Georgia Department of Transportation
Proposal

Date of Opening : October 17, 2014

Proposal ID : B34861-14-T00-0

Call Order : 006

Projects : 0011440

Project No. : 0011440

Counties : Talbot

DO NOT UNSTAPLE THIS BOOKLET....Enter all required information either by hand or by stamp.

Proposal ID : B34861-14-T00-0

8.900 MILLES OF PLANT MIX RESURFACING AND IMPROVEMENTS ON POBIDDY RD (CR 172) BEGINNING AT SR 22 AND EXTENDING SOUTH OF THE FLINT RIVER.

DBE Goal: 0.00% Proposal Guaranty: 5.00%

Time ID	Description	Completion Date or Number of Units	Time Type
00	COMPLETE CONTRACT	9/30/2015	DT
01	FAIL TO COMPLETE PAVING OPERATIONS - SEE SPEC PROV SEC 108	120	CD
02	FAIL TO COMPL ALL WORK EXCEPT PERM PAV-SEE SPEC PROV SEC 108	8/31/2015	DT

(*) - Indicates Cost Plus Time Site. See Schedule of Items for Cost Per Unit

NOTICE TO BIDDERS

If a DBE goal is specified, the bidder shall submit with this bid proposal a list of all proposed DBE participants. A form for this purpose is provided in this proposal. Please refer to the following specificatons:

102.07 Rejection of Proposals

Disadvantaged Business Enterprise Program (Special Provision)

Bidders must enter all unit prices, make all extensions, and total the bid.

Proposal ID: B34861-14-T00-0 Project(s): 0011440

SECTION: 0001 ROADWAY

Alt Set ID: Alt Mbr ID:

Proposal Line Number	Item ID Description	Approximate Quantity and Units	Unit Price Dollars	Unit Price Cents	Bid Amount Dollars	Bid Amount Cents
0005	150-1000 TRAFFIC CONTROL - 0011440	LUMP SUM	LUMP SUM		90,000.00	
0010	163-0232 TEMPORARY GRASSING	1.000 AC	_____	_____	_____	_____
0015	163-0240 MULCH	29.000 TN	_____	_____	_____	_____
0020	163-0300 CONSTRUCTION EXIT	2.000 EA	_____	_____	_____	_____
0025	163-0529 CONSTRUCT AND REMOVE TEMPORARY SEDIMENT BARRIER OR BALED STRAW CHECK DAM	7,500.000 LF	_____	_____	_____	_____
0030	165-0010 MAINTENANCE OF TEMPORARY SILT FENCE, TP A	50,000.000 LF	_____	_____	_____	_____
0035	165-0071 MAINTENANCE OF SEDIMENT BARRIER - BALED STRAW	3,750.000 LF	_____	_____	_____	_____
0040	165-0101 MAINTENANCE OF CONSTRUCTION EXIT	2.000 EA	_____	_____	_____	_____
0045	171-0010 TEMPORARY SILT FENCE, TYPE A	100,000.000 LF	_____	_____	_____	_____
0050	210-0100 GRADING COMPLETE - 0011440	LUMP SUM	LUMP SUM		_____	_____
0055	402-1802 RECYCLED ASPH CONC PATCHING, INCL BITUM MATL & H LIME	1,100.000 TN	_____	_____	_____	_____
0060	402-1812 RECYCLED ASPH CONC LEVELING, INCL BITUM MATL & H LIME	3,750.000 TN	_____	_____	_____	_____

Proposal ID: B34861-14-T00-0 Project(s): 0011440

SECTION: 0001 ROADWAY

Alt Set ID: Alt Mbr ID:

Proposal Line Number	Item ID Description	Approximate Quantity and Units	Unit Price Dollars Cents	Bid Amount Dollars Cents
0065	402-3100 RECYCLED ASPH CONC 9.5 MM SUPERPAVE, TYPE I, GP 1 OR BLEND 1, INCL BITUM MATL & H LIME	9,400.000 TN	_____._____	_____._____
0070	402-3190 RECYCLED ASPH CONC 19 MM SUPERPAVE, GP 1 OR 2,INCL BITUM MATL & H LIME	120.000 TN	_____._____	_____._____
0075	413-1000 BITUM TACK COAT	13,100.000 GL	_____._____	_____._____
0080	636-1033 HIGHWAY SIGNS, TP 1 MATL, REFL SHEETING, TP 9	64.000 SF	_____._____	_____._____
0085	636-2070 GALV STEEL POSTS, TP 7	72.000 LF	_____._____	_____._____
0090	636-2090 GALV STEEL POSTS, TP 9	39.000 LF	_____._____	_____._____
0095	643-8200 BARRIER FENCE (ORANGE), 4 FT	3,500.000 LF	_____._____	_____._____
0100	653-2501 THERMOPLASTIC SOLID TRAF STRIPE, 5 IN, WHITE	17.800 LM	_____._____	_____._____
0105	653-2502 THERMOPLASTIC SOLID TRAF STRIPE, 5 IN, YELLOW	17.800 LM	_____._____	_____._____
0110	654-1001 RAISED PVMT MARKERS TP 1	1,200.000 EA	_____._____	_____._____
0115	700-6910 PERMANENT GRASSING	2.000 AC	_____._____	_____._____
0120	700-7000 AGRICULTURAL LIME	4.000 TN	_____._____	_____._____

Proposal ID: B34861-14-T00-0 Project(s): 0011440

SECTION: 0001 ROADWAY

Alt Set ID: Alt Mbr ID:

Proposal Line Number	Item ID Description	Approximate Quantity and Units	Unit Price Dollars	Unit Price Cents	Bid Amount Dollars	Bid Amount Cents
0125	700-8000 FERTILIZER MIXED GRADE	2.000 TN	_____	_____	_____	_____
0130	700-8100 FERTILIZER NITROGEN CONTENT	400.000 LB	_____	_____	_____	_____
0135	713-3012 WOOD FIBER BLANKET, TP II, SHOULDERS	50,000.000 SY	_____	_____	_____	_____
0140	716-2000 EROSION CONTROL MATS, SLOPES	2,200.000 SY	_____	_____	_____	_____

Section: 0001 Total: _____._____

Total Bid: _____._____

GEORGIA SECURITY AND IMMIGRATION COMPLIANCE ACT AFFIDAVIT

Contractor(s) Name: _____

Letting: _____

Call No: _____

By executing this affidavit, the undersigned person or entity verifies its compliance with O.C.G.A. § 13-10-91, stating affirmatively that the individual, firm, or corporation which is contracting with the Georgia Department of Transportation has registered with, is authorized to participate in, and is participating in the federal work authorization program commonly known as E-Verify,* in accordance with the applicable provisions and deadlines established in O.C.G.A. § 13-10-91.

The undersigned person or entity further agrees that it will continue to use the federal work authorization program throughout the contract period, and it will contract for the physical performance of services in satisfaction of such contract only with subcontractors who present an affidavit to the undersigned with the information required by O.C.GA. § 13-10-91(b).

The undersigned person or entity further agrees to maintain records of such compliance and provide a copy of each such verification to the Georgia Department of Transportation within five(5) business days after any subcontractor(s) is/are retained to perform such service.

_____ _____

E Verify ™ Company Identification Number Date of Authorization

_____ _____

BY: Authorized Officer or Agent Date
(Name of Person or Entity)

_____

Title of Authorized Officer or Agent

_____

Printed Name of Authorized Officer or Agent

SUBSCRIBED AND SWORN
BEFORE ME ON THIS THE

_____ DAY OF _____, 201_

_____ [NOTARY SEAL]

Notary Public

My Commission Expires: _____

*** or any subsequent replacement** operated by the United States Department of Homeland Security or any equivalent federal work authorization program operated by the United States Department of Homeland Security to verify information of newly hired employees, pursuant to the Immigration Reform and Control Act of 1986 (IRCA), P.L. 99-603

Revised 12/12/12

REQUEST FOR ELIGIBILITY TO BID

GEORGIA DEPARTMENT OF TRANSPORTATION
OFFICE OF CONSTRUCTION BIDDING ADMINISTRATION
600 West Peachtree St., N.W.
Atlanta, GA 30308

Email SalesOffice@dot.ga.gov

GDOT FAX NUMBERS: (404)631-1070 Sales Office Fax
(404)631-1275 Sales Office Alternate Fax
(404)631-1945 Main Office CBA Fax

LETTING DATE:	
GDOT VENDOR CODE:	
COMPANY NAME:	
CONTACT PERSON:	
EMAIL ADDRESS:	

FOR OPTIMUM SERVICE, KEEP GDOT UP-TO-DATE
WITH YOUR CONTACT INFORMATION
(Mailing Address, Phone No., Fax No., E-mail Address, Primary Contact Person, etc.

Indicate below the three digits of the Call Order Number, and your bidding status

B = Bidding Prime

(Example: 1.) 001 B 2.) 006 B 3.) 018 B etc.)

1.		5.		9.		13.	
2.		6.		10.		14.	
3.		7.		11.		15.	
4.		8.		12.		16.	

Complete this form to Request For Eligibility To Bid. The deadline to submit this form to GDOT, Office of Construction Bidding Administration is no later than 12:00 p.m. on the day preceding the letting. ** **Failure to submit this document will result in ineligibility to Bid.**

CERTIFICATIONS

(English Project)

First Use Date 2013 Specifications: November 22, 2013

Failure to complete appropriate certification requirements identified below or submission of a false certification shall render the bid non-responsive.

EXAMINATION OF PLANS AND SPECIFICATIONS

I acknowledge that this Project will be constructed in English units.

I certify that I have carefully examined the Plans for this Project and the Standard Specifications 2013 Edition, Supplemental Specifications and Special Provisions included in and made a part of this Proposal, and have also personally examined the site of the work. On the basis of the said Specifications and Plans, I propose to furnish all necessary machinery, tools, apparatus and other means of construction, and do all the work and furnish all the materials in the manner specified.

I understand the quantities mentioned are approximate only and are subject to either increase or decrease and hereby propose to perform any increased or decreased quantities of work or extra work on the basis provided for in the Specifications.

I also hereby agree that the State, or the Department of Transportation, would suffer damages in a sum equal to at least the amount of the enclosed Proposal Guaranty, in the event my Proposal should be accepted and a Contract tendered me thereunder and I should refuse to execute same and furnish bond as herein required, in consideration of which I hereby agree that, in the event of such failure on my part to execute said Contract and furnish bond within fifteen (15) days after the date of the letter transmitting the Contract to me, the amount of said Proposal Guaranty shall be and is hereby, forfeited to the State, or the Department of Transportation, as liquidated damages as the result of such failure on my art.

I further propose to execute the Contract agreement described in the Specifications as soon as the work is awarded to me, and to begin and complete the work within the time limit provided. I also propose to furnish a Contract Bond, approved by the State Transportation Board, as required by the laws of the State of Georgia. This bond shall not only serve to guarantee the completion of the work on my part, but also to guarantee the excellence of both workmanship and materials until the work is finally accepted, as well as to fully comply with all the laws of the State of Georgia.

