E, 170ATC-CF or 2070 controller.

Batteries shall be housed in a NEMA 3R rated cabinet mounted to the side of the Model 332 Cabinet (see Figure 5 for details). This external cabinet shall conform to TEES, August 16, 2002 Chapter 7, Section 2-Housings for the construction and finish of the cabinet.

Batteries shall be mounted on individual Shelves.

Four shelves shall be provided. There shall be a minimum of 304.8mm (12") clearance between shelves. Each shelf shall be a minimum of 263.65mm (10.38") X 635.0mm (25"), and capable of supporting a minimum of 57kg (125 lbs.)

The external battery cabinet shall mount to the Model 332 Cabinet with a minimum of eight bolts. (See Figure 5)

The dimensions of the external battery cabinet shall be as shown in Figure 5.

The bottom shelf shall be removable.

The external battery cabinet shall be ventilated using louvered vents, filter, and one thermostatically controlled fan as per TEES Chapter 7 Section 2-Housings.

External battery cabinet fan shall be AC operated from the same line output of the Manual Bypass Switch that supplies power to the 332 Cabinet.

The external battery cabinet shall have a door opening to the entire cabinet. The door shall be attached to the cabinet using either a continuous stainless steel piano hinge or four, two-bolts per leaf, hinges as per TEES Chapter 7 Section 2. The door shall use a padlock clasp or latch and lock mechanisms as described in the TEES, in order to lock the door.

The external cabinet shall come provided with all bolts, washers, nuts and cabinet-cabinet coupler fittings provided, necessary for mounting the external cabinet to the 332 Cabinet.

Maintenance, Displays, Controls and Diagnostics

The BBS shall include a front panel alpha numeric LCD displays to allow reading of status, alarms, and 100 time stamped first in first out event logs. The unit shall be programmable from the front panel and have eight sets of signal relays that are each individually settable to 45 different criteria such as (system statuses alarms, battery voltage, time on battery, temperature…). The unit shall be capable of accepting an optional IP addressable interface. All logs shall be downloadable. The unit must continuously regenerate the output AC voltage and accept low cost generators and quasi-square wave inputs without switching to battery.

The BBS shall include a display and /or meter to indicate current battery charge status and conditions.

The BBS shall provide voltmeter standard probe input-jacks (+) and (-) to read the exact battery voltage drop at the inverter input.

The BBS shall include a 0 to 100% battery capacity LED indicator.

The BBS shall have lightning surge protection compliant with IEEE/ANSI C.62.41.

The BBS shall be equipped with an integral system to prevent battery from destructive discharge and overcharge.

The BBS and batteries shall be easily replaced with all needed hardware and shall not require any special tools for installation.

The BBS shall include a front-panel event counter display to indicate the number of times the BBS was activated and a front-panel hour meter to display the total number of hours the unit has operated on battery power. Both meters shall have push button resets.

Manufacturer shall include a set of equipment lists, operation and maintenance manuals, and board-level schematic and wiring diagrams of the BBS, and the battery data sheets. Manual shall conform to TEES August 16, 2002, Chapter 1, Section 1.2.4.2.

Battery System

Individual batteries shall be 12V type, 65 amp-hour maximum, and shall be easily replaced and commercially available of the shelf.

Batteries used for BBS shall consist of 4 to 8 batteries with a cumulative minimum rated capacity of 240 amp-hours.

Batteries shall be deep cycle, sealed prismatic lead-calcium based AGM/VRLA (Absorbed Glass Mat/ Valve Regulated Lead Acid).

Batteries shall be certified by the manufacturer to operate over a temperature range of – 25 °C to +74 °C.

The batteries shall be provided with appropriate interconnect wiring and corrosion-resistant mounting trays and/or brackets appropriate for the cabinet into which they will be installed.

Batteries shall indicate maximum recharge data and recharging cycles.

Battery Harness

Battery interconnect wiring shall be via two-part modular harness.

Part I shall be equipped with red (+) and black (-) 30.48 cm (12") cabling that can be permanently connected to the positive and negative posts of each battery. Each red and black pair shall be terminated into an Anderson style Power Pole connector or equivalent.

Part II shall be equipped with the mating Power Pole style connector for the batteries and a single, insulated Power Pole style connection to the inverter/charger unit. Harness shall be fully insulated and constructed to allow batteries to be quickly and easily connected in any order to ensure proper polarity and circuit configuration.

Power Pole connectors may be either one-piece or two-piece. If a two-piece connector is used, a locking pin shall be used to prevent the connectors from separating.

The length of the battery interconnect harness (Part II) shall be a minimum of 152.4 cm (60") from the Inverter/Charger plug to the first battery in the string. The lateral length of the harness between battery connectors shall be a minimum of 30.48 cm (12").

All battery interconnect harness wiring shall be UL Style 1015 CSA TEW or Welding Style Cable or equivalent, all of proper gauge with respect to design current and with sufficient strand count for flexibility and ease of handling.

Battery terminals shall be covered and insulated with molded boots to prevent accidental shorting.

7-4 SIGNAL FACES AND SIGNAL HEADS

7-4.01 Signal Faces and Signal Heads. Signal faces and signal heads shown on plans and the installation thereof shall conform to the Intertek LED Traffic Signal Modules Certification Program and shall include the ETL Verified Label.

Signal auxiliary equipment necessary for the installation of the signal faces and signal heads shall conform to Section 86-4, "Traffic Signal Faces and Fitting", of the State Standard Specifications and these Special Provisions.

The contractor shall cover all the non-functioning vehicle heads and pedestrian heads utilizing signal head covers which are specially fabricated for that purpose. Covers shall be designed to be easily installed by hand without the use of tools. Signal head cover shall be made from outdoor grade, weather resistant material of a tan color. The size of the cover shall closely fit and encapsulate the applicable signal head with stretch material. The cover shall be secured in place with bolt snaps attached to elastic straps. The straps shall be permanently attached to the cover. Cardboard and bags shall not be allowed to cover signal heads.

One new complete signal head shall be provided to the City for each new or modified traffic signal system installed. The signal head shall be delivered to the Traffic Signal Shop located in City Yard, 8095A Lincoln Avenue, prior to any traffic signal equipment installation.

Signal section housings, backplates, visors, etc. shall be metal; plastic parts are not acceptable.

New signal heads, vehicular and pedestrian, and appurtenant framework and terminal compartments shall be furnished with a powder coating finish. Prior to application of the powder coating, pre-treatment processing shall be chronologically as follows: (1) degreasing, (2) water rinse, (3) an iron phosphate bath, (4) water rinse and (5) seal bath.

Application of the powder coating shall consist of a dry off cycle at 300 degrees to 400 degrees F for a minimum of 10 minutes, followed by the electrostatic application of said coating at 75,000 to 90,000 volts. The final process shall be a heat treatment of 20 minutes at 400 degrees F.

Acceptance of powder-coated signals that do not meet the processing requirements must be by written approval of the Traffic Engineer. It will be the burden of the Contractor to demonstrate that the non-conforming process is equal to or exceeds the requirements specified herein.

Backplates. Sections shall be joined using: (1) aluminum rivets and washers; or (2) machine screws #8 or #10 X 32 with washer, lock washer and nut; or (3) a combination of (1) and (2). Rivets, washers, and nuts shall be painted to match backplate. Note; all fastener holes in the backplate shall contain a fastener.

Backplates shall be secured to the signal heads as indicated in the Standard Plans, with the added requirement that the screws shall also be TRUSS types; all screw holes for this purpose must contain screws. The Traffic Engineer must approve any deviation from these requirements.

All bolts, nuts, screws and washers shall be either brass, hot dipped galvanized or stainless steel for mounting pedestrian signals, and traffic signals to aluminum standards, pedestrian posts, and steel standards; except, that stainless steel shall be used for push buttons and push button signs.

Visors. All visors shall be tunnel, except cut-off types. Attachment screws for visors shall be truss head type No. 10 machine screws. Holes for visor attachment screws shall be tapped for machine screw threads. In addition, if a common hole is used for visor and lens attachment, the screws shall be of sufficient length not to cause BOTTOMING OUT. The downward tilt for all visors shall not exceed 3 degrees.

Visors shall be approximately 12" in length 12" lens, unless otherwise noted on plans.

All signal faces shall be provided with 12-inch sections.

The signal heads furnished for this project shall be supplied with the energy saving L.E.D. indications. These L.E.D. indications shall consist of a hermetic unit containing the lens, power assembly and diodes. All L.E.D. modules shall be certified in the Intertek LED Traffic Signal Modules Certification Program and shall include the ETL Verified Label. The modules shall be warranted for a minimum of five years from date of installation against failure. One complete signal head shall be delivered to the signal maintenance

shop for approval and testing prior to field installation. All modules must be certified in the Intertek LED Traffic Signal Modules Certification Program and be labeled with the ETL Verified Label.

All standards shall be drilled for mounting signal hardware and equipment. The use of signal mounting clamps is prohibited.

All terminal compartments, post-top adapters, and MAS mountings, etc., shall be bronze. All other fittings shall be cast iron.

The terminal strip shall be a 12-position pressure type. In addition, the void (hole) and securing mechanism (metal strip and screw) shall be designed to easily accept the insertion of the conductors. The metal contact-securing strip shall have a #10x24 stainless steel screw for pressure adjustment. This void and securing mechanism must easily accept 2-No. 10 conductors and is subject to the Engineer's approval. Marathon Electric Model No. 1012 or Traffic Signal Hardware Model No. 0567 meets these requirements.

The top head gasket for all signal and pedestrian heads shall be neoprene and shall have a minimum thickness of 1/8 inch. A metal washer of the same diameter size shall be placed on the top of the neoprene gasket to secure and provide a watertight fitting.

When the plans require the relocation of vehicular signals, the Contractor shall provide the necessary framework and modify the existing to accommodate either the circular tapered pole or the octagon concrete pole.

McCain, Peek, Automatic, or Alusig shall manufacture signal heads furnished for this project or a City approved equal. Refer to Sec. 7-1.04 of this PART 7 regarding "City approved equal".

All signal mounting framework shall incorporate the use of 1 ½" lock nipples.

7-4.03 Pedestrian Signals. Pedestrian signals shall conform to the provisions in Section 86-4.03, "Pedestrian Signal Faces", of the State Standard Specifications and these Special Provisions.

New pedestrian signals shall be McCain, ICC or City approved equal, and shall include the Z-crate front screen. The pedestrian signal shall be a countdown type, with a solid filled hand on the left-hand side of the pedestrian signal and the numerical "countdown" indication on the right-side of the pedestrian signal.

New pedestrian heads shall use a single LED module for both symbols. Modules shall have filled LED displays, outline only is not acceptable. Modules shall be warranted for a minimum of five years against failure. All modules shall be listed in the Intertek LED Traffic Signal Modules Certification Program (www.intertek-etlsemko.com/ledtraffic) and include the ETL Verified Label.

If the contract plans and/or these special provisions indicate the installation of auditory pedestrian signals, refer to Audible Pedestrian Traffic Signal herein.

When the plans require the relocation of pedestrian indications, the Contractor shall provide the necessary framework and modify the existing to accommodate either the circular tapered pole or the octagon concrete pole.

Audible Pedestrian Traffic Signal. The audible pedestrian signal shall supplement the visible "walk symbol" indication, and shall be mounted within the housing of the pedestrian signal on the walk symbol side. Output (electric circuit) shall be generated from the field conductors to the associated pedestrian signal head.

Audio output shall be adjustable. Additionally, audio output may be self-switching, from an adjustable low to an adjustable high, and shall be responsive to external ambient noise. Directional audio outputs for right-of-way designations shall be represented by 2 distinct bird chirping sounds. The northerly and southerly phase(s) shall utilize a "CUCKOO" sound. The easterly and westerly phase(s) shall utilize the "PEEP-PEEP" sound.

Operation parameters shall be:

115V AC +/- 15%, 60 Hz, 3 watts

-20 degrees C to 70 degrees C temperature range

90 dB/watts at 1 meter (max.) output

7-5 VEHICLE DETECTION

7-5.01 Vehicle Detectors. Vehicle Detectors shall conform to the provisions in Section 86-5, "Detectors", of the State Standard Specifications and these Special Provisions.

The Caltrans TEES specification requirement for detectors is amended with the following additional requirements. Detector units are not required to be listed on the Caltrans QPL but compliance with TEES design criteria will be part of the evaluation process. Detector units shall be two channel rack mount with an LCD or LED display of operational parameters. Programming shall be by front panel mounted momentary contact switches. Detector timing is not required, but may be supplied and will not be subject to front panel programming requirements. Output shall be "solid state". Currently evaluated and acceptable products are: RENO A&E Type C; EBERLE DESIGN Inc Type LMD222 or LMD 602t; or City Approved Equal.

Detector loop configuration shall be Type D for the front loops nearest to the limit line/crosswalk for all lanes including bicycle lanes. Detector loop configuration shall be Type E for the remaining detector loops.

Loop wire shall be Type 2.

In lieu of terminating the detector loop conduit stub-outs as indicated in the Standard Plans, said stub-outs shall terminate at the edge of the gutter; depth shall be below the bottom of the gutter. The lead-in sawcuts shall accommodate this depth providing a smooth transition to the conduit stub-out.

Potholes for detector loop stub-outs shall be capped with asphalt over silica sand.

Hot-Melt Rubberized Asphalt Sealant shall be used for detector loop installation. No exceptions.

It shall be the responsibility of the Contractor to layout and mark the pavement surface for all detector loop installations. Loop layout(s) shall be approved by the Traffic Engineer or his representative 48 hours prior to saw cutting.

As directed by the Traffic Engineer, loop lead-in cable and loop wire leads shall be marked to identify the area and/or lane of detection served.

Where curb (PCC) exists and/or is to be constructed as a part of this project, the alignment of the detector loop conduit stub-out(s), new or existing, shall be permanently marked on the curb face and gutter, as directed by the Traffic Engineer.

Loop stubouts shall be sized per Caltrans ES-5E and be constructed of schedule 40 PVC electrical conduit.

7-5.02 Pedestrian Push Buttons. The push button shall be designed to be highly vandal resistant with essentially no moving parts. It shall feature pressure activation using a piezo driven solid-state switch that requires an activating force of less than 3 lbs. Activation of the pedestrian button will be confirmed by the generation of an audible beep tone and a visual indication using an ultra bright red LED with a minimum intensity of 1200 mcd. The body of the button shall be traffic green in color. Polara BDLM2-G, Campbell Company 4evr120 round 4-bolt mount, or City approved equal.

Screws used to secure the sign plate to the housing shall be stainless steel #8-32 x 3/8 with tamper proof torx head, size T-15, or a City approved equal.

See Section 7-4 "Signal Faces and Signal Heads", of this Part 7 regarding bolts, nuts, etc.

7-6 LIGHTING AND APPURTENANCES

7-6.01 High-Pressure Sodium Luminaires. Luminaires shall conform to the provisions of Section 86-6.01, "High Pressure Sodium Luminaires", of the State Standard Specifications, other applicable parts of Section 86-6, and these Special Provisions.

Luminaires shall conform to the City of Riverside Standard Specifications 119 and UGS-801. All luminaires shall be of the "Power Door Type" with full cut-off light distribution.

Luminaires shall be provided with integral lag regulator type ballast and attached photoelectric control; both rated for 120V and 240V operations; volt usage shall be as shown on the plan(s).

The Contractor shall mark installation date on photo controls and lamps as provided for by manufacturers.

7-6.09 Internally Illuminated Street Name Signs. Internally illuminated street name signs shall conform to Section 86-6.09, "Internally Illuminated Street Name Signs", of the State Standard Specifications except that "Ballasts", "Lampholders", and "Lamps" sections shall not apply and instead an LED retrofit kit shall be provided. The internally illuminated street name signs shall be per the details shown on the plan(s), and these Special Provisions.

The LED retrofit kit shall have a Five-Year Warranty on parts and labor. It shall operate on a low voltage 24 V System, have all electronic components UL Certified, and have the LED modules water resistant. The LED retrofit kit may be obtained by contacting ILLumEcon at 909-223-3532 or at jim@jimmyer.com. The LED kits shall be specified for standard 6' or 8' IISNS frames and shall contain all parts necessary to be mounted on standard IISNS frames.

The LED retrofit kit shall be an ILLumEcon or City approved equal.

Signs shall be Type A.

3M Diamond Grade 3 (ASTM XI) Translucent Reflective Sheeting Series 4090T shall be used in the production of the internally illuminated street name sign panels, or a City approved equal. Refer to Sec. 7-1.04 of this PART 7 regarding "City approved equal".

Message. The message, as shown on the plans, shall be displayed on both sign panels. Letters shall be 8" upper case and 6" lower case.

Each sign shall have a photoelectric control cell. This photoelectric unit shall be contained in the sign housing and shall comply with the provisions of Section 86-6.11, "Photoelectric Controls", of the Standard Specifications.

A shop drawing of the "Message" for each sign shall be submitted for approval prior to fabrication and installation.

7-7 SALVAGING AND REINSTALLING ELECTRICAL EQUIPMENT

Salvaging and reinstalling or stockpiling electrical equipment shall conform to the provisions in Section 86-7, "Removing, Reinstalling or Salvaging Electrical Equipment", of the State Standard Specifications and these Special Provisions.

Salvaged electrical materials shall be hauled to and stockpiled at the City Yard, 8095A Lincoln Avenue.

Signal gear to be relocated shall be painted per Section 86-2.16, "Painting", of the State Standard Specifications.

7-8 PAYMENT

7-8.01 Payment. Payment for traffic signals and lighting shall conform to the provisions in Section 86-8.01, "Payment", of the State Standard Specifications and these Special Provisions.

The contract lump sum prices paid for traffic signals and lighting shall include payment for all necessary construction signing, traffic signs, painting of relocated signal gear, all Portland Concrete foundations, delivery of salvaged electrical equipment, including poles, pickup and delivery of equipment to the job site and sprinkler system(s) modification and repairs at the job site.

Payment for maintaining existing system including the Automated Red Light Enforcement System (ARLES) in operation, which may require placement of temporary poles, overhead conductors, service, detector loops and any other necessary signal and/or lighting components, including labor, shall be included in the lump sum bid for traffic signals and lighting. The extra work provisions of Section 86-1.05 shall not apply.

Full compensation for furnishing, installing, maintaining and removing temporary "Stop Ahead" and "Stop" signs, regardless of the number required, and for covering signs not in use shall be considered as included in the contract lump sum price paid for the signal item involved and no additional compensation will be allowed therefore.

Full compensation for hauling and stockpiling electrical materials shall be considered as included in the contract price paid for the item requiring the material to be salvaged, and no additional compensation will be allowed therefor.

Appendix L

Interpretive Panel Color Samples

1 TILE

Prior to 1769 - Pre-written History

"TIMES BOLD" FONT BOX WITH 1" LETTERING

(PMS 485C)

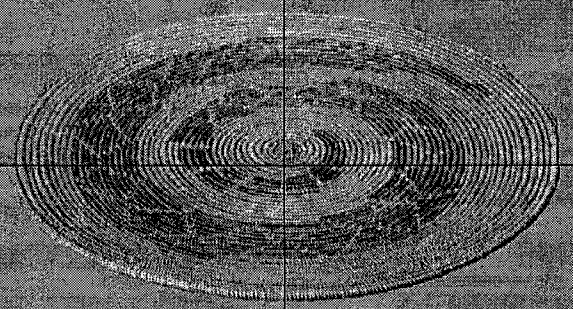
(DOT GRAY 6)

"TIMES" FONT BOX WITH 1/2" LETTERING

Early Native Americans

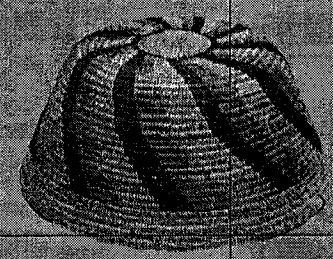
The Native Americans who lived in the vicinity of the Magnolia Bridge were hunters and gatherers. They relied on the Santa Ana River as a dependable water source and bathed frequently in the local hot springs.

7 1/2" X 9 1/2" IMAGE



1'-7 1/2" X 1'-11" COLOR IMAGE

1'-0" X 8 1/2" COLOR IMAGE



Excellent weavers, they made beautiful baskets and mats from local sumac. The decorative discs that adorn the bridge lights are based on their design of tray basket used to make offerings of goods during religious ceremonies. The diamond-shaped patterns connote fertility.

"TIMES" FONT BOX WITH 1/2" LETTERING

GENERAL NOTES:
1. ALL IMAGES SEPIA-TONED, UNLESS NOTED OTHERWISE.
2. FULL SIZE COLOR COPY OF INTERPRETIVE TILE PANEL PLANS IS AVAILABLE AT ARCHITECT'S OFFICE.
3. ALL IMAGES TO BE HAND-DRAWN BY A SOLE ARTISAN.
4. SHOP DRAWINGS, WHICH SHOW FINAL LAYOUT, TEXT, IMAGES, COLOR (WHERE OCCURS), DIMENSIONS, FONT TYPE & SIZE, ETC., SHALL BE SUBMITTED TO ARCHITECT FOR REVIEW AND APPROVAL.

REVISIONS				
MARK	DATE	DESCRIPTION	BY	APP'D

DESIGN BY: C. GULLEY		CHECKED BY: J. LOOMIS	
DETAILS BY: C. GULLEY		CHECKED BY: C. GULLEY	
QUANTITIES BY: J. LOOMIS		CHECKED BY: J. LOOMIS	
STATE BR. NO.		COUNTY BR. NO.	
ORIGINAL SCALE IN INCHES FOR REDUCED PLANS	0 1 2 3		

COUNTY OF RIVERSIDE
TRANSPORTATION
DEPARTMENT

LICENSED ARCHITECT JOHN C. LOOMIS No. C-8884 MAY 31, 2013 REN. STATE OF CALIFORNIA

thirtieth street architects, inc.
PROJECT ARCHITECT
DATE
2821 NEWPORT BLVD.
NEWPORT BEACH, CA 92663 PH: (949)673-2643

MAGNOLIA AVENUE/BNSF
GRADE SEPARATION

ARCHITECTURAL DETAILS

INTERPRETIVE TILE #1

WO B7-0784

COUNTY FILE No.

