

AMENDMENTS TO COUNTY STANDARD DETAILS AND STANDARD SPECIFICATIONS
(Issued 01/07/2011)

The County Standard Details Manual dated September 1997 contains amended, deleted and new standard details. These updates can be obtained from the County of Santa Clara Roads and Airports Department web site at:
<http://www.sccgov.org/portal/site/rda/>.

The amendments specified hereinbelow are incorporated into the County Standard Specifications Manual dated May 2000.

SECTION 2
BID REQUIREMENTS AND CONDITIONS

2.08 BID GUARANTY

- Section 2.08 “Bid Guaranty” (on page 19) is amended to read as follows:

“Each Bid over thirty thousand dollars (\$30,000) shall be accompanied by cash, a certified or cashier's check, or a Bidder's bond in the sum of not less than 10% of the total aggregate of the Bid including all additives and/or all alternate Bid items. The original Bid Bond must be provided by an admitted Surety insurer, authorized to issue Surety bonds in the State of California, and it must execute the Bid Bond. Said check or bond shall be made payable to the order of the County of Santa Clara.”

2.09 WITHDRAWAL OF BIDS

- The following sentence is added at the end of Section 2.09 “Withdrawal of Bids” (on page 19):

“For relief of Bidders, Bidder’s attention is directed to Section 2.12 “Relief of Bidders”.”

SECTION 3
AWARD AND EXECUTION OF CONTRACT

3.03 EXECUTION OF CONTRACT

- The following is added at the end of Section 3.03.01 “Submittals for Formal Contracts prior to Owner’s Execution of Contract Documents” (on page 22):

“(e) One original of the signed Contractor’s Certification of Worker’s Compensation.”

- The following is added at the end of Section 3.03.02 “Submittals for Minor Contracts prior to Owner’s Execution of Contract Documents” (on page 22):

“(d) One original of the signed Contractor’s Certification of Worker’s Compensation.”

SECTION 5 CONTROL OF WORK

5.07 WORKING AREA, STORAGE OF MATERIALS AND PROJECT REAL PROPERTY

- Section 5.07.02 “Project Site Real Property” (on page 50) is amended to read as follows:

“Project site real property shall be defined as property used by Contractor for Project construction purposes such as lay-down or staging area during the term of a construction project.

For projects constructed on a County expressway or roadway, which are administered by the Roads and Airports & Airports Department, if a construction lay-down or staging area is designated on the Project Plans, Contractor, with the approval of the Roads & Airports Department, can use the designated County-owned right-of-way free of charge. If a construction lay-down or staging area is not specified on the Project Plans, or should Contractor require additional real property over that specified on the Project Plans, Contractor shall be responsible for securing the real property at its own expenses. The Roads & Airports Department Property Section can be contacted to determine if Owner’s property is available for lease to Contractor at fair market value.

Clean up of Project site real property and/or any property occupied by Contractor shall be in compliance with CSS Section 22 “Clean-up”.

The costs for leasing or renting a Project site real property and any associated and incidental expenses, including clean-up costs as specified hereinabove, will not be paid for separately and will be considered as included in other items of work specified in the Project contract documents.”

5.08 LINES AND GRADES

- Section 5.08 “Lines and Grades” (on page 51) is amended to read as follows:

“Unless specified otherwise in the Project Contract Documents, the Owner will provide construction staking that is needed to construct the improvements to lines and grades as specified in the Contract Documents.

When the Contractor requires such stakes or marks to be set, the Contractor shall notify the Project Inspector in writing a minimum of 48 hours in advance of starting operations that require such stakes or marks. Stakes and marks set by the Owner shall be carefully preserved by the Contractor. In case such stakes and marks are destroyed or damaged, they will be replaced at the Owner’s earliest convenience. The Contractor will be charged for the cost of necessary replacement or restoration of stakes and marks which, in the judgment of the Project Engineer, were carelessly or willfully destroyed or damaged by the Contractor’s operations. This charge will be deducted from any moneys due or to become due the Contractor.”

5.11 EQUIPMENT AND PLANTS

- Section 5.11 “Equipment and Plants” (on page 52) is amended to read as follows:

“5.11 Equipment, Plants and Workers

Only equipment and plants suitable to produce the quality of work and materials required will be permitted to operate on the Project.

Plants shall be designed and constructed in accordance with general practice for such equipment and shall be of sufficient capacity to insure the production of sufficient material to carry the Work to completion within the time limit.

The Contractor shall provide adequate and suitable equipment and plants to meet the above requirements, and when ordered by the Project Engineer shall remove unsuitable equipment from the Work and discontinue the operation of unsatisfactory plants.

The Contractor shall identify each piece of its equipment, other than hand tools, by means of an identifying number plainly stenciled or stamped on the equipment at a conspicuous location, and shall furnish to the Project Engineer a list giving the description of each piece of equipment and its identifying number. In addition, the make, model number and empty gross weight or each unit of compacting equipment shall be plainly stamped or stenciled in a conspicuous place on the unit. The gross weight shall be either the manufacturer's rated weight or the scale weight.

On a daily basis, the Contractor shall provide to the Project Inspector a list of employees and equipment used on the Project.

The make, model, serial number and manufacturer's rated capacity for each scale shall be clearly stamped or stenciled on the load receiving element and its indicator or indicators. All meters shall be similarly identified, rated, and marked. Upon request of the Project Engineer, the Contractor shall furnish a statement by the manufacturer designating sectional and weighbridge capacities of portable vehicle scales."

5.13 DIFFERENT SITE CONDITIONS

- Section 5.13 "Different Site Conditions" (on page 54) is amended to read as follows:

"5.13 Differing Site Conditions

During the progress of the Work, the Contractor shall promptly, and, before the following conditions are disturbed, notify the Project Engineer, in writing, of any:

- Material that the Contractor believes may be hazardous waste, as defined in Section 25117 of the Health and Safety Codes, that is required to be removed to a Class I, Class II, or Class III disposal site in accordance with provisions of existing law.
- Subsurface or latent physical conditions at the site differing from those indicated by information about the site made to bidders prior to deadline for submitting bids.
- Unknown physical conditions at the site of any unusual nature, different materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract.

Upon receipt of the written notification, the Project Engineer will promptly investigate the conditions and will notify the Contractor of the Project Engineer's findings.

- If the Project Engineer finds that the conditions do materially so differ, or do involve hazardous waste, and cause a decrease or increase in the Contractor's cost of, or the time required for, performance of any part of the Work, the Owner will issue a Change Order under the procedures described in the Contract.
- In the event that a dispute arises between the Project Engineer and the Contractor whether the conditions materially differ, or involve hazardous waste, or cause a decrease or increase in the Contractor's cost of, or time required for, performance of any part of the Work, the Contractor shall not be excused from any scheduled completion date provided for by the Contract, but shall proceed with all work to be performed under the Contract. The Contractor shall retain any and all rights provided either by the Contract or by law which pertain to the resolution of disputes and protests between the Contractor and the Owner.

No Contract adjustment, which results in a benefit to the Contractor, will be allowed unless the Contractor has provided the required written notice.

No Contract adjustment will be allowed under the provisions specified in the Section for any effects caused on unchanged Work. Any Contract adjustment warranted due to differing site conditions will be made in accordance with the provisions in Section 4.02 "Changes" except as otherwise provided."

5.14 CHARACTER OF WORKERS

- Section 5.14 "Character of Workers" (on page 55) is amended to read as follows:

"If any Subcontractor or person employed by the Contractor appears to the Project Engineer to be incompetent, not possess the proper license or certification for the work performed as required by the California Labor Code or other applicable regulations, or act in a disorderly or improper manner, he/she shall be discharged immediately on the request of the Project Engineer, and such person shall not again be employed on the Work."

5.17 CORRECTION OF WORK AND GUARANTEE

- Section 5.17.02 "Year 2000 Compliance Warranty" (on page 57) is deleted in its entirety.

**SECTION 6
CONTROL OF MATERIALS**

6.09 TRADE NAMES AND ALTERNATIVES

- The second paragraph of Section 6.09 "Trade Names and Alternatives" (on page 71) is amended to read as follows:

"Contractor may offer, at any time during a period starting with the Notice to Proceed and ending 35 days later, any material, process or article, which shall be substantially equal or better in every respect to that so indicated or specified; provided, however, that if the material, process or article offered by Contractor is not, in the opinion of the Project Engineer, substantially equal or better in respect to that specified, then Contractor must furnish the material, process or article specified or one that, in the opinion of the Project Engineer, is substantially equal or better in every respect."

**SECTION 7
LEGAL RELATIONS AND RESPONSIBILITY**

7.08 WORKERS' TRAVEL AND SUBSISTENCE PAYMENTS

- Section 7.08 "Workers' Travel and Subsistence Payments" (on page 82) is deleted in its entirety.

7.22 PUBLIC CONVENIENCE AND PUBLIC SAFETY

- Section 7.22.03 "Intersection or Lane Closure" (on page 103) is amended in its entirety to read as follows:

"Lane or intersection closure shall be made in accordance with the latest California Manual on Uniform Traffic Control Devices for Streets and Highways, the following requirements and the project Special Provisions:

- (a) Traffic control/detour plan must be prepared by the Contractor as per CSS Section 4.06 "Submittals for Materials and Equipment" and submitted to the Project Engineer for review and acceptance.
- (b) Traffic signal operations shutdown must be limited to one intersection per a two (2) mile radius limit. In no event, two (2) adjacent intersections are permitted to be closed concurrently.
- (c) No lane closure on expressways is permitted between the hours of 6:00 AM - 9:00 AM and 3:00 PM - 7:00 PM. Lane closure set-up or removal activities are not permitted during the hours specified.
- (d) Only one traffic lane is allowed for closure in each direction of the roadway.
- (e) No shutdown of the traffic signal is permitted during the hours specified herein above. Uniformed police officer(s) shall be provided as specified in CSS Section 12.02 "Flaggers and Police Officers" to direct traffic during shutdown.
- (f) Existing facilities for bicycle and pedestrian must be maintained or alternative route conforming to ADA requirements provided during construction.
- (g) Upon completion of all work requiring lane closure, temporary traffic control signs and devices must be removed from the site of the work. Any temporary Owner-furnished temporary traffic control signs and devices, when no longer required, must be delivered to a location designated by the Project Engineer.

Unless otherwise specified in the Special Provisions, compensation for preparing traffic control/detour plan, furnishing, placing, maintaining and removing temporary traffic control devices and signs, including those furnished by Owner, is considered as included in the Contract price for traffic control."

**SECTION 8
PROSECUTION AND PROGRESS**

8.11 UTILITIES AND OTHER FACILITIES

- The third sentence in the second paragraph of Section 8.11.01 “Underground Service Alert (USA)” (on page 135) is amended to read as follows:

“...USA marking paint shall be of washable type and shall be removed as specified in CSS Section 22 “Clean-up (Finishing Roadway)”.”

**SECTION 9
MEASUREMENT AND PAYMENT**

9.03 PAYMENT FOR INCREASED OR DECREASED QUANTITIES

- Sections 9.03 “Payment for Increased or Decreased Quantities” (on page 159) is amended to read as follows:

“If there is any variance between the estimated amount of work shown with a unit price on the Bid Schedule and the actual amount of authorized work performed, there shall not be any adjustment of unit price by reason of overruns or underruns. All items of authorized work performed will be paid for at the contract unit price for that item.

Exception shall be made to federally funded contracts as follows.

Increase or decrease in the quantity of a Contract item of Work will be determined by comparing the total pay quantity of that item of Work with the Engineer’s Estimate therefor.

If the total pay quantity of any item of Work required under the Contract varies from the Engineer’s Estimate therefor by 25 percent or less, payment will be made for the quantity of Work of the item performed at the Contract unit price therefor, unless eligible for adjustment pursuant to CSS Section 4.02.01 “Changes in Character of Work.”

If the total pay quantity of any item of Work required under the Contract varies from the Engineer’s Estimate therefor by more than 25 percent, in the absence of an executed Extra Work Order or Change Order specifying the amount to be paid, the compensation payable to the Contractor will be determined in accordance with Section 9.03.01 “Increase of More than 25 Percent” and Section 9.03.02 “Decrease of More than 25 Percent”.”

9.07 STOP NOTICES

- Section 9.07 “Stop Notices” (on page 164) is amended to read as follows:
 “Owner will comply with California Civil Code Title 15, Chapter 4, Section 3179 regarding Stop Notices. All Preliminary and Stop Notices shall be sent to the attention and address indicated on the “Stop Notice Information” set forth in the Bid Forms section of the Project Special Provisions.”