CONFLICT OF INTEREST

By signing and submitting this Contract I hereby certify that employees of this company or employees of any company supplying material or subcontracting to do work on this Contract will not engage in business ventures with employees of the Georgia Department of Transportation (GA D.O.T.) nor shall they provide gifts, gratuities, favors, entertainment, loans or other items of value to employees of this Department.

Also, by signing and submitting this Contract, I hereby certify that I will notify the Georgia Department of Transportation through its District Engineer of any business ventures entered into between employees of this company or employees of any company supplying material or subcontracting to do work on this Contract with a family member of GA D.O.T. employees.

DRUG FREE WORKPLACE

The undersigned certifies that the provisions of Code Sections 50-24-1 through 50-24-6 of the Official Code of Georgia Annotated, relating to the "Drug-free Workplace Act", have been complied with in full. The undersigned further certifies that:

1. A drug-free workplace will be provided for the Contractors employees during the performance of the Contract; and

2. Each Contractor who hires a Subcontractor to work in a drug-free workplace shall secure from that Subcontractor the following written certification:

   "As part of the subcontracting agreement with (Contractors name), (Subcontractors name) certifies to the Contractor that a drug free workplace will be provided to and for the subcontractors employees during the performance of this Contract pursuant to paragraph (7) of subsection of Code Section 50-24-3."

Also, the undersigned further certifies that he will not engage in the unlawful manufacture, sale distribution, dispensation, possession, or use of a controlled substance or marijuana during the performance of the Contract.

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

NON-COLLUSION CERTIFICATION

I hereby certify that I have not, nor has any member of the firm(s) or corporation(s), either directly or indirectly entered into any agreement, participated in any collusion, nor otherwise taken any action in restraint of free competitive bidding in connection with this submitted bid.

It is understood and agreed that this Proposal is one of several competitive bids made to the Department of Transportation, and in consideration of mutual agreements of the bidders, similar hereto, and in consideration of the sum of One Dollar cash in hand paid, receipt whereof is hereby acknowledged, the undersigned agrees that this Proposal shall be an option, which is hereby given by the undersigned to the Department of Transportation to accept or reject this Proposal at any time within thirty (30) calendar days from the date on which this sealed proposal is opened and read, unless a longer period is specified in the Proposal or the successful bidder agrees in writing to a longer period of time for the award, and in consideration of the premises, it is expressly covenanted and agreed that this Proposal is not subject to withdrawal by the Proposer or Bidder, during the term of said option.

I hereby acknowledge receipt of the following checked amendments of the Proposal, Plans, Specifications and/or other documents pertaining to the Contract.

Amendment Nos.: 1____2____3____4____5____. I understand that failure to confirm the receipt of amendments is cause for rejection of bids.

Witness my hand and seal this the ____ day of _____, 20_____.

The bidder(s) whose signature(s) appear on this document, having personally appeared before me, and being duly sworn, deposes and says that the above statements are true and correct.

Sworn to and subscribed before me this _____
Day of _____, 20_____.

_____
(Notary Public)

My Commission expires the _____day of
_____, 20_____.

_____
(Federal ID No./IRS No.)

_____
(Print Company Name)

By _____(Seal)_
Corporate President/Vice President or
Individual Owner or Partner (Strike
through all except the one which applies.)

Joint Bidder:

_____
(Print Company Name)

By _____(Seal)_
Corporate President/Vice President or
Individual Owner or Partner (Strike
through all except the one which applies.)

Joint Bidder:

_____
(Print Company Name)

By _____(Seal)_
Corporate President/Vice President or
or Individual Owner or Partner (Strike
through all except the one which applies.)

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

Let Date: October 17, 2014

PROPOSAL INDEX

Call Order Number: 006 **Counties:** Talbot

Project No(s): 0011440

Listed below are modifications and additions to the 2013 State of Georgia Standard Specifications Construction of Transportation Systems.

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Certification/Drug Free Workplace
Signature Page
Proposal Index
Notice to All Bidders
Prompt Payment
Utility Conflicts
Sec. 102 - Bidding Requirements and Conditions (2)
Sec. 107 -Legal Regulations and Responsibility to the Public
Sec. 109 - Measurement and Payment
Sec. 150 - Traffic Control
Sec. 153 - Field Engineers Office
Sec. 161 - Control of Soil Erosion and Sedimentation
Sec. 162 - Erosion Control Check Dams
Sec. 163 - Miscellaneous Erosion Control
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Sec. 925 - Traffic Signal Equipment
TIA Funding Special Provision
Construction Details (Resurfacing & Widening)
Sec. 105 - Control of Work (TIA)
Sec. 108 - Prosecution and Progress (Failure or Delay in Completing Work on Time) (TIA)
Sec. 150 - Traffic Control
Sec. 713 - Wood Fiber Blanket

NOTICE TO ALL BIDDERS

To report bid rigging activities call:

1-800-424-9071

The U.S. Department of Transportation (DOT) operates the above toll-free "hotline" Monday through Friday, 8:00 AM to 5:00 PM, Eastern Time. Anyone with the knowledge of possible bid rigging, bidder collusion, or other fraudulent activities should use the "hotline" to report such activities.

The "hotline" is part of the DOT's continuing effort to identify and investigate highway construction contract fraud and abuse, and is operated under the direction of the DOT Inspector General. All information will be treated confidentially and caller anonymity will be respected.

Revised: November 19, 2006

SPECIAL PROVISION

PROMPT PAYMENT:

Prime Contractors, who sublet a portion of their work, shall pay their subcontractors for satisfactory performance of their contracts no later then 10 calendar days from receipt of each payment made to them.

Any delay or postponement of payment among the parties may take place only for good cause with prior written approval from the Department.

If the contractor is found to be in noncompliance with these provisions, it shall constitute a breach of contract and further payments for any work performed may be withheld until corrective action is taken. If corrective action is not taken, it may result in termination of the contract.

All subcontract agreements shall contain this requirement.

First Use Date: January 1, 2007
Revised: March 26, 2008
March 5, 2009
September 30, 2009
August 6, 2012

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

Utility Conflicts

Utility companies having known facilities that conflict with the construction of this project will be directed by the Department to adjust or relocate their facilities and will be notified of the contract award.

Conform to all the requirements of the Specifications as they relate to cooperation with utility owners and the protection of utility installations that exist on the project. Refer to the requirements of Section 107, Legal Regulations and Responsibility to the Public, with particular attention to Subsection 107.21.

Coordinate The Work with any work to be performed by others in any right of way clearance and arrange a schedule of operations that will allow for completion of the Project within the specified contract time. Where stage construction is required, notify the utility owner when each stage of work is completed and the site is available for utility work to proceed.

Information concerning utility facilities known to exist within the project limits, including the list of owners, is available for reference.

Under Georgia Code Section 32-6-171, utilities are required to remove or relocate their facilities. The Department is required to give the utility at least 60 days written notice directing the removal, relocation, or adjustment and the utility owner is required to begin work within the time specified in the utility's work plan or revised work plan.

Upon request, copies of all approved Work Plans submitted by utility companies having facilities on this project will be made available for examination by the Contractor at the Department's District Office. Utility Adjustment Schedules, when submitted to the Department by the utilities, will be made available to the Contractor after the Notice to Contractors has been posted by the Office of Construction Bidding Administration. The Contractor is responsible for considering in its bid all existing and proposed utility locations and the removals, relocations, and adjustments specified in the Utility's Work Plan.

For this Project, Utility Owners that are required to remove, relocate, or adjust their facility to accommodate the construction of this Project may be liable to the Contractor for damages or delay costs resulting from the Utility Owner's failure to clear conflicts

within the time specified in the approved Utility Work Plan. If the Utility Owner is unable to submit and obtain Department approval of a revised Work Plan or fails to complete the removal, relocation, or adjustment of its facilities in accordance with the approved Work Plan, the Utility Owner may be liable to the Department, or the Contractor, for damages or delay costs.

In accordance with Subsection 105.06 of the Specifications, the Department is not liable for payment of any claims due to utility delays, inconvenience or damage sustained by the Contractor due to interference of any utilities or appurtenances, or the operation of moving them.

In any case in which the Contractor believes that it will be entitled to damages or delay costs from the Utility Owner in accordance with O.C.G.A. 32-6-171, the Contractor shall provide written notice to the Utility Owner and the Department within ten (10) days from the time of the dispute or potential dispute is identified. The Contractor shall follow the Procedures for Utility Damages or Delay Costs outlined in the latest edition of The Utility Accommodation Policy and Standards Manual. Failure to follow the above will result in waiver of the Contractor's claim against the Utility Owner for damages or delay costs.

In accordance with Subsection 107.21.G delays by utilities will continue to be considered by the Department in charging Contract Time. For purposes of applying provisions of this paragraph, railroads and the Metropolitan Atlanta Rapid Transit Authority (MARTA) are considered utilities.

First Use Date: January 14, 2005

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

SECTION 102-Bidding Requirements and Conditions

The use of the Electronic Bid Bond Form in Expedite will be accepted by the Department for compliance with the Notice To Contractors requirement to utilize the "Bid Bond Form DOT 564-Rev. Dec. 13, 2004".

Office of Contract Administration

First use date: November 22, 2013

GEORGIA DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

Section 102—Bidding Requirements and Conditions

Delete Subsection 102.06 and Substitute the following:

102.06 Preparation of Proposal

The Bidder shall submit its Proposal on the form furnished by the Department (GADOT). The blank spaces on the Proposal shall be filled in correctly for each Pay Item (except alternate items) and the Unit Price or a Lump Sum Price as called for in the Proposal for each Pay Item listed therein. In addition, the Bidder shall also show the products of the respective Unit Prices and quantities and the total amount of the Bid by adding the amounts of all Bid Items. In the event of a discrepancy in any of the figures, the Unit Price will govern and the Bid will be recalculated.

In the case of Alternate items, Unit Prices shall be entered for only one alternate.

The Non-Collusion Certificate on the Department's standard form included in the Proposal shall be executed.

The Certificate of Current Capacity shall be executed under oath and substantiated by the report of Status of Contracts on Hand.

The Construction Contractors Bid Opportunity List standard form shall be completed with the required information.

The Georgia Security and Immigration Compliance Act Affidavit shall be completed with the required information.

The Bidder shall notify the GADOT Office of Construction Bidding Administration by transmitting the completed Request For Eligibility To Bid Form D. O. T. RFETB for each Letting Call Order Number in which the Bidder intends to submit a bid by no later than 12:00 p.m. the day preceding the letting.

The Bidder's Proposal shall be signed by Digital Signature by the individual, by one or more members of a partnership, or by one or more of the officers of a corporation, whichever is applicable. In the event of a joint venture, the Proposal shall be signed by Digital Signature by each individual involved, by each partnership through one or more of its members, or by each corporation through one or more officers of the corporation, whichever is applicable. Proposals not properly signed may be disqualified and rejected.