SHEET NO.	AD-4
SHEET	28 OF 40
PROJECT SHEET NO.	177
TOTAL SHEETS	263

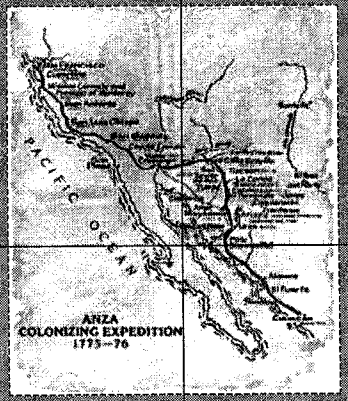
2

1776 - United States declares independence from England

TIMES BOLD FONT BOX WITH 11" LETTERING

(PMS 4059)

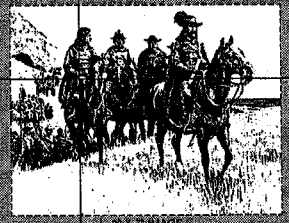
(COOL GRAY 9)



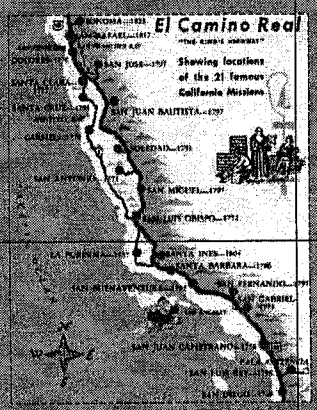
11" X 7" COLOR IMAGE

TIMES FONT BOX WITH 1/2" LETTERING

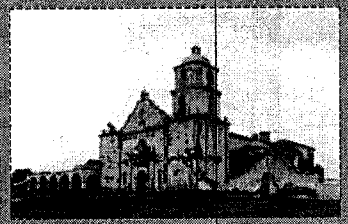
In 1769, the Portola expedition claimed "Alta California for Spain". Six years later, colonization began as Juan Bautista De Anza passed through Riverside en route to San Francisco from Mexico. Travel was by horseback and the journey took 5 1/2 months.



5" X 7" IMAGE



11" X 17" COLOR IMAGE



11" X 7" IMAGE

The Mission Period Lasted from 1769-1833 with the construction of a string of 21 missions from San Diego to Sonoma. The local Native Americans were converted to Christianity and became known as the Luiseno, named after Mission San Luis Rey, that was constructed in 1811. In 1822, Mexico declared independence from Spain and what is now California became part of Mexico.

TIMES FONT BOX WITH 1/2" LETTERING

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REVISIONS				
MARK	DATE	DESCRIPTION	BY	APP'D

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QUANTITIES BY:	J. LOOMIS	CHECKED BY:	J. LOOMIS
STATE BR. NO.		COUNTY BR. NO.	
ORIGINAL SCALE IN INCHES FOR REDUCED PLANS	0 1 2 3		

COUNTY OF RIVERSIDE
TRANSPORTATION
DEPARTMENT

LICENSED ARCHITECT JOHN C. LOOMIS No. C-8684 MAY 31, 2015 RENEWAL STATE OF CALIFORNIA

thirtieth street architects, inc.

PROJECT ARCHITECT — DATE

2821 NEWPORT BLVD.
NEWPORT BEACH, CA 92663 PH: (949)673-2643

MAGNOLIA AVENUE/BNSF
GRADE SEPARATION

ARCHITECTURAL DETAILS

INTERPRETIVE TILE #2

WO 87-0784

COUNTY FILE No.

SHEET NO.	
AD-5	
SHEET 29 OF 40	
PROJECT SHEET NO.	TOTAL SHEETS
178	263

3

1846 - California declares independence from Mexico and becomes the California Republic, also know as the Bear Flag Republic

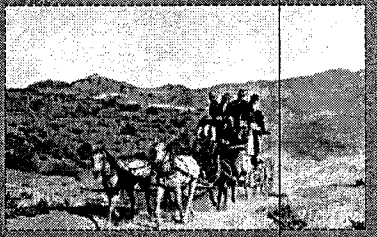
TIMES BOLD FONT BOX WITH 1" LETTERING

In 1848, the cry went out that "there's gold in them thar hills" after gold was discovered at Sutter's Mill. Two hundred and fifty thousand treasure seekers poured in to California on horseback or in wagons along the California Trail to get rich quick. They became known as the "forty-niners". Two years later, California became the 31st state in the United States of America.

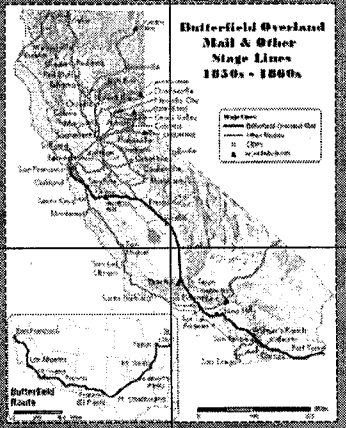
TIMES FONT BOX WITH 1/2" LETTERING

1'-0" X 7 1/2" IMAGE

8" X 7 1/2" IMAGE



1'-0" X 7 1/2" IMAGE



11" X 17" COLOR IMAGE

By 1858, the Butterfield Overland Stage Company began transporting mail and travelers from St. Louis, Missouri all the way to San Francisco, CA. Although the stage coaches ran at full gallop 24 hours a day, the journey took about 25 days. The route passed through what is now the Temecula area.

TIMES FONT BOX WITH 1/2" LETTERING

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QUANTITIES BY:	J. LOOMIS	CHECKED BY:	J. LOOMIS
STATE RR. NO.		COUNTY RR. NO.	
ORIGINAL SCALE IN INCHES FOR REDUCED PLANS	0 1 2 3		

COUNTY OF RIVERSIDE
TRANSPORTATION
DEPARTMENT

LICENSED ARCHITECT JOHN C. LOOMIS No. C-8684 MAY 31, 2013 REN. STATE OF CALIFORNIA

thirtieth street architects, inc.

PROJECT ARCHITECT — DATE 05/13/13

2821 NEWPORT BLVD.
NEWPORT BEACH, CA 92663 PH: (949)673-2643

MAGNOLIA AVENUE/BNSF
GRADE SEPARATION

ARCHITECTURAL DETAILS

INTERPRETIVE TILE #3

WO B7-0784

COUNTY FILE No.

SHEET NO. AD-6

SHEET 30 OF 40

PROJECT SHEET NO.	TOTAL SHEETS
179	263

4

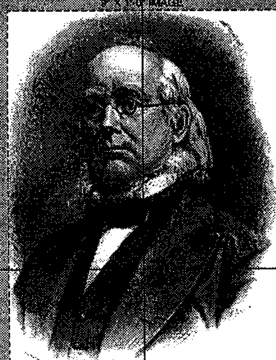
1861 to 1865 - The Civil War

"TIMES BOLD" FONT BOX WITH 1" LETTERING

(PMS 4655)

(COOL GRAY 9)

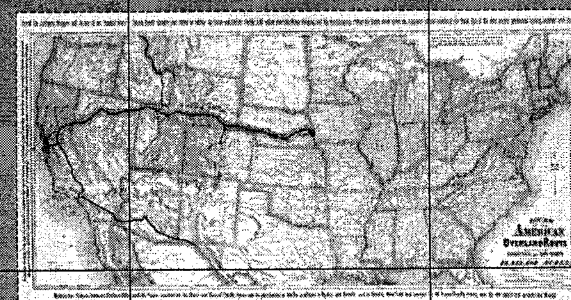
9" X 1'-0" IMAGE



"TIMES" FONT BOX WITH 1/2" LETTERING

In 1845, John O'Sullivan coined the term "Manifest Destiny". It was a belief held by most Americans that it was the right of the United States to expand westward, all the way to the Pacific Ocean. After the Civil War, author Horace Greeley reinforced this belief when he wrote his famous line "Go West young man". The notion was that if you traveled west and worked hard, you could find success.

1'-3" X 10 1/2" IMAGE



1'-7" X 10"
COLOR IMAGE

In 1869, the first Transcontinental Railroad was completed from Omaha, Nebraska to Sacramento, California. By 1881, the Southern Pacific completed a southern route to Los Angeles that passed through Riverside, generally following the route of the I-10 freeway today.

"TIMES" FONT BOX WITH 1/2" LETTERING

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QUANTITIES BY:	J. LOOMIS	CHECKED BY:	J. LOOMIS
STATE BR. NO.		COUNTY BR. NO.	
ORIGINAL SCALE IN INCHES FOR REDUCED PLANS	0 1 2		

COUNTY OF RIVERSIDE
TRANSPORTATION DEPARTMENT

LICENSED ARCHITECT, JOHN C. LOOMIS, No. C-6884, MAY 31, 2015, REN., STATE OF CALIFORNIA

thirtieth street architects, inc.

PROJECT ARCHITECT — DATE 05/13/13

2821 NEWPORT BLVD.
NEWPORT BEACH, CA 92663 PH: (949)673-2643

MAGNOLIA AVENUE/BNSF GRADE SEPARATION
ARCHITECTURAL DETAILS
INTERPRETIVE TILE #4

SHEET NO. AD-7
SHEET 31 OF 40
PROJECT SHEET NO. 180 — TOTAL SHEETS 263

WO B7-0784
COUNTY FILE No.

5

1873 - The Citrus Industry is born

TIMES BOLD FONT BOX WITH 1" LETTERING

(PMS 485S)

(COOL GRAY 9)

In 1873, Elizabeth Tibbets convinced William Saunders, Superintendent of the Bureau of Agriculture, to test grow new seedless oranges from Bahia, Brazil. They flourished and became know as Washington Navel Oranges. This started California's second gold rush and, by 1893, The Riverside area was the largest orange growing area in the United States.

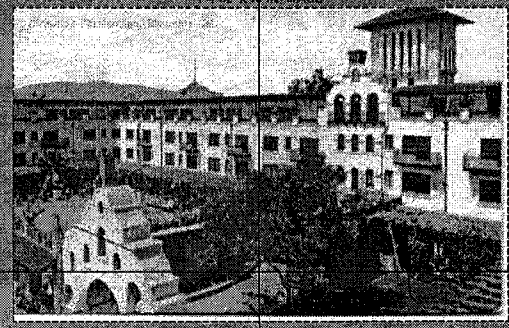
TIMES FONT BOX WITH 1/2" LETTERING

~5" X 8 1/2" COLOR IMAGE

The citrus labels that adorn the base of the light poles on the east end of the bridge are replications of original orange crate labels from Riverside orange growers.

TIMES FONT BOX WITH 1/2" LETTERING

3'-4 1/8" X 4 1/2" IMAGE



With the arrival of the Southern Pacific Railroad and the growth of the citrus industry, many land speculators were lured to Riverside and the City was marketed nationwide as a tourist destination. To accommodate these visitors, Frank Miller decided to construct a resort hotel in 1902. Since there were no California missions in the area, he asked his architect, Arthur Benton, to design his hotel called the Mission Inn in the "mission style".

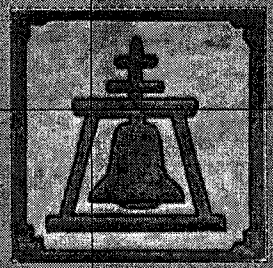
TIMES FONT BOX WITH 1/2" LETTERING

In 1908, Miller and Benton also designed and patented the Rainbow symbol. The lower portion of symbol features an image of the bell from Mission San Gabriel. The upper double cross elements is a Native American symbol that represents a rain god or dragonfly.

TIMES FONT BOX WITH 1/2" LETTERING

Riverside grew rapidly and was incorporated in 1883. The streetlights, fabricated stone and steel railing elements used on this bridge are reminiscent of similar designs used in downtown Riverside during the late 19th and early 20th centuries.

TIMES FONT BOX WITH 1/2" LETTERING



8 1/8" X 6 1/2" IMAGE

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QUANTITIES BY:	J. LOOMIS	CHECKED BY:	J. LOOMIS
STATE BR. NO.		COUNTY BR. NO.	

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

COUNTY OF RIVERSIDE
TRANSPORTATION
DEPARTMENT

LICENSED ARCHITECT JOHN C. LOOMIS No. C-8684 MAY 31, 2013 REN. STATE OF CALIFORNIA

thirtieth street architects, inc.

PROJECT ARCHITECT — DATE 8/1/2013

2621 NEWPORT BLVD.
NEWPORT BEACH, CA 92663 PH: (949)673-2643

MAGNOLIA AVENUE/BNSF
GRADE SEPARATION

ARCHITECTURAL DETAILS

INTERPRETIVE TILE #5

WO 87-0784

COUNTY FILE No.

SHEET NO.	
	AD-8
SHEET	32 OF 40
PROJECT SHEET NO.	TOTAL SHEETS
181	263

6

1912 - On it's maiden voyage, the Titanic strikes an iceberg in the North Atlantic Ocean and sinks

"TIMES" BOLD FONT BOX WITH 1" LETTERING (PMS 4606)

"COOL GRAY 9"

"TIMES" FONT BOX WITH 1/2" LETTERING

Corona's early industry includes the Temescal Tin Mine that actively produced tin until 1895. In 1886, the Pacific Clay Company began mining clay used in the manufacturing of clay roof tiles. They are still made there today. It is likely that if you live in southern California in a house with a clay tile roof, the roof tiles were made in Corona.

2"X 5" IMAGE

2"X 5" IMAGE

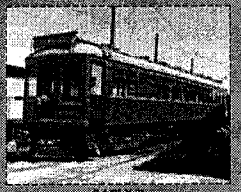
Originally called South Riverside, the city voted in 1886 to incorporate and change its name to Corona, meaning "crown". The City was named after Grand Avenue, and circular street 3 miles in diameter, that was built by R.B. Taylor for the residents to parade around in their fancy carriages.

"TIMES" FONT BOX WITH 1/2" LETTERING

"TIMES" FONT BOX WITH 1/2" LETTERING

Early land speculators bought up land to develop citrus groves, but found that lemons were more suited to the area than oranges. By 1912, Corona was billed as "The Lemon Capitol of the World". Later, the first lemon processing plant in the Nation was built in Corona. The citrus labels on the west end of the bridge are replications of citrus labels from Corona's lemon growers.

7'-8" X 11"
COLOR IMAGE



7"X 11"
COLOR IMAGE

From 1915 to 1931, Riverside and Corona were linked by the Pacific Electric Red Car Line. The tracks were located along the center of Magnolia Avenue and the 6.6 mile trip took 22 minutes.

8 1/2" X 5" IMAGE

Auto races were held on Grand Avenue in 1913, 1914 and 1916 that each attracted more than 100,000 people to Corona. A world speed record was set by Earl Cooper in 1913. After the 1916 race, future races were cancelled due to the high cost of promotion.

"TIMES" FONT BOX WITH 1/2" LETTERING

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ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

COUNTY OF RIVERSIDE
TRANSPORTATION
DEPARTMENT

LICENSED ARCHITECT JOHN C. LOOMIS No. C-8684 MAY 31, 2013 REN. STATE OF CALIFORNIA

thirtieth street architects, inc.

PROJECT ARCHITECT — DATE 05/13/13

2821 NEWPORT BLVD.
NEWPORT BEACH, CA 92663 PH: (949)673-2643

MAGNOLIA AVENUE/BNSF
GRADE SEPARATION

ARCHITECTURAL DETAILS

INTERPRETIVE TILE #6

SHEET NO. AD-9

SHEET 33 OF 40

PROJECT SHEET NO. 182 | TOTAL SHEETS 263

WO 87-0784 | COUNTY FILE No.

7

1929 to 1936 - The Great Depression

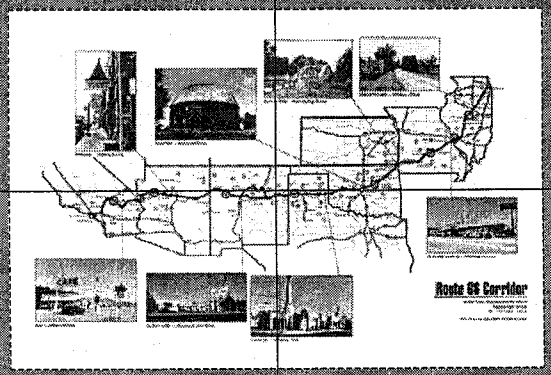
"TIMES BOLD" FONT BOX WITH 1" LETTERING

(PMS 4656)

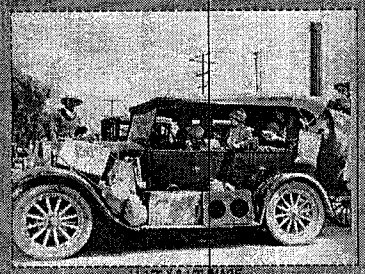
(WOOD GRAIN)

"TIMES" FONT BOX WITH 1½" LETTERING

In 1938, Route 66 was completed linking Chicago, Illinois to Santa Monica, California with a continuous, 2,400-mile, two-lane highway. It took 14 days or more to complete the trip. John Steinbeck, in his book *Grapes of Wrath*, called Route 66 "the Mother Road".



4' X 1'-0"
COLOR IMAGE



11 1/2" X 6 1/2" IMAGE

Due to the hard times and the dust bowl years, many families abandoned their farms, packed up their trucks with all their belongings and headed west to seek their fortunes. Although they were down to their last few dollars, they proclaimed their spirit and gumption by attaching home made signs to the back of their vehicles that read, "California or bust!" Portions of the original Route 66 still exist along Foothill Blvd. in Fontana, CA.

"TIMES" FONT BOX WITH 1½" LETTERING

3'-9" X 11'-9" IMAGE

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STATE BR. NO.		COUNTY BR. NO.	

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0

COUNTY OF RIVERSIDE
TRANSPORTATION
DEPARTMENT

LICENSED ARCHITECT JOHN C. LOOMIS No. C-6684 MAY 31, 2013 REN. STATE OF CALIFORNIA

thirtieth street architects, inc.

PROJECT ARCHITECT — DATE 05/13/13

2821 NEWPORT BLVD.
NEWPORT BEACH, CA 92663 PH: (949)673-2643

MAGNOLIA AVENUE/BNSF
GRADE SEPARATION

ARCHITECTURAL DETAILS

INTERPRETIVE TILE #7

WO B7-0784

COUNTY FILE No.

SHEET NO. AD-10

SHEET 34 OF 40

PROJECT SHEET NO.	TOTAL SHEETS
183	263

Appendix L

8

Early 1950's - First Television and Television Stars

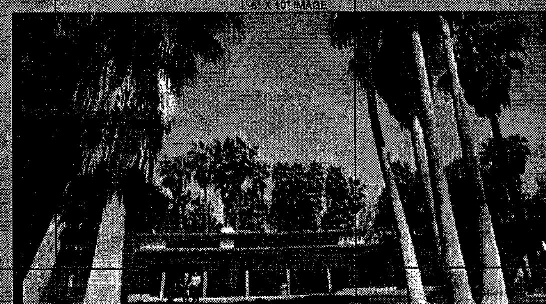
"TIMES BOLD" FONT BOX WITH 1" LETTERING

"TIMES" FONT BOX WITH 1/2" LETTERING

In 1951, Lucille Ball and Desi Arnaz starred in the popular TV show called I Love Lucy.

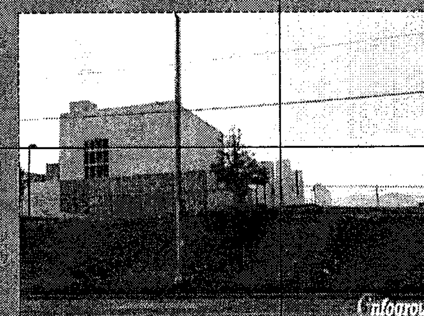
"TIMES" FONT BOX WITH 1/2" LETTERING

In 1983, a portion of the ranch was sold for the construction of the Golden California Cheese Factory, that was, at that time, the largest cheese factory in the world. Both Desi's house and the cheese factory still exist near the intersection of Lincoln Ave. and Rincon, about 6 miles west of this bridge.



Desi, who was originally from Cuba, decided to build a house and thoroughbred horse ranch in Corona. He designed the house himself in the Spanish Colonial Style and was probably heavily influenced by the home of his friend, silent film star Francis Lederer. After Desi's divorce from Lucy and his retirement, Desi lived at the ranch for the rest of his life. The house is now in private ownership.

"TIMES" FONT BOX WITH 1/2" LETTERING



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ORIGINAL SCALE IN INCHES FOR REDUCED PLANS

COUNTY OF RIVERSIDE
TRANSPORTATION DEPARTMENT

LICENSED ARCHITECT JOHN C. LOOMIS No. C-8684 STATE OF CALIFORNIA

thirtieth street architects, inc.

PROJECT ARCHITECT — DATE

2821 NEWPORT BLVD.
NEWPORT BEACH, CA 92663 PH: (949)673-2643

MAGNOLIA AVENUE/BNSF GRADE SEPARATION
ARCHITECTURAL DETAILS
INTERPRETIVE TILE #8

SHEET NO. AD-11
SHEET 35 of 40
PROJECT SHEET NO. 184 — TOTAL SHEETS 263

WO B7-0784

COUNTY FILE No.