**SECTION 10
DUST CONTROL**

- Section 10 “Dust Control” (on page 172) is amended to read as follows:
 “Dust control shall conform to the provisions in Section 14 “Environmental Stewardship” of the most current edition of the State Standard Specifications.”

**SECTION 12
CONSTRUCTION AREA TRAFFIC CONTROL DEVICES**

12.01 CONSTRUCTION SIGNS

- Section 12.01 “Construction Signs” (on page 175) is amended to read as follows:
 “Contractor shall furnish, install, maintain, and remove, upon the completion of the Work, construction area signs. Signs shall meet the minimum standards set forth in Part 6 of the latest California MUTCD (Manual on Uniform Traffic Control Devices for Streets and Highways). Signs of types W20-1 (ROAD WORK AHEAD) and G20-2 (END ROAD WORK) shall be installed on all approaches to the Work area. On high-speed arterials, type W13-1 (Advisory Speed Plaque) sign shall be provided. The Engineer will determine the applicable advisory speed limit to be indicated on such signs. At intersections where the signal system is inoperative and crosswalks are delineated, temporary W3-4 (BE PREPARED TO STOP) and W11-2 (PEDESTRIAN CROSSING) and W16-7P (Diagonal Downward Pointing Arrow Symbol) signs shall be provided for the duration of the non-functional signal system. The requirements of this section shall apply to any other signs required in the Contract Documents.”

SECTION 86
SIGNAL, LIGHTING, TRAFFIC COMMUNICATIONS AND
OTHER ELECTRICAL SYSTEMS

86.01 GENERAL

- Section 86.01.02 “Definitions” (on page 235) is amended to read as follows:

“86.01.02 ABBREVIATIONS AND DEFINITIONS

Terms for signals, lighting and electrical systems shall be defined in accordance with SSS Section 86-1.015 “Definitions” and the following:

Backup Timing	Preset, standard timing and configuration values used to setup the controller in a known state of operation; also referred to as default timing.
BBS	Battery Back-up System.
CA MUTCD	California Manual of Uniform Traffic Control Devices.
Concurrent phase	A phase that is allowed to time at the same time as another phase (a phase in a different timing ring).
Conflicting phase	A phase that can not be allowed at the same time as another phase due to potential hazards if displayed.
Demand	The service of a timing phase based on the detection of a vehicle or pedestrian presence, not the result of the preemption sequence.
EEPROM	Electrically erasable, programmable read only memory.
EPROM	Erasable programmable read only memory.
FCC	Federal Communications Commission
L.C.D., LCD	Liquid Crystal Display.
L.E.D., LED	Light Emitting Diode.
Non-concurrent phase	A phase that is not allowed to time at the same time as another phase. (A phase across the barrier from another phase or a phase which would cause a conflicting movement.)

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Non-conflicting phase	A phase that is allowed to time and be displayed at the same time as another phase.
PTCSI	Pedestrian Traffic Control Signal Indications.
Slack	Conductor or cable slack is the amount of conductor or cable exposed within the pullbox or mastarm tenon after being installed in conduit or mastarm.
TEES	California Transportation Electrical Equipment Specifications.
VTCSH	Vehicle Traffic Control Signal Heads.

- The second paragraph in Section 86.01.06 “Maintaining Existing and/or Temporary Electrical Systems and Traffic Communication Systems” (on page 242) is amended to read as follows:

“Maintenance responsibilities of the existing and/or temporary electrical systems and communication systems shall be as defined in SSS Section 86-1.06 "Maintaining Existing and Temporary Systems" for the duration of the Work and until the Acceptance of the Work by the Owner, and the following.”

- The first paragraph in Section 86.01.07 “Scheduling of Work” (on page 243) is amended to read as follows:

“Work shall be scheduled as specified in SSS Section 86-1.07 “Scheduling of Work” and as follows.”

86.02 MATERIALS AND INSTALLATION

- Section 86.02.04 “Foundations” (on page 245) is amended to read as follows:

“Foundations shall conform to CSS Sections 86.01.07 "Scheduling of Work" and 86.02.10 "Bonding and Grounding" and SSS Section 86-2.03 "Foundations" and the following:

- (1) Controller cabinet foundation shall be for Type P controller cabinet. Foundation and bonding details shall conform to CSD E/4 and E/47, respectively.
- (2) Service cabinet foundation shall be for Type III-AF service cabinet. Foundation and bonding details shall conform to CSD E/2D and E/48, respectively.

- (3) Foundation for Type 15 lighting standard shall conform to the State Standard Plans. Foundation for Post-top lighting standard shall conform to CSD E/6B. Foundation bonding details shall conform to CSD E/47.
- (4) Foundations for traffic signal standards with mastarm lengths of 16.8 m (55 ft) or 19.8 m (65 ft) shall conform to CSD E/43. Foundations for standards with other mastarm lengths shall conform to the applicable details in the State Standard Plans. Foundation bonding details shall conform to CSD E/47.
- (5) Foundation for Type 1-B signal standard shall conform to the details in the State Standard Plans.
- (6) Battery backup system cabinet foundation shall conform to CSD E/50.
- (7) Mortar shall be placed under the base plate of each standard, post, or pedestal, which does not rest directly on top of the foundation. Mortar mix shall be as specified in SSS Section 86-2.03 "Foundations" and installed after the standard, post, or pedestal is in proper position and/or alignment. The exposed portion of the mortar shall be formed to present a neat appearance.

Post, poles, standards, pedestals, and cabinets shall not be erected or installed until the foundation has set at least 7 days, and shall be plumbed or raked as directed by the Project Inspector.

Compensation for the Work specified in this Section will be made at the Contract unit prices for the appropriate foundations installed complete in place and per the specified details."

- Sub-section (4) in Section 86.02.05 "Standards, Steel Pedestals and Posts" (on page 246) is amended to read as follows:

"(4) Lighting standard shall be Type 15 per the State Standard Plans unless specified otherwise in the Contract Documents."

- Section 86.02.06A "Material" (on page 247) is amended to read as follows:

"Rigid non-metallic conduit shall be Schedule 80 Polyvinyl Chloride (PVC), Schedule 80 High Density Polyethylene (HDPE) or approved equivalent conforming to the requirements of Article 347 "Rigid Non-Metallic Conduit" of the National Electrical Code. Conduit bonding shall be as specified in Section 86.02.10 (1) below. Non-metallic conduit installed by the directional boring method shall be colored red impregnated throughout the thickness of the conduit wall.

Metallic conduit shall be Type 1 hot-dip galvanized rigid steel conduit per SSS Section 86-2.05A "Material." Type 4 waterproof flexible metal conduit may only be used if specified in the Contract Documents."

- Section 86.02.06B “Application” (on page 248) is amended to read as follows:

“The minimum conduit diameter shall be Size 53 (2 in.) except the following:

- (1) Conduit between pedestrian push button post and adjacent pull box shall be Size 41 (1-1/2 in.).
- (2) Conduit between electrolier and adjacent pull box shall be size as specified on Detail D of CSD E/6B.
- (3) Conduit between signal mastarm-type standards and pull box shall be Size 78 (3 in.).
- (4) Conduit crossing under roadway pavement at signalized intersection shall be Size 78 (3 in.).
- (5) Conduit between detector handhole and pull box shall be as specified on Detail J of CSD E/5A
- (6) Conduit between utility service pole, pull box and service equipment cabinet shall be of sizes as specified in CSD E/2A.
- (7) Conduit in foundation of signal controller cabinet shall be of size as specified in Detail C of CSD E/4.
- (8) Conduit in foundation of battery backup system cabinet shall be of size as specified in Detail A of CSD E/50.
- (9) Conduit in foundation of electrical service equipment cabinet shall be of sizes as specified in CSD E/2D.”

- Section 86.02.06C (6) (on page 249) is amended to read as follows:

“(6) Underground conduit shall be installed at a minimum depth of 1 M (36 inches) below finished grade of paved and unpaved surfaces. Placement of conduit on top of roadway pavement within the paved median island shall not be permitted. At locations where conflict with other existing underground facility arises and requires an installation depth lesser than 1 M (36 in.), conduit shall be placed by the opened trench method and protected with a 150 mm (6 in.) minimum thick cap of red-colored slurry cement backfill, as specified in SSS Section 19-3.062 “Slurry Cement Backfill”, on sides and top of conduit.”

- Section 86.02.06C (7) (on page 249) is amended to read as follows:

“(7) Rigid non-metallic conduits shall be used for all underground installations including under roadway pavement and LRT tracks except at the following locations where rigid steel conduit shall be used:

- (a) In concrete structures, including pole and cabinet foundations;

- (b) Attached to the surface of a structure;
- (c) Underground, including under sidewalks, that are adjacent to gasoline service stations or other underground gasoline or diesel storage, piping, or pumps, that lead to a controller cabinet, circuit breaker panel, service or any enclosure where an arc may occur during normal operations. Such conduit shall be sealed if located within the limits specified in the National Electrical Code for Class 1, Division 1, Hazardous Locations.
- (d) Underground with an installation depth lesser 760 mm (30 in.) below finished grade. A red-colored slurry cement backfill as specified in CSS 86.02.06C (6) hereinabove shall be installed.
- (e) Under roadway pavement, freight railroad tracks, and at locations where conduit is installed by bore-and-jack method.”

- The following provision is added at the end of Section 86.02.06 C “Installation” after sub-section (12) (on page 250):

“(13) Where pull boxes are placed or replaced in conduit runs, metallic conduit stub-ups shall be threaded, fitted with threaded bushings, and bonded; and PVC and HDPE conduit stub-ups shall be fitted with end bells.”

- Section 86.02.07A “Material” (on page 251) is amended to read as follows:

“No. 3-1/2, No. 5, No. 6, and traffic-rated No. 3-1/2(T), No. 5(T), No. 6(T) pull boxes, covers and extensions shall be precast steel reinforced Portland cement concrete type conforming to SSS 86-2.06A “Materials.”

Fiber-optic cabling system pull box, cover and extension shall be polymer concrete type meeting the following minimum mechanical property requirements:

Compressive strength:		103 MPa (15,000 psi)
Tensile strength:		7.5 MPa (1,100 psi)
Flexural strength:		41 MPa (6,000 psi)
Static design load:	Vertical	66.5 KN (15,000 lbs.)
	Lateral	38 kPa (800 lbs/sq. ft.)
Static test load:	Vertical	100 KN (22,500 lbs.)
	Lateral	57.5 kPa (1,200 lbs/sq. ft.)
Cover Weight (2-piece w/ bolts, max.):		93.4 kg (206 lbs)”

- Section 86.02.07B “Cover Marking” (on page 252) is amended to read as follows:

“Marking of pull box covers shall conform to SSS Section 86-2.06B “Cover Marking.” Identification shall be engraved, welded or casted on the

top face of pull box lids in accordance with the pull box application per CSD E/8.”

- Section 86.02.07C “Application” (on page 252) is amended to read as follows:

“Pull boxes shall be No. 5 with the following exceptions:

- (1) No. 6 pull box shall be used when four (4) or more conduits entering the pullbox.
- (2) No. 3 1/2 pull box may be used if it is solely used for lighting purpose.
- (3) When specified in the Contract Documents, No. 3 ½(T), No. 5(T) and No. 6(T) pull boxes shall be used in roadway traffic lanes and shoulders.
- (4) Fiber-optic cabling system (FO) pull box may be used as homerun pull box at signal controller cabinet location at signalized expressway intersections. It shall be used for fiber-optic splice enclosures for end-to end splices and splices between main and lateral cables.”

- Section 86.02.07D “Installation” (on page 253) is amended to read as follows:

“The installation of pull boxes shall conform to CSD E/8 and the following:

- (1) Pull boxes for fiber-optic cable run shall be spaced at 150 M (500 feet) maximum interval. Pull boxes for other applications shall be spaced at 61 M (200 ft) maximum interval.
- (2) Where the roadway median or shoulder is not separated from the travel lanes by curb, new pull boxes shall be located a minimum of 3 m (10 ft.) from the shoulder stripe or edge of pavement.
- (3) Pull boxes located in sidewalk or paved areas shall be installed with top of pullboxes flush with finished grade of surrounding pavement. Electrolier pull box location shall conform to CSD E/46; other pull box locations shall conform to CSD E/47.
- (4) Pull boxes, including existing ones requiring adjustment, shall have base prepared according to CSD E/8.
- (5) No more than one (1) extension shall be added to a pull box unless specified otherwise in the Contract Documents.
- (6) Pull boxes shall be installed with their long side parallel to the general alignment of the roadway curb line or edge of pavement. It shall be leveled and conformed to the top of curb when installed at back of curb.”