All bids shall be submitted using the GADOT/AASHTO (American Association of State Highway and Transportation Officials) Electronic Bidding System (Expedite). When submitting a bid electronically, the Bidder's Proposal shall consist of the Bid pages generated by the Expedite software including the Cover page, Bid Item pages, Disadvantaged Business Enterprise (DBE) pages (if applicable), Miscellaneous Data pages and the Signature page. By submitting a bid electronically, the Bidder acknowledges all requirements included in the proposal, amendments, plans, Standard Specifications, and Supplemental Specifications are a part of the Bid and Contract.

The electronic bid shall be submitted by the following method:

A. Electronic Bid Submission via the Internet and Bid Express™.

(Note: The Bidder shall secure an account and a valid Digital Signature from Bid Express™ (www.bidx.com) in order to use this method.

Instructions for preparing and submitting bids by this method is as follows:

1. Access to the electronic bidding information is available on Bid Express™ at www.bidx.com and the GADOT Construction Bidding Administration Internet Web Site at www.dot.ga.gov/doingbusiness/contractors/pages/default.aspx.
2. When installing the Bid program the Bidder shall enter their vendor code in the following format: 2DO900. Before running the electronic bidding programs, the Bidder shall read the on-line help documentation for the Expedite software.
3. **Zero (0) is considered to be a valid bid. The Bidder shall not enter 0 in any Unit Price field unless zero is the intended bid for that item.**
4. All addenda shall be included in the electronic bid submitted.
5. **"Joint Bids" are allowed with Electronic Bid Submission via the Internet and Bid Express™**
6. The Bidder shall select **tools** and then **check bid** from the Windows Expedite menu to check the bid and assure there are no errors prior to submitting the electronic bid. The electronic bid may be changed and resubmitted electronically to Bid Express™ as many times as desired prior to the advertised cutoff time specified in the Notice To Contractors. The last bid submitted for a given Letting Call Order Number prior to the cutoff time will be the Bid.
7. The Bidder shall make no claim against the Department in the event it is unable to submit its bid to Bid Express™ and/or Bid Express™ is unable to submit the bid(s) to the Department. The Department reserves the right to postpone the public reading of bids in the event of technical difficulties.

B. Proposal Guaranty and Power of Attorney via the Internet and Bid Express™.

A fully executed Proposal Guaranty and Power of Attorney for each Letting Call Order Number bid shall be submitted by via the Internet and Bid Express™ by the time and date set in the Notice To Contractors for submission of Proposals.

The Proposal Guaranty for a "Joint Bid" shall include the names of all Joint Venture parties involved in the bid.

Office of Construction Bidding Administration

January 10, 2014

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SUPPLEMENTAL SPECIFICATION

Section 107—Legal Regulations and Responsibility to the Public

Delete Subsection 107.21 and Substitute the following:

107.21—Contractor's Worksite Utility Coordination Supervisor

107.21 General Description

The Contractor shall designate, prior to beginning any work, a Worksite Utility Coordination Supervisor (WUCS) who shall be responsible for initiating and conducting utility coordination meetings and accurately recording and reporting the progress of utility relocations and adjustment work. Also, the WUCS shall prepare an Emergency Response Plan for the purpose of planning, training, and communicating among the agencies responding to the emergency. The WUCS shall be the primary point of contact between all of the Utility companies, the Contractor and the Department. The WUCS shall recommend the rate of reoccurrence for utility coordination meetings and the Engineer will have the final decision on the regularity for utility coordination meetings. In no case will utility coordination meetings occur less than monthly until controlling items of utility relocations and adjustment milestones are completed. The WUCS shall contact each of the utility companies for the purpose of obtaining information including, but not limited to, a Utility Adjustment Schedule for the controlling items of utility relocations and adjustments. The WUCS shall notify the appropriate utility company and/or utility subcontractors and the Department of the status of controlling items of relocations and adjustment milestones as they are completed. The WUCS shall furnish the Engineer, for approval, a Progress Schedule Chart, immediately following the receipt of the Notice to Proceed unless otherwise specified, which includes the utility companies controlling items of work and other information in accordance with Section 108.03 or elsewhere in the Contract documents.

A. Qualifications

The WUCS shall be an employee of the Prime Contractor, shall have at least one year experience directly related to highway and utility construction in a supervisory capacity and have a complete understanding of the Georgia Utilities Protection Center operations, and shall be knowledgeable of the High-voltage Safety Act and shall be trained on the Georgia Utility Facility Protection Act (GUFPA). The Department does not provide any training on GUFPA but will maintain a list of the Georgia Public Service Commission certified training programs developed by other agencies. Currently the following companies offer approved GUFPA training programs:

Associated Damage Consultants

Phone: 706.234.8218 or 706.853.1362

Georgia Utility Contractors Association

Phone: 404.362.9995

Georgia Utilities Protection Center

Phone: 678.291.0631 or 404.375.6209

H B Training & Consulting

Phone: 706.619.1669 or 877.442.4282 (Toll Free)

The Prime Contractor is responsible for obtaining the GUFPA training for their employees.

Questions concerning the Georgia Public Service Commission GUFPA training program should be directed to:

Georgia Public Service Commission

244 Washington St. SW

Atlanta, GA 30334-5701

404.463.9784

B. Ticket Status

During the utility coordination meetings the WUCS shall collect and maintain the Ticket Status information to determine the status of all locate requests within the project limits. This information will be used to assure those planning to use mechanized equipment to excavate or work within the project limits are prepared to begin work when they have reported or estimated beginning work. At points where the Contractor's or utility company's operations are adjacent to or conflict with overhead or underground utility facilities, or are adjacent to other property, damage to which might result in considerable expense, loss, or inconvenience, work shall not commence until all arrangements necessary for the protection thereof have been made.

C. Notice

The names of known utility companies and the location of known utility facilities will be shown on the Plans, or listed in the Subsurface Utility Engineering Investigation if performed or in the Special Provisions; and the WUCS shall give 24-hour notice to such utility companies before commencing work adjacent to said utility facilities which may result in damage thereto. The WUCS shall further notify utility companies of any changes in the Contractor's work schedules affecting required action by the utility company to protect or adjust their facilities. Notice to the utility companies by the Department of the Award of Contract, under Subsection 105.06, shall not be deemed to satisfy the notice required by this paragraph. Furthermore, this 24-hour notice shall not satisfy or fulfill the requirements of the Contractor as stated in Chapter 9 of Title 25 of the Official Code of Georgia Annotated, known as the "Georgia Utility Facility Protection Act".

D. Agenda

The WUCS shall cooperate with the companies of any underground or overhead utility facilities in their removal and relocations or adjustment work in order that these operations may progress in a reasonable manner, that duplication of their removal and relocations or adjustment work may be reduced to a minimum, and services rendered by those parties will not be unnecessarily interrupted. To promote this effort the WUCS shall prepare an agenda for the utility coordination meetings and circulate same in advance of the meeting to encourage input and participation from all of the utility companies. The agenda will be prepared by an examination of the project site and may include photographs of potential/actual utility conflicts.

E. Emergency Response Plan

The WUCS shall prepare an Emergency Response Plan within 30 days following the receipt of the Notice to Proceed. The WUCS shall clearly mark and highlight the gas, water and other pressurized pipeline shut-off valves and other utility services including overhead switch locations on the utility plans; and prepare a chart to indicate the location of each site (Street address or intersections), the utility company or operator of the facility with emergency contact information and the working condition of the device to facilitate prompt shut-off. The WUCS shall post the Emergency Response Plan in an area readily accessible to the Department. In the event of interruption to gas, water or other utility services as a result of accidental breakage or as a result of being exposed or unsupported, the WUCS shall promptly notify the appropriate emergency officials, the Georgia Utilities Protection Center and the appropriate utility facility company or operator, if known. Until such time as the damage has been repaired, no person shall engage in excavating or blasting activities that may cause further damage to the utility facility.

F. Submission

Provisions for reporting all utility coordination meetings, the progress of utility relocation and adjustment work milestones and ticket status information will be reported on a form developed by the WUCS and will be distributed by the WUCS to all of the utility companies as milestones are met and shall be included as part of the project records. These reports shall be delivered to the Engineer for review, on a monthly basis. The WUCS shall immediately report to the Engineer any delay between the utility relocation and adjustment work, the existing Utility Adjustment Schedule, or the proposed Utility Adjustment Schedule so that these differences can be reconciled.

G. Delays

Delays and interruptions to the controlling Item or Items of The Work caused by the adjustment or repair of water, gas, or other utility appurtenances and property may be considered for an extension of Contract Time as provided in Subsection 108.07.E unless such delays are due to the negligence of the Contractor.

H. Facilities Supported on Bridges

If the utility facilities are to be supported on bridges, the following provisions shall apply:

1. The Plans will show the location of the facility and the auxiliary items necessary to support the facility.

2. The Contractor constructing the bridge shall install anchor bolts, thimbles, inserts, or other auxiliary items attached to the bridge as a part of the support for the utility facility. The Utility Company shall furnish these auxiliary items, unless the Contract indicates these items are to be furnished by the Contractor as a part of the bridge construction.

3. The Utility or its subcontractor constructing the utility facility shall install hanger rods, pipe rollers, and other attachments necessary for the support of the utility facility as indicated on the Plans. The Utility Company shall furnish these attachments at no cost to the Department or the prime contractor unless otherwise specified. This work shall also include:

   a. Caulking the openings around the utility where it passes through endwalls to prevent the passage of undesirable materials.

   b. Painting the exposed portions of utility supports unless such supports are corrosion resistant. Painting shall be done in accordance with the applicable portions of Section 535, unless otherwise specified.

4. The sequence of bridge construction work may be set forth in the Plans and/or the Special Provisions and will show at what stage of the Work a utility company will be allowed to make the utility installation. Further, all or any portion of The Work under Subsection 107.21.H.3 may be included in the bridge Contract by the Plans and/or the Special Provisions.

5. Any damage to the bridge structure caused by the utility installation shall be repaired to the satisfaction of the Engineer at the expense of the Utility or its subcontractor installing the utility facility.

I. Clearances

The Plans provide for at least minimum clearance of utilities as required by the National Electrical Safety Code, U.S. Department of Commerce, and National Bureau of Standards. Any additional clearance the Contractor may desire or require in performing The Work shall be arranged by the Contractor with the utility company. The Department will pay no extra compensation for such additional clearances.

J. Utility Relocation Progress Schedule

The purpose of the Utility Adjustment Schedule is to provide the Contractor with the pertinent information, including any utility staging required, dependent activities, or joint-use coordination that is required for the creation of a feasible progress schedule. A suitable Utility Adjustment Schedule form is available from the Department for the WUCS to circulate to utility companies for any proposed project construction staging or should a utility company not duly file a Utility Adjustment Schedule to the Department during the preconstruction phase of the project. The WUCS shall submit a Utility Relocation Progress Schedule showing together the Progress Schedule Chart referenced in Section 108.03 and the proposed Utility Adjustment Schedules from all utility companies to the Engineer for review and approval. Copies of existing Utility Adjustment Schedules with utility companies having facilities on this project will be made available at the Georgia Department of Transportation, Office of Construction Bidding Administration, located at One Georgia Center, 600 West Peachtree Street, NW, Atlanta, GA 30308, for examination by the Contractor. The Utility Adjustment Schedules are available on-line at: http://www.dot.ga.gov/doingbusiness/contractors/Pages/default.aspx

K. Compensation

There will be no separate measurement or payment for this Work. The cost associated with this Work shall be included in the overall Bid submitted.