9

1956 - Federal Aid Highway Act

"TIMES BOLD" FONT BOX WITH 1" LETTERING

(PMS 4685)

(COOL GRAY 9)

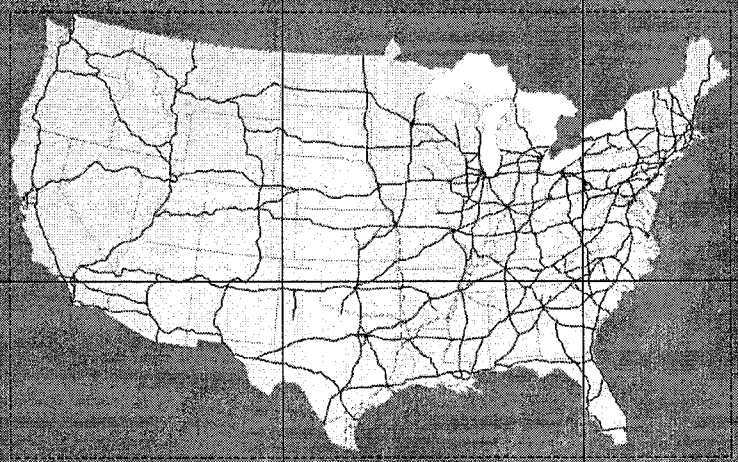
"TIMES" FONT BOX WITH 1/2" LETTERING

During the late 1950's, President Eisenhower decided to construct a nation wide system of super highways.

3 1/2" X 4 1/2" IMAGE

A system would eventually permit travel from coast to coast without a single traffic signal in about 5 or 6 days. Originally conceived for strategic military purposes, this roadway system along with TV shows like *Route 66* during the early 1960's fostered interstate travel by American families and an increase in tourism at National Parks. The 91 Freeway was constructed as part of that Interstate system in 1962.

"TIMES" FONT BOX WITH 1/2" LETTERING



2'-0" X 1'-3" COLOR IMAGE

GENERAL NOTES:

1. ALL IMAGES SEPIA-TONED, UNLESS NOTED OTHERWISE.
2. FULL SIZE COLOR COPY OF INTERPRETIVE TILE PANEL PLANS IS AVAILABLE AT ARCHITECT'S OFFICE.
3. ALL IMAGES TO BE HAND-DRAWN BY A SOLE ARTISAN.
4. SHOP DRAWINGS, WHICH SHOW FINAL LAYOUT, TEXT, IMAGES, COLOR (WHERE OCCURS), DIMENSIONS, FONT TYPE & SIZE, ETC., SHALL BE SUBMITTED TO ARCHITECT FOR REVIEW AND APPROVAL.

REVISIONS				
MARK	DATE	DESCRIPTION	BY	APP'D

THE COUNTY OF RIVERSIDE OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF ELECTRONIC COPIES OF THIS PLAN SHEET.

DESIGN BY:	C. GULLEY	CHECKED BY:	J. LOOMIS
DETAILS BY:	C. GULLEY	CHECKED BY:	C. GULLEY
QUANTITIES BY:	J. LOOMIS	CHECKED BY:	J. LOOMIS
STATE BR. NO.		COUNTY BR. NO.	
ORIGINAL SCALE IN INCHES FOR REDUCED PLANS	0 1 2 3		

COUNTY OF RIVERSIDE
TRANSPORTATION
DEPARTMENT

LICENSED ARCHITECT JOHN C. LOOMIS No. C-8684 MAY 31, 2013 REN. STATE OF CALIFORNIA

thirtieth street architects, inc.

PROJECT ARCHITECT — DATE 05/13/13

2821 NEWPORT BLVD.
NEWPORT BEACH, CA 92663 PH: (949)673-2643

MAGNOLIA AVENUE/BNSF
GRADE SEPARATION

ARCHITECTURAL DETAILS

INTERPRETIVE TILE #9

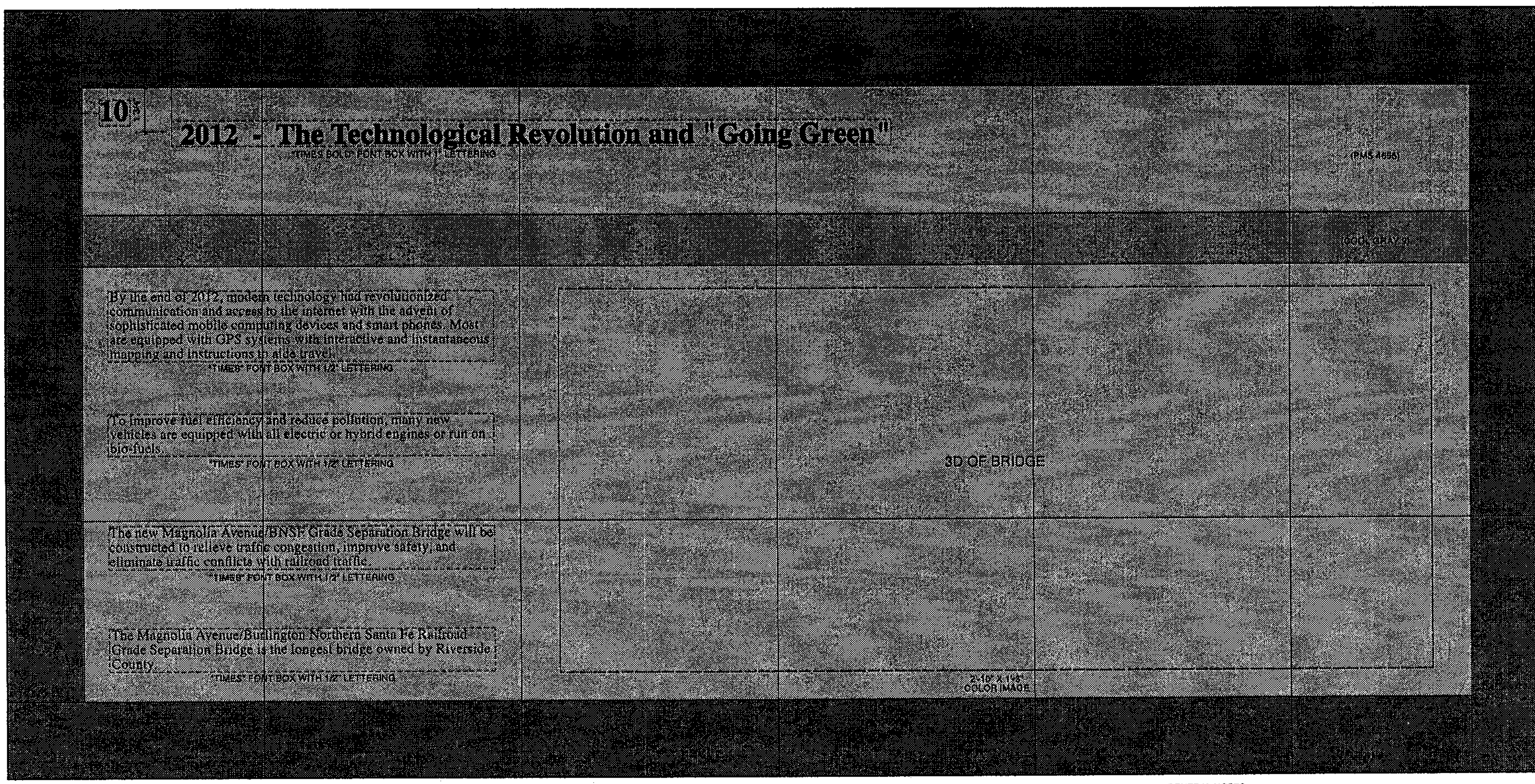
SHEET NO. AD-12

SHEET 36 OF 40

PROJECT SHEET NO. 185 | TOTAL SHEETS 263

WO 87-0784

COUNTY FILE No.



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STATE BR. NO.		COUNTY BR. NO.	

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

COUNTY OF RIVERSIDE TRANSPORTATION DEPARTMENT

LICENSED ARCHITECT JOHN C. LOOMIS No. C-8884 MAY 31, 2013 REN. STATE OF CALIFORNIA

thirtieth street architects, inc.

PROJECT ARCHITECT DATE

2821 NEWPORT BLVD. NEWPORT BEACH, CA 92663 PH: (949)673-2643

MAGNOLIA AVENUE/BNSF GRADE SEPARATION

ARCHITECTURAL DETAILS

INTERPRETIVE TILE #10

SHEET NO. AD-13

SHEET 37 OF 40

PROJECT SHEET NO.	TOTAL SHEETS
186	263

WO B7-0784

COUNTY FILE No.

Appendix M

City of Riverside
Public Utility Department
Water Engineering Division

Water Pipeline Specifications

CITY OF RIVERSIDE

PUBLIC UTILITIES DEPARTMENT

WATER ENGINEERING DIVISION

TECHNICAL SPECIFICATION NO. 882
RIVERSIDE COUNTY PROJECT NO. B7-0784

(THIS TECHNICAL SPECIFICATION IS INTENDED TO ADDRESS THE **MATERIALS AND INSTALLATION** FOR THE WATER PIPELINE AND RELATED APPURTENANCES **ONLY**)

SPECIAL PROVISIONS

STANDARD DRAWINGS

AND

PROPOSAL FORMS

TO ACCOMPANY PLANS

D5-1323318

FOR

FURNISHING AND INSTALLING

MAGNOLIA AVENUE GRADE SEPARATION PROJECT (COUNTY)

Prepared and Issued by:

City of Riverside
Public Utilities Department
Water Division
6230003830-470734XX-1323318

AUGUST 2013

K. D. M

SIGNATURE

8/13/13

DATE

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SPECIAL PROVISIONS

PART 1
GENERAL PROVISIONS

SPECIAL PROVISIONS

Introduction: The format of these SPECIAL PROVISIONS follows that of the 2012 Edition of the "STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION" which is, by reference included within the Contract Documents of this project. (See Section 2-5.1.1 herein.) These SPECIAL PROVISIONS supplement, modify and take precedence over the STANDARD SPECIFICATIONS. The Standard Specifications are hereby amended and supplemented as follows:

SECTION 2 - SCOPE AND CONTROL OF THE WORK

2-1 AWARD AND EXECUTION OF CONTRACT.

2-1.1 Scope of The Project. The work to be done, in general, shall include furnishing all labor, materials, tools, equipment, and incidentals, unless otherwise specified, to construct the waterline complete in place in accordance with the Plans and Specifications. The project involves the construction of a potable waterline and appurtenances consisting of approximately, 440 linear feet of 20-inch Ductile Iron Pipe, and 310 linear feet of 12-inch Ductile Iron Pipe, and 50 linear feet of 24-inch split-weld steel casing pipe, as awarded by the City under Bid Schedule "A".

2-1.1.1 Job Location. The project is located within the Right-of-Way of Magnolia Avenue within the City of Riverside as shown on Drawing D5-1323318.

2-1.7.1 Contractor's License. The work requires an A or C-34 license. Bidders must be properly licensed to perform the work of the project at the time they submit a bid proposal in accordance with the provisions of Chapter 9 of Division 3 of the Business and Professions Code and the Rules and Procedures of the California State Contractor's License Board and in good standing with the Board. Proof of such license shall be provided as required by Business and Professions Code Section 7031.5. Failure to be so licensed shall result in rejection of the proposal as non-responsive.

2-3.3 Subcontractor Qualifications. The Subcontractors, if any, shall have a minimum of five years of continuous experience in the construction of potable water transmission mains. The duration of the experience shall be counted in reverse chronological order, beginning from the date bids are opened for this project. Qualifying experience shall be under current contractor's license and company name.

2-5.3 Shop Drawings and Submittals.

2-5.3.2 Shop Drawings. The City approved "Shop Drawings," showing fabrication, assembly, or other required details as specified by the "Materials Contractor" are hereby

made a part of these Special Provisions by reference.

Submittals need not be reproducible. A minimum of two copies shall be submitted for approval. "Shop Drawings" will be required for the following:

a. Pipe Fabrication Details and Layout Sheets.
   (1) Mortar Lined and Coated Steel Pipe.
   (2) Ductile Iron Pipe.
b. Fittings, valves and all appurtenances.
c. Trench Shoring Details.
d. Asphalt Concrete Pavement.
e. Crushed Aggregate Base.
f. Concrete Vaults and Covers.
g. Paint Schedule.

2-5.3.3 Submittals. See Section 313 for "As Built" Drawings submittals.

2-5.4 Plans. By reference the Plans and Standard Drawings listed below are incorporated herein as part of these Contract Documents.

MAGNOLIA AVENUE GRADE SEPARATION PROJECT (COUNTY)	
TITLE	SHEET NUMBER
Title Sheet, Index, Benchmark, Basis of Bearing, Legend, Location & Vicinity Map	D5-1323318-1
Notes and Abbreviations	D5-1323318-2
Pipeline Plan and Profile	D5-1323318-3
Construction Details	D5-1323318-4

2-5.6 Publications. All manufacturers publications shall be the latest edition unless otherwise shown on the construction drawings, standard drawings, or these specifications.

2-5.7 Material List and Drawing. The Contractor shall submit to the Engineer, for the Engineer's approval, an original list of materials which the Contractor proposes to install. The Contractor shall be responsible for any material purchased, labor performed, or delay to the work prior to such approval. The list shall be complete as to the name of the manufacturer, size and catalog number of unit; and shall be supplemented by such other data as may be required, including detailed scale drawings, and any non-standard special

material, and shall show any proposed deviation from the Plans. The Contractor shall submit for approval when requested, sample articles of any materials proposed for use. All such data shall be submitted in duplicate for checking. After checking, correction and approval, not less than three complete sets shall be submitted to the Engineer.

The Contractor shall also furnish all literature and drawings which are received with the maintenance of that equipment.

2-6.1 Labor and Materials Provided by Others. Labor and materials for connecting to existing waterlines will be provided by City forces, unless otherwise shown.

2-7 SUBSURFACE DATA. The Contractor assumes all responsibility for the foreknowledge of the extent and nature of the soil properties in the construction zone before and during construction. It is the Bidder's responsibility to examine the site and perform any and all testing and evaluations necessary from which to draw conclusions regarding:

1. The ease or difficulty of excavation.

2. The presence, nature and extent of any rock.

3. The depth of groundwater.

4. The stability of excavations.

5. The suitability and quantity of excavation materials for the pipe bedding and backfill or sources for importing bedding and backfill materials.

2-9 SURVEYING.

2-9.4 Line and Grade. With regard to vertical alignment, pipelines shall be constructed so that actual flow line elevations, measured at pipe joints, are within 0.1 foot of design flow line elevations. Pipelines, when installed, shall have continuous slope upgrade or downgrade, corresponding with design slope, without any high spots.

With regard to horizontal alignment, waterline shall be constructed so that actual waterline centerlines, measured at pipe joints, are within 0.1 foot of design centerlines.

2-9.4.1 Grade Sheets. All grade sheets will be issued by the Engineer at the Engineer's office at 3750 University Avenue, 3rd floor, Riverside, California. No grade sheet will be issued until the Contractor has obtained and paid for all necessary permits. See Subsection 7-5.

2-11 INSPECTION.

2-11.2 Pipe Interior Inspection. Inspection of the interior of the 20-inch pipeline shall be done by remote video camera after installation of 500 linear feet or less. The video camera and equipment shall be clean and shall be inspected by the City before it is used to inspect the water main. In addition, the camera shall be equipped with the necessary components to inspect and video 360 degrees of the pipe joints and all pipe connections. The contractor is responsible to clean the pipe thoroughly before the video inspection begins.

The Contractor shall give the Engineer a two (2) business day notice that video inspection will occur. Contractor shall provide a complete video inspection of all welded joints. Once the Engineer and Inspector are satisfied with the quality of welds and no corrections are needed then the Contractor can proceed to grout all joints. Contractor shall then video inspect the grouted joints. Once the Engineer and Inspector are satisfied with the quality of the grouted joints and no corrections are needed, then the Contractor can continue with construction. No additional compensation to the Contractor shall be provided for the video inspection process.

For pipe joint identification purposes, the video shall display pipe information, but it shall not be limited to, pipe station and type of issue. All issues with the lining and pipe shall be recorded. Contractor shall provide video inspection of each run on DVD to the Engineer. Contractor shall deliver to the City original copies of all the video records and data logs.

The Contractor is responsible to re-video, at no additional cost to the City, the water main at locations where deficiencies were identified and repairs were needed to comply with these specifications.

The interior of the pipe is considered a permitted confined space. In order for a person to enter or occupy the interior of the pipe, a confined space permit shall be obtained from OSHA.

SECTION 9 - MEASUREMENT AND PAYMENT

9-1.1 GENERAL. Delete the second sentence of the first paragraph of the Standard Specifications.

9-3 PAYMENT.

9-3.1.1 Payment. Payment for the Various items of the Bid Sheets, as further specified herein shall include all compensation to be received by the Contractor for

furnishing all tools, equipment, supplies, and manufactured articles, and for all labor, operations, and incidentals appurtenant to the items of work being described, as necessary to complete the various items of work specified and shown on the drawings, including all appurtenances thereto, and including all costs of compliance with the regulations of public agencies having jurisdiction, including Safety and Health requirements of the California Division of Industrial Safety and the Occupational Safety and Health Administration of the U.S. Department of Labor (OSHA). No separate payment will be made for any item that is not specifically set forth in the Bid Sheet(s), and all costs therefore shall be included in the price named in the Bid Sheet(s) for the various listed items of work. The City of Riverside payment process is through an electronic transfer process. Contractors or Suppliers must be set up for this payment process in order to be compensated for materials and or services.

9-3.1.2 Basis of Payment for Water Distribution/Transmission Mains.

(1) Pipelines

Payment for pipelines shall be based upon the amounts bid and the net horizontal constructed lengths, as determined by the survey data upon which the Construction Drawings are based. Said net horizontal constructed length shall extend through such appurtenances as valves, tees, crosses, reducers, horizontal bends, and flanges.

The amounts bid by Contractor for furnishing pipe and fittings shall include all costs for all materials, equipment, and labor unless separate bid items are included in the bid sheets. Said amounts shall include, but not be limited to, pipe materials (including fittings), delivery, unloading and stringing.

The amounts bid by Contractor for installing pipe and fittings shall include all costs for all materials, equipment, and labor, unless separate bid items are included in the bid sheets. Said amounts shall include, but not be limited to, public notification signs, utility location and verification (excavating, exposing, and verifying top, bottom, and side of utility facilities), removal of macadam, relocation of existing utilities as required for construction, all asphalt and concrete pavement removal and disposal and replacement, trenching, excavating and exporting unsuitable material, Steel plating, bedding (including imported selected material), furnishing and installing all pipe, vertical and horizontal bends, appurtenances including polyethylene encasement, thrust blocks, joint restraints, pipe supports, backfilling (including imported select material or select native material), hauling excess excavated material off-site and disposing of same, compacting, furnishing and installing temporary asphalt concrete pavement, testing, disinfecting, protecting in place or removing and replacing all existing utilities, and public and private improvements (including berms, curbs, gutters, sidewalks, cross-gutters, spandrels, medians, driveways, landscaping, landscaping materials, irrigation systems, fencing, walls, mail boxes, power poles, poles, signs, guard rails, traffic signal loops, detectors, conduits, and conductors),

removing and disposing of existing waterlines where specified, removing and disposing of all temporary asphalt pavement, abandonment of existing facilities, pavement (traffic) striping and restriping, and restoring all areas and improvements to pre-existing improvements, trench dewatering and rock excavation all in accordance with the Contract Documents.

(2) Pipeline Appurtenances

Payment for pipeline appurtenances shall be based upon the amount bid and the appurtenances constructed. The amounts bid by Contractor shall include all costs for all materials, equipment, and labor unless separate bid items are included in the bid sheets. Said amounts shall include, but not be limited to, furnishing and installing appurtenances; vertical and horizontal bends, all asphalt and concrete pavement removal and disposal, trenching, excavating and exporting unsuitable material, trench shoring, Steel plating, backfilling (including imported select material or select native material), hauling excess excavated material off-site and disposing of same, compacting, furnishing and installing temporary asphalt concrete pavement, protecting in place or removing and replacing all utilities and public and private improvements; removing and disposing of or constructing around abandoned facilities; and asphalt concrete pavement and concrete removal and replacement; all in accordance with the Contract Documents.

(3) Connection Material to be Furnished and Installed by Contractor

Payment for connections shall be based upon the amount bid and the connection constructed. The amounts bid by Contractor shall include all costs for all materials, equipment, and labor unless separate bid items are included in the bid sheets. Said amounts shall include, but not be limited to, furnishing, delivering, and unloading materials and construction for connection work; all asphalt and concrete pavement removal and disposal, trenching, excavating and exporting unsuitable material, trench shoring, steel plating, K-Rails, backfilling (including imported select material or select native material), hauling excess excavated material off-site and disposing of same, compacting, furnishing and installing base material and temporary asphalt concrete pavement, steel plating, protecting in place or removing and replacing all utilities and public and private improvements, removing and disposing of or constructing around abandoned facilities, and asphalt concrete pavement and concrete removal and replacement, provide traffic control, all in accordance with the Contract Documents.

9-3.1.3 Bid Items. The prices bid shall include any amount for applicable California sales or use tax, County or City taxes.

Quantities of work set forth in the bidding sheets shall represent all of the work to be performed in accordance with the Contract unless errors are found in the basic surveying as represented by the Construction Drawings, in the Construction Drawings

themselves, or in the quantities set forth in the bidding sheets. All changes in work shall be covered by change order and amounts for said changes in work, either additions or deletions, shall be based on the amounts bid for the quantities of work specified.

Contractor shall verify, to Contractor's own satisfaction, the quantities of work shown on the bidding sheets. If Contractor finds the quantities to be in error, Contractor shall immediately notify the Engineer so that if changes in quantities are found necessary, an addendum may be issued to all bidders.

Reference is made to Section 7-9 "Protection and Restoration of Existing Improvements" of the Standard Specifications.