- The first paragraph in Section 86.02.08 “Conductors and Cables” (on page 254) is amended to read as follows:

“Conductor material, size, identification, and application shall conform to SSS Section 86-2.08 “Conductors and Cables” and the following.”
- The first paragraph in Section 86.02.08C “Signal Cables” (on page 254) is amended to read as follows:

“At the option of the Project Engineer and where shown on the Project Plans, signal cable shall be installed in lieu of individual conductors. Signal cable shall conform to SSS Section 86-2.08C “Signal Cable”, and the following.”
- The last paragraph of Section 86.02.08F(2)(g) (on page 260) is amended to read as follows:

“The finished cable shall be capable of withstanding a pulling tension of 2,700 Newtons (600 lbs) minimum.”
- The first sentence of the last paragraph of Section 86.02.08F(3)(a) (on page 262) is amended to read as follows:

“The cable shall withstand a tensile load of 2,700 Newtons (600 lbs) without exhibiting an average increase in attenuation of greater than 0.10 dB (single mode).”
- Subsection (2) of Section 86.02.09B “Installation and Tagging of Conductors and Cables (Other Than Fiber-Optic Cable)” (on page 264) is amended to read as follows:

“(2) Unless specified otherwise, all installed conductors, cables, including spare conductors and cables, shall each be provided with 2 m (6 feet) long minimum of slack in each pull box. Slack shall be neatly grouped together without tangles or crossovers, taped to form a neat coil and then placed inside the pull box. At locations other than pull box, such as in unused tenons, the conductor slack shall be left inside the mastarm and the conductor ends shall be securely fastened to a convenient location inside the tenon. Slack in pull box will be measured by removing the pull box lid and extending the conductor or cable slack loop vertically to a point where the apex of the conductor or cable slack loop measures 1 m (3 ft) minimum above the finished grade of the pull box. Slack in unused mastarm tenon shall be measured by extending the conductor slack loop horizontally to a point where the apex of the slack loop measures 1 m (3 feet) minimum from the end of tenon.”

- Subsection (2) “Aerial Installation of Temporary System” of Section 86.02.09C “Installation of Fiber-Optic Cable” (on page 266) is amended to read as follows:

“(2) Cable Slack

Unless otherwise specified, fiber-optic cable slack shall be provided as follows:

In No. 6 pull box	2 meters (6 ft) minimum.
In fiber-optic pull box (with splice enclosure)	7 meters (23 ft) minimum on each side of splice enclosure.
In fiber-optic pull box (without splice enclosure)	15 meters (50 ft) minimum.
In communication hub	50 meters (164 ft) minimum of each cable entering the hub.
In new or home run pull box with conduit to side-mounted fiber equipment enclosure	3 meters (10 ft) minimum.

Slack in pull box shall be measured by removing the pull box lid and extending the cable vertically or horizontally to a point where the apex of the cable slack loop measures at least one-half of the hereinabove specified length, above or from, respectively, the finished grade of pull box.”

- Section 86.02.09H “Measurement and Payment” (on pages 272 & 273) is amended to read as follows:

“Work specified in this section, except as specified below, will be paid for at the Contract lump sum price for wiring, including the furnishing and installation of conductors, conductor slacks and bonding/grounding as specified in CSS Sections 86.02.08 “Conductors and Cables” and 86.02.10 “Bonding & Grounding.”

Telemetry or signal interconnect cable will be measured by the linear meter or linear foot, horizontally on a straight line between centerlines of pull boxes or between centerlines of pull box and cabinet, as specified in the Contract Documents, and paid for at the Contract price for furnishing and installing telemetry or signal interconnect cable completed in place. No separate measurement or payment shall be made for other sections or lengths of cable such as underground cable’s vertical rise into pull boxes, cable rising into or routed within a cabinet, cable following a locally curved conduit path, and required cable slack in pull boxes and cabinets.

Fiber-optic cable will be measured by the linear meter or linear foot as specified in the Contract Documents. Measurement will be made horizontally on a straight line between centerlines of pull boxes, between centerlines of pull box and cabinet at which the cable enters, or between centerline of pull box and the side of the communication hub structure at

which the cable enters. In an aerial installation when specified in the Contract Documents, the length of cable rising on utility pole will be measured for payment from the base of the utility pole to the point of attachment of the messenger wire on the utility pole, and the length of cable spanned between poles will be measured horizontally on a straight line between centerlines of poles. No separate measurement or payment shall be made for other sections or lengths of cable such as underground cable's vertical rise into pull boxes, cable rising into or routed within a cabinet, cable following a locally curved conduit path, cable sag, or required cable slack coiled in splice chambers, pull boxes, cabinets, and communication hubs. Fiber-optic cable will be paid for at the Contract price for furnishing and installing fiber-optic cable completed in place and compensation shall include the furnishing and installation of fiber-optic connectors and providing the required Optical Time Domain Reflectometer tests and test results on the fiber-optic cable at different phases of the cable installation.

Fiber-optic splices will be measured as each unit installed completed in place, and successfully passes the required tests and paid for at the Contract price for making and testing lateral fiber-optic splice, trunkline fiber-optic splice or pigtail splice as specified in the Contract Documents. Splice closures will be measured as each unit furnished, installed and securely attached to the rack and hook assembly upon completion of splices and paid for at the Contract price for furnishing and installing fiber-optic splice closures.”

- Section 86.02.11B “Service Controls” (on page 274) is amended to read as follows:

“The type and size of breakers shall be as specified on Standard Detail E/2D (Sheet 2 of 2) in the County Standard Details Manual.”

- Section 86.02.12 “Sign Illumination Control” (on page 275) is amended to read as follows:

“The control of sign illumination shall conform to SSS Section 86-2.13 “Light an Illumination Control”.”

86.03 CONTROLLER ASSEMBLIES

- Section 86.03 “Controller Assemblies” (on pages 280-312) is amended in its entirety to read as follows:

“86.03 CONTROLLER ASSEMBLIES

Controller assembly shall be Type 90 conforming to NEMA Standards for Traffic Control Assemblies with NTCIP Requirements per Publication No. TS 2-2003 v02.06, Type 2 Controller Unit, and the following.

86.03.01 GENERAL REQUIREMENTS

- (1) All equipment shall operate over an input voltage range of 100-133 volts.
- (2) During a power interruption not exceeding 0.5 second duration, the controller assembly shall continue in cyclic operation and shall retain all actuations registered prior to the interruption.
- (3) Following a power interruption exceeding 1.0 second duration, the controller preprogrammed initialization and start-up sequence shall begin and vehicle and pedestrian calls shall be placed on all active phases.
- (4) Following a power interruption between 0.5 and 1.0 second duration, the controller assembly shall continue in cyclic operation or the pre-programmed initialization and start-up sequence shall begin and vehicle and pedestrian calls shall be placed on all active phases.
- (5) All timing shall be synchronized to the time base of the 60-HZ power line frequency.
- (6) All of the input and output terminations specified in Section 3 – Controller Units, Type 2, of the NEMA Publication TS 2-2003 v02.06, shall be brought to an external terminal via the regular controller connector and wiring harness. The pin used for each function shall be the pin used for the same function on all controllers with similar model and of the same manufacturer.
- (7) All indicator lights shall be L.E.D.'s (light emitting diodes) and/or L.C.D.'s (liquid crystal displays). All displays shall be plainly visible in all normally occurring light levels. No false nor ambiguous indications shall be displayed.
- (8) All software necessary to operate, monitor, and maintain the system shall be compatible with the system currently operated by the County.
- (9) Controller assembly shall be tested as specified in CSS Section 86.02.13 "Testing."
- (10) Warranty shall conform to CSS Section 86.01.05 "Warranties, Guarantees and Instruction Sheets."

86.03.02 CONTROLLER

- (1) Error checking shall be provided as part of the controller unit which shall protect against operator and remote programming errors, loss of programmed data integrity, and any and all cycling or safety related problem(s) with the controller operations. Minimally, the controller shall monitor the minimum clearance, minimum green, stop or unusual cycling. Error identification shall be provided to assist in identifying the

- cause of errors. Invalid data shall not be accepted by the controller.
- (2) "Stop Timing" as described in Section 3.4.5.2 (6) of the NEMA Publication TS 2-2003 v02.06, Type 2 Controller Unit, shall hold the interval at the value that existed when stop time was applied. The controller shall cause the interrupted interval to time the complete programmed interval upon release of the "Stop Time" input.
 - (3) The controller shall provide:
 - (a) Copying functions for program entry capable of selectable phase to phase and phase to multiple phase copying, all with selected intervals.
 - (b) A simultaneous gap-out feature for each timing ring.
 - (c) Calling/passage detection and stop bar detection for each phase.
 - (4) The controller shall provide individual bicycle functions for each phase as follows:
 - (a) It shall provide a means of individual and separate bicycle actuation to the controller.
 - (b) It shall provide an individual and separate bicycle extension interval (0-40 second).
 - (c) Actuation of the bicycle actuation input shall cause a locked call to be placed on the associated phase until served.
 - (d) The bicycle extension interval shall begin at the beginning of the associated phase minimum green interval and shall time concurrently. The bicycle extension interval shall reset during application of a bicycle actuation input. Extension of the associated phase shall function identical to the NEMA defined functions of the vehicle extension interval. Extension shall be limited by the phase maximum interval.
 - (e) It shall provide an individual and separate bicycle clearance with programmable interval that extends the yellow and all-red clearance terminating phase at least as long as the bicycle clearance programmed value and times concurrently with the yellow + all-red interval of the phase. If the last detection prior to gap-out is received from a bicycle detector, the controller will extend the red-clearance of the phase to insure the total bicycle clearance specified for the phase.

- (5) Similar time reference shall be utilized at all controllers in a coordinated system such that identically programmed events shall occur at identical times.
- (6) Each controller shall be microprocessor-based sixteen (16) phases with user-programmable barriers. Four (4) separate barriers shall allow programming for applications from one (1) to sixteen (16) phases in each barrier, four (4) overlap phases, density and pedestrian functions for each phase, modular construction, full traffic actuated, solid-state, utilizing digital timing and integrated circuits.
- (7) Program memory shall be EEPROM.
- (8) Controller function and timing programming shall be accomplished by keyboard entry from the face of the controller, by telemetry data link via Ethernet.
- (9) Status and operation shall be indicated by LCD indicators and alphanumeric display on the face of the controller.
- (10) It shall be provided with a detector rack failure input which shall be reported through telemetry as programmed. The detector rack failure input shall programmably cause the controller to place a constant vehicle call on all phases when active.
- (11) Permanent memory shall be provided for backup or default in conformance with the following:
 - (a) Programmable functions consisting of, but not limited to, any and all controller timing intervals, detector memory, controller phase usage, and startup configuration data.
 - (b) Data in permanent memory shall be easily transferred to the controller active database upon user initiated command and shall be automatically transferred due to the manufacturer's design for normal program failure or data integrity loss detection.
 - (c) The permanent memory shall be EEPROM conforming with the following:
 - Approved security means must be provided such that inadvertent keyboard entry or random program activity shall not modify data.
 - Data contained in permanent memory shall be programmable by the County. Contractor shall furnish the necessary software to facilitate programming.
 - Batteries or other power storage devices shall not be required for maintenance of permanent memory data.

86.03.03 ACCESS SECURITY CONTROL SYSTEM

- (1) It shall be secure and it shall not be possible to gain access to the systems without a valid password.
- (2) A time-out of security access privileges shall be provided. The time-out period shall expire and cause reduction of access privileges to the lowest level of access if there is no keyboard activity within a programmable period. The period shall be programmable only during the highest level of access.
- (3) At least four (4) levels of access shall be provided:
 - (a) Administrative, password control, and all the following functions.
 - (b) Read/write PC timing and operational data, upload controller timing and operational data, and all the following functions.
 - (c) Download controller timing and operational data, and all the following functions.
 - (d) Monitor controller activity.
- (4) At least 64 access codes shall be provided.
- (5) The programmable selected capability of dial-back to programmed phone numbers based on entry of a valid access code shall be provided.
 - (a) The dial-back requirements may be programmable defeated for the lowest level of access.
 - (b) The dial-back phone number shall be received with the access code or shall be selected by the controller assembly based on access code received upon initial contact.
 - (c) The number of dial-back attempts and the telephone area codes allowing access shall be programmable.
 - (d) A caller ID feature as provided by the serving telephone company shall be provided. The caller ID shall be logged and if, authorized for access and a valid access code were received, access shall begin without the requirement of the dial-back as specified above.
- (6) Logging of all access activities shall be maintained.
 - (a) It shall log phone number, caller ID or network access, date and time for each access or attempted access.
 - (b) The log shall be re-settable only from the signal monitor under the highest level of access.
- (7) Software tools shall be provided within the signal monitor system to facilitate update and change of all passwords in all connected systems. Upon access at the highest level,

passwords may be selectively updated, using the tool. The tool shall only require entry of the new passwords and selection of the locations to be updated.