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

Section 109—Measurement and Payment

Add the following:

109.11 Price Adjustments

A. Asphalt Cement Price Adjustments will be computed on a ***monthly*** basis in accordance with the following:

PA = Price Adjustment.
APM= the "Monthly Asphalt Cement Price (Georgia Base Asphalt Price)" for the month the hot mix asphalt/bituminous tack/bituminous surface treatment is placed.
APL = the "Monthly Asphalt Cement Price (Georgia Base Asphalt Price)" for the month which the project was let.
TMT = Total Monthly Tonnage of asphalt cement computed by the Engineer based on the Hot Mix Asphaltic Concrete of the various types per ton (megagram)//Total Monthly Tonnage of asphalt cement used for bituminous tack coat (asphalt cement tack coat only, emulsified bituminous materials for tack coat are excluded) converted from gallons to tons (megagrams) by the Engineer//Total Monthly Tonnage of asphalt cement used for bituminous surface treatment (total gallons of asphalt emulsion used, as measured from distributors, will be multiplied by a factor of 0.65 to determine the quantity in gallons of asphalt cement used) converted from gallons to tons (megagrams) by the Engineer and certified for payment.

a. If the asphalt cement price for the month is *greater* than the asphalt cement price for the month in which the project was let to contract, the contractor will be paid an amount calculated in accordance with the following formula:

PA = [((APM-APL)/APL)] x TMT x APL

b. If the asphalt cement price for the month is *less* than the asphalt cement price for the month in which the project was let to contract, the Department will deduct an amount calculated in accordance with the following formula:

PA = [((APM-APL)/APL)] x TMT x APL

1. **"Monthly Asphalt Cement Price":** The Department will determine the "Monthly Asphalt Cement Price" based on the following formulas:

   Monthly Asphalt Cement Price = 100% Georgia Base Asphalt Price;

   Where;

   GBAP = "Georgia Base Asphalt Price", (in dollars/ton) is based on the arithmetic average posted price of PG asphalt cement as specified in Section 820, from the Department's monthly survey obtained from approved asphalt cement suppliers of bituminous materials to the Department projects F.O.B. the suppliers terminal. However, the highest price and the lowest price are excluded from the calculation of price, GBAP.

2. **"Asphalt Cement Quantity Calculation":** The calculation of asphalt cement quantity for each mix type will be based on the asphalt cement content (***AC %***) of the approved Job Mix Formula (JMF) as specified in Subsection 400.1.03.C. The following calculation formula will be used to determine asphalt cement quantity:

Asphalt Cement Quantity = Hot Mix Asphaltic Concrete monthly total in tons (megagrams) per mix type certified for the payment x ***AC (%)***

The Total Monthly Tonnage (TMT) of asphalt cement computed by the Engineer will be calculated as follows:

TMT = Sum of all asphalt cement quantities, including polymer modified asphalt binder and non-modified asphalt cement, based on the Hot Mix Asphaltic Concrete of the various mix types per ton (megagram)// Sum of all asphalt cement quantities used as bituminous tack coat converted from gallons to tons (megagrams)// Sum of all asphalt cement quantities used for bituminous surface treatment (total gallons of asphalt emulsion used, as measured from distributors, will be multiplied by a factor of 0.65 to determine the quantity in gallons of asphalt cement used) converted from gallons to tons (megagrams) by the Engineer certified for payment.

Asphalt Cement Price for the Month (APM) will be adjusted monthly. Price adjustments (PA) will be made monthly and all calculations for Price Adjustments shall be performed by the Engineer as specified in SOP-39 "Determination of Asphalt Cement Index and Asphalt Cement Price Adjustment".

B. **Price Adjustment Trigger:** No price adjustment will be made on any project with less than 366 Calendar Days from the Contract Letting Date to the specified completion date. If the original Contract contains 366 Calendar Days or more, the Price Adjustment shall be made on quantities placed from the Contract Letting Date to the specified completion date.

C. **"Monthly Asphalt Cement Price":** The Department will publish a "Monthly Asphalt Cement Price" based on the formula contained within this specification.

D. **"Other Restrictions":**

1. No asphalt cement price adjustment will be made for cut-back, and emulsified asphalt when used for bituminous tack coat with Hot Mix Asphaltic Concrete Construction.

2. There is a cap of 60% above the APL for any price adjustment.

3. Unless specifically provided for by Supplemental Agreement or Contract Amendment, no positive Price Adjustments Asphalt Cement that result in a payment to the Contractor will be made after the original Contract Time has expired. Irrespective of any other provisions in the Contract, for purposes of this specification, "Contract Time" does not include any time extensions or Supplemental Agreements which affect the completion of the Contract. Negative Price Adjustments for Asphalt Cement for any work placed after the original Contract Time expires resulting in a return of funds to the Department will be made and shall be computed based on the Monthly Asphalt Cement Price at the time the Contract Time has expired or the Monthly Asphalt Cement Price at the time the Contract was let, whichever is less.

E. **Final Adjustment:** If there are differences between the final audited quantities and the sum of the quantities used to determine the asphalt cement adjustment, the Engineer will make a pro-rated increase or decrease in the price adjustment.

Payment for Price Adjustment will be made under:

Item No. 109	Price Adjustment- Asphalt Cement	$ (+/-)

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

Section 150—Traffic Control

150.01 GENERAL

This section as supplemented by the Plans, Specifications, and Manual on Uniform Traffic Control Devices (MUTCD) shall be considered the Temporary Traffic Control (TTC) Plan. Activities shall consist of furnishing, installing, maintaining, and removing necessary traffic signs, pedestrian signs, barricades, lights, signals, cones, pavement markings and other traffic control devices and shall include flagging and other means for guidance and protection of vehicular and pedestrian traffic through the Work Zone. This Work shall include both maintaining existing devices and installing additional devices as necessary in construction work zones.

When any provisions of this Specification or the Plans do not meet the minimum requirements of the MUTCD, the MUTCD shall control. The 2009 Edition of the MUTCD shall be in effect for the duration of the project.

The needs and control of all road users (motorists, bicyclists and pedestrians within the highway right-of-way and easements, including persons with disabilities in accordance with the Americans with Disabilities Act of 1990 (ADA), Title II, Paragraph 35.130) through a Temporary Traffic Control (TTC) zone shall be an essential part of highway construction, utility work, maintenance operations and management of traffic incidents.

The Worksite Traffic Control Supervisor (WTCS) shall have a copy of Part VI of the MUTCD and the Contract on the job site. Copies of the current MUTCD may be obtained from the FHWA web page at http://mutcd.fhwa.dot.gov.

A. WORKER SAFETY APPAREL

All workers, including emergency responders, within the right-of-way who are exposed either to traffic (vehicles using the highway for purpose of travel) or to work vehicles and construction equipment within the TTC zone shall wear high-visibility safety apparel that meets the Performance Class 2 or 3 requirements of the ANSI/ISEA 107-2004 publication entitled “American National Standard for High-Visibility Safety Apparel and Headwear”, or equivalent revisions, and labeled as meeting the ANSI 107-2004 standard performance for Class 2 or 3 risk exposure. Emergency and incident responders and law enforcement personnel within the TTC zone may wear high-visibility safety apparel that meets the performance requirements of the ANSI/ISEA 207-2006 publication entitled “American

National Standard for High-Visibility Public Safety Vests", or equivalent revisions, and labeled as ANSI 207-2006, in lieu of ANSI/ISEA 107-2004 apparel. Firefighters or other emergency responders working within the right-of-way and engaged in emergency operations that directly expose them to flame, fire, heat, and/or hazardous material may wear retroreflective turn-out gear that is specified and regulated by other organizations, such as the National Fire Protection Association.

B. WORKSITE TRAFFIC CONTROL SUPERVISOR

ALL HIGHWAYS (ADDITIONAL REQUIREMENTS BELOW FOR INTERSTATES): The Contractor shall designate a qualified individual as the Worksite Traffic Control Supervisor (WTCS) who shall be responsible for selecting, installing and maintaining all traffic control devices in accordance with the Plans, Specifications, Special Provisions and the MUTCD. A written resume documenting the experience and credentials of the WTCS shall be submitted and accepted by the Engineer prior to beginning any work that involves traffic control. The WTCS shall be available on a twenty-four (24) hour basis to perform his duties. If the work requires traffic control activities to be performed during the daylight and nighttime hours it may be necessary for the Contractor to designate an alternate WTCS. An alternate WTCS must meet the same requirements and qualifications as the primary WTCS and be accepted by the Engineer prior to beginning any traffic control duties. The Worksite Traffic Control Supervisor's traffic control responsibilities shall have priority over all other assigned duties.

As the representative of the Contractor, the WTCS shall have full authority to act on behalf of the Contractor in administering the TTC Plan. The WTCS shall have appropriate training in safe traffic control practices in accordance with Part VI of the MUTCD. In addition to the WTCS all other individuals making decisions regarding traffic control shall meet the training requirements of the Part VI of the MUTCD.
The WTCS shall supervise the initial installation of traffic control devices. The Engineer prior to the beginning of construction will review the initial installation. Modifications to traffic control devices as required by sequence of operations or staged construction shall be reviewed by the WTCS.

The WTCS shall be available on a full-time basis to maintain traffic control devices with access to all personnel, materials, and equipment necessary to respond effectively to an emergency situation within forty-five (45) minutes of notification of the emergency.

The WTCS shall regularly perform inspections to ensure that traffic control is maintained. Unless modified by the special conditions or by the Engineer, routine deficiencies shall be corrected within a twenty-four (24) hour period. Failure to comply with these provisions shall be grounds for dismissal from the duties of WTCS and/or removal of the WTCS from the project. Failure of the WTCS to execute his duties shall be considered as non-performance under Subsection 150.08.

The Engineer will periodically review the work for compliance with the requirements of the TTC plan.

On projects where traffic control duties will not require full time supervision, the Engineer may allow the Contractor's Project Superintendent to serve as the WTCS as long as satisfactory results are obtained.

CERTIFIED WORKSITE TRAFFIC CONTROL SUPERVISOR

ADDITIONAL REQUIREMENTS FOR INTERSTATE AND LIMITED ACCESS HIGHWAYS: In addition to the requirements above, the WTCS shall have a minimum of one year's experience directly related to work site traffic control in a supervisory or responsible capacity. The WTCS shall be currently certified by the American Traffic Safety Services Association (ATSSA) Work Site Traffic Supervisor Certification program or the National Safety Council Certification program.

Any work performed on the interstate or limited access highway right-of-way that requires traffic control shall be supervised by the Certified Worksite Traffic Control Supervisor. No work requiring traffic control shall be performed unless the certified WTCS is on the worksite. Failure to maintain a Certified Worksite Traffic Control Supervisor on the work will be considered as non-performance under Subsection 150.08.