9-3.2.1 Partial and Final Payments. The 5 percent retention in Section 9-3.2 will not be reduced during the Contract. The Contractor shall submit for approval a request for payment by Bid Item.

The following percentages of unit price items will be paid for work completed:

(1) Trench shoring and bracing:

(a) Will be based on the percentage of pipe installed.

(2) Pipe Furnished:

(a) Pipe and fittings delivered to jobsite and material invoice shall be furnished by Contractor.....100%

(3) Pipe Installed:

(a) Pipe and Fittings installed in excavated trench with bedding, and back-filled materials 55%

(b) Trench back-fill material passing compaction test.....25%

(c) Bearing, Thrust and Anchor blocks poured 10%

(d) Completed pressure test and disinfected.....10%

(4) Appurtenances:

(a) Installed.....90%

(b) Completed pressure test and disinfected 10%

(5) Connection Materials and Appurtenances Furnished and installed by Contractor:

(a) Materials delivered to jobsite 80%

(b) Materials installed 20%

PART 2
CONSTRUCTION MATERIALS

All as provided in Part 2 of the Standard Specifications, except as otherwise provided below.

SECTION 200 – ROCK MATERIALS

200-2 UNTREATED BASE MATERIALS.

200-2.1 General. Crushed slag base is deleted as an option to crushed aggregate base.

SECTION 201 - CONCRETE, MORTAR, AND RELATED MATERIALS

201-1 PORTLAND CEMENT CONCRETE.

201-1.1.2 Concrete Used. Concrete used for this project shall be in accordance with the Standards Specifications. Concrete for thrust blocks shall be Class 450-C-2000, Type II Cement. Concrete for curb, gutter, sidewalk, and driveway replacement shall be Class 520-C-2500, Type II Cement.

201-1.1.3 Concrete Specified by Compressive Strength. Mix designs with more than 45% of fine and coarse aggregate shall not be permitted.

201-1.2.1.1 Materials. Prepackaged cement-aggregate mix shall not be allowed.

201-1.4.4 Hand Mixing. Hand mixed concrete shall not be allowed.

201-5 CEMENT MORTAR.

201-5.1 General. Hand-mixed mortar shall not be allowed. Cement mortar shall be used within 45 minutes after mixing with water.

SECTION 203 - BITUMINOUS MATERIALS

203-5 EMULSION AGGREGATE SLURRY.

203-5.2 Material: . Additive used with the Emulsion Aggregate Slurry to decrease curing

time shall be Aluminum Sulfate.

203-5.3 Composition and Grading: The grading of the combined aggregate and the percentage of emulsified asphalt shall conform to the requirements for Type II Slurry.

203-6 ASPHALT CONCRETE. Where dense graded asphalt is being constructed in two layers or more, the Asphalt Concrete pavement for the base course shall be B-PG-64-10. When dense graded asphalt is being constructed in a single layer and for a finishing course or Asphalt Concrete overlay, the Asphalt Concrete pavement shall be C2-PG-64-10.

The asphalt pavement used for the construction of speed humps shall be D2-PG-64-10.

203-6.1 Asphalt Types for Various Uses. The materials listed below shall be used.

Blast furnace or steel slag is not acceptable as an aggregate in asphalt concrete.

TYPE	USE
B-PG-64-10	Base course for streets
B-PG-64-10	Base course for trench resurfacing
C2-PG-64-10	Surface course for streets and trenches
D2-PG-70-10	Type 1 asphalt concrete berm
D2-PG-64-10	Overlay less than 1-inch thick

203-6.6 Mixing. Automatic batch mixing is required.

SECTION 207 - PIPE

The following Sections shall be used in the construction of the water main and appurtenances.

All affidavits of compliance and certifications referenced herein shall be addressed to the City of Riverside, identifying the item supplied, and specifying the project or plan number for which the material is being supplied.

Written Certification from the pipe manufacturer indicating that all supplied pipe materials have been manufactured, sampled, and tested according to these Specifications, must be submitted by the Contractor and approved by the Engineer prior to construction.

The manufacturer shall also supply copies of the certified physical test results, identifiable to the class and size of pipe, shift period, the date of test, and the purchase order number.

Pipe furnished for this Contract shall be in accordance with the Standard Specifications unless otherwise specified herein.

The pipe manufacturer shall submit shop drawings covering all pipe manufacturing specifications and fabrication details, along with a layout sheet showing the physical placement of each piece of pipe for City approval before starting the manufacturing of pipe. The layout sheet shall include the invert elevation at the end of section of pipe (only required when the construction drawings include a pipeline profile).

The pipe manufacturer shall provide pipe specials and fitting drawings showing all pertinent details and dimensions of elbows, reducers, connections, outlets, tees, crosses, bulkheads, closures and their required items.

The Engineer, the inspector, or designee shall reserve the right to reject pipe on their own discretion. Contractor shall schedule inspection of pipe delivery a minimum of 48 hour in advance.

207-9 DUCTILE IRON PIPE AND FITTINGS.

207-9.1 General. These Specifications apply to Ductile Iron Pipe (DIP) for water distribution. All Ductile Iron Pipe shall be of the class shown on the plans and in accordance with ANSI A21.51/AWWA C151 and shall be cast, tested, cleaned, cement lined, coated, tested and certified at a single manufacturing facility with all manufacturing units contiguous to one another.

Ductile Iron Pipe installed shall be pressure class 350 for 12-inch diameter and smaller. Pressure class shall be 250 for 20-inch diameter.

All DIP used for below ground installations shall be the push-on or the mechanical joint type and encased in a polyethylene sleeve and cement lined as specified herein, unless otherwise indicated on the Plans or in these Specifications.

207-9.2.2 Pipe Joints. Ductile Iron Pipe and fittings shall have one of the following joint types as shown on the Plans or Standard Drawings.

(1) Mechanical joint ANSI A21.11/AWWA C111

(2) Rubber gasket push-on joint - ANSI A21.11/AWWA C111

(3) Flanged joint - ANSI A21.10/AWWA C110

(4) Restrained joint - ANSI A21.10/AWWA C110. "Field-LOK" Gaskets, for use with "Tyton" joint pipe only, as manufactured by U.S. Pipe and Foundry Company, or McWane "Sure Stop 350" Gaskets, for use with "Tyton" joint pipe only, as manufactured by Pacific States Cast Iron Pipe Company, or "Fast-Grip" Gaskets, for use with "Fastite" joint pipe only, as manufactured by American Cast Iron Pipe Company, or "Grip Ring", as manufactured by Romac Industries, Inc., or "Lok-Ring" as manufactured by American Cast Iron Pipe Company, are accepted for joint restraint. EBAA Iron, "Megalug" and Romac Industries, "RomaGip" are acceptable on 14-inch water mains and larger, "Gripper Gaskets" by the Gripper Gasket Company are not permitted. **Any restrained joint gasket must be inspected, by the City Inspector, before use.**

207-9.2.3 Fittings. This section covers all fittings required for closures, bends, tees, crosses, reducers, plugs, caps, blowoffs, fire hydrant buries, and connections to mainline valves shown on the Plans.

All fittings shall have a minimum pressure rating of 250 psi and shall be manufactured per ANSI A21.10/AWWA C110 and/or ANSI A21.11/AWWA C111. Ductile Iron compact fittings shall have a minimum pressure rating of 350 psi and shall be manufactured per ANSI A21.53/AWWA C153.

207-9.2.4 Lining and Coating. Ductile Iron Pipe and fittings shall be lined with cement mortar per ANSI A21.4/AWWA C104. The coating shall be a bituminous coating with a minimum thickness of one (1) mil.

207-9.2.5 Inspection and Certification. The manufacturer shall submit a sworn statement that the pipe furnished has been sampled, tested and inspected in accordance with these Specifications and that the results thereof comply with the requirements of this Specification.

207-9.4 Inspection and Testing. Inspection in the plant shall be by the manufacturer. Copies of all test reports shall be submitted to the Engineer. If pipe is manufactured outside of the continental United States, then Engineer shall be sent to manufacturing facility and witness all pipe being manufactured for required project in compliance with this specification and allowable AWWA sections, all at the Manufacturer's and Contractor's cost. Under no circumstances shall exceptions be allowed.

207-9.5 Approved Pipe Manufacturers.

a. Pacific States Cast Iron Pipe Company

b. United States Pipe and Foundry Company

c. American Cast Iron Pipe Company

d. Griffin Pipe Products Company

207-9.6 Approved Fittings Manufacturers.

a. Star

b. Sigma/Nappco

c. Tyler/Union

d. SIP Industries

207-10 STEEL PIPE.

207-10.2.1.1 General. The Grade of steel used, for the steel cylinders, with thickness less than 0.230-inches, shall be per ASTM A1011, SS Grade 36 (formerly ASTM A570). For thickness greater than or equal to 0.230-inches, shall be per ASTM A1018, SS Grade 36 (formerly ASTM A907), as referenced in AWWA C200, Standard for Steel Water Pipe.

207-10.2.1.2 Bonding Jumpers. Bonding jumpers are required at all pipe joints. Bonding jumpers shall be the type as indicated in the Standard Drawing CWD-924 and shall be sized to limit the resistance of the jumpers divided by the resistance of the cylinder to a maximum of 0.30 ohm to a minimum of 0.10 ohm. Bonding jumpers will be required for steel pipe unless indicated otherwise on the plans or in these Specifications. Bonding jumpers are not required for ductile iron pipe.

207-10.4.2.1 Cement Mortar Lining and Coating. All steel pipe furnished shall be cement mortar lined and coated in accordance with AWWA C205 and Sub-section 207-10 except that Table 1, AWWA C205 is revised as follows:

Pipe Diameter (inches)	Lining		Coating	
	Thickness (inches)	Tolerance (inches)	Thickness (inches)	Tolerance (in.) (No minus tolerance)
4 thru 12	5/16	±1/16	3/4	+1/4
14 thru 18	3/8	±1/16	3/4	+1/4
20 and Larger	1/2	±1/16	3/4	+1/4

Type II Cement shall be used for the lining and Type II cement shall be used for the coating.

The pipe manufacturer shall provide internal bracing for all pipe sizes 10-inches and larger. Bracing shall remain in the pipe until installation, bedding, and backfill materials operations have been completed. The pipe shall be braced with 4pt, 2 places 12-inches from each end. Bracing to be 2" x 4" with wedges.

These bracing requirements shall be considered as a minimum. The Contractor shall provide additional internal bracing and take the necessary precautions as required to ensure that the pipe will not deflect more than 2 percent.

207-10.4.2.2 Approved Pipe and Fittings Manufacturers.

(a) Ameron Pipe Products Group

(b) Imperial Pipe Services, LLC

(c) Kelly Pipe Company

(d) Northwest Pipe and Casting Company

(e) Southland Pipe Corp.

(f) West Coast Pipe Linings Inc.

207-25 MISCELLANEOUS PIPE.

207-25.1 General. These Specifications apply to miscellaneous piping for appurtenant construction and water services. All miscellaneous piping shall conform to these Specifications unless shown otherwise on the Plans or Standard Drawings.

207-25.1.1 Copper Tubing or Pipe. Copper tubing or pipe used for service connections, air valves, or blowoffs shall be Type "K" soft copper conforming to ASTM B-88. Hard drawn copper shall be used for air valve risers, and blowoff risers. When wrought copper solder type fittings are shown on the Plans or Standards Drawings the joints shall be soldered using a lead free, tin based alloy solder meeting federal requirements for lead free solders mandated by the Federal Safe Drinking Water Act, with a flux specifically designed for the solder alloy. Use J.W. Harris Company, Stay Safe 50, Stay Safe Bridget, or City approved equal.

1" copper – sweat fittings are not permitted.

2" copper – full 20 foot lengths are to be used keeping solder couplings to a minimum.

207-25.2 Red Brass Pipe. Red brass pipe used for service connections, air valves, or blowoffs shall conform to ASTM B-43.

207-25.3 Steel Pipe. Steel pipe used in 4-inch and larger fire or domestic services and guard posts shall conform to ASTM A-120, Schedule 40.

207-25.4 Galvanized Steel Pipe. Galvanized Steel Pipe used as 2-inch service bypasses shall conform to ASTM A-120, Schedule 40.

207-25.5 Gate Box Material. The respective minimum thicknesses of steel pipe used for 8-inch and 10-inch gate boxes shall be 12 Gauge Pipe and shall be seamless steel, conforming with the requirements of ANSI/AWWA C200. Material shall be factory dipped in Trumble Asphalt Dip, or an approved equal.

SECTION 210 - PAINT AND PROTECTIVE COATINGS

210-1.5 Paint Systems.

Painting Schedule:

		Primer			Paint		
No.	**Application**	**Coats (min.)**	**Approved Manufacturer**	**Color**	**Coats (min.)**	**Approved Manufacturer**	**Color**
1	Gate Box Caps & Rims	1 Coat	Rust-Oleum / Dunn Edwards / Devoe	Red	2 Coats	Rust-Oleum / Dunn Edwards / Devoe	Safety Blue
2	Air Valves	1 Coat	Rust-Oleum / Dunn Edwards / Devoe	Red	2 Coats	Rust-Oleum / Dunn Edwards / Devoe	Forest Green
3	Fire Hydrants	1 Coat	Rust-Oleum / Dunn Edwards / Devoe	Red	2 Coats	Rust-Oleum / Dunn Edwards / Devoe	Safety Yellow
4	Blowoff Hydrants	1 Coat	Rust-Oleum / Dunn Edwards / Devoe	Red	2 Coats Body / 2 Coats Top	Rust-Oleum / Dunn Edwards / Devoe	Safety Yellow/ Safety Blue

5	Air Valve Guard Posts	1 Coat	Rust-Oleum / Dunn Edwards / Devoe	Red	2 Coats	Rust-Oleum / Dunn Edwards / Devoe	Forest Green
6	Hydrant Guard Posts	1 Coat	Rust-Oleum / Dunn Edwards / Devoe	Red	2 Coats	Rust-Oleum / Dunn Edwards / Devoe	Safety Yellow
7	Locating Guard Post	1 Coat	Rust-Oleum / Dunn Edwards / Devoe	Red	2 Coats	Rust-Oleum / Dunn Edwards / Devoe	Safety Yellow
8	Steel Vault Lid	1 Coat	Rust-Oleum / Dunn Edwards / Devoe	Red	2 Coats	Rust-Oleum / Dunn Edwards / Devoe	Soft Grey
9	Above Grade Piping	1 Coat	Rust-Oleum / Dunn Edwards / Devoe	Red	2 Coats	Rust-Oleum / Dunn Edwards / Devoe	San Tan
10	Curb Markings	N/A	N/A	N/A	1 Coat	Rust-Oleum / Dunn Edwards / Devoe	Safety Blue

a. All paint and protective coatings shall be holiday free.

b. All paint and protective coatings shall comply with the California/South Coast Air Quality Management District (SCAQMD) VOC (Volatile Organic Compound) regulations.

c. All paint and protective coatings, with the exception of red primer, shall be industrial strength, solvent based paint.

d. A minimum thickness of 5 mils, as determined by the engineer, shall be attained after the final paint coat has dried.

e. Spray paint and spray primer shall not be permitted, except for temporary marking paint.

f. Red colored primer can be substituted with equivalent grey colored primer.

g. All substitutions for paint and protective coatings listed above shall be reviewed and approved by the engineer.

h. Marking paint shall not be permitted for permanent paint or primer coating applications.

i. Suppliers

    a. Dunn Edwards, Riverside – (951) 784-1758

b. Vista Paint, Riverside – (951) 689-2501

c. Glidden Professional, Riverside – (951) 274-7888

SECTION 250 - VALVING, APPURTENANCES AND MISCELLANEOUS MATERIALS

250-1 NUTS AND BOLTS. Where nuts and bolts are to be furnished for fastening flanged joints, they shall be hexagonal head machine bolts and hexagonal nuts. Steel Standard ASTM A-307 Grade B; dimensions of bolts and nuts, ANSI/ASME B-18.2.1 and ANSI/ASME B-18.2.2 respectively; threads of bolts and nuts, ANSI B1.1 coarse thread series, Class 2A fit on bolts and Class 2B fit on the nuts; nuts and bolts shall be cadmium plated conforming to ASTM A-165, type TS; electroplated zinc per ASTM B-633, SC 1; or hot-dip galvanized per ASTM A-153, Class C. Minimum bolt lengths shall be the sum of the mating flange thicknesses, the gasket, and the depth of the nut plus 1/8" before torquing. Break-off bolts shall have a hole drilled in the shank with the dimensions of 11/32-inch (for 5/8-inch bolts) and 13/32-inch (for 3/4-inch bolts) and 2 3/8-inch deep and shall be supplied filled with silicone.

250-2 GASKETS. Where gaskets are to be furnished, they shall be 1/8" minimum thickness, micro finish, full face, red rubber material style 50 by "Garlock Rubber Technologies" or City approved equal.

250-3 INSULATION GASKETS. Unless otherwise specified, insulation gaskets shall conform to the following:

1. The insulation gasket shall fit between the class of flanges as specified, with a pressure rating equal to, or greater than, the flange pressure rating.

2. Insulation gaskets shall be full pattern, neoprene face phenolic, 1/8-inch thick.

3. The gaskets shall have the following assembly minimum physical characteristics:

   a. Compression strength ..... 24,000 psi

   b. Dielectric strength ..... 500 V/Mil

   c. Operating temperature ..... up to 175° F

   d. Water absorption 1.6%

4. A one-piece Acetal Resin sleeve and Washer shall be used in combination with a single phenolic washer on each bolt. A steel washer designed to be used with the insulating washer shall be used, one each side of the flange bolts.

   a. One-piece sleeve washer shall have the following physical characteristics:

      (1) Sleeve thickness 1/32-inch

      (2) Washer thickness 5/32-inch

      (3) Dielectric strength ..... 1200 V/Mil

      (4) Operating temperature ..... up to 175° F

      (5) Water absorption ..... 0.22% Max.

   b. Single phenolic washers shall have the following physical characteristics:

      (1) Thickness 1/8-inch

      (2) Dielectric strength ..... 500 V/Mil

      (3) Compressive strength ..... 26,000 psi

      (4) Operating temperature ..... up to 300° F

      (5) Water absorption ..... 1% Max.

   c. Flange Insulation kits shall be:

      (1) PSI Products, Inc., Burbank, California

      (2) Central Plastics Company, Shawnie, Oklahoma

      (3) CALPICO Inc., San Francisco, California

250-4 BUTTERFLY VALVES.

250-4.1 Butterfly Valves. Butterfly valves shall conform to the latest revision of AWWA C504 and the following:

1. Butterfly valves and operators shall be class 150B, constructed for direct burial and have flanged ends.

2. Butterfly valves shall be furnished with operators of the traveling nut or worm gear type, self-locking in any position, and sealed (with gaskets), and lubricated to withstand a submersion in water to 10 psi. The valve shall open by counter-clockwise rotation of a 2-inch square AWWA operating nut.

3. The operator shall be capable of meeting the torque requirements for opening and closing the valve against:

   a. 150 psi upstream and 0 psi downstream pressure.

   b. Maximum inlet-outlet velocity of 12 feet per second, normal velocity of 6 feet per second, and shall be provided with AWWA stops capable of absorbing up to 300 foot-pounds of input torque without damage to the valve or operator.

4. Butterfly valves shall have Buna N seat bonded or mechanically retained without use of metal retainers or other devices located in the flow stream, to the body and have a disc seating edge of ni-chrome or stainless steel. All internal mountings or working parts shall be stainless steel. All internal nuts and bolts, excepting the operating nut shall be of stainless steel.

   Butterfly valves shall have the shaft V-type self-adjusting packing. The shaft shall not be exposed between the valve body and the operator.

5. The use of a stop or lug cast integrally with or mechanically secured to the body for the purpose of limiting disc travel by means of direct contact or interference with the valve disc in either the open or closed position and which utilizes a ferrous metal bearing surface in direct rubbing contact with an opposing ferrous metal surface, will not be acceptable.

6. Butterfly valves shall be furnished with records of tests specified in AWWA C504, Section 2.3 and Section 5. Butterfly valve seats shall be tested and certified for a 150 psi working pressure. The certificate shall be attached to the Butterfly valve. All valves shall be furnished with certified drawings and parts list of the valve and operator. An affidavit of compliance to AWWA C504 shall be furnished for all valves. Five sets of the above information shall be furnished to the City.

7. Butterfly valves shall have their internal and external surfaces epoxy coated, except flange faces and stainless steel and rubber surfaces, with a minimum of 8 mils of "Ameron" Amercoat 370 epoxy coating, Holiday Free, or City approved equal.

"Ameron" Amercoat 370 epoxy coating shall be applied at the manufacturer's plant or approved manufacturer's representative's plant in accordance with the manufacturer's application specifications.

250-4.1.1 Approved Manufacturers:

a. Pratt - Groundhog, Triton XR-70.
b. Mueller – Lineseal III.
c. De Zurick – BAW. or City approved equal.

250-5 GATE VALVES.

250-5.1 2-inch to 3-inch Gate Valves. Unless otherwise specified, gate valves 2-inch through 3-inch shall conform to ANSI/NSF 61 and the following:

a. Gate valves shall be rated 250 psi max working pressure, Iron body with 10 mils epoxy coating interior and exterior, Triple O-ring seal, non-rising stem, iron wedge and threaded ends.

b. Gate valves used in 2-inch air valve, 2-inch blowoff or 2-inch service installations shall have a 2-inch square cast iron operator nut.

c. Iron gate valves shall be:

(1) Mueller Co. A-2360.

250-5.2 Resilient Seat Gate Valves.

250-5.2.1 General. This section of the Specification covers resilient-seated gate valves for use in the water distribution system.

Resilient-seated gate valves shall conform to the latest revision of AWWA C509 or C515 and the following:

(1) Resilient-seated gate valves shall be iron bodied with all stainless steel internal mountings and working parts. Valve Stems shall be cold rolled stainless steel 430F with a minimum yield strength of 40,000psi.