86.03.04 CONDITIONAL SERVICE AND RE-SERVICE

86.03.04A CONDITIONAL SERVICE

Conditional service is the feature which allows re-service of NEMA odd phase after normal service to that phase. It shall be program- enabled for each phase or phase pair.

Conditions for conditional service shall be as follows:

- (1) The master phase is the lagging phase in an odd/even phase pair in the opposite ring from the phase exercising conditional service or re-service. The non-master phase is the lagging phase in an odd/even phase pair whose leading phase exercised conditional service. In a normal sequence of phases, the odd phases are the leading phases and the even phases are the lagging phases.
- (2) A call exists on any phase across the barrier from the master phase.
- (3) A call exists on the NEMA leading phase while the NEMA lagging phase is timing.
- (4) A NEMA lagging phase in the same cycle gaps out or maxes out.
- (5) It shall allow re-service of leading phases provided that sufficient time remains in the concurrent lagging phase (master phase) to service the minimum timing intervals of the phase to be reserved.
- (6) The vehicle clearance time of the gapped/maxed out phase, plus the conditional service minimum green time is less than or equal to the timing remaining on the maximum timer of the lagging (master) phase.

86.03.04B CONDITIONAL RE-SERVICE

Conditional re-service is the feature which allows the controller in conditional service to serve the non-master phase which was terminated as part of a leading phase conditional service cycle, prior to crossing the barrier.

Conditions for conditional re-service shall be as follows:

- (1) There is sufficient time remaining in the concurrent master phase to service the minimum timing intervals of the phase to be served again.
- (2) The phase to be served again has not been served twice during the existing service of the controlling master phase.

- (3) The controller unit shall not reactivate the re-serviced phase maximum timer.
- (4) The detectors assigned to the re-serviced phase shall be programmably switched to the controlling master phase.
- (5) Re-service shall not preclude an active pedestrian movement.
- (6) Re-service shall not occur if the time necessary to fully service the phase is greater than the time remaining in the controlling master phase.

86.03.05 PLATOON PROGRESSION

Platoon progression shall be provided to synchronize closely spaced intersections. Platoon progression shall be accomplished through the internal logic of the controller. The logic shall provide for four (4) directions of transmitting (T) and receiving (R).

86.03.05A TRANSMITTER OPERATION (EACH CHANNEL)

- (1) Definition: "T-phase" = Transmit phase(s), the phase(s) that are related to the pulse generation.
- (2) It shall generate an individual output pulse through the inter-cabinet communications system to downstream cabinets at the beginning of the programmed events.
- (3) It shall have an individually programmable delay before output (0-255 sec.).
- (4) It shall be individually programmable for phase(s) which shall originate the pulse.
 - (a) Pulse shall originate at beginning of phase next for programmed phase(s).
 - (b) Pulse shall be inhibited on transition from one programmed phase to another programmed phase.
- (5) The controller outputs assigned by NEMA as pedestrian clearance outputs may be programmably assigned as the individual transmitter outputs.

86.03.05B RECEIVER OPERATION (EACH CHANNEL; MAY BE COMMON TO THE LOW PRIORITY PRE-EMPTION SEQUENCE)

- (1) Definition: "R-phase" = Receive phase(s), the phase(s) to be held.
- (2) Pulses may be received by either the inter-cabinet communications system or by discreet controller inputs (as selected by the user).

- (3) It shall have an individually programmable delay after receipt of pulse before activating the coordination sequence.
- (4) It shall have an individually programmable inhibit which shall inhibit response to received pulses (by time-of-day control, by manual control, by coordination plan, or by higher level pre-emption).
- (5) Upon receipt of the pulse, after the delay period has expired and if the programmed R-phase(s) are not green:
 - (a) The controller, if enabled by user program, shall force off any individually selected phase except of timing pedestrian or minimum intervals.
 - (b) The programmed R-phase(s) shall be held if green. At the beginning of the hold period, the programmed phase maximum interval shall be reset. The maximum interval shall be reset only once per cycle. A programmable option shall be provided to allow clearing the lockout if demand did not exist on any opposing phase upon expiration of the delay. The hold period shall be adjustable from 0-100 seconds.

86.03.06 SYSTEM DETECTORS

Each detector shall be capable of being programmed for coordination sampling by volume and/or occupancy, traffic counting, or vehicle speed; and the information shall be available to the Traffic Operations Center system monitor.

86.03.07 TELEMETRY AND INTERCONNECT

The telecommunications system shall be an integral unit and provided with every controller. The telemetry system functions shall conform to the following.

- (1) Each controller shall be capable of operating within a telemetry system of interconnect operation and communicating with the Traffic Operations Center central computer via an Ethernet TCP/IP network.
- (2) Each controller shall have the capability to monitor status of intersection parameters and its performance; capability to diagnose malfunctions or no activity on various system functions, such as detectors, telemetry communication, intersection operations, and other available special functions. All diagnostic data and information generated shall be capable of being recorded and logged in by the remotely located Central Computer at the Traffic Operations Center. All diagnostic data and information shall be available for display on computer monitor and on printed report at the Traffic

Operations Center central computer. Diagnostics shall be programmably selectable for report only or defined for action on failure.

- (3) The following functions, as a minimum, shall be programmably capable of continuous input to the system monitor.
 - (a) Each Phase Green.
 - (b) Each Phase Yellow.
 - (c) Each Phase Red.
 - (d) Each Phase Vehicle Call.
 - (e) Each Phase Walk.
 - (f) Each Phase Don't Walk.
 - (g) Each Phase Pedestrian Call.
 - (h) Each System Sampler detector.
 - (i) Each Local Coordination Counter.
 - (j) System Samplers volume and occupancy.
 - (k) System Sampler speed data.
 - (l) All programmed reportable events.

All data returned via telemetry from each system monitor shall be available to external software in real time. It shall be possible to control the operating mode of the system monitor from external software.

The following events shall be reported, programmably on request, at specified time, or on occurrence to the system monitor. Inputs shall be provided as necessary:

Detector failure (i.e. open shorted or intermittent loop)

- (a) Conflict monitor flash status change.
 - (b) Police/Maintenance panel flash status change.
 - (c) Signal lamp failure, (load change +/- 0.5 Amp).
 - (d) Street lighting lamp failure (load change +/- 0.5 Amp).
 - (e) Street lighting on/off.
 - (f) Cabinet door opened/closed.
 - (g) All preempt calls.
 - (h) Coordination status change (dial, offset, split, and if traffic responsive or time of day mode).
 - (i) Controller access (keyboard and modem).
 - (j) Power interruption (as defined in these Specifications).
 - (k) Loss of communications between local and master controllers.
- (4) Event log shall be able to store a minimum of last ten of events (event log shall be programmably resettable).
 - (5) The maximum delay in the occurrence of a reportable event and the receipt of the report by the signal monitor system shall be no greater than three (3) minutes. The maximum delay in the update of information during real-time monitoring mode shall

be no greater than one second for a system with six or fewer controllers connected to the master one.

- (6) Each controller shall provide an effective means of preventing misdirected data transfers. This may be accomplished by cabinet hardware addresses (each address bit shall be brought to a terminal strip) for each controller, by use of controller identification system which is part of the backup configuration data such as controller serial number, or by other effective means as approved by the Engineer.
- (7) Upload and download capabilities shall be provided as follows:
 - (a) All data downloaded shall be verified for accuracy: error identification and correction of the error.
 - (b) All programmable features of the controller shall be downloaded except as approved by the Engineer. Any feature that would cause an unsafe condition may be deleted from downloaded data. Any data not included in the download will be identified both at the controller and at the signal monitor. Any data that is downloaded as above shall remain in the uploaded data. Uploaded data shall be verified against the database stored in the signal monitor and any differences shall be identified.

86.03.08 DATA LOGGING

The controller shall have programmable data collection capabilities separate from the time-base program requirements, as follows:

- (1) It shall provide traffic volume data at one (1) second resolution for programmably selected periods of 5, 10, 15, 30, 60 minutes.
- (2) It shall record data for the previous 24 hour (for 15 minute periods) before overwriting stored data (oldest data may then be overwritten). An effective means of reporting data to the Central Computer Center signal monitor shall be provided which shall enable continuous recording of data.
- (3) Any of the minimum sixteen (16) system detectors shall be programmable for traffic counting, or vehicle speed sampling and the information shall be stored in a log.
- (4) Logs of vehicle counts and average vehicle speed data shall have programmable sample periods (minimum 5, 10, 15, 30, 60 minute intervals).
- (5) The controller shall upload the data to the signal monitor and shall initiate a request to transfer data to the signal monitor in advance of any data loss.

86.03.09 COORDINATION SYSTEM

- (1) The coordination system shall have upload/download capability to change all settings. Additionally, it shall be capable of

calculating all force-off points for phase termination, vehicle and pedestrian permissive periods and local split selection from intersection demand.

- (2) The coordination system shall provide offset correction, permissive period operation, remote MUTCD flash, manual override, coordinated phase actuated extension capability, and conditional service and re-service.
- (3) The coordination system shall programmably provide both conditional service and re-service as part of each coordination plan. Conditional service and re-service shall operate similar to free mode conditional service and re-service specified elsewhere in this specification, except that the conditional service may cross the barrier and may service more than one non-coordinated phase. The controller may programmably yield a second time within the same cycle when there is no conflicting coordinated phase detector call present. If a second yield occurs, it shall meet the coordination permissive and split requirements such that the guaranteed beginning of the coordinated phase is not altered and the coordinated phase actuated extension capability is maintained.
- (4) Coordination Plan Switches.
 - (a) Each controller shall be capable of operating forty eight (48) unique cycle plans and thirty-two (32) unique splits. These dial/split combinations shall be termed "Coordination Plans," and the combination of plan/split shall develop a minimum of 48 unique coordination plans.
 - (b) Each controller shall provide for smooth transition for cycle length, offset, or split changes. (Shall not go free as part of transition).
 - Correction shall be evenly distributed over all phases.
 - Amount of correction shall be individually programmable for each cycle. Programmable "shrink" and "expand" intervals shall be provided.
 - Phase sequence shall transition directly to the next programmed sequence without going free or other unusual sequencing.
 - If phase sequence is identical in next programmed sequence, then the sequence shall not change during the transition to the next coordination plan.
 - If phase sequence is not identical in the next programmed sequence, the new sequence shall take

effect after serving any phase(s) across the barrier from the coordinated phase(s) and then returning to the same side of the barrier as the coordinated phase(s).

- (c) Each coordination plan shall allow the selection by phase of:
- NOT USED (Phase not active.)
 - COORDINATED PHASE (1 per ring only.)
 - MINIMUM RECALL (Any phase.)
 - MAXIMUM RECALL (Any phase.)
 - PEDESTRIAN RECALL (Any phase.)
 - PEDESTRIAN II TIMES (Any phase.)
 - FIXED PHASE (Release of a "FIXED PHASE" occurs at a fixed point in the coordinated cycle.)
 - ACTUATED PHASE (Any phase not assigned another function switch.)

- (5) Selection of these coordinated plan switches shall be by internal software and shall not require external hardware interfaces. These coordinated plan switches shall be alterable by software download from the Central Computer Center.

86.03.10 LOCAL COORDINATOR

The local coordinator shall be capable of:

- (1) Buffering downloaded data such that keyboard or down loaded data does not cause changes in current timing intervals but becomes effective on the next cycle.
- (2) Responding to programmed changes in current coordination plan with buffering as above.
- (3) Providing alternate sequencing capability:
 - (a) It shall be individually enabled as coordination plan options.
 - (b) It shall be individually selectable by time of day.
 - (c) It shall provide coordination of special phasing sequences without special or unusual programming considerations.
 - (d) It shall provide for implementation of non-concurrent left turn phases on coordinated streets.
- (4) Providing for display of master cycle position during free mode.
- (5) Providing coordination status bit outputs to indicate the current coordination plan in effect, and providing a synchronization output pulse.