The WTCS shall perform, as a minimum, weekly traffic control inspections on all interstate and limited access highways. The inspection shall be reported to the Engineer on a TC-1 report. The Engineer will furnish a blank copy of the TC-1 report to the Contractor prior to the beginning of any work on the interstate or limited access right-of-way.

C. TRAFFIC CONTROL DEVICES

All traffic control devices used during the construction of a project shall meet the Standards utilized in the MUTCD, and shall comply with the requirements of these Specifications, Project Plans, and Special Provisions. All devices shall be tested at NCHRP Test Level III. Reference is made to Subsections 104.05, 107.07, and 107.09.

D. REFLECTORIZATION REQUIREMENTS

All rigid fluorescent orange construction warning signs (black on fluorescent orange) shall meet the reflectorization and color requirements of ASTM Type VII, VIII, IX or X regardless of the mounting height.

Portable signs which have flexible sign blanks shall meet the reflectorization and color requirements of ASTM Type VI.

Warning signs (W3-1a) for stop conditions that have rumble strips located in the travelway shall be reflectorized with ASTM Type IX fluorescent yellow sheeting.

All other signs shall meet the requirements of ASTM Type III or IV except for "Pass With Care" and "Do Not Pass" signs which may be ASTM Type I unless otherwise specified.

CHANNELIZATION DEVICES: Channelization devices shall meet the requirements of ASTM Type III or IV high intensity sheeting.

E. IMPLEMENTATION REQUIREMENTS

No work shall be started on any project phase until the appropriate traffic control devices have been placed in accordance with the Project requirements. Changes to traffic flow

shall not commence unless all labor, materials, and equipment necessary to make the changes are available on the Project.

When any shift or change is made to the location of traffic or to the flow patterns of traffic, including pedestrian traffic, the permanent safety features shall be installed and fully operational before making the change. If staging or site conditions prevent the installation of permanent features then the equivalent interim devices shall be utilized. This work shall also include any necessary removal and reinstallation of guardrail panels to achieve the required panel lap to accommodate the appropriate shift and traffic flow including the final traffic flow configuration (The cost of performing this work shall be included in Traffic Control-Lump Sum).

Any section of the work that is on new location shall have all permanent safety features installed and fully operational before the work is opened to traffic. Safety features shall include but are not limited to the following items:

1. Guardrail including anchors and delineation with properly lapped panels
2. Impact attenuators
3. Traffic signals
4. Warning devices
5. Pavement markings including words, symbols, stop bars, and crosswalks
6. Roadway signs including regulatory, warning, and guide

Outdoor lighting shall be considered as a safety feature for welcome centers, rest areas, and weigh station projects. For typical roadway type projects new street lighting is not considered a safety feature unless specifically noted in the plans or in the special conditions.

F. MAINTENANCE OF TRAFFIC CONTROL DEVICES

Traffic control devices shall be in acceptable condition when first erected on the project and shall be maintained in accordance with Subsection 104.05 throughout the construction period. All unacceptable traffic control devices shall be replaced within 24 hours. When not in use, all traffic control devices shall be removed, placed or covered so as not to be visible to traffic. All construction warning signs shall be removed within seven calendar days after time charges are stopped or pay items are complete. If traffic control devices are left in place for more than ten days after completion of the Work, the Department shall have the right to remove such devices, claim possession thereof, and deduct the cost of such removal from any monies due, or which may become due, the Contractor.

G. TRAFFIC INTERRUPTION RESTRICTIONS

The Department reserves the right to restrict construction operations when, in the opinion of the Engineer, the continuance of the Work would seriously hinder traffic flow, be needlessly disruptive or unnecessarily inconvenience the traveling public. The Contractor shall suspend and/or reschedule any work when the Engineer deems that conditions are unfavorable for continuing the Work.

Advanced notification requirements to the Contractor to suspend work will be according to the events and the time restrictions outlined below:

Incident management	No advanced notice required
Threatening/Inclement weather	24 hours
Holidays. sporting events, unfavorable conditions	Three (3) calendar days

If the work is suspended, the Contractor may submit a request for additional contract time as allowed under Section 108. The Department will review the request and may grant additional contract time as justified by the impact to the Contractor's schedule. Compensation for loss of productivity, rescheduling of crews, rental of equipment or delays to the Contractor's schedule will not be considered for payment. Additional contract time will be the only consideration granted to the Contractor.

H. SEQUENCE OF OPERATIONS

Any Sequence of Operations provided in this Contract in conjunction with any staging details which may be shown in the plans, is a suggested sequence for performing the Work. It is intended as a general staging plan for the orderly execution of the work while minimizing the impact on pedestrian facilities, mainline, cross-streets and side streets. The Contractor shall develop detailed staging and temporary traffic control plans for performing specific areas of the Work including but not limited to all traffic shifts, detours, bridge widenings, paces, or other activities that disrupt traffic or pedestrian flow. The Engineer may require detailed staging and TTC plans for lane closures or disruption to pedestrian facilities. These plans shall be submitted for approval at least two weeks prior to the scheduled date of the activity. Activities that have not been approved at least seven (7) days prior to the scheduled date shall be rescheduled.

Where traffic is permitted through the work area under stage construction, the Contractor may choose to construct, at no additional expense to the Department, temporary on-site bypasses or detours in order to expedite the work. Plans for such temporary bypasses or detours shall be submitted to the Engineer for review and approval 30 calendar days prior to the proposed construction. Such bypasses or detours shall be removed promptly when in the opinion of the Engineer; they are not longer necessary for the satisfactory progress of the Work. Bypasses and detours shall meet the minimum requirements of Section 150.02.B.4.

As an option to the Sequence of Operations in the Contract, the Contractor may submit an alternative Sequence of Operations for review and approval. Alternate Sequence of Operations for pedestrian facilities shall be in compliance with the MUTCD and ADA. Pedestrian needs identified in the preconstruction phase shall be included in the proposed alternate plan.

The Department will not pay, or in any way reimburse the Contractor for claims arising from the Contractor's inability to perform the Work in accordance with the Sequence of Operations provided in the Contract or from an approved Contractor alternate.

The Contractor shall secure the Engineer's approval of the Contractor's proposed plan of operation, sequence of work and methods of providing for the safe passage of vehicular and pedestrian traffic before it is placed in operation. The proposed plan of operation shall supplement the approved traffic control plan. Any major changes to the approved TTC plan, proposed by the Contractor, shall be submitted to the Department for approval.

Some additional traffic control details will be required prior to any major shifts or changes in traffic. The traffic control details shall include, but not be limited to, the following:

1. A detailed drawing showing traffic locations and laneage for each step of the change.

2. The location, size, and message of all signs required by the MUTCD, Plan, Special Provisions, and other signs as required to fit conditions. Any portable changeable message signs used shall be included in the details.

3. The method to be used in, and the limits of, the obliteration of conflicting lines and markings.

4. Type, location, and extent of new lines and markings.

5. Horizontal and vertical alignment and superelevation rates for detours, including cross-section and profile grades along each edge of existing pavement.

6. Drainage details for temporary and permanent alignments.

7. Location, length, and/or spacing of channelization and protective devices (temporary barrier, guardrail, barricades, etc.)

8. Starting time, duration and date of planned change.

9. For each traffic shift, a paving plan, erection plan, or work site plan, as appropriate, detailing workforce, materials, and equipment necessary to accomplish the proposed work. This will be the minimum resource allocation required in order to start the work.

   A minimum of three copies of the above details shall be submitted to the Engineer for approval at least 14 days prior to the anticipated traffic shift. The Contractor shall have traffic control details for a traffic shift which has been approved by the Engineer prior to commencement of the physical shift. All preparatory work relative to the traffic shift, which does not interfere with traffic, shall be accomplished prior to the designated starting time. The Engineer and the Contractor's representative will verify that all conditions have been met prior to the Contractor obtaining materials for the actual traffic shift.

150.02 TEMPORARY TRAFFIC CONTROL (TTC) ZONES:

A. DEVICES AND MATERIALS:

In addition to the other provisions contained herein, work zone traffic control shall be accomplished using the following means and materials:

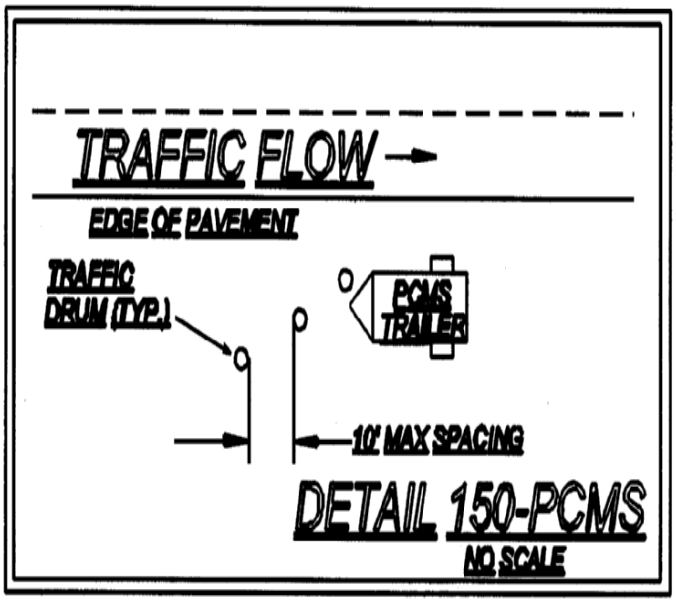
1. **Portable Advance Warning Signs**
   Portable advance warning signs shall be utilized as per the requirements of the temporary traffic control plans. All signs shall meet the requirements of the MUTCD and shall be NCHRP 350 crashworthy compliant.

2. **Arrow Panels**
   Portable sequential or flashing arrow panels as shown in the Plans or Specifications for use on Interstate or multi-lane highway lane closure only, shall be a minimum size of 48" high by 96" wide with not less than 15 lamps used for the arrow. The arrow shall occupy virtually the entire size of the arrow panel and shall have a minimum legibility distance of one mile. The minimum legibility distance is that distance at which the arrow panel can be comprehended by an observer on a sunny day, or clear night. Arrow panels shall be equipped with automatic dimming features for use during hours of darkness. The arrow panels shall also meet the requirements for a Type C panel as shown in the MUTCD. The sequential or flashing arrow panels shall not be used for lane closure on two-lane, two-way highways when traffic is restricted to one-lane operations in which case, appropriate signing, flaggers and when required, pilot vehicles will be deemed sufficient.

   The sequential or flashing arrow panels shall be placed on the shoulder at or near the point where the lane closing transition begins. The panels shall be mounted on a vehicle, trailer, or other suitable support. Vehicle mounted panels shall be provided with remote controls. Minimum mounting height shall be seven feet above the roadway to the bottom of the panel, except on vehicle mounted panels which should be as high as practical.