(2) Resilient-seated gate valves shall have non-rising stems, "O"-ring sealed with two "O"-rings above the thrust collar, with a 2-inch square operating nut, opening counter-clockwise, and shall be designed for 200 psi water working

pressure.

(3) Resilient-seated gate valves shall have sizes and type of valve ends as shown on the plans or Standard Drawings.

(4) Resilient-seated gate valve suppliers shall furnish the City with an affidavit of compliance to AWWA C509 or C515.

(5) Resilient-seated gate valves shall have their internal and external surface epoxy coated, Holiday Free, except stainless steel and rubber surface with epoxy applied by the manufacturer of the valve.

250-5.2.2 Resilient Seat Gate Valves - Tapping. Tapping gate valves shall conform to all requirements of Subsection 250-5.2.1 and the following:

(1) Tapping valves shall have a Class 125, ANSI B16.1 flanged inlet and an outlet as shown on the construction plans.

(2) Tapping valves shall be compatible with the tapping sleeve and the tapping machine utilized for wet tapping the water main.

250-5.2.3 Approved Manufacturers.

(1) American Flow Control Series 2500

(2) Clow Series 6100

(3) AVK Series 25

(4) Mueller Model- 2360 or 2362

(5) M & H Style 4067 NRS

250-5.3 Tapping Sleeves.

a. Tapping sleeves shall be:

(1) Ductile Iron body construction, with mechanical type joints on both sleeve ends, and a class 125 ANSI B16.1 flanged outlet.

(2) ASTM A-276, type 304 or 304L stainless steel body construction, with full circumference gasket, and flange outlets meeting the requirements of Section 250-9. Flanges materials may include ASTM A-276, type 304

or 304L stainless steel.

b. Sleeves shall be compatible with the tapping gate valves.

c. Sleeves shall be designed for a working pressure of 200 psi and be supplied with a 1/2" or 3/4" IPF coupling or tap and corporation stop for pressure testing sleeve.

250-5.3.1 Approved Manufacturers.

Stainless Steel Sleeve

(1) Smith-Blair 662 and 663

(2) Romac SST or Romac FTS 420

(3) Powerseal 3490-AS

Mechanical Type Joint

(1) Mueller-Mechanical Joint Tapping Sleeve

(2) Clow-Mechanical Joint Tapping Sleeve

(3) American Flow Control - Mechanical Joint Tapping Sleeve

250-5.4 Abandoning Existing Valves. All existing valves shall be abandoned by Contractor unless otherwise noted on the plans. After pipelines have been tested and disinfected by Contractor, and accepted by City, and after City has completed all service connections and waterline connections, Contractor shall remove valve cans a minimum of 12" below finish grade, remove operating nut extensions, and fill valve cans with concrete. Thereafter, Contractor shall sawcut existing asphalt concrete pavement (2' square section) or concrete (at construction joints) around existing valve boxes, remove said asphalt concrete pavement or concrete and dispose of same at a legal disposal site, and place concrete or asphalt concrete pavement over abandoned valve boxes.

250-6 VALVE BOX CAPS. Where valve box caps are to be furnished; the valve box caps shall be composed of 8-inch or 10-inch valve boxes and shall consist of a cap of cast iron with the cap marked CWD with the City of Riverside pattern. The cap shall be supplied with two coats of paint thereon and one coat primer. See painting schedule, Section 210-1.5. Cap shall be manufactured by South Bay Foundry, San Diego, CA, or City approved equal.

250-7 AIR VALVES. Unless otherwise specified, air valves, 2-inch and larger, shall conform to the following:

1. Air valves shall have their internal body casting epoxy coated with a minimum of 12 mils of "Ameron" Amercoat 370 epoxy coating, Holiday Free, or City approved equal. The "Ameron" Amercoat 370 epoxy coating shall be applied at the manufacturer's plant or approved manufacturer's representative's plant, in accordance with the manufacturer's application specifications.

2. Air valves shall be: Crispin, 2-inch - UL20.1-Universal Air Release Valve.
   Crispin, 4-inch – UL41.1-Universal Air Release Valve.
   A.RI., 2-INCH THRU 10-INCH – D-060-C HF.

250-7.1 Abandoning Existing Air Valves. See Abandoning Existing Valves (Section 250-5.4).

a. All existing air valves shall be abandoned by Contractor unless otherwise noted on the plans. After pipelines have been tested and disinfected by Contractor, and accepted by City, Contractor shall remove air valves and piping a minimum of 12" below finish grade and fill void and piping with concrete. Thereafter, Contractor shall sawcut existing concrete at construction joints around abandoned air valves, remove said concrete and dispose of same at a legal disposal site, and place concrete over abandoned air valve. If existing air valves are located in an area without concrete, Contractor shall remove and replace, in kind, the area around abandoned air valves.

b. Contractor shall restore landscaping and existing improvements around abandoned air valves.

c. Air Valves shall be delivered to the City of Riverside, Utilities Operation Center. Call the Water Superintendent at (951) 351-6384.

250-8 BRASS AND BRONZE ITEMS. Brass and bronze items cover corporation stops, angle ball meter valves, meter couplings and service fittings. All material used in the manufacture of this equipment shall be copper base alloy complying with ASTM B62 and AWWA C800. All compression fittings shall be pack joint type connection for use with tubing.

250-8.1 Service Fittings. All angle ball meter valves and corporation stops shall be constructed of the following: Heavy cast bronze body, double Buna-N rubber 0-rings in stem, molded Buna-N rubber seat and supplied with lockwing.

250-8.1.1 Approved Manufacturers and Models.

ITEM	FORD	JONES	A.Y. McDONALD	MUELLER	CAMBRIDGE BRASS
1" Ball Corp. MIPT X MIPT	FB500-4	E-1943	3131B	B-20013	301-M4M4
1" Couplings FIPT X Pack Joint for CTS	C14-44G	E-2607	4754-22	P-15451	
2" Ball Corp. MIPT x MIPT	FB-500-7	E-1943	3131B		301-M7M7
2" Corp. Stop CC x IPT	FB-400-7	E-1944	3128B		
1" Angle Ball Meter Stop	BA43-444W	E-1963W	4602B-22	B-24258	210-H4T4
2" Angle Ball Meter Stop	BFA13-777W	E-1974W	4604B		210-F7MF7
2" Coupling (MIPT x Comp.)	C84-77	E-2605			117-H7M7
1" x 3/4" Meter Adaptor	A34	E-128-H			440-N4R2
1" Meter Coupling	C38-44-2.625	E-134	4620	H-10891	417-T4M4
3/4" Meter Coupling	C38-23-2.5	E-134	4620	H-10891	417-T3M3

250-8.2 Service Saddles (Service Clamps). Saddles shall be all bronze double strap type, with neoprene seal ring gasket.

250-8.2.1 Approved Manufacturers and Models.

(1) Mueller Cat. No. BR 2 B 0474 IP, BR 2 B 0684 IP, BR 2 B 0899 IP, BR 2 B 1104 IP, BR 2 B 1314 IP

(2) Smith-Blair Cat. No. 323-0510 thru 323-1426

(3) R.H. Baker Cat. No. 183-413 TAP thru 183-1426 TAP

(4) Jones Cat. No. E-979

(5) McDonald No. 3826

(6) Ford - 202B

(7) Cambridge Cat. No. 810

250-8.3 Water Sampler Fittings. All angle ball meter valves and corporation stops shall be constructed of the following: Heavy cast bronze body, double Buna-N rubber 0-rings in stem, molded Buna-N rubber seat and supplied with lockwing.

250-8.3.1 Approved Manufacturers and Models.

ITEM	FORD	JONES
1" Corp. Stop IPT x Compression	1"-F-1100	1"-E-3403
1" Corp. Stop IPT x 1 PT	1"-F-500	1"-E-41
1" Angle Ball Meter Stop	BA43-444W	1"-E-1963W
1" x 3/4" Meter Adaptor	A34	1" x 1-1/4", E-128-H

250-9 FLANGES. Unless otherwise specified, flanges shall conform to the following:

1. All steel flange sizes 4-inch through 20-inch shall be Class "D" and shall comply with AWWA C207, Section 1. All ductile iron flanges shall conform with the requirements of AWWA C115.

2. Steel flange sizes 4-inch through 20-inch shall be furnished in the slip-on welding type.

3. Flanges shall be faced smooth or may have a serrated finish of approximately 32 serrations per inch, approximately 1/64-inch deep. Serrations may be spiral or concentric.

4. Plate or blind flanges shall have all flange faces machined flat and shall be center drilled and tapped, 1-inch IPT, 4-inch through 10-inch; 2-inch IPT 12-inch and larger; and furnished with a standard square head pipe plug.

5. Final machining on the contact faces of all flanges shall be done prior to being

welded to the full length adjacent steel-plate section. Flange faces shall be checked with a straight edge and shall be perpendicular to the pipeline. All warped flanges will be returned to the pipe company for adjustment. The Contractor is responsible for all additional expenses and delays.

6. For 1-1/2 inch and 2-inch water service installations, a 2-inch brass screw meter flange shall be used, conforming with Section 4.4 of AWWA C701.

250-10 FIRE HYDRANTS/BLOWOFF ASSEMBLIES. Unless otherwise specified, fire hydrants and blowoff hydrants shall conform to the latest revision of AWWA C503 and the following:

1. Hydrants shall have 6- inch flanged inlet connection with 6-3/4 inch holes drilled on a 9-3/8 inch bolt circle.

2. Hydrants shall have outlet nozzles of the quantity and size specified with National Standard Hose Thread.

3. Hydrants shall be furnished with 1-3/4 inch pentagon spanner nuts on operator stems and nozzle caps. Nozzle caps shall be constructed of cast iron.

4. Hydrants from Clow Corporation shall be supplied with Type B carrier valves. Valve rubber shall be 5/8-inch thick for 2-1/2 inch outlets and 3/4-inch thick for 4-inch outlets.

5. Hydrant valves shall be slow opening.

6. Hydrant stems shall have "O" ring packing and be constructed of ASTM B-62 (85% copper, 5% tin, 5% lead, 5% zinc).

7. Hydrants shall be painted per AWWA C503. Exterior color shall be fire hydrant yellow.

8. Hydrant supplier shall furnish an affidavit of compliance to AWWA C503.

9. Hydrant (1 - 2-1/2" and 1 - 4" Outlets), Super Hydrant (2 - 2-1/2" and 1 - 4" Outlets)

250-10.1 Approved Manufacturers and Models.

a. Regular Hydrant:

CLOW CORP., Corona, California, 900 Series, Model 950

AMERICAN AVK CO., Fresno, California, Model 2472

b. Super Hydrant:

CLOW CORP., Corona, California, 900 Series, Model 960

AMERICAN AVK CO., Fresno, California, Model 2492

250-10.2 Abandoning Existing Fire Hydrants.

a. All existing fire hydrants shall be abandoned by Contractor unless otherwise noted on the plans. After pipelines have been tested and disinfected by Contractor, and accepted by City, Contractor shall remove fire hydrants and fire hydrant burys a minimum of 12" below finish grade and fill fire hydrant burys with concrete. Thereafter, Contractor shall sawcut existing concrete at construction joints around abandoned fire hydrant burys, remove said concrete and dispose of same at a legal disposal site, and place concrete over abandoned fire hydrant burys. If existing fire hydrants are located in an area without concrete, Contractor shall remove and replace in kind area around abandoned fire hydrant burys.

b. Contractor shall restore landscaping and existing improvements around abandoned fire hydrants.

c. Contractor shall notify City Fire Department of the location of the fire hydrants that are out of service.

d. Hydrants to be delivered to the City of Riverside, Utilities Operation Center. Call the Water Maintenance Superintendent at (951) 351-6384.

250-10.3 Abandoning Existing Blowoffs. See Abandoning Existing Fire Hydrants (Section 250-10.2) and Abandoning Existing Valves (Section 250-5.4).

250-11 BOLTED, SLEEVE-TYPE COUPLINGS. Unless otherwise specified bolted, sleeve-type couplings shall conform to the latest revision of AWWA C219.

250-11.1 Flexible Couplings.

a. Each coupling shall consist of one steel middle ring, two steel followers, gaskets, and sufficient numbers of steel bolts to compress the gasket without distorting the followers.

b. The thickness of the middle ring shall be such that the stress in the steel shall

not exceed 50 percent of the yield point when subjected to the hydrostatic test pressure of the pipe line. The middle ring thickness shall not be less than the thickness of the pipe jointed.

c. Middle rings shall be cold expanded a minimum of 1 percent increase in diameter to test the weld and the size to the proper dimension.

d. The middle rings shall be coated with "Ameron" Amercoat 370 epoxy coating, Holiday Free, or City approved coating to a minimum dry film thickness of 10 mils. Follower rings shall be coated with a compatible shop coat for field coating.

e. Bolts shall be 5/8-inch diameter carriage bolts with hexagon nuts. Steel bolts shall have a minimum yield strength of 40,000 psi.

f. Gaskets shall be composed of a crude or synthetic rubber base suitable for use in potable water supply systems.

250-11.1.1 Approved Manufacturers and Models.

(1) Baker Series 200
(2) Dresser Style 38
(3) Smith-Blair 411 and 441
(4) Romac Style 501
(5) Ford Style FC1 and FC2

250-11.2 Flanged Coupling Adapters.

a. Each adapter shall consist of an adapter flange body, follower flange, wedge gasket, and sufficient bolts to compress the gasket without distorting the follower.

b. Adapter flange and follower shall be constructed of steel or ductile iron. Ductile iron adapters shall meet or exceed ASTM A536, grade 65-45-12. The flange bolt dimensions shall meet AWWA C207 for a Class "D" flange.

c. Gasket shall be composed of a rubber base meeting, or exceeding, ASTM D2000 3 BA 715 and suitable for use in potable water supply systems.

d. Nuts and bolts shall conform with requirements of AWWA C111, and the above flexible coupling requirements listed in 250-11.1.

e. Adapter flange and follower shall be painted with a factory applied shop coat.

250-11.2.1 Approved Manufacturers and Models.

(1) Baker Series 601
(2) Smith-Blair 912, 913, and 914
(3) Ford Style FFCA
(4) Romac FCA 501

250-12 METER BOXES. Pre-cast concrete meter boxes shall be provided for 5/8-inch through 2-inch water meters. Meter boxes shall be furnished with a Polymer concrete cover and lid except where cast iron or steel traffic covers are specified. Where meter boxes are to be placed within a landscaped area, plastic boxes shall be used.

250-12.1 Approved Manufacturers and Models. Meter boxes provided shall be one of the following models. Many other manufacturers are readily available. Any substitution must be approved by the Engineer and shall be of the same size and description as those specified below:

a. 3/4" and 1" Meters:

Manufacturer	Model
Armorcast	No. 37 (Polymer Concrete Cover)
Carson Industries	1017 (Plastic Box and Cover with Reading Lid)
J & R Concrete Products	No. 4 ½ (Polymer-Water Meter Box Series)

b. 1-1/2" and 2" Meters:

Manufacturer	Model
Armorcast	No. 65 (Polymer Concrete Cover)
J & R Concrete Products	No. 5 ½ (Polymer-Water Meter Box Series)

250-12.2 Terminal Housing Boxes. Meter boxes shall be provided for test lead terminal housing and water quality sampling station. The size shall be the same as for a 5/8-inch meter to 1-inch meter but shall be furnished with a cast iron traffic cover.

250-12.3 Approved Manufacturers and Models. Terminal housing boxes provided shall be one of the following models. Many other manufacturers are readily available. Any substitution must be approved by the Engineer and shall be of the same size and description as those specified below:

Manufacturer	Model
Armorcast	No. 37 (Polymer Concrete Cover)
J & R Concrete Products	No. 4 ½ (Polymer-Water Meter Box Series)

250-13 JOINT LUBRICANT. Joint lubricant used on ductile iron and steel pipe joints where there is no internal sealing of the space between the pipe sections shall contain an effective preservative per U.S. Pharmacopeia, 1975, 19th Edition. The supplier shall submit test reports from an independent laboratory for approval.

250-14 POLYETHYLENE ENCASEMENT. Polyethylene encasement shall have a minimum thickness of 8 mil and conform with Section 4.1 of AWWA C105/ANSI A21.5.

PART 3
CONSTRUCTION METHODS

All as provided in Part 3 of the Standard Specifications, except as otherwise provided below.

SECTION 306 - UNDERGROUND CONDUIT CONSTRUCTION

306-1 OPEN TRENCH OPERATIONS.

306-1.1 Trench Excavation.

306-1.1.1 General. Unless otherwise specified in these Specifications, excavation shall include the removal of all materials of whatever nature encountered, including rock and all other obstructions of any nature that would interfere with the proper execution and completion of the Work.

Payment for excavation shall be included in the installation cost of the pipe for the items involved, regardless of trench width, adjustment to pipeline horizontal and vertical alignment or realignment, and no additional compensation will be allowed.

306-1.1.3.1 Trench Cave-In. Where the maximum trench width is exceeded and the trench sides are caving-in, the Engineer may, require the Contractor to use concrete or other means of special bedding for vertical distance of not less than one-half the pipe outside diameter.

306-1.1.3.2 Minimum Cover and Clearance. Unless otherwise shown on the plan, the minimum depth of cover listed below shall be provided between the top of the main and the undisturbed subgrade or finished grade, whichever provides the greater cover.

(a) Cover between top of the valve stem and the subgrade surface at the time of construction shall be 6-inches.

(b) A minimum vertical clearance of 12-inches shall be maintained between all structures and utilities.

(c) Minimum cover between the top of the water main and the subgrade surface at the time of construction shall be 4 feet.

306-1.1.5 Removal and Replacement of Surface Improvements. The cost of

removal and replacement of existing improvements interfering with the Contractor's operations shall be included in the price bid for the item involved unless otherwise specified.

306-1.1.6 Bracing Excavations (Trench Shoring).

306-1.1.6.1 General. The lump sum bid for shoring, bracing or trench sloping, shall be full compensation for designing, providing, installing, maintaining, relocating and removing any shoring or trench sloping system in accordance with applicable State and Local Safety requirements and in compliance with Section 6500 and 6707 of the Labor Code, which reads substantially as follows:

Whenever the City issues a call for bids for the construction of a pipeline, sewer, sewage disposal system, boring and jacking pits, or similar trenches or open excavations, which are five feet or deeper, such call, shall specify that each bid submitted in response thereto shall contain as a bid item, adequate sheeting, shoring, and bracing or equivalent method for the protection of life or limb which shall conform to applicable safety orders. Nothing in this section shall be construed to impose tort liability on the body awarding the contract or any of its employees.

Contractor shall hire a Registered Civil Engineer in the State of California to design the trench shoring for this project.

306-1.1.7 Trench Dewatering. Prior to submitting Contractor's bid, it shall be the Contractor's responsibility to determine the extent of the ground water. The Contractor shall be responsible for removal of such ground water per section 7-8.6.2.

Where groundwater or soft, spongy, unstable material is encountered and the native material does not afford a solid foundation for pipe sub-grade, the trench shall suitably be dewatered and a firm, stable base shall be constructed for the pipe by excavating any unsuitable material to twenty four inches minimum depth below sub-grade base, or if required a stable base shall be constructed by placing a City approved rock bedding upon which the sub-grade can be prepared. If the necessity for such additional bedding material is required for control of groundwater, the Contractor shall bear the expense of the additional excavation and bedding.

All costs involved in the removal of ground water shall be included in the contract lump sum price, and no separate compensation will be allowed.

306-1.2 Installation of Pipe.

306-1.2.1 Bedding. Bedding Material as defined in the Standard Specifications shall include the following:

(1) The Contractor shall import sand bedding material and place the sand bedding material in accordance with CWD-040-1 & 2. The bedding material shall have a "sand equivalent" 30 or greater.

(2) Where unstable soil consisting of loose, soft, spongy, or organic earth is encountered, it shall be removed from trench bottom to depth determined in the field by the Engineer and trench shall be refilled to proper grade with imported sand bedding material, tamped in place to 90% relative compaction minimum. Said imported bedding material shall have a sand equivalent 30 of greater. Trench bottom shall be graded flat and prepared to provide firm and uniform bearing for pipe.

Where unyielding soil consisting of rock, rocky earth, or cemented earth is encountered, it shall be removed from trench bottom to at least 9 inches below grade and trench shall be refilled to proper grade with imported sand bedding material, tamped in place to 90% relative compaction minimum. Said imported bedding material shall have a sand equivalent 30 or greater. Trench bottom shall be graded flat and prepared to provide firm and uniform bearing for pipe.

(3) Bell holes shall be dug from the bedding material such that the pipe barrel, when first laid, shall uniformly bear on the bedding material. The bedding material shall be compacted to 90% of relative compaction by hand or mechanical tamping method.

(4) Initial backfilling shall be performed as soon as possible after pipe has been laid. Loose, moist bedding material shall be placed in trench simultaneously on each side of pipe to a depth not greater than pipe centerline (springline) or 12 inches (loose measurement), whichever is less, and it shall then be tamped under pipe so that all voids are eliminated and material is compacted to 90% relative compaction minimum.

(5) Subsequent backfilling shall be performed immediately following initial backfilling. Loose, moist backfill material shall continue to be placed in trench simultaneously on each side of pipe in lifts not exceeding 12 inches in thickness (loose measurement), with each lift being tamped, until the pipe has been covered by at least 12 inches of well compacted material. Alternatively, backfill material may be densified by water settlement until the pipe has been covered by at least 12 inches of well densified material. Backfill material shall be tamped or settled to 90% relative compaction minimum.

(6) Regardless of compaction or densification technique, care in backfilling shall be exercised to avoid any damage to pipe, fittings, and appurtenances, to avoid any damage to persons or property, and to achieve relative compaction of backfilled material of at least 90% minimum.