- (6) Allowing free operation at any individual intersection in a coordination system control.

86.03.11 PREEMPTOR SYSTEM

- (1) The preemptor system function shall be an integral unit of and provided with every controller. The Preemptor System function shall conform with the following:
 - (a) The priority of preemption shall be as follows: starting with the highest priority, Train, then High Priority, then Low Priority. If the controller is serving a lower level priority and receives a call for a higher level preemption, the controller shall serve the higher priority preempt call.
 - (b) A cable for any train preemptor function shall be interlocked such that, if the cable is not connected to the preemptor, the intersection shall remain in the flash mode.
 - (c) Each preemption sequence (Train or any of the separate High Priority and Low Priority preemption sequences) shall have separate timing intervals.
 - (d) A decoded input to the Controller shall be provided to discriminate the priority of preemption for each of the four separate High Priority and Low Priority preemption sequences. The decoding shall be compatible with the existing equipment currently in use by the County with a steady state low level input indicating a high level input and a pulsing low level input indicating a low level input.
 - (e) Preemption sequences shall be programmable for each associated phase.
- (2) Each controller shall have a minimum total of nine (9) distinct preemption sequences to provide timing and logic for Train, High Priority, and low Priority preemptions. One (1) sequence is for the Train preemption, four (4) sequences are for the High Priority preemption and the other four (4) sequences are for the Low Priority preemption.
- (3) A priority status shall be assignable to each preemption sequence so that a Train preemption sequence can interrupt an in-process High Priority sequence which in turn can interrupt an in-process Low Priority sequence. This priority shall be assignable on a "first-come-first-serve" basis or in a specified order within the type of preemption.
- (4) High Priority Preemption (Emergency)
 - (a) Upon acceptance of a High Priority call when the desired traffic signal display is being indicated, the controller shall hold the desired traffic signal display while

terminating all conflicting pedestrian walk displays and then shall time appropriate pedestrian clearance intervals. The controller shall have the programmable capability to allow concurrent non-conflicting pedestrian movement to time normally, advance to the solid "DON'T WALK" display, or time pedestrian clearance interval.

- (b) Upon acceptance of a High Priority call requiring the controller to advance to the desired traffic signal display, the controller shall sequentially:
 - Terminate all conflicting pedestrian "WALK" displays (both concurrent and non-concurrent) and have a programmable capability to terminate concurrent non-conflicting pedestrian "WALK" displays.
 - Service all vehicle and pedestrian clearance intervals for the priority phase(s) and have a programmable capability to terminate pedestrian clearance interval for the non-priority phase. Upon advancing to the priority phase, the controller shall have the programmable capability to allow concurrent non-conflicting pedestrian movement to time normally, advance to solid "DON'T WALK", or time pedestrian clearance interval.
 - Skip all intervening phases to obtain the desired traffic signal display.
 - (c) Upon termination of a High Priority call, the controller shall inhibit further Low Priority call(s). The inhibit shall be removed at the beginning of green for the designated High Priority phase(s) after having completed full service of all non-designated High Priority phase(s) because of normal demand and then returning to the High Priority phase(s).
 - (d) Calls shall not be placed on any non-priority phase as part of the preemption sequence except by normal demand or by user individually programmable option. Detector response during preemption shall be normal.
- (5) Low Priority Preemption.
- (a) Inputs and controls shall be provided to inhibit each individual Low Priority preemption sequence by internal time clock and by external input.
 - (b) No Low Priority calls shall be processed while the controller is servicing:
 - A conflicting pedestrian interval.

- Another Low Priority preemption sequence.
 - A High Priority preemption sequence.
 - A Train preemption sequence.
 - Low Priority call is inhibited by latching as defined in these Specifications.
 - Low Priority call is inhibited by individual external input.
- (c) Upon acceptance of a Low Priority call when the desired traffic signal display is being indicated, the controller shall hold the desired traffic signal display until that the Low Priority call is terminated and the Low Priority minimum interval or Low Priority maximum interval has elapsed or a higher level preemption call is received.
- (d) Upon acceptance of a low priority call requiring the controller to advance to the desired traffic signal display, the controller shall sequentially:
- Time out the remaining balance of the conflicting phase's minimum green time setting.
 - Time out all conflicting non-concurrent pedestrian "WALK" displays.
 - Service all vehicle clearance and conflicting non-concurrent pedestrian clearance intervals for the active non priority phase(s).
 - Skip all intervening phase(s) to obtain the desired traffic signal display.
 - Non-conflicting phases shall not be forced off nor skipped. The concurrent non-conflicting phase(s) shall be allowed to time normally after the desired traffic signal has been displayed. The concurrent non-conflicting phase(s) shall be served by demand and shall not be held or served by the preemption sequence.
 - If the low priority call should cease before the desired traffic signal display is obtained, the controller shall advance to and hold the desired traffic signal display for a programmable minimum interval adjustable from 0 to 25 seconds.
- (e) Upon termination of a Low Priority sequence the controller shall inhibit further Low Priority preemption call(s). The Low Priority preemption inhibit shall be removed at the beginning of green for the designated Low Priority phase(s) after having completed full service of all non-designated Low Priority phase(s) and then

returning to the Low Priority phase(s) because of normal demand.

- (f) Calls shall not be placed on any non-priority phase as part of the preemption sequence except by normal demand or by user individually programmable option. Detector response during preemption shall be normal. Preemption operation and status indicators for each preemption sequence shall be provided on the face of the controller including non-conflicting concurrent phase(s). The display shall indicate the complete status of the preemption sequence including all timing intervals. Controller display shall reflect field display.

86.03.12 TIME-OF-DAY-CLOCK

The Time-of-Day Clock function shall be an integral unit and provided with every Controller. The Time-of-Day Clock function shall conform to the following:

- (1) Daylight savings time adjustment shall be provided. Date of adjustment shall be programmable for twice-a-year change of date.
- (2) Automatic leap-year adjustment shall be provided.
- (3) A minimum of 150 programmable events shall be provided. Events shall be programmable for year, date, hour, and minute and shall have a minimum repeatable accuracy of one second. Events shall have a minimum programmability for repetition as one time, weekdays, weekend, everyday, or selected days.
- (4) Eight (8) special function outputs shall be provided and be programmable for any intended use. Each output shall conform with the same requirements as NEMA specified outputs.
- (5) Manual control of all special function outputs shall be provided via keyboard entry which shall override program control of the outputs.
- (6) The Time-of-Day Clock function shall override system functions but shall not override manual functions.
- (7) The Status of the special function outputs shall be capable of being displayed by the controller.
- (8) The following functions, minimally, shall be programmable internally by the time of day control: any coordination mode, MUTCD Flash, any phase Minimum recall, any phase Maximum recall, any phase soft recall, any alternate time periods (Max 2, Max 3, Ped. 2), any phase conditional re-service, Dual entry, Red rest, Low priority inhibits, Dimming enable, Detector fail table parameters.

- (9) HOV (High Occupancy Vehicle) Signal Control shall conform with the following:
- (a) Six (6) of the Special Function outputs shall be used.
 - (b) Two (2) standard load switches shall be used to provide six (6) outputs for remote activation of sign controls. These load switches shall be sources from an individual circuit breaker, shall not be wired to the flash bus and shall be individually fused.
- (10) Each controller shall be capable of operating in a non-interconnected (time based) coordination mode controlled by Time of Day Clock. The digital clock shall use the 60Hz power line frequency as a time base and shall be provided with a lithium battery or other effective means for backup power capable of maintaining the operation of the clock for 1 year of continuous operation and with a battery life of eight years before required replacement.

86.03.13 (BLANK)

86.03.14 COMMUNICATIONS

- (1) Communications between controllers shall:
- (a) Be via fiber-optic cable or, when specified, no more than two (2) pairs of existing twisted shielded conductors.
 - (b) Provide for proper suppression of noise and sufficient signal strength and clarity such that communications is easy under high background noise conditions.
 - (c) Use Ethernet TCP/IP network. Controllers shall be equipped with the following on the controller front panel:
 - A minimum of two (2) RS-232 ports and an FSK port. These ports are keyboard programmable with selectable baud rates from 300 to 57.6K with full and half duplex options.
 - A RS-485 SDLC Bus Interface Port is provided for all TS2 applications.
 - An Ethernet port RJ45 with female 8-pin connector TCP/IP at 10/100MBPS.

86.03.15 CONTROLLER CABINET

86.03.15A CABINET CONSTRUCTION

Controller cabinet shall be County standard Type P conforming to the requirements in SSS Section 86-3.04A "Cabinet Construction," and 86-3.04B "Cabinet Ventilation," State Standard Plan No. ES-3A, except the following:

- (1) Cabinet and doors shall be fabricated of 1.8 mm (0.073-in.) minimum thickness cold rolled steel.

- (2) Cabinet shelves shall provide spaces with minimum dimensions of 300 mm high by 480 mm wide by 300 mm deep (12 in. x 19 in. x 12 in.).
- (3) Painting of cabinet shall be as specified in CSS Section 86.02.15 "Painting."
- (4) All equipment and modules shall be secured when properly installed. Vibration and minor shaking of the cabinet shall not cause any equipment or module to become dislodged from its proper position nor its operation to fail.
- (5) When Caltrans standard steel cabinets are specified, they shall conform with the following:
 - (a) The controller assembly design shall be submitted as specified in CSS Section 86.01.04C "Controller cabinet Submittals."
 - (b) All functions of the County standard controller assembly shall be maintained. All equipment shall operate in the County closed loop system and with the existing County signal monitor system.
 - (c) All equipment shall be interchangeable with the equipment specified for the County standard controller assembly.
 - (d) Adapter cables and/or connectors shall be provided and attached in the cabinet to convert from the County standard controller and conflict monitor to the basic functions of the Caltrans 170 controller and conflict monitor. Any other functions requiring adaptation to convert the supplied cabinet to Caltrans standard control equipment shall be provided. The functions of the County Standard controller assembly shall not require adaptors.

86.03.15B CABINET WIRING

Wiring shall conform to the requirements in CSS Sections 86.01.04C "Controller Cabinet Submittals," and 86.02.09 "Wiring," SSS Section 86-3.04C "Cabinet Wiring," and the following.

- (1) All of the input-output terminations specified in Section 3 of NEMA Publication TS 2-2003 v02.06, Type 2 Controller Unit, shall be brought to an external terminal via the regular controller connector and wiring harness. The pin used for each function shall be the pin used for the same function on all similar model controllers of the same manufacturer.

- (2) All wires terminating on a terminal strip shall be neatly dressed with adequate service loop.
- (3) All solid conductors installed in the cabinet (such as component pigtails), when a crimp connector is applied, shall be soldered.
- (4) All equipment connecting cables shall have full length conductors on each connector pin. All unused or spare conductors that are not required by these Standard Specifications or to be terminated, shall be identified with the connector origin and appropriate pin number or letter. All equipment cables shall be protected by sleeves. Nylon wire ties shall not be used to lace cables.
- (5) All cabinet conductors that are terminated shall be identified with a label within 25 mm (1 inch) of its attachment to the terminal and litho labeling is permitted on rear side of load bay. The label shall identify the point of origin of the conductor and shall be referenced to the cabinet print callouts.
- (6) No more than three wires shall be attached to the rear of each terminal of a feed-through type terminal block, and it shall be possible to alter or interrupt any and all equipment and terminal interconnections at the front of aforementioned terminal block(s). Jumpers shall be allowed on the rear of terminals in order to bus logic power, logic grounds, and other signals for multiple distributions to front mounted terminations.

86.03.15C CABINET ACCESSORIES

The following accessories or features shall be provided and included as part of the controller cabinet assembly:

- (1) A two position "Stop Time Auto-Manual" switch shall be provided stop time of the controller unit when the police panel "Flash-Auto" switch is placed into the "Flash" position. When placed in the "Manual" position, the controller unit will be stop timed. The "Stop Time Auto-Manual" switch shall not have an off position. A separate "Stop Time Disable" momentary pushbutton switch shall be provided near the "Stop Time Auto-Manual" switch to interrupt all stop timing input to the controller unit.
- (2) An "Equipment Power On-Off" switch shall be provided on the control panel to disconnect power to all equipment in the cabinet except the vehicle flasher circuit, which shall remain operable.