   For emergency situations, arrow display panels that meet the MUTCD requirements for Type A or Type B panels may be used until Type C panels can be located and placed at the site. The use of Type A and Type B panels shall be held to the minimum length of time possible before having the Type C panel(s) in operation. The Engineer shall determine when conditions and circumstances are considered to be emergencies. The Contractor shall notify the Engineer, in writing, when any non-specification arrow display panel(s) is being used in the work.

3. **Portable Changeable Message Signs**
   Portable changeable message signs meeting the requirements of Section 632 and the MUTCD. Any PCMS in use that is not protected by positive barrier protection shall be delineated by a minimum of three drums that meet the requirement of Section 150.05.A.1. The drum spacing shall not exceed a maximum of ten (10') feet as shown in Detail 150-PCMS. When the PCMS is within twenty (20') feet of the opposing traffic flow, the trailing end of the PCMS shall be delineated with a minimum of three drums spaced in the same manner as the approach side of the PCMS.



When not in use the PCMS shall be removed from the roadway unless protected by positive barrier protection. If the PCMS is protected by positive barrier protection the sign panel shall be turned away from traffic when not in use.

4. **Channelization Devices**
   Channelization devices shall meet the standards of the MUTCD and Subsection 150.05.

5. **Temporary Barrier**
   Temporary barrier shall meet the requirements of Sections 622.

6. **Temporary Traffic Signals**
   Temporary traffic signals shall meet the requirements of Section 647 and the MUTCD.

7. **Pavement Marking**
   Pavement marking incorporated into the work shall comply with Subsections 150.04.A and 150.04.B.

8. **Portable Temporary Traffic Control Signals**
   The use of Portable Temporary Traffic Control Signals shall meet the following minimum requirements:

   Only two-lane two-way roadways will be allowed to utilize Portable Temporary Traffic Control Signals.

   All portable traffic control signals shall meet the physical display and operational requirements of conventional traffic signals described in the MUTCD.

   Each signal face shall have at least three lenses. The lenses shall be red, yellow, or green in color and shall give a circular type of indication. All lenses shall be twelve (12”) inches nominal in diameter.

A minimum of two signal faces shall face each direction of traffic. A minimum of one signal head shall be suspended over the roadway travel lane in a manner that will allow the bottom of the signal head housing to be not less than seventeen (17') feet above and not more than nineteen (19') feet above the pavement grade at the center of the travel lane. The second signal head may be located over the travel lane with the same height requirements or the second signal head may be located on the shoulder. When the signal head is located on the shoulder the bottom of the signal head housing shall be at least eight (8') feet but not more than (15') feet above the pavement grade at the center of highway.

Advance warning signage and appropriate pavement markings shall be installed as part of the temporary signal operation.

The signals shall be operated in a manner consistent with traffic requirements. The signals may be operated in timed-mode or in a vehicle-actuated mode. The signals shall be interconnected in a manner to ensure that conflicting movements can not occur. To assure that the appropriate operating pattern including timing is displayed to the traveling public, regular inspections including the use of accurate timing devices shall be made by the Worksite Traffic Control Supervisor. If at any time any part of the system fails to operate within these requirements then the use of the signal shall be suspended and the appropriate flagging operation shall begin immediately.

The Worksite Traffic Control Supervisor (WTCS) shall continuously monitor the portable traffic control signal to insure compliance with the requirements for maintenance under the MUTCD. The signal shall be maintained in a manner consistent with the intention of the MUTCD, with emphasis on cleaning of the optical system. Timing changes shall be made only by the WTCS. The WTCS shall keep a written record of all timing changes.

The portable temporary signal shall have two power sources and shall be capable of running for seven calendar days continuously.

The Contractor shall have an alternate temporary traffic control plan in the event of failure of the signal.

9. RUMBLE STRIPS

Rumble strips incorporated into the work shall meet the requirements of Section 429 and the MUTCD. Existing rumble strips that are positioned in the traveled way to warn traffic of a stop condition shall be reinstalled based on the following requirements:

INTERMEDIATE SURFACES: Intermediate surfaces that will be in use for more than forty-five (45) calendar days shall have rumble strips reinstalled on the traveled way in the area of a stop condition. Non-refundable deductions in accordance with Subsection 150.08 will be assessed for any intermediate surface in place for greater than 45 days without rumble strips.

FINAL SURFACES: Rumble strips shall be installed on the final surface within fourteen (14) calendar days of the placement of the final surface in the area of the stop condition. Failure to install within fourteen (14) calendar days will result in assessment of non-refundable deductions in accordance with 150.08.

Prior to the removal of any rumble strips located in the travelway, stop ahead (W3-1a) warning signs shall be double indicated ahead of the stop condition. These warning signs shall be a minimum of 48 inches by 48 inches. The reflectorization of the warning signs shall be as required by Subsection 150.01.D. These warning signs shall remain in place until the rumble strips have been reinstalled on the traveled way. Any existing warning signs for the stop ahead condition shall be removed or covered while the 48" X 48" (W3-1a) signs are in place. When the rumble strips have been reinstalled these warning signs should be promptly removed and any existing signage placed back in service.

10. GUARDRAIL: When the removal and installation of guardrail is required as a part of the work the following time restrictions shall apply unless modified by the special conditions:

MULTI-LANE HIGHWAYS: From the time that the existing guardrail or temporary positive barrier protection is removed the Contractor has fourteen (14) calendar days to install the new guardrail and anchors. During the interim, the location without guardrail shall be protected with drums spaced at a maximum spacing of twenty (20') feet. The maximum length of rail that can be removed at any time without being replaced with positive barrier protection is a total of 2000 linear feet of existing rail or the total length of one run of existing rail, whichever is less.

ALL OTHER HIGHWAYS: From the time that the existing guardrail is removed or from the time that temporary positive barrier protection is removed the Contractor has thirty (30) calendar days to install the new guardrail and anchors. During the interim, the location without guardrail shall be protected with drums spaced at a maximum spacing of twenty (20') feet. The maximum length of rail that can be removed at any time without being replaced with positive barrier protection is a total of 1000 linear feet of existing rail or the total length of one run of existing rail, whichever is less.

Based on existing field conditions, the Engineer may review the work and require that the guardrail be installed earlier than the maximum time allowed above by giving written notification to the Contractor via the TC-1 traffic control report.

ALL HIGHWAYS: The contractor shall install new guardrail such that traffic exposure to fixed objects is minimized. Within the same work day, temporary attenuators, as defined in Subsection 150.05.B, should be installed on the approach to fixed objects that can't be protected with guardrail. Truck mounted attenuators may be used to shield exposed fixed objects for periods not to exceed forty-eight (48) hours. No separate payment will be made for truck mounted attenuators.

When the roadway is open to traffic, guardrail panels shall be lapped to comply with the directional flow of traffic. Should the staging of the work require that the lap of the guardrail be changed, this work shall be completed before the roadway is opened to traffic. The work to change the lap of any guardrail shall be included in Traffic Control-Lump Sum.

Failure to comply with the above time and quantity restrictions shall be considered as non-compliance under Section 150.08.

11. STOP SIGN REGULATED INTERSECTIONS: For intersections that utilize stop sign(s) to control the flow of traffic and to restrict the movement of vehicles, the stop sign(s) shall be maintained for the duration of the work or until such time that the stop condition is eliminated or until an interim or permanent traffic signal can be installed to provide proper traffic control. The traffic signal shall be installed and properly functioning before the removal of the existing stop sign(s) is permitted. If the existing intersection is enhanced traffic control features such as stop bars, double indicated stop signs, oversized signs, advanced warning stop ahead signs, rumble strips on the approaches or flashing beacons located overhead or on the shoulders then these features shall be maintained for the duration of the project or until the permanent traffic control plan has been implemented.

Whenever the staging of the work requires that the traveled-way be relocated or realigned the Contractor shall reinstall all enhanced traffic control features noted above on the newly constructed sections of the work. The cost of relocating the stop bars, stop signs, advanced warning signs, the rumble strips and the flashing beacons shall be included in the price bid for Lump-Sum-Traffic Control unless individual pay items are included in the contract for rumble strips and/or flashing beacons. When pay items are included in the contract for rumble strips or flashing beacons then these items will be paid per each.

When staging requires the relocation or realignment of an existing stop condition it may be necessary to consider the addition of enhanced traffic control features even though none existed at the original location. Horizontal and vertical alignment changes at a new location may have decreased or restricted sight distance or the stop condition may occur sooner than in the previous alignment. If these conditions occur then the Engineer and/or the WTCS should consider additional measures to enhance the motorist's awareness of the changes even though the staging plans may not address enhanced features. Stop signs should be a minimum of 36 inches for interim situations. The use of 48 inch stop signs may be warranted under project specific conditions. Flags may be used on interim/permanent stop signs that are mounted at seven (7') feet in height for a short duration in order to direct additional attention to a new or relocated stop sign(s). Flags should not be used for durations exceeding two weeks unless unusual or site specify conditions warrant a longer period of time. The use of Type "A" flashing red light(s) attached to the stop sign(s) may be appropriate during the same period that the flags are in use to increase attention.

The use of rumble strips and/or portable changeable message signs may be considered. The use of new rumble strips, where none previously existed, shall have the prior approval of District Traffic Operations before being included as part of the temporary traffic control plan. The message(s) displayed on any PCMS shall have the prior approval of the Engineer and the message(s) shall be included as part of the TTC plan for the interim staging.

The placement of any additional interim ground-mounted signs and posts or stop bars shall be considered as incidental to the price bid for Lump Sum-Traffic Control. The installation of rumble strips, flashing beacons or the use of Portable Changeable Message Signs (PCMS) shall be considered as Extra Work unless pay items are included in the contract.

B. WORK ZONE RESTRICTIONS:

1. Interstate

The Contractor shall not simultaneously perform work on both the inside shoulder and outside shoulder on either direction of traffic flow when the Work is within 12 feet of the travel-way, unless such areas are separated by at least one-half mile of distance.

2. Non-Interstate Divided Highways

The Contractor shall not simultaneously perform work on both the inside shoulder and outside shoulder on either direction of traffic flow when the Work is within 12 feet of the travel-way, unless such areas are separated by at least one-half mile distance in rural areas or at least 500 feet of distance in urban areas.

3. Non-Divided Highways

a. The Contractor shall not simultaneously perform work on opposite sides of the roadway when the work is within 12 feet of the travel-way, unless such areas are separated by at least one-half mile of distance in rural areas or at least 500 feet of distance in urban areas.

b. On two-lane projects where full width sections of the existing subgrade, base or surfacing are to be removed, and new base, subgrade, or surfacing are to be constructed, the Contractor shall maintain one-lane traffic through the construction area by removing and replacing the undesirable material for half the width of the existing roadway at a time. Replacement shall be made such that paving is completed to the level of the existing pavement in the adjacent lane by the end of the workday or before opening all the roadway to traffic.

4. All Highways:

a. There shall be no reduction in the total number of available traffic lanes that existed prior to construction except as specifically allowed by the Contract and as approved by the Engineer.

b. Travelway Clearances: All portions of the work shall maintain the following minimum requirements:

Horizontal: The combined dimensions of the paved shoulder and the roadway surface remaining outside the Work Zone shall be no less than sixteen (16) feet in width at any location.