(7) At the close of the construction day, the pipe end shall be closed with a watertight, rodent-proof plug and backfilled.

(8) In the inspection of the water mains, no more than 300 feet of pipe shall be laid without being inspected.

(9) The Sand Bedding Material is suitable for water jetting.

Trench backfill material, above the pipe bedding material zone, shall not be placed until the compaction of the pipe bedding material zone complies with the specified compaction as shown on the Plans and Specifications.

306-1.2.2.1 System Connections (General). The Water Division will make all system connections to the existing mains, unless otherwise shown on the plans.

The Contractor shall verify the station, offset, depth, pipe diameter, and material of the existing connection point prior to laying the last 100 feet toward that station. The Contractor shall make necessary cut-to-fits, and shall adjust the line and grade as necessary. After the chlorination, and pressure and bacteriological tests have passed inspection, but prior to final paving, the system connection closures will be made by the City of Riverside Field Forces unless specified otherwise on the plans. **If City Forces have to make corrections to the line or grade to make the system connections then all labor and materials shall be charged to the Contractor to perform work.** Valves shall be operated by City of Riverside field forces only.

Payment for Contractor installed system connections materials shall be at the bid item unit price. The system connection bid item includes all materials and appurtenances required for the complete closure installation, including but not limited to cut-to-fit fabrication closure pipe, fittings, outlets, valves and flange insulation kits.

It is anticipated that it will take the City Forces approximately seven (7) calendar days to install the "system connections" on the project. It is the Contractor's responsibility to cooperate with the City Forces in the prosecution of this work.

306-1.2.2.2 Sanitary Precautions. The Contractor shall take necessary precautions to protect the pipe interior and fittings from contamination. Fabricated pipe will be delivered to the work site with temporary end seals. The Contractor shall leave these seals in place until the pipe is ready for use to minimize the entrance of dirt or

foreign material.

When pipe laying is not in progress, or at the end of the days work, all openings in the pipeline shall be closed with watertight, rodent-proof plugs. The Contractor shall have an emergency plug at the pipe heading at all times during pipe laying for use in case of an accidental break of an adjacent or crossing facility. Should water, mud, or any other matter enter the pipe, the pipe shall be thoroughly cleaned.

All exterior joints of the pipe laid in the trench shall be completed before the work day is stopped.

Contaminated material or material capable of supporting prolific growth of micro-organisms shall not be used for sealing joints. Packing material shall be handled in such a manner as to conform to AWWA C600. Materials such as jute or hemp shall not be used.

The lubricant used in the installation of sealing gaskets shall be suitable for use in potable water. The lubricant shall be delivered in closed containers and shall be kept clean.

306-1.2.2.3 Construction Water. Water required for the initial filling, pressure testing, leakage testing, flushing, and chlorination, may be obtained from an existing City main or fire hydrant by use of a City meter and an Approved Backflow Prevention Device.

The Contractor shall not operate any gate valve on any existing main. All water must be measured through a meter which can be checked out from the City's Utilities Operation Center (UOC) located at 2911 Adams Street.

All construction equipment involving the filling, pumping, spraying and carrying of water, etc., shall be under cross-connection control regulations, of the City Water Division and shall be checked by the Cross-Connection Technician prior to using the equipment on the job site, (Phone 951-351-6320). An approved backflow device shall be used while filling, flushing or chlorinating the mains. Valves at the system connections shall not be opened to supply water for any purpose until all testing is accepted by the Engineer.

NOTE: The Contractor shall pay all rental and deposit fees for the use of fire hydrant meters or backflow devices. Before the "fire hydrant meters" and "backflow devices" are obtained, all rental deposits and water charges shall be paid by the Contractor, to the City's Utility Operation Center, Customer Service Division, located at 3025 Madison Street, Riverside, CA., (Phone 951-351-6223).

306-1.2.2.4 Pipe Installation.

(1) Loading, Transporting, and Unloading

After the pipe has been tested, it shall be loaded on rubber-tired vehicles, and adequately supported and checked to prevent any damage during transportation, and delivered to the Work site. During loading, unloading, and stringing operations, pipe and fittings shall be moved with care to prevent damage thereto. Unloading shall be accomplished in a workmanlike manner as directed by the manufacturer. Under no circumstances are pipe and fittings to be dropped or bumped in handling.

(2) Defective or Damaged Material

Pipe and fittings shall be carefully inspected for defects. Any pipe found to be defective in workmanship or materials or so damaged as to make repair and use impossible shall be rejected and removed from the Work site.

In the event that pipe is damaged, damaged portions may be removed, as approved by the Engineer, and discarded. Contractor shall be responsible for any and all damage to material and he shall stand the expense of repairing or replacing same. Contractor shall take proper precautions to assure that rubber gaskets are protected from oxidation or undue deterioration.

(3) Installation

Pipe manufacturer, fitting manufacturer, and material supplier, in addition to the City's representative(s), shall have access to the Work during installation. Contractor shall use assistance provided by either manufacturer or supplier where required for proper installation of pipe, fittings, or materials; however, Contractor shall limit role of either manufacturer or supplier to advisory service.

(4) Ductile Iron Pipe

All pipe shall be laid true to line and grade and at the locations shown by the construction drawings or as specified. Pipe shall be installed in accordance with applicable provisions of AWWA C600, latest, applicable provisions of Ductile Iron Pipe Research Association "Guide for the Installation of Ductile Iron Pipe", latest, and manufacturer's directions. Bell ends shall be placed uphill unless otherwise permitted.

After pipe has been set in trench, exterior of spigot and interior of bell shall be thoroughly cleaned. Lubricant recommended by pipe manufacturer and as approved by the Engineer shall be applied to rubber gasket. Lubricant shall be water soluble, nontoxic, shall impart no objectionable taste or odor

to the water, shall have no deteriorating effects on the rubber gaskets, and shall not support growth of bacteria. Excess lubricant shall be removed. Pipe ends shall be aligned, and spigot shall be pulled into bell with come-along devices, or hoists with chains and slings, unless permitted otherwise. If either the pry bar or the backhoe bucket method is permitted, a timber header shall be placed between the pipe and the pry bar or backhoe bucket before the spigot is pushed into bell.

Curved alignment by use of pulled joints will be permitted. Maximum joint deflection shall be 80% of the manufacturer's recommended joint deflection. For purposes of reducing angular deflections at pipe joints, Contractor may install pipe sections of less than standard length.

Whenever cutting of pipe is required, it shall be done with a special cutting tool specifically made for cutting and machining ductile iron pipe. Cut ends and rough edges shall be ground smooth and beveled for push-on joints.

As Work progresses, a pipe cleaning tool as approved by the Engineer shall be drawn through pipe to remove dirt, rocks, or other foreign material. At the end of each day's work, all openings in the pipeline shall be plugged with watertight expandable plugs or approved equal.

(5) Cement Mortar Lined and Coated Welded Steel Pipe

(a) Pipe and fittings shall be laid to the lines and grades shown on the contract drawings except as amended and supplemented by the manufacturer's tabulated layout drawings as approved by the Engineer.

(b) Prior to assembling the pipe joints, thoroughly clean the bell and spigot groove surfaces and rubber gasket, the initial 2-inches of the bell entry. The spigot groove and the rubber gasket shall be lubricated with a soft, vegetable soap compound. The gasket shall be positioned in the spigot groove so that the rubber is distributed uniformly around the circumference.

(c) The position of the gasket shall be checked with a thin metal feeler gauge, around the entire circumference. If the gasket is out of position, then the pipe shall be withdrawn and the gasket checked to see that it is not cut or damaged, the pipe shall then be relaid and the gasket rechecked for position.

(d) Pipe shall be joined together to provide the proper space between abutting pipe ends. To maintain the laying length shown on the

contract drawings, the joint space width may be varied to compensate for the pipe length and field installation tolerances.

(e) Inside joint recesses shall be filled with stiff cement mortar consisting of 1 part cement to 1-1/2 parts sand. For pipe diameters 21-inches and smaller an accessory such as a specially designed rubber ball wrapped in burlap shall be used to screed off excess mortar leaving a smooth and continuous surface between pipe sections as it is pulled through the pipe.

(f) Exterior joint spaces shall be filled with cement mortar consisting of 1 part cement to 2 parts of sand. The mortar shall be poured into the opening of a polyethylene foam grout band which is centered over the pipe joint and is snugly strapped in the exterior wall. The mortar grout shall completely fill the outside annular space between pipe ends and around the complete circumference. After the spaces have been filled, the opening shall be closed and the mortar allowed to set before bedding and backfilling at the joint. The pipeline field test shall be planned so that no pipe section is hydrostatically tested to less than 150 psi.

306-1.2.4.1 Field Jointing of Mortar Lined and Coated Steel Pipe. Mortar lined and coated steel pipe and fittings shall be joined in accordance with the manufacturer's installation manual and AWWA M11. Bonding jumpers or flange insulation is required.

(1) Adjustment Pipe.

The Contractor shall provide necessary cut-to-fits to place all valves, elbows, or outlets on the design station.

(2) Joint Deflection.

The Contractor may deflect the joints to "pull through" the vertical angle points as shown on the plans. The Contractor shall limit deflection of the joint to 80 percent of that listed by the manufacturer.

306-1.2.6 Field Jointing of Ductile Iron Pipe. Ductile Iron Pipe and fittings shall be joined in accordance with the manufacturer's installation manual and AWWA C600.

(1) Adjustment Pipe

The Contractor shall provide necessary cut-to-fits to place all valves, elbows, or outlets on the design station. All cut ends and rough edges shall be ground

smooth and for push-on type joints, the cut end shall be beveled slightly.

(2) Joint Deflection

The Contractor may deflect the joints to "pull through" the vertical angle points or horizontal curves shown on the plans. The Contractor shall limit deflection of the joint to 80 percent of that listed by the manufacturer.

(3) Polyethylene Encasement

All Ductile Iron Pipe shall be wrapped with 8 mil. minimum thickness polyethylene encasement per Section 4.1 of the latest edition of AWWA C105/ANSI A21.5. The Contractor may use Method A, B, or C for installing the polyethylene tube or sheet in accordance with manufacture specifications.

306-1.2.6.1 Flanged Joints (General). In assembling a flanged joint, the Contractor shall align the flanges and draw up the flange bolts evenly so that no portion of the assembly will become prestressed.

All nut and bolt threads shall be lubricated with oil and graphite or "No-Ox-Id-Grease" prior to installation.

Flange joints shall be coated with Koppers #50 bitumastic or City approved equal after assembly.

Flange joints shall be wrapped with two layers of 8 mil polyethylene and shall be secured to the pipe and valve with 2-inch wide polyethylene adhesive tape, Scotchwrap #50, or City approved equal.

306-1.2.14 Welded Joints and Split Butt-Straps. All welding carried out by the Contractor shall be governed by AWWA C206, Field Welding of Steel Water Pipe, and as noted below.

(a) General

1. Field welding of steel pipes and fittings shall conform to requirements of AWWA C206. Field welding of ductile and cast iron pipe or fittings is prohibited.

2. All welding shall be done by an unvarying arc-welding process which excludes the atmosphere during the process of deposition and while the metal is in a molten state. The size and type of electrode used,

and the current and voltage required, shall in all cases be subjected to the approval of the Engineer. The type of wire and flux to be used for automatic processes shall also be subject to the approval of the Engineer.

3. Rusted or otherwise damaged electrodes shall not be used, and violation of this provision shall be sufficient cause for rejection of the work. Used flux from automatic welders shall be sifted free of fines and coarse pieces and shall have all mill scale removed before reusing.

4. All welds shall be of uniform composition, neat, smooth, full strength, ductile, and shall be made with a technique which will ensure uniform distribution of load throughout the welded section with a minimum tendency to produce eccentric stress or distortion in the weld or in the metal adjacent thereto.

(b) Quality of Welds

1. There shall be no greater evidence of oxidation in the metal of the weld than in the metal of the unwelded plate. All welded joints shall be of a type that will produce complete fusion of the plates and shall be free from unsound metal, pinholes, and cracks.

2. The finish of welded joints shall be reasonably smooth and free from grooves, depressions, burrs, and other irregularities, and there shall be no valley or undercut in the center or edges of any weld.

3. All back chipping on both automatic and hand welding, whether for repairs or preparation of the groove for the original weld, shall be subject to inspection before being filled with weld metal. All butt welds shall be back chipped with a round-nosed tool to sound metal and inspected before welding the reverse side.

(c) Field Joints

1. Field joints shall be of the weld bell and spigot type. Welded joints shall conform to the details shown on the drawings for welded field joints or for butt-strap joints where required for closure.

2. At all welded lap or butt-strapped field joints, the outside weld or welds, as the case may be, shall be made with at least one (1) downhand pass and one (1) uphand pass. Fitting of butt straps shall be done with angle- bar clips and bolts pulled tight; provided that such

angle-bar clips shall be removed to the satisfaction of the Engineer upon completion of welding. The use of chains and jacks to pull up straps will not be permitted.

(d) Hand Welding

1. In all hand welding, the metal shall be deposited in successive layers so that there will be at least as many passes or beads in the completed weld as indicated in the following table:

Plate Thicknesses (inches)	Fillet Weld, Minimum Number of Passes
3/16	1
1/4	2
5/16	3
3/8	3
13/32	3
7/16	4
15/32	4
1/2	4
More than 1/2	1 for each 1/8 inch and any remaining fraction thereof

2. For all hand butt welds and other hand welds where possible, except plain 90-degree fillet welds, the plate edges shall be so prepared that there will be sufficient angle in the welding groove to prevent side arcing of the electrode and to permit penetration at the deepest point of the groove. All such welds shall be back chipped with a round-nosed tool to clean metal on the reverse side from the side of deepest penetration before any welding is done on said reverse side. Each hand pass and each back chipped welding groove shall be subject to inspection before the ensuing pass is made. Each hand pass shall be the full width of the weld.

3. For all hand welds, not more than 1/8" of metal shall be deposited in each pass. Each pass except the final one, whether in butt or fillet welds, shall be ground and/or chipped to remove dirt, slag, or flux before the succeeding bead is applied. Each pass shall be thoroughly fused into the plates at each side of the welding groove or fillet and shall not be permitted to pile up in the center of the weld. Undercutting along the side will not be permitted.

(e) Defects

All porosity and cracks, trapped welding flux, or other defects in the welds shall be completely chipped out in a manner which will permit proper and complete repair by welding. Defective welds shall in general be repaired by hand welding; provided that the repair of defects in automatic welds shall be made on automatic welding machines where, in the Engineer's opinion, the defect is so extensive as to make a hand repair undesirable.

(f) Contractor's Equipment

The Contractor's equipment for all welding and flame cutting shall be designed and maintained in such condition, at all times, as to permit qualified welding operators to obtain the requirements prescribed in these specifications. In all welding by an automatic process, both the rate of deposition of weld metal and the rate of travel of the electrode shall be automatically controlled. The submerged arc process shall be used for automatic welding.

(g) Welders

1. Welding shall be done by skilled welders who have had adequate experience in the method and materials to be used. All welding operators shall be qualified under the standard qualification procedure of the latest edition of the ASME Boiler and Pressure Vessel Code, Section IX, Welding Qualifications. Any welder or welding operator performing work under this contract shall have been qualified for the process involved within the past three (3) years.

2. The Contractor, when required by the Engineer, shall conduct tests of his welders to determine their ability to produce welds that are in compliance with these specifications. Tests shall be made in accordance with the above-named qualification procedure using machines and electrodes similar to those that are to be used on the work and in the presence of the Engineer, who shall determine the quality of the work done. In lieu of tests conducted in the presence of the Engineer, the City may require that welders be qualified under the ASME qualification procedure by a testing agency approved by the City. The specimens shall be welded in the same position in which the welder is qualifying to work, and the same number of passes shall be used.

3. The City may call for additional test plates as the work progresses and may demand the removal of any welder from the work under the contract whose work on the pipe is not satisfactory, regardless of the quality of the test welds. The Contractor shall furnish all materials and bear all expense of qualifying welders.

4. The sequence of welding and all welding procedures shall be subject to approval by the Engineer.

Field Weld joints shall have the exterior joint recess grouted; split butt-straps shall be coated with a stiff Class "C" mortar in accordance with the Standard Specification and reinforced with expandable metal lath or two layers of 2" x 4" x 13 gauge weld mesh.

306-1.3 Backfill and Densification.

306-1.3.1 General. The backfill material as defined in the Standard Specifications shall include the following:

(1) The Backfill Zone shall be considered as the volume between the top of the bedding zone to the bottom of the paving base material.

(2) The excavated material is not suitable to be used within the pipe zone nor in the pipe bedding zone unless the excavated material is blended with imported coarse grain sandy soil to meet the project specifications. The excavated material is suitable to be used as backfill material in the pipe trench zone provided it is free form organic matter and other deleterious materials.

(3) Backfill material shall consist of moist clean loose earth, sand, gravel, or rock free of clay and silt as well as brush, roots, and organic substances. From the top of selected backfill for the bedding material to within 1 foot of ground surface or pavement subgrade, backfill material shall be free of material exceeding 3 inches in greatest dimension. It shall also be compacted to 90 percent relative compaction minimum. Within 1 foot of ground surface or pavement subgrade, backfill material shall be free of material exceeding 2 inches in greatest dimension and it shall be compacted to 95 percent relative compaction minimum. Rocks shall be mixed with suitable soil to eliminate voids; they shall not be nested. Backfill material shall be well graded.

(4) Backfill material shall be placed in lifts not exceeding 12 inches in thickness (loose measurement) and each lift shall be compacted to 90 percent relative

compaction minimum by hand tampers, pneumatic tampers, or mechanical compactors except that the upper 12 inches of backfill shall be compacted with mechanical compactors or compaction equipment, excluding stompers, to 95 percent relative compaction. Alternatively and except for the upper 12 inches of backfill, sandy, granular soils may be densified by water settlement. Trench to be backfilled by water settlement shall be diked at suitable intervals not exceeding 100 feet. Impounded water shall be of sufficient depth so that earth pushed or shoveled into trench will at all times fall into water, becoming completely saturated. If necessary, jetting may augment flooding. Backfill densified by water settlement shall be densified to 90 percent relative compaction minimum. Contractor shall use mechanical compactors or compaction equipment, excluding stompers, to achieve required compaction if required densification is not achieved by water settlement.

(5) Internal pipe bracing or strutting shall not be removed until the backfill material is compacted to the specified requirement. If the backfill material is densified with water, the bracing shall not be removed until the backfill material has settled and dried.

306-1.3.2 Mechanically Compacted Backfill. At the discretion of the Contractor, impact type pavement breakers (stompers) will be permitted over Ductile Iron and Mortar Lined and Coated Steel Pipe. Damaged mains or appurtenances shall be replaced at the Contractor's expense.

306-1.3.3.1 Flotation of Pipe. The Contractor shall at all times protect the pipe against flotation due to water entering the trench from any source, and shall assume full responsibility for any damage due to this cause. If the pipe is displaced due to flotation, the Contractor, shall, at Contractor's expense, restore and replace the pipe to its specified condition and grade.

306-1.3.3.2 Compacting. The native backfill material is not suitable for water jetting.

306-1.4 Testing Pipelines. See Part 7 of this Specification, Testing and Disinfection of Water Mains and Appurtenances.

306-1.5 Trench Resurfacing. Compaction and trench resurfacing in the public street right-of-way is performed under the jurisdiction of the City Public Works Department. The Contractor must meet all requirements of that department as it relates to this portion of the Work. Final payment for trench resurfacing items will not be made until acceptance is received from the Public Works Director or his authorized representative.

306-1.5.1.1 Temporary Resurfacing. Temporary resurfacing, 3-inches deep (minimum), will be required at the following locations:

(a) All paved trench areas.

(b) Payment shall be the bid item price per linear feet of temporary resurfacing material placed on the trench and shall include full compensation for furnishing, placing, maintaining, removing, and disposing of such temporary materials as specified in these Specifications.

(c) Temporary pavement shall be maintained in a smooth cohesive condition, flush with the existing pavement, until replaced by permanent pavement. Any voids, ripples, breaks, etc., shall be repaired before the end of the work day.

306-1.5.2.1 Permanent Resurfacing. Permanent resurfacing shall consist of placing the asphalt concrete pavement material in accordance with the City of Riverside, Public Works Department, Standard drawing 453, and these Specifications.

Measurement of payment for permanent asphalt concrete pavement and crushed aggregate base shall be at the unit price indicated in the bid item and shall include pavement for all system connections and fire hydrant, blow-off, air valve and service laterals and all related costs for providing, placing and compacting the asphalt concrete pavement and crushed aggregate base, including all materials and labor necessary to complete the work.

The Contractor shall adjust all water facilities to finished grade, clean the inside of the valve boxes, clean pavement off the valve lid, prime and paint per CWD-515.

Re-striping of the streets shall be done by the Contractor per City standards. If the bid schedule does not include a specific bid item for striping, striping shall be included in the pipe unit price.

306-1.5.3 Sanitary Sewer Clearance. Broken or damaged sanitary sewer laterals shall be immediately repaired or remodeled per PWD Standard Drawing Nos. 554-1 and 2. Stipulated prices apply only for laterals requiring remodeling. The Contractor shall support and backfill the sanitary sewer lateral at said locations.

306-9 APPURTENANT PIPELINE STRUCTURES AND INSTALLATION

306-9.1 General. The Contractor shall furnish all transportation, materials, equipment, and labor to complete the excavations, backfill materials, street repairs and other earthwork incidental to the construction of appurtenant structures and appurtenances, and any work necessary or incidental to provide a complete and operating

water main as contemplated in the plans and these Specifications.