- (3) A “Controller Unit On-Off” switch shall be provided on the maintenance panel. It shall remove power from both the controller unit and the conflict monitor.
- (4) The cabinet lighting fixture “On-Off” switch shall be a toggle switch type conforming to SSS Section 86-3.06A “Toggle Switches”. The light fixture shall be mounted on the inside control panel and equipped with a door switch to shut off the cabinet light when the door is closed.
- (5) A transparent, easily removable cover over the face, top and sides of the cabinet power panel to prevent accidental contact with energized electrical parts shall be provided. The cover shall be at least 3 mm (0.125 inch) thickness material. Access holes of approximately 13 mm (1/2in.) diameter shall be provided in the cover to allow access to the terminal lugs of the signal contactor, lighting contactor, and the circuit breakers.
- (6) Guards shall conform to the following:
 - (a) Guards shall be provided over all circuit breakers to prevent accidental manual tripping of the breaker. The guard shall not interfere with the normal operation of the breakers, and shall not inhibit visual confirmation of any ratings, markings, or the operational status of the breakers.
 - (b) Guards shall be provided to protect against damage to all rear and side mounted equipment by shelf mounted equipment.
 - (c) Guards shall be provided to protect the door mounted maintenance panel switches from accidental actuation.

86.03.15D AUXILIARY EQUIPMENT

The following auxiliary equipment shall be provided:

- (1) The load bay shall be fastened with hinges near the bottom rear of its point of attachment to the cabinet. It shall be possible, by removing no more than two (2) fasteners at the top of the rack, to swing the rack downward and gain access to the rear of the rack and its wiring. The lowest portion of the load bay or any part thereof, including any field conductor terminal blocks attached to it, shall be at least 150 mm (6 in.) from the cabinet bottom when in the down position and not more than 300mm (12 in.) from the cabinet bottom when in the upright position.
- (2) Load switches shall be securely supported by a well braced metal bar or shelf located underneath the load

switches. The support shall not interfere with load switch convection cooling or with full utilization of the load switch handle to facilitate the insertion and removal. The front portion of the support shall contain the phase/function label(s) for the load switches. The labels shall be visible while either standing or kneeling in front of the cabinet. All load switches shall be of solid state design and shall be provided with LED indicators of the input and output status.

- (3) Conflict monitors shall conform to Section 3 of NEMA Publication TS 2-2003 v02.06, Type 2 Controller Unit; and the following.
 - (a) Type 12 monitor with twelve (12) fully programmable input channels shall be used.
 - (b) The monitor shall have the capability to detect the absence of phase color, switch failure, no lamp load conditions and more than one color (R, Y, or G) being on at the same time for each channel. It shall also be capable to detect short clearance intervals for each phase. The minimum interval shall be fixed at 2.5 seconds or shall be adjustable between 2.5 seconds and 2.8 seconds.
 - (c) Conflict monitors are required to monitor voltage levels per NEMA standards regardless of sensed voltage phase shift with respect to cabinet voltage. This shall include 180 degree out of phase shift with respect to cabinet voltage.
 - (d) Conflict monitors shall not latch upon the failure of the Controller Voltage Monitor (NEMA CVM) output; however, conflict monitors shall latch upon failure of either 24 volt monitor circuit.
 - (e) The conflict monitor shall monitor both the controller 24 VDC power supply and the auxiliary power supply. The 24 volt monitor shall operate as follows:
 - If the monitoring device places the signals into flashing operation because of activation of either +24 VDC monitoring circuit, the flashing operation shall lock-in and shall release only upon operation of a reset switch and restoration of the proper +24 VDC levels. If a complete power failure to the controller assembly occurs after the monitoring device has placed the signals into flashing operation

because of activation of either +24 VDC monitoring circuit, the flashing operation may release if proper +24 VDC levels exist when power is restored.

- Circuitry to provide this feature shall be fully contained within the conflict monitor unit.
 - In no case shall a complete power failure to the controller assembly, which was functioning properly and in normal or “automatic” mode prior to the power failure, cause the signals to be in flashing operation, due to false or erratic operations of the aforementioned circuitry, after restoration of power.
 - All conflict monitor wiring for channel assignments to field indications shall be connected only to the field terminal block(s), not to the rear of load switch sockets.
 - The conflict monitor logic power shall be furnished by the controller power switch. The power to the conflict monitor relay shall be furnished from the unswitched main power.
- (4) An auxiliary, series-regulating type power supply shall be installed to provide power to load switches, detectors, indicators, relays, external logic and other required equipment. The auxiliary power supply shall conform to the following:
- (a) It shall be shelf-mounted, plug removable and provide positive 24 (± 0.5) volts DC output with one (1) percent regulation or better over an AC line voltage variation from 95 to 135 volts and from no-load to full-load. Current capability shall be from four (4) to five (5) amperes continuous, and with less than 0.5 volts peak-to-peak ripple.
 - (b) The fuse shall be provided and located on the power supply. Fuse shall be accessible for checking and/or replacing without removing the case.
 - (c) It shall be contained in a protective housing. The connector on the power supply shall be a MS 3102A-18-1P, keyed standard, and the pin callout shall be as follows:

<u>PIN</u>	<u>FUNCTION</u>
A	120 VAC Neutral
B	-24 VDC Negative (DC-)
C	120 VAC (Hot)
G	+24 VDC Output
H	Chassis Ground

- (5) Two (2) convenience outlets shall be provided in each cabinet, conforming to the requirements in SSS Section 86-3.05B "Convenience Receptacle" and the following:
- (a) It shall be located on the interior left side of the cabinet wall and approximately 460 mm (18 inches) to 1 M (40 inches) from the base of the cabinet. Devices plugged into the convenience outlet shall not be damaged or interfered by the cabinet door movement.
 - (b) It shall be equipped with ground fault circuit interrupter (GFCI) protection.
- (6) All isolators, interfaces, cables, and related equipment for pedestrian circuitry, telemetry, and preemption systems shall be provided regardless of whether those systems will be provided. The optical discrimination module shall only be provided when specified.
- (7) When HOV sign controls are specified in the special provisions, the controller cabinet shall contain two (2) 15 amp. circuit breakers and two (2) load switches contained in the load bay to power and control the two (2) separate and remote NEMA Type F cabinets.

Wiring for HOV sign control in controller cabinet and Type F cabinet shall conform to the Contract Documents.

86.03.15E DETECTOR CARD RACK AND DETECTOR TERMINATION PANEL

- (1) Detector Card Rack
- (a) Each controller cabinet shall be provided with two TS2 rack-mount card racks, capable of providing 64 channels of loop detection :
 - The first card rack shall be able to accommodate up to 32 channels and provided with integrated slots for:
 - Two (2) BIUs,
 - Eight (8) four-channel TS2 detector cards, and

- One (1) dual Emergency Vehicle Preemption (EVP) detector. One EVP slot shall operate channels A, B, C, D and the other shall operate channels C and D.
 - The second detector rack shall be able to accommodate an additional 32 channels and provided with integrated slots for:
 - Two (2) BIUs, and
 - Eight (8) four-channel TS2 detector cards.
- (b) Detector card racks shall have a rigid aluminum frame and shall have slots set in a modular fashion such that the PCB edge connectors shall plug into the rear while sliding between top and bottom card guides for each module. Mounting flanges shall be provided and be turned outward for ease of access. Detector card racks shall be bolted to and unbolted from the cabinet shelf using simple tools.
- (c) All wiring to the racks shall be labeled and neatly run to other parts of the cabinet and detector termination panel.
- (d) Card rack slots shall be numbered 1 to 16 from left to right when viewed from the front of the rack. A flange shall be provided on the top and the bottom of the rack to label each individual channel.
- (e) Detector card racks shall be powered by an external DC power supply.
- (f) Rack chassis ground shall be bussed to a common point and wired to the detector panel.
- (g) Rack logic ground shall be bussed to both the controller logic ground and the external logic ground at a common point and wired to the detector panel.
- (h) Data address for the detector channels shall be according to TS 2.
- (2) Detector Termination Panel
- The controller cabinet shall be provided with a loop detector termination panel mounted in the interior right side of the cabinet. The detector panel shall meet the following:

- (a) Detector termination panel shall provide for all connections between detector loops installed in the street and detector amplifiers.
- (b) Detector termination panel shall be constructed of 3.2 mm / (1/8 in.) thick aluminum.
- (c) Detector termination panel shall contain a 76 mm (3 inches) horizontal slot in each corner to accommodate 6 mm (1/4 inch) mounting bolts.
- (d) All inputs from the loops shall be brought through posted 10/32 inch X 5/16 inch binder screw terminals or 8/32 inch X 5/16 inch binder screw terminals.
- (e) Each loop pair shall be protected by lightning surge suppressor. The suppressors shall be mounted to the back of the panel using feed-through screw terminals.
- (f) Detector terminals shall each have a test switch such that when the switch is closed, a call is placed upon that detector input. The test switch shall be on momentarily.
- (g) A chassis ground bus bar shall be provided on the panel and connected to the cabinet by an insulated braided copper ground strap. The strap shall be bonded to the cabinet.
- (h) The detector termination panel shall provide connection points for :
 - External 24V power supply,
 - Loop inputs,
 - Logic ground, and
 - Chassis ground bus.”

86.04 TRAFFIC SIGNAL FACES AND FITTINGS

- Section 86.04.01 “Vehicles Signal Faces” (on page 312) is amended to read as follows:

 “Vehicle signal faces shall have metal signal sections conforming to SSS Section 86-4.01 “Vehicle Signal Faces.”
 Visors shall be full circle and metal type conforming to SSS Section 86-4.01B “Visors.”
 Louvers shall not be used unless specified in the Contract Documents.”
- Section 86.04.02 “Backplates” (on page 312) is amended to read:

“Backplates shall be furnished and installed on all signal faces. Backplate shall be made of aluminum and installable from the front of the signal head and conform to the requirements in SSS Section 86-4.04 “Backplates” and State Standard Plan ES-4C.

The use of plastic backplates will not be accepted.”

- Section 86.04.03 “Signal Mounting Assemblies” (on page 313) is amended to read as follows:

“Signal mounting assemblies shall conform to CSD E/3A and the requirements in SSS Section 86-4.08 “Signal Mounting Assemblies” except that terminal compartments, post top adapters, and plain side pole mounts shall be cast bronze. “Clam Shell” mounts shall not be used.”

- Section 86.04.04A “Pedestrian Signal Faces (on page 313) is amended to read as follows:

“Pedestrian signal faces shall conform to the requirements in SSS Section 86-4.06 “Pedestrian Signal Faces” except the following:

- (1) Message symbols for pedestrian signal faces shall be white “WALKING PERSON” and side-by-side Portland orange “UPRAISED HAND” with “COUNTDOWN NUMBER” as specified in Section 86.04.05 “Light Emitting Diode (LED) Signal Modules”.

- Section 86.04.05 “Signal Lamps” (on page 314) is amended to read as follows:

“86.04.05 LIGHT EMITTING DIODE (LED) SIGNAL MODULES

86.04.05A LED VEHICULAR SIGNAL MODULE

(1) General

- (a) LED vehicular signal modules shall be of 200 mm (8 in.) and 300 mm (12 in.) red, yellow, green circular indications and 300 mm (12 in.) red, yellow and green arrow indications, designed to be installed as a retrofit in the door frame of existing standard traffic signal housing.
- (b) LED vehicular signal modules shall be from the same manufacturer and each size shall be the same model.
- (c) Each LED vehicular signal module shall come as a sealed unit with 2 conductors for connecting power, a printed circuit board, a power supply, a lens with gasket, and shall be waterproof after installation and connection. The circuit board and power supply shall be contained inside

the LED module. Circuit boards shall conform to Chapter 1, Section 6, of Caltrans-published "Transportation Electrical Equipment Specifications." Conductors shall be 1 M (3 feet) in length with terminals attached.