Vertical: The overhead clearance shall not be reduced to less than fifteen (15) feet at any location.

The restrictions above apply to all shifts, lane closures, on-site detours and off site detours whether shown in the contract or proposed by the Contractor. It shall be the responsibility of the Contractor to verify that these minimum requirements have been met before proceeding with any phase of the Work.

Two-lane two-way roadways may have temporary horizontal restrictions of less than sixteen (16) feet provided a flagger operation for one-way traffic is utilized to restrict access to the work area by over-width loads. The minimum horizontal clearance shall be restored before the flagging operation is removed.

c. Highway Work Zone: All sections or segments of the roadway under construction or reconstruction shall be signed as a Highway Work Zone except non-state highway two-lane two-way resurfacing projects. Two conditions can be applied to a Highway Work Zone. Condition 1 is when no reduction in the existing speed limit is required. Condition 2 is when worksite conditions require a reduction of the speed limit through the designated Work Zone. Properly marking a Highway Work Zone shall include the following minimum requirements:

1. NO REDUCTION IN THE EXISTING POSTED SPEED LIMIT IN HIGHWAY WORK ZONE:

   a) Signage (Detail 150-HWZ-1) shall be posted at the beginning point of the Highway Work Zone warning the traveling public that increased penalties for speeding violations are in effect. The HWZ-2 sign shall be placed a minimum of six hundred (600') feet in advance of the Highway Work Zone and shall not be placed more than one thousand (1000') feet in advance of the Work Zone. If no speed reduction is required it is recommended that the HWZ-2 be placed at 750 feet from the work area between the ROAD WORK 500 FT. and the ROAD WORK 1000 FT. signs.

      HWZ-2 signs shall be placed at intervals not to exceed one mile for the length of the project. HWZ-2 signs should be placed on the mainline after all major intersections except State Routes. State Routes shall be signed as per the requirements for intersecting roadways below.

   b) The existing speed limit shall be posted at the beginning of the Work Zone. Existing Speed Limit signs (R2-1) shall be maintained.

   c) INTERSECTING ROADWAYS: Intersecting state routes shall be signed in advance of each intersection with the Work Zone with a HWZ-2 sign to warn motorists that increased fines are in effect. All other intersecting roadways that enter into a designated Highway Work Zone may be signed in advance of each intersection with the Work Zone. When construction equipment and personnel are present in the intersection on the mainline of a multi-lane roadway, the intersecting side roads shall be signed in advance with HWZ-2 signs. As soon as the work operation clears the intersection the signage may be removed.

   d) Sign HWZ-3 shall be posted at the end of the Highway Work Zone indicating the end of the zone and indicating that increased penalties for speeding violations are no longer in effect.

   e) When a designated Highway Work Zone is no longer necessary all signs shall be removed immediately.

2. REDUCING THE SPEED LIMIT IN A HIGHWAY WORK ZONE:

Highway Work Zone signs shall be posted as required in Condition 1 above.

For limited access (interstate) highways and controlled access multi-lane divided highways the posted speed limit shall be reduced as required below.

Speed Limit signage (R2-1) for the reduced speed limit shall be erected at the beginning of the work zone. Additional signs shall be placed to ensure that the maximum spacing of the reduced speed limit signs shall be no greater than one (1) mile apart. Existing speed limit signs shall be covered or removed. On multi-lane divided highways the speed limit signs shall be double indicated when the reduced speed is in use.

When any one or more of the following conditions exist and the existing speed limit is 65 mph or 70 mph, the speed limit shall be reduced by 10 mph. If the existing speed limit is 60 mph, the speed limit should be reduced by 5 mph. If the existing speed limit is 55 mph or less, the Contractor can only reduce the speed limit with the prior approval of the Engineer. The reduction in the speed limit shall be no greater than 10 mph:

a) Lane closure(s) of any type and any duration.
b) The difference in elevation exceeds two inches adjacent to a travel lane as shown in Subsection 150.06, Detail 150-B, Detail 150-C.
c) Any areas where equipment or workers are within ten feet of a travel lane.
d) Temporary portable concrete barriers located less than two (2') feet from the traveled way.
e) As directed by the Engineer for conditions distinctive to this project.

When the above conditions are not present the speed limit shall be immediately returned to the existing posted speed limit. A speed reduction shall not be put in place for the entire length of the project unless conditions warranting the speed reduction are present for the entire project length. All existing speed limit signs within the temporary speed reduction zone shall be covered or removed while the temporary reduction in the speed limit is in effect. All signs shall be erected to comply with the minimum requirements of the MUTCD.

As a minimum the following records shall be kept by the WTCS:

a) Identify the need for the reduction.
b) Record the time of the installation and removal of the temporary reduction.
c) Fully describe the location and limits of the reduced speed zone.
d) Document any accident that occurs during the time of the reduction.

A copy of the weekly records for reduced speed zones shall be submitted to the Engineer.

Reduced speed zones shall, as a minimum, be signed as per Detail 150-HWZ-1. Interim signs shall meet the requirements of 150.03 D. Additional signs may be necessary to adjust for actual field conditions.

When a pilot vehicle is used on a two-lane two-way roadway the speed limit should not be reduced. For special conditions specific to the work, on two-lane two-way roadways or multi-lane highways, the contractor may reduce the posted speed limit with the prior approval of the Engineer.

5. MILLED SURFACE RESTRICTIONS:

Unless modified by the special conditions, a milled surface on any asphaltic concrete surface shall not be allowed to remain open to traffic for a period of time that exceeds thirty (30) calendar days.

6. INSTALLATION/REMOVAL OF WORK AREA SIGNAGE:

No payment will be made for Traffic Control-Lump Sum until the Work has actually started on the project. The installation of traffic control signage does not qualify as the start of work. Advanced warning signs shall not be installed until the actual beginning of work activities. Any permanent mount height signs installed as the work is preparing to start shall be covered until all signs are installed unless all signs are installed within seven (7) calendar days after beginning installation.

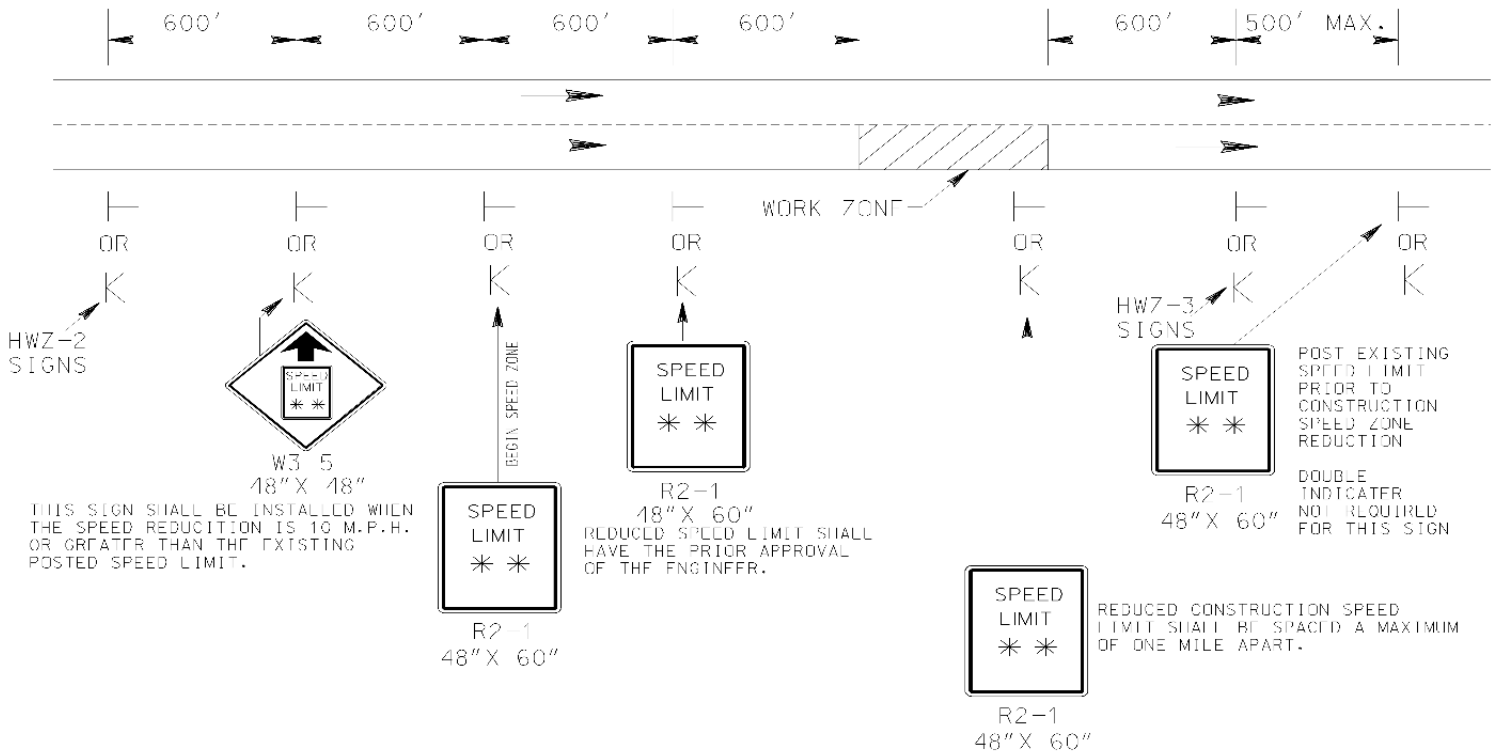
All temporary traffic control devices shall be removed as soon as practical when these devices are no longer needed. When work is suspended for short periods of time, temporary traffic control devices that are no longer appropriate shall be removed or covered.

All construction warning signs shall be removed within seven (7) calendar days after time charges are stopped or pay items are complete. If traffic control devices are left in place for more than ten (10) calendar days after completion of the Work, the Department shall have the right to remove such devices, claim possession thereof, and deduct the cost of such removal from any monies due, or which may become due, the Contractor.

PUNCHLIST WORK: Portable signs shall be utilized to accomplish the completion of all punchlist items. The portable signs shall be removed daily. All permanent mount height signs shall be removed prior to the beginning of the punchlist work except "Low/Soft Shoulder" signs and any signs that have the prior written approval of the Engineer to remain in place while the punchlist work is in progress.

Failure to promptly remove the construction warning signs within the seven (7) calendar days after the completion of the Work or failure to remove or cover signs when work is suspended for short periods of time shall be considered as non-performance under Section 150.08.