306-9.2 Flange Insulation and Test Lead Installation.

a. No less than 2 snug fitting alignment pins shall be used in aligning the flanges for the insulating joints. These pins shall remain in place until the bolts have been installed in all the remaining holes and have been drawn up tightly.

b. The City shall make electric tests after the installation to ensure that the insulating sections are effective.

c. The #4 stranded copper test leads shall be attached to steel pipe with Cadweld HA-3 connection, CAHAA-IL W/F33, standard charge; and to Ductile Iron Pipe with Cadweld HB connection, CAHBA-IL, XF-19 charge.

d. Mix and firmly apply epoxy putty to provide a watertight seal at least 1/4-inch thick over weld and bare wire. Overlay wire insulation by 1/2-inch.

e. Upon completion of the project and prior to placing the trench pavement, the Contractor, at his own expense, shall hire a qualified testing firm to test the continuity of all bonds. Tests shall be conducted between test stations and the measured resistance shall not exceed the theoretical resistance by more than 130%. All test data shall be submitted to the Engineer for review and approval. Contractor, at his own expense, shall repair all bonds that fail the continuity test and shall retest those sections for continuity.

306-9.3 Valve Installations.

a. Valves shall be installed in a level position with the operation stem vertical except where shown otherwise on the plans.

b. After installation of the mainline pipe is completed, the Contractor shall apply one coat of Koppers #50, or City approved equal, bitumastic coating to damaged areas of buried valves and shall wrap the entire valve with two layers of 8 mil polyethylene and seal all seams with 2-inch wide #50 Scotchwrap tape.

c. Valves shall be stabilized and supported separately from the pipeline as shown on the plans or on the Standard Drawings.

d. Mainline and appurtenant valves shall be tested for leak-proof tightness after the main line has been pressure tested, at the test pressure.

e. "Valve Location Ties" shall be made by City Forces either in accordance with

Section 306-9.8 in these Special Provisions or as a white 4" x 4" witness post set at the property line.

f. All valves shall be installed in accordance with Appendix A of AWWA C500.

g. Butterfly valves shall be installed with the valve operator on the "up station", right side of the valve.

h. All butterfly valves shall be installed in accordance with Appendix A of AWWA C504.

306-9.4 Valve Box Installations.

a. The Contractor shall install valve box, cap and rim, and valve operator extensions of the type indicated in the Standard Drawings.

b. Operator extensions and sleeves shall be centered and set plumb over the valve operator nut.

c. Shaft extension is required where the distance between the finished ground surface to the valve operator nut is greater than 3.5 feet.

d. Operator extensions shall be fitted with an AWWA 2-inch square operating nut and a tapered socket end for the valve operating nut. The extension shaft shall extend from the valve nut to within 18-inches of the finished ground surface.

e. Operator extension shaft, nut, socket and centerline guide shall be painted with one coat of primer after fabrication.

f. The valve box caps shall be set flush to 1/4" above the finished pavement surface.

g. Where valve box or Manhole installations are not within paved areas, a 6-inch thick concrete pad, 520-A-2500, 24-inches greater in diameter shall be formed around the appurtenance.

h. The valve box cap shall be painted per paint schedule, Section 210-1.5.

i. Valve box caps shall fit securely in the slip sleeves, to prevent displacement due to traffic loads.

306-9.5 Blowoff Installations.

a. The piping between the outlet valve and the pumper riser shall be at a continuous downgrade of not less than 1/4-inch per foot.

b. Where blowoff manholes are placed in sidewalk areas, the sidewalk shall be saw-cut and removed to the nearest score line. The manhole cover and rim shall be set to sidewalk grade and the sidewalk replaced.

c. Where blowoff manholes are placed in unpaved areas, the cover and rim shall be set flush with the existing edge of pavement or as directed by the Engineer.

d. The manhole cover and rim shall be Alhambra Foundry A-1252, diamond thread finish and lettered CWD.

e. The blind and mating flange shall be painted with two (2) coats of primer paint.

306-9.5.1 Temporary Blowoff Installations.

(1) Temporary blowoffs may be used for pressure testing, flushing and disinfecting the main.

(2) Should the Contractor use a concrete thrust block, Contractor shall provide a suitable separation material (such as tar paper or wood blocking) so that Contractor may remove the thrust block without disturbing the end cap. The Contractor shall remove any temporary concrete thrust block prior to system connection by City.

306-9.6 Air Valve Installations.

a. The piping between the outlet valve and the elbow on the air valve riser shall be at a continuous up grade of 1/4-inch per foot.

b. On 2-inch air valves, all joints shall be sweat welded per Section 207-25.1.1 unless shown as a screwed fitting. The riser shall be hard drawn copper.

c. On 4-inch air valves or larger, all joints shall be welded per Section 306-1.2.14 unless shown as a screwed fitting.

d, The long axis of the air valve shall be set parallel to the street.

306-9.7 Terminal Housing Installations.

a. The Contractor shall install terminal housing boxes at the locations shown on the Standard Drawings.

b. All terminal housing boxes located in the sidewalk or paved areas shall be set flush with the existing surface.

306-9.8 Concrete for Thrust, Anchor and Bearing Blocks.

a. Concrete thrust blocks and anchors shall be poured at the locations and to the dimensions shown on the Plans and Standard Drawings.

b. Sandbags may be used to form thrust blocks or anchors.

c. Concrete shall be placed such that bell ends of fittings shall be available for repairs. Concrete placed over joints shall be removed.

d. Structural steel exposed directly to the soil shall be coated with Koppers #50 bitumastic coating, or a City approved equal, prior to pouring the thrust blocks.

306-9.9 Curb Markings. "Location ties" for valves and blowoffs shall be marked with a 2" x 1/2" wide "+" using blue marking paint on the **top** of the closest curb from two locations. One edge of the "+" in the direction of the tie shall be elongated 1-inch with the distance from tie to curb face shown in 2-inch high lettering. One set of the Plans shall be marked with the locations and dimensions and submitted to the Engineer upon completion of the Work. "Location Ties" shall be installed by City Forces.

306-9.9.1 Abandoning Curb Markers. After the existing water valves have been abandoned, the Contractor shall remove existing painted "Location Ties" to the satisfaction of the City. All stray markings shall be removed by Contractor.

306-10 Protective Coating. All ferrous metal fittings and joints (valves, couplings, flanges, etc.) in contact with the soil shall be coated with one coat of Koppers #50 bitumastic after assembly to the main-line pipe and shall be wrapped with two layers of 8 mil polyethylene which shall be secured to the pipe with two-inch wide Scotchwrap #50 or City approved equal.

SECTION 310 - PAINTING

310-1 GENERAL. Refer to Section 210-1.5 for description of color designation for water appurtenances and approved manufacturers.

SECTION 313 - "AS-BUILT" DRAWINGS

After construction has been completed and before pressure testing and flushing can commence, "As-Built" drawings shall be submitted by the Contractor showing pipe size, material, class and/or pipe thickness, the actual locations (invert elevations) and stations of all valves, tees, special fittings, and stationing of all water service laterals and their run length. . The Contractor shall show and note any deviations from the original plans on the "As-Built" drawings.

"As-Built" drawings shall be prepared on a clean blueprint and shall be legibly marked in red ink.

PART 4

SECTION 400 - ALTERNATIVE ROCK PRODUCTS, ASPHALT CONCRETE, PORTLAND CEMENT CONCRETE AND UNTREATED BASE MATERIAL

400-2.3 Disintegrated Granite.

400-2.3.1 General. Disintegrated granite (DG) base will only be allowed if the existing base on either side of the trench has previously been built using disintegrated granite. The minimum R-value of DG shall be 73.

PART 5

SECTION 500 - PIPELINE SYSTEM REHABILITATION

(DELETED)

PART 6

SECTION 600 - MODIFIED ASPHALTS, PAVEMENTS AND PROCESSES

Not Used

PART 7

SECTION 700 - TESTING AND DISINFECTION OF WATER MAINS AND APPURTENANCES

700-1 GENERAL. All water mains and appurtenances shall be tested for pressure and leakage, shall be disinfected, and bacteriological tests accepted by the Riverside Public Utilities prior to utilizing the water mains and appurtenances for domestic use.

Testing and disinfection of water mains and appurtenances shall be in accordance with the applicable AWWA Standards except as herein modified.

All testing, disinfection and bacteriological sampling shall be made in the presence of the Engineer. The Contractor shall notify the Engineer not less than 48 hours in advance of the actual time of testing and/or disinfection so that the Engineer may observe the procedure.

When the pressure test, leakage test, chlorination or bacteriological tests fail to meet the requirement of the Specifications, the Contractor shall make necessary repairs, replacements or repetition of procedures to conform to the specified requirements at Contractor's expense.

700-2 PRESSURE TEST. All water mains and appurtenances shall be tested as described herein. The pressure test shall **not** be performed until the following conditions have been met:

1. All blowoffs, air valves, services, hydrants, and other appurtenances have been installed and adjusted to final grade and location;

2. The backfill material shall have been compacted to the required compaction through the 90 percent compaction zone as shown on CWD-040-1&2.

3. All concrete anchor and thrust blocks shall be allowed to cure for a minimum of three days.

4. Base materials with the exception of the final surface course of asphalt concrete, may be placed prior to the pressure test.

5. "As-built" drawings and all affidavits and certificates of compliance have been submitted to the Inspector.

The pressure test shall be maintained on the test sections as stated below. The Contractor may at Contractor's convenience conduct a preliminary pressure test at any time prior to the City's pressure test. The results of the preliminary test will not be considered by the

City.

The test pressure shall be 200 psi, for 2 hours for the 12-inch Ductile Iron Pipe, and 4 hours for the 20-inch Ductile Iron Pipe as measured at the lowest elevation of the water main under test.

The length of water main to be tested, at one time, shall be determined by the Engineer.

Each section of the water main to be tested shall slowly be filled with water from the nearest source by a means approved by the Engineer. The pipelines shall be filled with water and placed under a slight pressure for at least twenty-four hours before the pressure test.

All air shall be vented from all high points in the water main, fire hydrants, and services before making a pressure test. If hydrants or other outlets are not available, taps shall be made at the high points to expel the air by the Contractor at Contractor's own expense. These taps shall be capped by the Contractor prior to testing.

The test pressure shall be applied by means of a pump connected to the pipeline in a manner approved by the Engineer. The pump, pipe connections, bulkheads, pressure gages and other equipment, labor and materials required to perform the test shall be furnished by the Contractor, at no additional cost to the City.

The Engineer may check the test pressure by installing City pressure gages in place of the Contractor's gage. In case of a difference in pressure readings between gages, the City's gage reading shall govern.

All appurtenant facilities shall be tested at the same pressure and for the same duration as the mainline pipe.

All valves shall be tested for leak-proof tightness after the mainline pressure test with the test pressure on one side of the valve and atmospheric pressure on the other side.

Wet tap valve sleeves shall be hydrostatically pressure tested for a period of 1 hour at a test pressure of 200 psi. During and at the end of test, a solution of soapy water shall be applied at all joints to test for leakage. No pressure loss or leakage will be permitted.

700-3 LEAKAGE TEST. All water mains and appurtenances shall be tested as described herein.

The test pressure applied to the water main for the leakage test shall be maintained as constant as possible for not less than 2 hours for the 12-inch Ductile Iron Pipe and 4 hours for the 20-inch Ductile Iron Pipe. The leakage test shall be held concurrently with the pressure test.

The lengths of fire hydrant, blowoff or air valve laterals and service lines are not included in the overall length of pipe in determining the allowable leakage. All welded sections of steel pipe mains are also excluded from the calculated allowable leakage.

All noticeable leaks shall be stopped regardless of the results of the test. Defective pipe, fittings, valves, and other appurtenances discovered leaking during the test shall be removed and replaced. Repair clamps of any kind or type are not allowed.

The allowable leakage volume shall not exceed the following: Non-welded steel joints, and Ductile Iron Pipe = 15 gal/in. dia./mile/24 hours. The allowable leakage for pipes with welded joints = 0.

It is the Contractor's responsibility for locating leaks and restoring the bedding material, in accordance with the Standard Plans and these Specifications, resulting from leaks discovered during the pressure leakage test. Any retesting shall be at Contractor's expense.

The pump, pipe connection, measuring devices, gages and all other equipment, labor and materials necessary for performing the leakage test shall be furnished by Contractor. The Engineer may, however, use City's measuring device in place of Contractor's equipment. In case of a difference in the measured leakage rate between the measuring devices, the City's measured leakage shall govern.

700-4 FLUSHING. The new mains shall be cleaned and flushed prior to chlorination. The flushing velocity to be obtained for pipes 12-inches and smaller in diameter shall not be less than 2.5 feet per second. The Contractor shall make the necessary arrangements to attain the minimum velocity. The Contractor shall take due precaution in providing for adequate drainage from the site. The minimum volume of water to be flushed, at required velocity, shall be not less than 1.5 times the volume of the pipe line from the point of filling to the point of blowoff. The Contractor shall verify that hydrants to be used have adequate pressure to perform his flushing operation. If necessary, the Contractor shall use a pump to acquire adequate pressure for his flushing operation, all at his expense. The following table is a guide only:

REQUIRED OPENINGS TO FLUSH PIPELINES
(40 psi Residual Pressure)

Pipe Size	Flow Required to Produce 2.5 ft/sec	Orifice Diameter	Hydrant Number	Outlet Diameter
INCHES	**GPM**	**INCHES**		**INCHES**
4	100	15/16	1	2-1/2
6	220	1-3/8	1	2-1/2
8	390	1-7/8	1	2-1/2

12	880	2-13/16	1	4-0
16	1570	3-3/4	1	4-0

If, in the opinion of the Engineer, dirt enters the pipe, the interior of the pipe shall be cleaned and swabbed as necessary with five percent hypochlorite disinfecting solution.

It is the responsibility of the Contractor to dispose of the flushed water from the project area. The Contractor is responsible for any damage as a result of flushing operations.

The flushed water shall have a residual chlorine content not to exceed 0.10 mg/l prior to discharging into the storm drain system. The flushing operation shall be in accordance with the California Regional Water Quality Control Board requirements.

The Contractor shall provide adequate drainage from the site.

The Contractor is hereby informed that hydrant meters and backflow devices rented from the City have the following limitations:

2-inch backflow devices: ..... 160 gpm

2-inch fire hydrant meter: ..... 200 gpm

700-5 CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD, SANTA ANA REGION PERMIT. Contractor shall channel (using sandbags or other means) flushing flow. Contractor shall protect all property from flooding and other damage during flushing operations. Contractor shall post "flooding ahead" signs in streets as required and as directed by Engineer. Because of demand on existing water system, the Engineer may require Contractor to flush the pipeline over several days, in the evenings, weekends, or holidays, at Contractor's expense.

Contractor shall not allow any discharges from the construction site which may have an adverse effect on receiving waters of the United States.

Contractor shall, at his expense, obtain a discharge permit from the California Regional Water Quality Control Board, Santa Ana Region (Regional Board) for discharge of water from trench dewatering, line flushing, and testing operations. A copy of said discharge permit shall be provided to the City. Contractor shall comply with conditions therein and perform the monitoring required. If the Regional Board determines that a discharge permit is not required for said work, then the Contractor shall comply with any and all applicable criteria and conditions established by the Regional Board, including compliance with the requirements of the General Water Discharge Requirements for Discharges to Surface Waters which pose an insignificant De Minimus threat to water quality (Order No. 98-67).

Order No. 98-67 includes submittal of a Notice of Intent and a waste discharge report to the Regional Board. In addition, Template Monitoring and Reporting Program No. 98-67, appended to Order No. 98-67, includes the following monitoring and reporting requirements:

1. Estimate and report daily discharge flow, collect samples of each discharge and have them analyzed for the 8 parameters listed on Pages 2 and 3 of the Template Monitoring and Reporting Program No. 98-67. All samples shall be representative of the waste discharge under conditions of peak load.

   All sample collection, sample preservation, and analyses shall be performed in accordance with the latest edition of "Guidelines Establishing Test Procedures for Analysis of Pollutants" promulgated by the U.S. Environmental Protection Agency (40 CFR 136). All sample analyses shall be performed by an analytical laboratory certified by the California Department of Health Services to perform such analyses.

2. Report any discharge which is in violation of the discharge specifications (Order No. 98-67) to the Regional Board, Santa Ana Region within 24 hours.

3. Notify the Regional Board 5 days before commencing any discharge.

4. Prepare monthly monitoring reports for submittal to the Regional Board. The reports shall include:

   a. Results from all analyses for the previous month.

   b. Daily flow data.

   c. A report detailing Contractor's compliance or noncompliance with Order No. 98-67 and the discharge authorization letter.

700-6 DISINFECTION. All newly laid water mains and appurtenances shall be disinfected in accordance with AWWA C-651, Disinfecting Water Mains, except as modified herein.

Disinfection shall be performed after the pressure and leakage tests have been accepted by the Engineer.

Contractor must use one of the RPU approved companies who are licensed to perform chlorination (Mattchlor, Inc; Southwest Chlorination, Inc; Aqua Backflow; Spencor Inc; Morr-is Tested; Peirce Chlorine). Should the contractor choose to use a different company, of equal qualifications, contractor shall obtain prior approval from the Engineer.

Chlorine used for disinfection shall be a liquid chlorine solution by directly feeding, hypo (sodium hypochlorite less than or equal 15%; typically 12.5%) or by mixing Cal-hypo

(calcium hypochlorite 65-70%) granular or tablets into a liquid solution by pre-dissolving or using a feeder. Either product sodium hypo or calcium hypo shall be NSF 61 approved for potable water use. Tablets inserted (glued) inside each pipe length shall not be used. Safe handling practices contained in A.W.W.A. Manual M-20 shall be followed by the Contractor. The chlorine solution shall be applied by the continuous feed method as outlined in Sub-section 5.2 of AWWA C-651-05 except as may be modified by the Engineer. Contractor must keep Material Safety Data Sheet (MSDS) onsite.

The chlorine solution shall be applied, at the beginning of the water main to be disinfected, through a corporation stop installed for this purpose, or through curb stop, or through any other opening as may be allowed or required by the Engineer. Fire hydrants and air valves shall not be used for this purpose. However, an air valve riser pipe with the air valve removed may be an appropriate chlorine solution feed point.

Water used to convey the chlorine solution throughout the water main shall be obtained from an existing distribution system. The rate of flow shall be so controlled that water will flow slowly into the un-disinfected main during the application of chlorine. The end of the main being chlorinated shall be kept open and running during the application of chlorine and until the desired chlorine concentration is reached, after which each curb stop, fire hydrant, air valve line or any other connection to the water main shall be individually opened and flushed with the chlorine solution. After the water main and all appurtenances thereto have been loaded with chlorine to the proper concentration, the water source, chlorine feeder and all other openings to the water main shall be closed.

The initial minimum concentration shall not be less than fifty (50) milligrams per liter (Mg/L) of chlorine, but not greater than 150 (Mg/L). The chlorine solution shall remain in the water main for not less than twenty-four (24) hours after which the treated water through the length of the main shall contain not less than twenty-five (25) Mg/L of chlorine. The chlorine content of the water shall be tested by the Engineer and if found to be less than twenty-five (25) Mg/L after twenty-four (24) hours contact, the water main and appurtenances shall be re-chlorinated and held for another minimum twenty-four (24) hour period.

No chlorination shall be started unless it can be completed by 2 p.m. on a Thursday. During the period of chlorination, all main line valves and blow-off valves shall be operated to insure that the discs and seats are fully open to chlorinated water. Air valves, when removed, shall be chlorinated separately under the direction of the Engineer.

Upon approval of the chlorine residual at twenty-four (24) hours by the Engineer, the chlorine solution shall be flushed from the water main through each service, fire hydrant and blow-off. Flushing shall continue until the chlorine residual is not more than five-tenths (0.5) Mg/L as determined by the Engineer using a digital instrument. In no case shall a chlorine solution of over five-tenths (0.5) Mg/L be held in the main or appurtenances for more than five (5) days from the initial injection to the final flushing. It is the responsibility of the Contractor to dispose of the chlorinated water from the project area.

The chlorinated water shall have a residual chlorine content not to exceed 0.10 Mg/L prior to discharging into the storm drain system. The flushing operation shall be in accordance with the California Regional Water Quality Control Board requirements.

The Contractor has two options for disposing of the chlorinated water from the project site.

Option 1. The Contractor can treat the chlorinated water with chemicals. This treatment shall neutralize any chlorine residual from the water. After treatment the dechlorinated water can be discharged into the street storm drain system.

Option 2. The Contractor shall dispose of the chlorinated water at a State of California approved treatment disposal plant. The Contractor is responsible for any damage as a result of the disinfection operation and shall provide adequate drainage from the project site.

The Contractor is responsible for any damage as a result of the disinfection operation and shall provide adequate drainage from the project site.

The Contractor is hereby informed that hydrant meters and backflow devices rented from the City have the following limitations:

2-inch backflow devices: ..... 160 gpm

2-inch fire hydrant meter:..... 200 gpm

700-7 BACTERIOLOGICAL TESTS. A twenty-four (24) hour period between the final flushing and the taking of bacteriological samples is required. No flushing or any movement of water in pipe is allowed during sampling phase. Following the 24 hour period, the Contractor shall have a representative of employee of California Department of Public Health (CDPH) certified laboratory take water samples for bacteriological tests. All sampling shall be done in the presence of the Inspector. Contractor shall notify the Engineer 48 hours in advance of sampling procedures.