- (d) Connections of LED vehicular signal module shall be to the terminal block in the signal face or shall utilize an adapter that screws into the medium base lamp socket. Contacts shall be brass. Splices shall not be allowed.
- (e) The lens of the LED vehicular signal module shall be clear and transparent, integral to the unit, shall be convex with a smooth outer surface, and be made of UV stabilized plastic or glass. The lens and shell materials shall be capable of withstanding UV (direct sunlight) exposure for a minimum of 60 months without exhibiting evidence of deterioration.
- (f) The LED vehicular signal module shall be sealed in the door frame with a one-piece ethylene propylene rubber (EPDM) gasket.
- (g) The LED shall utilize Aluminum Indium Gallium Phosphate (AlInGap) technology for red, amber and yellow indications, and Gallium Nitride (GaN) technology for green indications, and shall be the ultra bright type or equivalent rated for a minimum of 100,000 hours of continuous operations from -40°C (-40°F) to +74°C (+165°F).
- (h) The individual LED shall be wired such that physical damage or the failure of one LED will result only in the loss of light of the damaged or failed LED.
- (i) LED vehicular signal modules shall not exceed the following power consumption requirements:

<u>LED VEHICULAR SIGNAL MODULE</u>	<u>25°C (77°F)</u>	<u>74°C (165°F)</u>
12-inch Circular	25 W	30 W
8-inch Circular	15 W	18 W
12-inch Arrow	15 W	18 W

- (j) LED vehicular signal modules shall be rated for a minimum useful life of 60 months.
- (2) Physical and Mechanical Requirements
- (a) LED vehicular signal modules shall be designed as retrofit replacements for optical units of standard traffic signal sections and shall not require special tools for installation. LED vehicular signal modules shall fit into

existing traffic signal section housings, built in conformance with the requirements in the ITE publication ST-017B "Vehicle Traffic Control Signal Heads", without modification to the housing.

- (b) Installation of LED vehicular signal modules shall not require the removal of material in the traffic signal section except the optical unit components (i.e., lens, gaskets, lamp, lamp socket and reflector). Installed LED vehicular signal modules shall fit securely in the door frame and shall be watertight.
- (c) LED vehicular signal modules shall have a maximum weight of 1.8 kg (4 pounds).
- (d) The lens of LED vehicular signal modules shall be tinted and, if made of polymeric material, shall have a front surface coating or chemical surface treatment for abrasion resistance.
- (e) LED vehicular signal modules shall be single, self-contained devices, not requiring on-site assembly for installation into existing traffic signal housing.
- (f) Each LED vehicular signal module shall have the manufacturer's name, trademark, model number, serial number, lot number and the month and year of manufacture, nominal operating voltage, power consumption and wattage, permanently marked on the back of the module.
- (g) LED vehicular signal modules shall be operationally compatible with Naztec TS2 controller assemblies (solid state load switches, flashers, and conflict monitors).
- (h) LED vehicular signal modules shall meet the following test standards and operating specifications:

<u>Test Type/ Parameter</u>	<u>Standards/ Specifications</u>
Luminous Intensity	ITE VTCSH (Vehicle traffic Control Signal Head) Standard Part 2
Chromaticity	ITE VTCSH Standard Part 2
Moisture Resistance	NEMA Standard 250 Type 4 Enclosure
Mechanical Shock/ Vibration	MILITARY Standard 883 Method 2007
Electronic Noise	FCC Title 47 Sub. B Sec. 15
Transient Voltage Protection	ITE VTCSH Standard Part 2

Controller Compatibility	NEMA TS-2
Operating Temperature Range	-40°C (-40°F) to +74°C (+165°F)
Operating Voltage Range	80 V(AC) to 135 V(AC) @ +/-60 Hz
Power Factor	>90%
Total Harmonic Dispersion	<20%
Voltage Turn-off	45 V
Wiring	600 V, 20 AWG Minimum, Color Coded with Strain Relief, NEC Compliance for Service at or >105°C (221°F)

86.04.05B LED COUNTDOWN PEDESTRIAN SIGNAL MODULE

(1) General

- (a) Countdown pedestrian signal indication shall fully comply with the requirements of the California Manual of Uniform Traffic Control Devices (CA MUTCD) and as specified hereinbelow.
- (b) Countdown pedestrian signal indication shall come as a single, self-contained LED module with enclosed power supply and electronic components and wiring for final connection. The module shall be readily to be installed into existing pedestrian signal housing without modification to the existing housing.
- (c) Installation of a countdown pedestrian signal module shall only require the removal of existing optical unit components (i.e., lens, lamp module, gaskets and reflector in an incandescent lamp model or existing retrofit non-countdown LED module model) and direct connection to existing electrical wiring without supplemental wiring. The module shall fit securely in the housing and the entire installation assembly shall be weather tight.

(2) Physical & Operating Characteristics

(a) Size

- Message bearing surface shall have a nominal size of 16 inches high by 18 inches wide.
- Message bearing surface shall have an overlaid LED-filled WALKING PERSON/ UPRAISED HAND symbols and a dual row of 9-inch high LED-filled counting NUMBER symbol.

(b) Materials

- Lens and shell materials shall be UV-stabilized polycarbonate conforming to ASTM specifications.
- Enclosures containing the power supply and electronic components shall be made of UL94VO flame retardant material.
- LEDs for UPRAISED HAND and NUMBER symbols shall be Portland Orange color AllnGap type.
- LEDs for WALKING PERSON shall be White Lunar color InGaN type, conforming to the ITE PTCSI Standard Part 2.

(c) Identification

Module shall be identified on the backside with:

- Manufacturer's name, trademark, model number, serial number, lot number and the month and year of manufacture.
- Operating characteristics such as nominal operating voltage, power consumption and wattage.
- UP ARROW symbol or word UP or TOP for correct orientation of the module inside the signal housing.

(d) Environmental Requirements

- Module shall be rated for use in the ambient operating temperature range of -40°C (-40°F) to +74°C (+165°F).
- Moisture resistance shall comply with NEMA Standard 250 - 1991 Type 4 Enclosures.
- Module lens shall have a smooth surface on the outside to reduce dust and dirt collection.
- Module shall include an installed gasket for a weather tight installation.
- Module shall be capable of withstanding mechanical shock and vibration in accordance with MILITARY Standard 883 Method 2007.

(e) Electrical Requirements

- Wiring shall comply with the National Electrical Code.
- Module circuitry shall voltage surge protection to withstand high-repetition noise transient and low-repetition, high-energy transients as per ITE PTCSI

Standard Part 2 and NEMA Standard TS2 – 1992
Section 2.1.6.

- Electronic noise emission from LED module and on-board circuitry shall conform to the regulations of Federal Communications Commission (FCC) Title 47, Subpart B, Section 15.
- LED module shall operate over a voltage range between 80 V to 135 V on a 60 ± 3 Hertz AC line power. LED module circuitry shall prevent perceptible flicker at less than 100 Hz over the entire voltage range. The fluctuations of line voltage shall have no visible effect on the luminous intensity of the indications. Rated voltage for measurements shall be 120 VAC.
- There shall be no illumination from the module when the applied voltage (low voltage turn-off) is less than 45 VAC.
- LED module shall provide a power factor of 90% or greater while operating throughout the temperature range as specified in Section (2)(d) hereinabove.
- Total harmonic distortion shall not exceed 20% while operating throughout the temperature range as specified in Section (2) (d) hereinabove.
- Fluctuation in the line over the voltage range shall not affect luminous intensity by more $\pm 10\%$.

(f) Operating Requirements

- LED module shall be rated for a minimum useful life of 60 months.
- Failure of a single LED in the UPRAISED HAND, WALKING PERSON and/or COUNTDOWN 2-DIGIT NUMBER symbols shall result in loss of light from only that LED and not result in loss of light of remaining LEDs.
- LED module shall be operationally compatible with Naztec TS2 controller assemblies (solid state load switches, flashers, and conflict monitors).
- LED module shall automatically adjust to the programmed intervals of the traffic controller.
- LED luminous intensity, when measured normal to the plane of the symbol surface shall be:

<u>SYMBOL</u>	<u>BRIGHTNESS INTENSITY (MIN.)</u>
WALKING PERSON	2,200 cd/m2
UPRAISED HAND & COUNTDOWN NUMBER	1,400 cd/m2

LED luminous intensity shall meet or exceed 85 % of the value indicated for the corresponding symbol after 60 months of continuous use over the temperature range, as specified in Section (2)(d) hereinabove, in a signal operation.

- Maximum power consumption for each symbol shall be as follows:

<u>SYMBOL</u>	<u>25° C (77° F)</u>	<u>74° C (165° F)</u>
UPRAISED HAND	10 W	12 W
WALKING PERSON	9 W	12 W
COUNTDOWN 2-DIGIT NUMBER	8 W	11 W

- LED module shall be capable of 3 modes of operations which are set by means of a built-in waterproof toggle switch:
 - Mode 1: Countdown during the Clearance sequence,
 - Mode 2: Countdown during the Walk + Clearance sequences,
 - Mode 3: Countdown feature off allowing for only Upraising Hand/Walking Person operation.”

86.05 DETECTORS

- Section 86.05.01 “Detector Units” (on pages 314-316) is amended in its entirety to read as follows:

“86.05.01 DETECTOR UNITS

Detector units shall conform to the requirements in Section 15 “Inductive Loop Detectors” of the NEMA Standards for Traffic Control Systems (Publication No. TS 2-2003 v02.06) and the following:

- (1) Sixteen (16) detector modules shall be provided with each cabinet.

- (2) Detectors shall be four (4) channel units with a maximum width of 28.4 mm (1-1/8 in.) in width.
 - (3) Each detector channel shall have both a standard selectable pulse/presence output with delay and extension capabilities. Individual delay and extension timers (minimum of 0-31 seconds delay and 0-15 seconds extension).
 - (4) Each detector module shall provide a loop fail diagnostic output. This output shall become true upon detection of an open loop, shorted loop, or sudden unusual change in loop inductance.
 - (5) Transformer isolation of the loops shall be provided.
 - (6) Detector unit shall be digital in design, using digital timing.
 - (7) A minimum of nine (9) selectable sensitivity levels shall be provided.
 - (8) A minimum of eight (8) selectable operating frequency ranges shall be provided.
 - (9) A LCD display type indication shall be provided on the front panel of the operating status, (active output, delay timing, extension timing, loop failed).
 - (10) All controls for frequency (crosswalk control), mode (pulse or presence), and sensitivity shall be located on the front of the detector unit.
 - (11) Detector shall be self-tuning.
 - (12) Detector performance characteristics shall conform to the following:
 - (a) Sensor units shall provide an output true condition for each vehicle passing through the response area of the loop at speeds up to 120 km/h (75 mph) and shall also provide an output true condition of at least three (3) minutes duration when a vehicle is occupying the response area of the loop.
 - (13) Detector card edge pins 1, 2, 3, and 10 shall be isolated from all other pins and circuitry on the detector card.”
- Section 86.05.02 “Detector Rack” and its sub-sections 86.05.02A “Use Options,” 86.05.02B “Detector Output Program Cards,” and 86.05.02C “Others” (on pages 316-318) are deleted in its entirety. Refer to Section 86.03.15E “Detector Card Rack and Detector Termination Panel.”
 - The first paragraph in Section 86.05.03 “Detector Loop Materials” is amended to read as follows:

“Inductive loop detector materials shall conform to the requirements in SSS Section 86-5.01A(3) “Construction Materials” and the following.”

- Section 86.05.04 “Detector Loop Installation” (on page 318) is amended to read as follows:

“The installation of inductive loop detectors shall conform to the requirements in SSS Section 86-5.01A(4) “Installation Details,” on CSD E/5A and the following:

- (1) Detector loops homeruns shall not cross more than two (2) traffic lanes before entering the handhole.
- (2) Detector lead-in cables between pullbox (immediately adjacent to the detector handhole) and controller cabinet shall run continuously and shall be unspliced throughout the length of the conductors.
- (3) Detector loops shall have diamond or circular configuration conforming to CSD E/5A.
- (4) The sealant for filling slots shall be asphaltic emulsion sealant for asphaltic concrete pavement application and hot-melt rubberized asphalt sealant for Portland cement concrete pavement; both as specified in the State Standard Specifications.

Work on detector loop shall be measured and paid for at the Contract unit price for detector loop furnished and installed complete in place, including pavement sawcut and restoration. Work on detector handhole and pull box shall each be measured and paid for at the Contract unit prices for each type furnished and installed complete in place including furnishing and installing conduit connecting the handhole and pull box.”

86.06 LIGHTING

- The first paragraph in Section 86.06.02 “Photoelectric Controls” is amended to read as follows:

“Photoelectric control shall be Type II consisting of a remote photoelectric unit, a separate contactor and a test switch meeting the requirements in SSS Section 86-6.08 “Photoelectric Controls” and the following.”

86.07 REMOVING, REINSTALLING OR SALVAGING SIGNAL/ELECTRICAL EQUIPMENT & FACILITIES

- Section 86.07 “Removing, Reinstalling or Salvaging Signal/Electrical Equipment & Facilities” (on page 321) is amended to read as follows:

“86.07 REMOVING, REINSTALLING, DISPOSING AND/OR SALVAGING SIGNAL/ELECTRICAL EQUIPMENT

The work specified in this section shall conform to SSS Section 86-7 “Removing, Reinstalling or Salvaging Electrical Equipment” and the following.

86.07.01 ABANDONED FOUNDATIONS

Signal and luminaire standard foundations to be abandoned shall be removed to a depth of not less than 500 mm (1.5 ft.) below the finished grade of the adjacent roadway pavement regardless of the foundation location. Cabinet foundations shall be removed completely. Holes resulted from the removed foundation shall be treated as follows:

- (1) At locations where no pavement structural section exists, structural sand, as specified in SSS Section 19-3.025B "Sand Bedding", shall be used in backfilling and top finished section shall match in kind and conform to adjoining finished grade. Placement of backfill material shall conform to the requirements in SSS Section 19-3.06 "Structure Backfill."
- (2) At locations with an existing pavement structural section, a 500 mm (1.5 feet) full depth asphalt concrete, as specified in SSS Section 39 "Asphalt Concrete," shall be installed to match with existing grade of surrounding pavement section. Top finished section such as in traffic islands shall match in kind and conform to adjoining finished grade.

86.07.02 REMOVAL & STORAGE OF SALVAGED EQUIPMENT

Light and signal standards, signal frameworks, miscellaneous equipment and materials when specified by the Contract Documents to be salvaged, traffic signal controller and fiber-optic communication assemblies, battery backup system assemblies, and Type III-AF service assemblies, and LED signal modules shall be delivered by Contractor to the following address prior to the final acceptance of the Project:

Santa Clara County East Yard
1505 Schallenberger Road
San Jose, CA 95131

Signal heads shall be disassembled from their frameworks. Visors and backplates shall be disassembled from signal heads. Frameworks, and pedestrian push buttons, signs, and bands shall be removed from signal standards. All non built-in wiring shall be removed from salvaged equipment or materials. Care shall be taken to insure that equipment is returned in an undamaged condition.

The Contractor shall be responsible for the damage, loss, and interim storage of all salvaged materials and equipment until delivered and accepted by the Engineer at the specified site. Salvaged materials and equipment shall remain the property of the County.

The removal and disposal and/or salvage of signal/electrical equipment specified in this Section 86.07 will be compensated at the Contract lump sum price for removal and disposal and/or salvage of

electrical equipment as indicated in the Contract Documents. Unless indicated otherwise in the Contract Documents, the reinstallation of existing equipment shall be considered as incidental and its compensation will not be made separately and shall be considered as included in the Contract price for the appropriate item of work.”

86.10 MEASUREMENT AND PAYMENT

- Section 86.10 “Measurement and Payment” (on page 323) is replaced with Section 86.10 “Battery Backup System” and Section 86.11 “Measurement and Payment” as follows:

“86.10 BATTERY BACKUP SYSTEM

The Battery Backup System (BBS) shall be provided for all new LED signal system installations and retrofits of existing LED signal systems. It shall provide emergency temporary power to maintain signal operations in the event of utility power failure or interruption.

86.10.01 BBS MINIMUM REQUIREMENTS

- (1) The BBS shall conform to the requirements of the latest Caltrans Transportation Electrical Equipment Specifications (TEES), Chapter 4 – Specifications for Battery Backup System and the following.
- (2) The BBS shall be designed for outdoor applications in accordance with the latest Caltrans Transportation Electrical Equipment Specifications (TEES), Chapter 1 - Electrical Equipment General Specifications.
- (3) The BBS shall be capable of providing instant and reliable emergency battery power to the vehicle and pedestrian traffic signal control system in the event of power failure or interruption.
- (4) The BBS shall be capable of providing power for full run-time operation of a signalized intersection equipped with vehicle and pedestrian LED signal indications or for flashing-mode operation of an intersection using red LED signal indications. The minimum duration for the full run-time operation is specified hereinbelow.
- (5) BBS Assembly

The BBS assembly shall be comprised of, but not be limited to, the following:

- Inverter/charger,
- Power transfer relay,
- Batteries,
- A separate manually operated non-electric bypass switch,

- A stand-alone weatherproof NEMA-rated enclosure with all necessary hardware and interconnect wiring to house the components and batteries.

86.10.01A OPERATION REQUIREMENTS

The BBS shall comply with the operation requirements:

Battery Pack	24 V, AGM/VRLA (Absorbed Glass Mat/Valve Regulated Lead Acid) maintenance free, sealed and individually fused type, 50 lbs max.
Battery Recharge Time	4 Hours to 95% min. of full charge capacity.
Battery Wiring	24 V parallel and hot (in battery backup Mode) swap system for battery replacement and addition (for additional run-time); heavy-duty and toolless battery connection system.
Full Run-Time Operation	4 hours min. with capability for up to 8 Hours min. with battery addition.
Operating Temperature (for all components)	-37oC to +74oC (-35oF to +165oF)
Output Capacity	1,000W min. @ +25oC (+77oF) with 80% min. inverter efficiency while running on battery backup mode
Output Voltage (in Backup Mode)	120 VAC \pm 5 VAC with THD \leq 3%, 60 Hz \pm 0.05 Hz
Relay and Switch Ratings	240 VAC/30 Amps, Min.
System Compatibility	NEMA Type 90 Controller TS2
System Voltage	24 VDC
Transfer Time (from disruption of normal utility line voltage to stabilized Backup Mode voltage)	40 milliseconds max.

86.10.01B PROTECTION AND SAFETY FEATURES

The BBS shall be equipped with the following protection and safety features for:

(1) AC Power Feedback

The BBS shall be capable of preventing a malfunction feedback of AC power to the controller cabinet or from feeding back to the utility service. In the event that AC

power feeding the BBS is interrupted, the AC voltage measured at the AC inputs to the BBS (Line to Neutral) shall be less than 1 VAC.

(2) Surge Protection

The BBS shall be protected from electrical surge caused by lightning in compliance with IEEE/ANSI C.62.41. It shall be capable of withstanding 2,000 volt surges applying 50 times across line and neutral without causing the BBS to transfer to Backup mode.

(3) Unit Failure

In the event of inverter/charger failure, battery failure or complete battery discharge, the Power Transfer Relay shall revert to the NC (Normally Closed) or de-energized state, here utility line power is connected to the controller cabinet.

(4) Overload

In the event of an overload at the output, the BBS must be able to shut down automatically in order to protect against internal damage.

(5) Bypass

Placing the Manual Bypass Switch into "Bypass" shall cut utility power to the Inverter/Charger and route utility power to the controller cabinet. In this condition, the Inverter/Charger unit is disabled and batteries are disconnected from the system for safe removal while still allowing the signal system to function normally.

(6) The Manual Bypass Switch (that must be external to the Inverter) and Power Transfer Relay shall be separate functional units but may share a common enclosure.

86.10.01C DISPLAYS AND CONTROLS

The BBS shall be equipped with the following:

(1) Display

A backlit LCD screen type display that can be viewed in both bright sunlight and darkness. The following information shall be displayed on the screen on a continuous basis for viewing: operating mode, utility input voltage, BBS output voltage, charger status, percent battery charge, battery voltage, any alarms and faults, and relay status information.

(2) Keypad

A well defined keypad (with Arrow, Enter and Escape keys) on the front face of the Inverter/Charger unit for

user to navigate the system menu, make system programming changes, and retrieve status information.

(3) Status Indicators

Three system status LED indicators to draw user's attention to the LCD screen for information: Red LED for system faults, Yellow LED for system alarms and Green LED for change to system output.

(4) Event Log and Counter

An event log and counter to record at a minimum the number of times that the BBS unit was in Backup mode and the total hours and minutes that the unit has operated in that mode since last reset. The BBS shall also keep a running log with the latest events. For each event, the log shall contain as a minimum: a date/time stamp, the current operating mode, event description. All this information shall be displayed through the LCD screen and shall be available for viewing via the EIA-232 port and the Ethernet port.

(5) Relay Contacts

A terminal block with six programmable dry relay contacts, each rated for a minimum of 1 Amp @ 125VAC, shall be provided on the front panel of Inverter/Charger. When any relay is energized, it shall be displayed on the LCD screen. The programming options shall be: On Battery, Low Battery, Timer, Alarm, Fault, and Off. Each relay shall have its own common and its own set of Normally Open (NO) and Normally Closed (NC) terminals. The terminals for each relay shall be oriented and labeled as NO-C-NC from left to right. In addition, each contact shall be labeled as C1 thru C6 (with each followed by the application label), and each terminal as 1 thru 18, all from left to right.

(6) Wiring

System wiring, including battery cables and harness, shall be readily capable to accommodate additional batteries inside cabinet to expand to the full 8-hours run-time. All wires and cables shall be bundled, secured neatly, and tagged accordingly for ease of reference.

(7) Communications

System communications shall include serial and Ethernet communications ports for local and remote configuration and management. The serial port shall be a RS-232 (DB9-Female) connector and the Ethernet port shall be RJ45, EIA 568B Pinout connector.

86.10.01D ENCLOSURE

A weatherproof NEMA 3R type cabinet shall be provided as part of the BBS assembly meeting the following requirements:

- (1) It shall be fabricated from 14 gauge minimum stainless steel with all welded construction.
- (2) It shall be pad-mounted and have a depth and width not to exceed the dimensions of the Portland cement concrete pad per CSD E/50. Its height shall be 60 inches maximum.
- (3) It shall be provided with empty shelf space to accommodate additional batteries for the 8-hour full runtime operation, and a chassis ground point.
- (4) It shall have a cut-out bottom with all-side flanges, pre-punched for anchor bolt holes, to accommodate conduit risers on the PCC pad.
- (5) It shall have fully-framed side, stainless steel piano-hinged door with close tolerance for flush fit with drip lip and closed cell neoprene flange compressed gaskets or approved equal. The door shall be equipped with pad-lockable, welded-in-place, and vandal-proof latch and tab and a State no. 2 lock handle.
- (6) Cabinet ventilation shall be by means of louvers located at top and bottom of the enclosure with encapsulated bug screens and cleanable filters, and a fan to completely change air at a minimum rate of 25 times per minute. The fan shall be factory-wired and thermostat-operated at temperatures set by the BBS manufacturer.
- (7) Mounting methods of the BBS components inside the cabinet can be either shelf-mount, rack-mount, swing-tray mount, or a combination of either, for ease of access to the components for maintenance and replacement. Mounting of BBS components to the inside face of the enclosure door panel shall not be permitted in any circumstance.
- (8) Cabinet shall come with complete hardware for mounting, i.e., shelves, racks, anchor bolts, wiring circuits, fan, and all necessary components. All BBS components, except batteries, shall be factory-mounted with wires and cables installed and terminated inside the cabinet. A plastic covered wiring diagram shall be attached to the inside door panel for reference.
- (9) All components shall be factory-wired and conform to the required NEMA, NEC and UL standards, and shall be securely fastened at the factory for delivery.

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86.10.02 TESTING

Acceptance and field tests of the BBS assembly shall be performed in accordance with CSS Section 86.02.13A "Materials and Equipment Testing" and CSS Section 86.02.13B "Field Testing."

86.10.03 WARRANTY

The BBS assembly shall have a two (2) year factory repair and/or replacement warranty on all parts and labor.

86.10.04 MEASUREMENT AND PAYMENT

Unless specified otherwise in the Contract Documents, the work on the BBS assembly shall be paid for per each BBS unit furnished and installed complete in place as specified in this section.

Compensation for the BBS cabinet foundation shall be as specified in CSS Section 86.02.04 "Foundations."

86.11 MEASUREMENT AND PAYMENT

Measurement and payment shall be as per CSS Section 9 "Measurement and Payment" and SSS Section 86-8 "Payment" and as follows.

Unless specified otherwise in this CSS Section 86 or in the Contract Documents, the Work specified will not be measured and paid for separately. Compensation shall be considered as included in the Contract prices for the appropriate items of Work provided in the Contract Bid Schedule.

When the terms "furnishing and installing, complete in place" are specified in the measurement and payment for an item, it shall mean that compensation made shall include all required labor, materials, and equipment to perform and complete such item of work as specified, including all incidentals required to complete the item of work according to the applicable standards, codes or regulations. No additional compensation shall be made unless indicated otherwise."