Samples will be taken in the field by a state certified laboratory technician using a digital colorimeter and transported to the laboratory for testing. Such tests shall meet CDPH requirements for drinking water standards. The number and location of such samples will be as directed by the Engineer at every 500 foot interval; however, a minimum of one bacteriological test sample per 500 feet of main and a minimum of 2 samples per day, per test section, are required. The sample locations may be increased to 200 foot intervals, if the contractor fails to take adequate precautions to keep the pipe clean, or as otherwise deemed necessary by the engineer. The Contractor shall install sample points, as needed to meet the spacing requirements, in accordance with standard plan CWD-432, at no additional cost to the city. **One set of samples are required for two consecutive days, 24**

hours apart. All samples, each day, must indicate absent for total coliform and have a heterotrophic plate count (HPC) of less than 200 CFU/mL. Failure of any sample will require complete retesting, under these procedures, for two consecutive days. It is very important that all test results be submitted in writing to the Water Inspector as soon as available. Chain of Custody to be given to the inspector at time samples are taken.

All laboratory testing shall be at the Contractor's expense. Original report of the test results shall be given directly to the Engineer. Emailing the results to the Engineer is preferable. It is the responsibility of the Contractor to accomplish this task. System connections cannot be scheduled until this report is submitted to the Engineer. All results must be submitted to RPU Engineer or his designee no later than three calendar days of sample date or risk resampling all samples.

Upon successful completion of bacteriological testing, the pipeline will be accepted for use in the City potable water system; however, standard policy is to accept the water mains for use upon the City giving written Notice of Final Acceptance.

700-8 CONTRACTOR'S RESPONSIBILITY FOR TESTING AND DISINFECTION. It is the sole responsibility of Contractor to construct a water main which passes the pressure and leakage test and to complete the disinfection of the water main. The fact that City provides inspection during the construction, testing of the water facilities, and receives laboratory testing results to determine the sterility of the water mains, does not relieve Contractor's responsibility in this regard.

It is the responsibility of Contractor to prevent the consumption of water for any and all uses from unsterile mains whether by workers, Subcontractors or any other person who may come in contact with the water from the unsterile main.

Contractor shall indemnify and save the City harmless from any suits, claims, or actions brought by any person or persons for, or on account of, any illness or death sustained or arising out of the consumption of water from the main until final acceptance by the City.

Water required for the initial filling, pressure testing, leakage testing, flushing and chlorination, may be obtained from an existing City of Riverside main or fire hydrant by use of a City of Riverside Water Division meter and an Approved Backflow Prevention Device.

All water must be measured through a City of Riverside Water Division meter. The Contractor may use Contractor's own Approved Backflow Prevention Device, however, it shall be approved by the City of Riverside, Water Operations, Backflow Technician before use. The operation of any valve on any existing main shall be performed by the utility owner.

The Contractor shall pay all rental and deposit fees for fire hydrant meters or Backflow Prevention Devices checked out from the City of Riverside Water Services Division plus

charges for water used, unless otherwise specified.

700-9 SYSTEM CONNECTIONS TO EXISTING CITY WATER LINES. No permanent connection between any Contractor installed water main and existing water mains shall be made by the Contractor, unless otherwise shown on the plans. The valves installed on the system connections, in accordance with the plans, shall remain closed.

The Contractor shall not operate any valve on any existing main.

City of Riverside, Field Forces shall dewater the proposed and existing water mains as necessary.

Appendix N

Home Gardens Sanitary District

Sewer line Specifications

SECTION 02710

VITRIFIED CLAY PIPE FOR GRAVITY SEWERS

PART 1- GENERAL

A. **Description**

This section describes materials, testing, and installation of vitrified clay pipe (VCP) and fittings for sanitary sewers.

B. **Submittals**

1. Shop drawings shall be submitted in accordance with the General Provisions and the following.
2. Provide certificates of compliance with all standards referenced in this section to the Engineer,
3. Provide copies of the manufacturer's required tests to the following conducted on project pipe:
   a. Crushing test.
   b. Record of retests and rejections.

C. **Measurement and Payment**

1. Payment for work in this section shall be in accordance with the General Provisions and the following.
2. Payment shall be by the linear foot for each diameter and for each pipe strength designation measured horizontally over the pipe centerline, exclusive of the distance between the inside faces of each structure, manhole or other similar connecting structure. Unless otherwise specified herein, no additional payment shall be made for curved or radius pipe. Such pipe shall be measured and paid for in the same manner as described above for straight pipe.

PART 2 – MATERIALS

A. **Vitrified Clay Pipe**

1. General: All VCP and fittings shall be extra strength, and shall comply with ASTM C700. Pipe and fittings shall be homogenous in structure; thoroughly burned through their entire thickness; impervious to moisture; and free from cracks, checks, blister, broken extremities, or other imperfections. Pipe ends shall be square with the longitudinal axis, and sockets shall be true, circular, and concentric with the barrel of the pipe. The thickness of the shell, the depth of the socket, and the dimension of the annular space shall be within the limits of permissible variation to dimension standards of the specifications of ASTM C700, for the size of pipe indicated on the plans.
2. Pipe Marking: All pipe or fittings shall be clearly marked with the name of the manufacturer or with a trademark and with the size and strength of the pipe as

shown on the plans and as herein specified.

3. Testing: All costs of furnishing, transporting, and handling the pipe for testing and conducting the tests shall be borne by the Contractor.

   Where specifically approved by the Engineer, a certified statement from the pipe manufacturer, in lieu of witnessing by a testing laboratory may be furnished stating that all prescribed tests have been made and the pipe to be used on the project has met all requirements of the specifications.

   All pipe shall be subject to inspection at the factory, trench, or other point of delivery by the Engineer. The purpose of the inspection shall be to cull and reject any pipe that, independent of the physical tests herein specified, fails to conform to the requirements of these specifications or that may have been damaged during transportation or in subsequent handling.

4. Causes for Rejection: The following imperfections in a pipe or special fitting shall be considered injurious and cause for rejection without consideration of the test results specified above.

   A single crack in the barrel of the pipe will cause rejection.

   Surface imperfections, such as lumps, blisters, pits or flakes, on the interior surface of a pipe or fitting shall cause rejection.

   When the bore or socket of the pipe varies from a true circle more than 3% of its nominal diameter, it shall be rejected.

   The pipe or fitting shall be rejected if it is designated to be straight and it deviates from a straight line more than 1/16-inch per lineal foot. The deviation shall be measured from a straight edge at a point midway between the ends of the pipe.

   A joint of pipe with a piece broken from either the socket or spigot end shall be rejected.

   Pipe joints that have tramp clays, grog or other foreign matter flushed permanently to the exterior or interior surface of the pipe or fittings shall be rejected.

5. Joints: Unless otherwise specified, all VCP pipe and fittings joints shall be of the bell and spigot compression type, complying with ASTM C425. The compression joint on the spigot and bell ends of the pipe shall be factory made of plastisol, polyurethane elastomer, or other approved resilient element bonded onto the outside of the spigot and the inside of the bell to the pipe and molded and cured to a uniform hardness and compressibility to form a tight compression coupling when assembled.

   Where pipe from different manufacturers is to be jointed together, an adapter pipe with the proper matching joint on each end for the respective manufacturer shall be used. Hot poured joints or concrete encasement of plain end joints shall not be permitted.

6. Branches: Branches of the type shown on the plans shall be furnished with connections of the sizes specified and shall be securely and completely fastened to the barrel of the pipe in the process of manufacture. Tee branches shall have their axis perpendicular to the longitudinal axis of the pipe. Wye branches shall have

their axis approximately 45-degrees (unless otherwise specified on the plans) to the longitudinal axis of the pipe, measured from the socket end. All branches shall terminate in sockets and the barrel of the branch shall be of sufficient length to permit making a proper joint.

7. Stoppers: The stoppers for all pipe 8-inches in diameter and smaller, in which a sealing component for a flexible compression-type joint is cast, shall be neoprene, polyethylene, or polyurethane. Stoppers in all other cases shall be discs of the same material as the pipe, equal in diameter to the outside of the pipe barrel, and made and installed as approved by the Engineer.

   Neoprene stoppers shall be manufactured from a compound containing not less than 50 percent neoprene by volume, which shall be the sole elastomer. Stoppers shall not be adversely affected when exposed to the chemical and bacteriological environments normally found in wastewater sewers.

   When installed and braced in place in branch spurs, stoppers shall withstand a hydrostatic pressure test of 10 psi with no leakage. When unbraced, stoppers shall remain in place when subject to a maximum air pressure test of 5 psi.

PART 3 - EXECUTION

A. Related Installation Specification

VCP pipe shall be installed in accordance with the requirements of Section 002715, Gravity Sewer Pipeline Installation.

B. Horizontal Curve Installation

Unless noted otherwise on the Plans or Specifications, horizontal curves using Vitrified Clay Pipe shall not be less than the following radii:

Pipe Size	Length				
	6'	5'	4'	3'	2'
6"-12"	175'	150'	125'	85'	57'

END OF SECTION

SECTION 002715

INSTALLATION OF GRAVITY SEWER PIPELINES

PART 1- GENERAL

A. **Description**

This section describes the installation of gravity sewer pipelines fabricated of vitrified clay pipe (VCP) and polyvinyl chloride (PVC).

B. **Submittals**

1. Shop drawings shall be submitted in accordance with the General Provisions and the following:

   An installation schedule (tabulated layout) shall be submitted which includes:

   a. Order of installation and closures.

   b. Pipe centerline station and elevation at each change of grade and alignment.

   c. Locations of manholes.

PART 2 – MATERIALS

A. **Installation Material**

Refer to Section 002710, Vitrified Clay Pipe For Gravity Sewers for material requirements.

PART 3 - EXECUTION

A. **Delivery and Temporary Storage of Pipe at Site**

1. Onsite Storage Limitation: Onsite pipe storage shall be limited to a maximum of one week, unless exception is approved by the Engineer.

2. Care of Pipe: At times when the pipe laying is not in progress, the open end of the pipe shall be closed with a tight-fitting cap or plug to prevent the entrance of foreign matter into the pipe. These provisions shall apply during the noon hours as well as overnight. In no event shall the sewers be used as drains for removing water which has infiltrated into the construction trenches.

B. **Handling of Pipe**

1. Moving Pipe: Pipes shall be lifted with handling beams or wide belt slings as recommended by the pipe manufacturer. Cable slings shall not be used. Pipe shall be handled in a manner to avoid damage to the pipe. Pipe shall not be dropped or dumped from trucks or into trenches under any circumstances.

2. Inspection Pipe: The pipe and accessories shall be inspected for defects prior to

lowering into the trench. Any defective, damaged or unsound pipe shall be repaired or replaced. All foreign matter or dirt shall be removed from the interior of the pipe before lowering into position in the trench.

C. **Placement of Pipe in Trench**

1. General: All pipe shall be laid without a break, upgrade from structure to structure, with the bell ends of the pipe upgrade. Pipe shall be laid to the line and grade given so as to form a close concentric joint with the adjoining pipe and prevent sudden offsets of the flow line.

2. Pipe Base Thickness: Unless shown otherwise on the drawings, pipe base material shall be 3/4-inch crushed rock.

3. Subgrade at Joints: At each joint in the pipe, the pipe subgrade shall be recessed in firm bedding material so as to relieve the bell of the pipe of all load and to ensure continuous bearing along the pipe barrel.

4. Cleaning: The interior of the sewer pipe shall be cleaned of all dirt and superfluous materials as the work progresses.

5. Joints: The mating surfaces of the pipe to be joined shall be wiped clean of all dirt and foreign matter and a lubricant applied that is approved by the pipe manufacturer. Then, with the surfaces properly lubricated, the spigot end of the pipe shall be positioned inside the bell and the joint shoved home. For larger diameter pipe where a lever attachment is required, the necessary precautions shall be taken to insure an undamaged pipe installation.

6. Pipe Alignment: Unless specified otherwise, pipeline line and grade shall be as shown on the plans. Grade shall be measured along the pipe invert.

7. Short Lengths of VCP Pipe: When using VCP, two 1-foot lengths of sewer pipe shall be used to provide curve flexibility and prevent cracking or shearing failures as shown on the plans or as may be required by the Engineer during construction. The use of short lengths of pipe is particularly required, but not necessarily limited to these locations: (1) inlets and outlets to all manholes; and (2) ends of steel casing pipe.

8. Laterals: VCP wyes, and other types of branches shall be furnished and installed along with the VCP sewer. Wyes sized as specified on the plans shall be installed for all sewer house connections and for future sewer house connections as shown on the plans. The longitudinal barrel of branch fittings, to be placed in line and grade with the sewer mains, shall be of the same diameter, quality, and type as specified herein for sewer installations. Earthwork and bedding for branches and shall conform to the applicable provisions set forth for vitrified clay sewer pipe. Unless otherwise specified, the branch of wye fittings shall be inclined upward at an angle not greater than 45 degrees from a horizontal line. No wye for sewer house connection branch shall be placed closer than 5 feet downstream of the centerline of any structure.

D. **Cleaning**

After the VCP sewer installation is complete, each pipe shall be thoroughly cleaned from manhole to manhole with a sewer scrubbing ball, and all debris and trash shall be removed from each manhole.

E. **Closed-Circuit Television Inspection**

1. General: All new sewer lines shall be inspected using closed-circuit television (CCTV) equipment. The inspection shall be conducted after all utilities have been installed prior to paving. The inspection shall be conducted by the Contractor, and re-inspection, if defective sections requiring repair are found, shall be conducted by the Contractor at his cost.

2. Labor: All labor and equipment necessary to conduct CCTV inspections shall be furnished by the Contractor.

3. Notification: Requests for sewer line inspection shall be made to the Engineer a minimum of two working days in advance of the requested inspection date.

4. Repair of Defects: Even though the sewer line may have successfully passed the leakage and infiltration tests, any defects in the line shall be repaired to the satisfaction of the District. Following repair, mandrel testing, and CCTV inspection shall again be conducted for the repaired pipeline section and these re-inspection costs shall be the sole responsibility of the contractor.

F. **Final Inspection**

After paving has been completed and all manholes raised to grade (where required), a final visual inspection shall be made. The necessary labor shall be furnished to assist the Engineer in making the final inspection. Additional balling may be required if the lines are dirty, even though lines were previously balled. The Contractor shall furnish a responsible person or supervisor for the final inspection to remove manhole covers and to note any corrections required by the Engineer in order to obtain final approval. Final inspection shall be requested through the Engineer by giving at least one day's notice.

END OF SECTION

SECTION 03461

PRECAST REINFORCED CONCRETE SEWER MANHOLES

PART 1- GENERAL

A. Description

This section includes materials, testing, and installation of precast concrete manholes, manhole bases, manhole frames and covers.

B. Submittals

1. Shop drawings shall be submitted in accordance with the General Provisions.
2. Submit manufacturer's catalog and test data on precast concrete manholes, frames, and covers along with installation recommendations for inlet and outlet seals and watertight caulking. Show dimensions and materials of construction by ASTM reference and grade. Show manhole cover lettering and pattern.

PART 2 - MATERIALS

A. Precast Concrete Manholes

1. General: Precast reinforced concrete manholes shall comply with ASTM C 478, with a minimum wall thickness of 5-inches.
2. Design Load: Manhole components shall be designed for H-20 highway loads.
3. Concrete: Precast reinforced concrete manhole risers and tops shall be constructed of Class A concrete with Type II or Type V cement.
4. Manhole Section Configuration: Manholes shall be fabricated only from eccentric taper sections and standard cylinder units of the proper internal diameter.
6. Steps: Manhole sections shall be cast without steps.

B. Manhole Frames and Covers

1. General Requirements: Manhole frames and covers shall be made of ductile iron conforming to ASTM A 536, Class 400, or cast iron conforming to ASTM A 48, Class 30. Casting shall be smooth, clean, and free from blisters, blowholes, and shrinkage. Frames and covers shall be of the traffic type, designed for H-20 loading.
2. Fit and Matchmarking: Each manhole cover shall be ground or otherwise finished so that it will fit in its frame without rocking. Frames and covers shall be matchmarked in sets before shipping to the site.
3. Cover Inscription: Covers shall have the words "HGSD" and "SEWER" cast thereon as shown in Standard Drawing No. S-1 or on the plans. No other lettering on the top side shall be permitted. Cast letters shall be 1 1/2-inches and the relief depth shall be at least

3/16-inch. Top surface of the letters and diamond tread pattern shall be flush with the outer ring edge and the frame top surfaces.

4. Inspection and Coating: Before leaving the foundry, castings shall be cleaned and subjected to a hammer inspection. Castings shall then be dipped twice in a preparation of asphalt or coal tar and oil applied at a temperature of not less than 290°F, not more than 310°F, and in such a manner as to form a firm and tenacious coating.

C. Manhole Bases

Concrete used in pouring the manhole base shall be Class A concrete, Type II or Type V cement.

D. Cement-Mortar Grout

Grout for watertight joints between precast sections shall be composed of one part portland cement to two parts of clean well-graded sand of such size that all pass a No. 8 sieve.

E. Epoxy Grout

Epoxy grout shall be used in repairing manhole and manhole base surfaces. Epoxy grout shall be made with epoxy and sand. The sand shall be clean, bagged, graded, and kiln dried silica sand. The prepared grout shall wet the contact surface and provide proper adhesion, or a coat of epoxy shall be applied prior to placing the epoxy grout.

PART 3 - EXECUTION

A. Work Within Existing Manholes

Any proposed work inside an existing manhole that is part of a wastewater system in service, shall not be undertaken until all the tests and safety provisions of Article 4, Section 1532 "Confined Spaces" State of California Construction Safety Orders have been made.

C. Manhole Base

1. Matching Pipe Crown Elevations: Invert elevations of connecting sewers many vary depending upon sizes. The crown elevation of all pipes shall be the same as the crown elevation of the largest pipe unless otherwise indicated on the plans.

2. Channel Configuration: The invert of the manhole base shall be formed so as to provide smooth channels conforming in size and shape to the lower portions of the inlet and outlet pipes. The channel shall vary uniformly in size and shape from inlet to outlet, and a shelf shall be constructed higher than the pipe as indicated on the drawings. The manhole base shall extend 9-inches below the bottom of the lowest pipe.

3. Transitions: All transitions shall be smooth and of the proper radius to give an uninterrupted transition of flow.

4. Finishing: The concrete base shall be shaped with a wood float and shall receive a hard steel trowel finish before the concrete sets.

5. Placement of Additional Mortar: In the event additional mortar is required after initial set has taken place, the surface to receive the mortar shall be primed, and the mortar

mixed with "Willhold Concrete Adhesive" in the amounts and proportions recommended by the manufacturer and as directed by the Engineer in order to secure as chip-proof a result as possible.

6. Curing Time Before Further Construction: Unless approved otherwise by the Engineer in advance, the bases shall set a minimum of 24 hours before the manhole construction is continued.

D. Installing Manholes

1. Joints: Precast concrete manhole units shall be set in a bed of grout to make a watertight joint at least 1/2 inch thick with the concrete base or with the preceding unit. Manhole sections shall be set perfectly plumb. Joints shall be pointed and trowelled and smoothed inside and outside of the manhole shaft joint. The excess grout shall be wiped off and removed. Preformed, cold-applied, ready-to-use, plastic joint sealing compound may be substituted for grout between units and must be used when groundwater is encountered.

2. Finish Elevation of Manhole Covers: Precast sections shall be assembled so that the cover conforms to the elevation determined by the manhole location as follows, but limited to a maximum of 18-inches of grade ring unless otherwise instructed by the Engineer.

   a. Paved Area: Top of cover shall be flush with the paving surface.

   b. Un-paved Areas: Top of cover shall be flush with the existing surface where it is in the "traveled way" or shoulder, and the concrete pad shall be 2 inches above the adjacent unpaved surface.

3. Manhole Frame and Cover: The manhole frame shall be secured to the grade ring with grout and cement mortar. After the frames are securely set, the frames and the covers shall be cleaned and scraped free of foreign materials, and shall be ground or otherwise finished as needed so the cover fits in its frame without rocking.

4. Watertightness: It is the intent of these specifications that manholes and appurtenances be watertight and free from infiltration. All manholes are to be banded both inside and outside with cement-mortar grout. Where called for in the plans or supplemental specifications, manholes that are to be given a protective lining or coating shall be free of any seeping or surface moisture.

5. Stubs: Sewer pipe shall be furnished and installed in manholes at the locations shown and in conformance with the detail drawings and plans. All stubs shall be plugged with stoppers as shown on the plans for various sizes of pipe.

6. Sealing Before Completion: In order to prevent accidental use of the new sewer before completion and acceptance, the inlet to existing tie-in manholes shall be sealed with broken brick and mortar. Installation of these plugs shall be approved by the Engineer. Plugs shall be removed at the time of final inspection or as directed by Engineer.

7. Bulkheads: Brick and mortar bulkheads shall be installed at the downstream end of all unused stub channels to prevent the creation of a septic condition resulting from ponding of sewage and debris in the unused channels, and until such time as the

manhole stub is connected and normal sewage flow can occur.

8. New Connections to Existing Manholes: New connections to existing manholes wherein stubs have not been provided shall be made by core drilling through the base, as directed by the Engineer.

9. Backfill: Backfill around the precast concrete manhole shall be imported sand, and shall be placed and compacted in accordance with the plans.

10. Concrete Collar: Class B concrete collar shall be cast around manhole frames that are flush with the surface. The collar shall be placed after final grading or paving together with final cleanup.

11. Pavement Replacement: Replacement of bituminous or concrete pavement shall be in accordance with the plans.

E. Manhole and Manhole Base Repairs

Manhole sections and bases that exhibit defects in the concrete surface may be rejected. Defective concrete surfaces of manhole sections and bases not rejected shall be repaired by chipping away unsound or imperfect concrete. Edges shall be left sharp and square with the surface. Loose material and dust remaining after chipping shall be removed by means of an air jet. Epoxy grout shall be applied to the surface to be repaired in accordance with the manufacturer's instructions. The grout shall wet the contact surface and provide proper adhesion, or a coat of epoxy shall be applied prior to placing the epoxy grout.

F. Manhole Liners / Coatings

Where called for in the plans or supplemental specifications, manhole liners and/or manhole coatings shall be provided.

END OF SECTION