SPEED LIMIT REDUCTION FOR HIGHWAY WORK ZONE
INTERSTATE AND MULTI-LANE DIVIDED HIGHWAY SIGNING SHALL BE DOUBLE INDICATED (RIGHT SHOULDER AND MEDIAN SHOULDER)

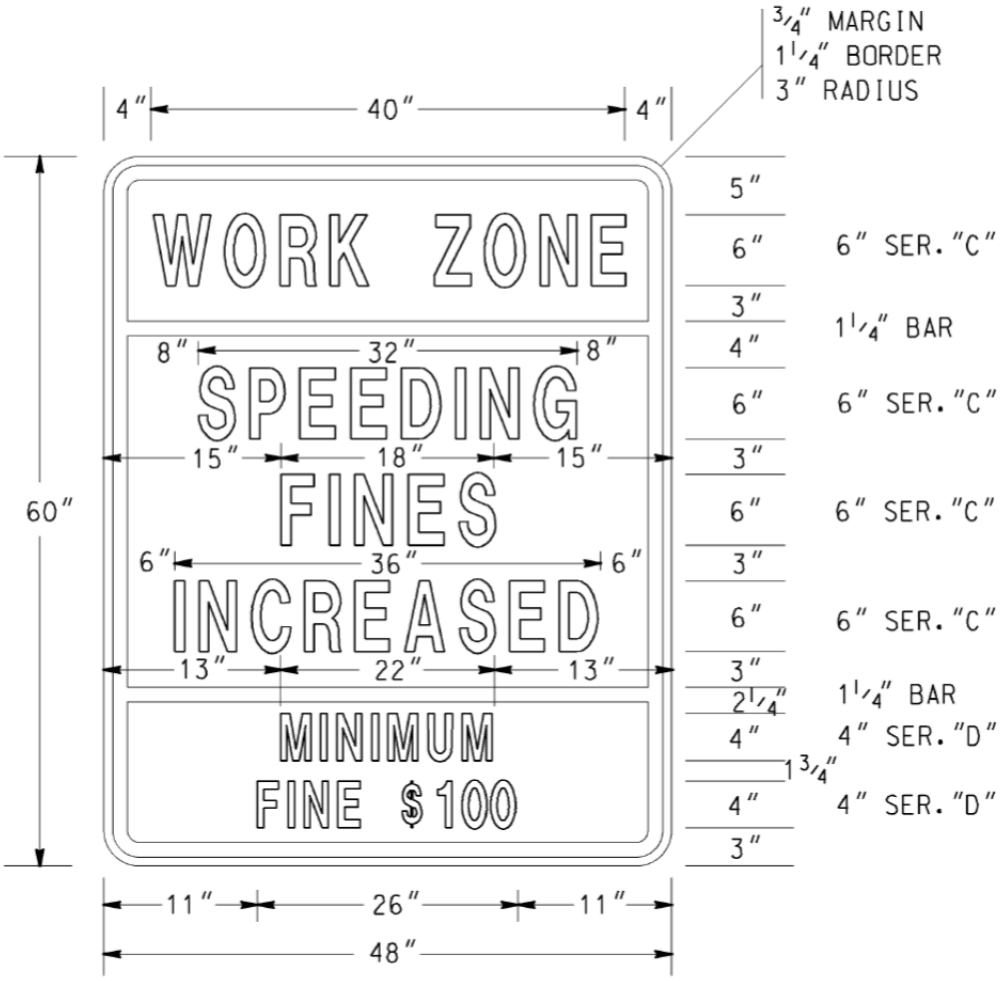


ALL INTERSECTING ROADWAYS SHALL BE SIGNED WITH A HWZ-2 SIGN TO WARN MOTORIST ENTERING THE HIGHWAY WORK ZONE.

INTERSTATE AND MULTI-LANE HIGHWAY SIGNING SHALL BE DOUBLE INDICATED (RIGHT SHOULDER AND MEDIAN SHOULDER).

SIGN SIZES SHOWN ARE FOR INTERSTATE AND MULTI-LANE DIVIDED HIGHWAY.
FOR OTHER HIGHWAYS USE STANDARD SIZE SIGNS AS PER THE M.U.T.C.D. EXCEPT HWZ-2 AND HWZ-3 SIGNS.

DETAIL 150-HWZ-1



HWZ-2

COLORS

TOP PANEL

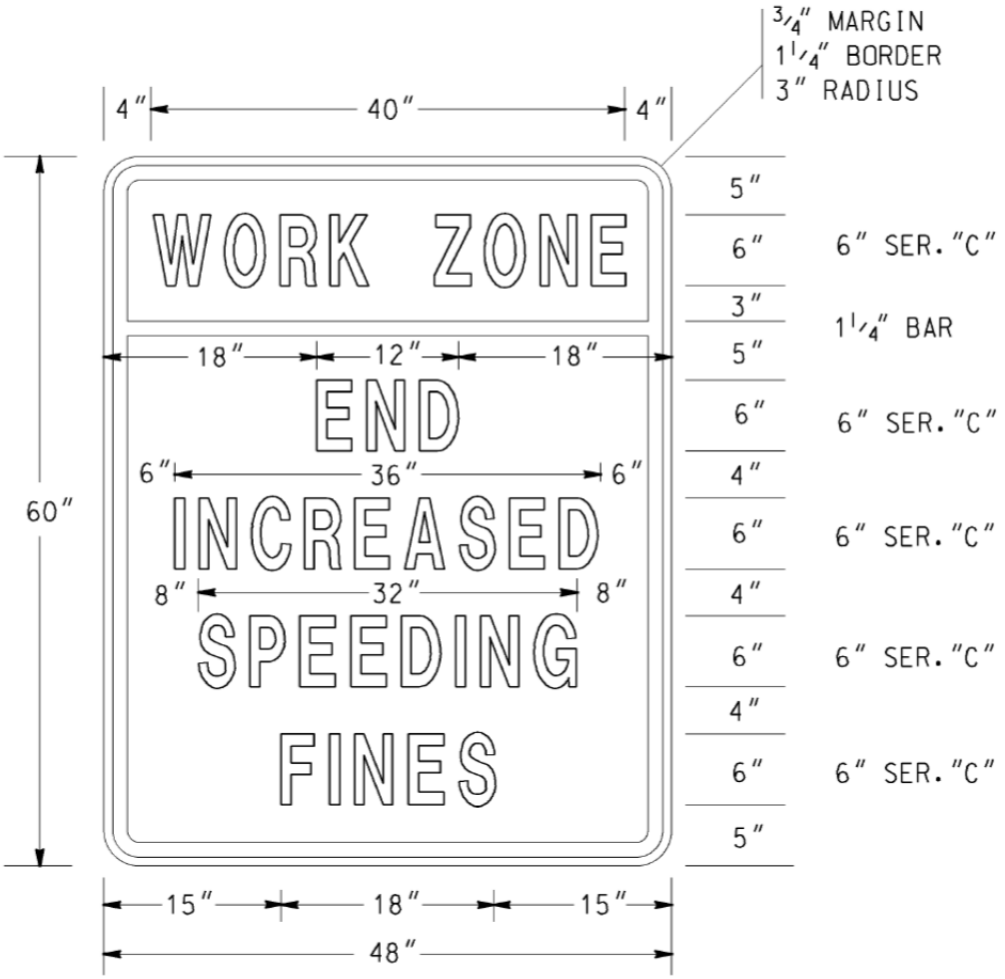
LEGEND & BORDER - BLACK (NON-REFL)
BACKGROUND - FLUORESENT ORANGE
(ASTM TYPE VII, VIII, IX or X)

MIDDLE & BOTTOM PANELS

LEGEND & BORDER - BLACK (NON-REFL)
BACKGROUND - WHITE (ASTM TYPE III OR IV REFL SHEETING)

NOTES:

1. ALL HWZ-2 SIGN PANELS SHALL BE RIGID.
2. THE SIZE OF THE HWZ-2 SIGN SHALL NOT BE REDUCED FOR USE ON TWO-LANE ROADWAYS.



HWZ-3

COLORS

TOP PANEL

LEGEND & BORDER - BLACK (NON-REFL)
BACKGROUND - FLUORESENT ORANGE
(ASTM TYPE VII, VIII, IX or X)

BOTTOM PANEL

LEGEND & BORDER - BLACK (NON-REFL)
BACKGROUND - WHITE (ASTM TYPE III OR IV REFL SHEETING)

NOTES:

1. ALL HWZ-3 SIGN PANELS SHALL BE RIGID.
2. THE SIZE OF THE HWZ-3 SIGN SHALL NOT BE REDUCED FOR USE ON TWO-LANE ROADWAYS.

C. LANE CLOSURES:

1. Approval / Restrictions

All lane closures of any type or duration shall have the prior approval of the Engineer.

a. The length of a lane closure shall not exceed two (2) miles in length excluding the length of the tapers unless the prior approval of the Engineer has been obtained. The Engineer may extend the length of a lane closure based upon field conditions however the length of a workzone should be held to the minimum length required to accomplish the Work. Lane closures shall not be spaced closer than one mile. The advanced warning signs for the project should not overlap with the advanced warning signs for lane shifts, lane closures, etc.

b. Lane closures that require same direction traffic to be split around the Work Area will not be approved for roadways with posted speeds of 35 mph or greater, excluding turn lanes.

c. For Interstate, Limited Access and Multi-lane Divided Highways, a Portable Changeable Message Sign (PCMS) shall be placed one (1) mile in advance of a lane closure with a message denoting the appropriate lane closure one mile ahead. The Portable Changeable Message Sign (PCMS) shall be placed on the outside shoulder in accordance with Detail 150-PCMS. This is in addition to the other traffic control devices required by Standard 9106.

d. The following are lane restrictions to lane closures relative to Atlanta Braves home games:

1) Interstate lane closures on and within I-285 shall be prohibited for a minimum period of 3 hours before the game begins and continue until 2 hours after the game has ended for all Atlanta Braves home games.

2) Restriction shall apply in the direction of game influenced traffic on I-75, I-85, GA 400, and I-20 within I-285. Such restrictions may be lessened or waived in the opposing direction of travel.

3) Projects requiring lane closures on other roadways within the I-285 perimeter located near the Atlanta Braves stadium shall be extended the same hours of restriction.

2. Removal Of Lane Closures

To provide the greatest possible convenience to the public in accordance with Sub-Subsection 107.07, the Contractor shall remove all signs, lane closure markings, and devices immediately when lane closure work is completed or temporarily suspended for any length of time or as directed by the Engineer. All portable signs and portable sign mounting devices shall be removed from the roadway to an area which will not allow the sign to be visible and will not allow the sign or sign mounting device to be impacted by traffic.

3. **Exit And Entrance Ramps**
On multilane highways where traffic has been shifted to the inside lanes, the exit and entrance ramps shall have channelization devices placed on both sides of the ramp. This requirement will apply to any situation where traffic is shifted to contra flows or inside staging lanes to facilitate reconstruction work in the vicinity of exit and entrance ramps. The temporary ramp taper length shall be greater than, or equal to, the existing taper length. Interim EXIT gore signs shall be placed at the ramp divergence. The "EXIT OPEN" sign shown in Figure TA-42 of the MUTCD shall be utilized. For exit ramps, channelization device spacing shall be decreased to 10 feet for 200 feet in advance of the temporary gore, and be decreased to 10 feet for the first 100 feet of the temporary gore.

4. **Lane Drop/Lane Closure**
The first seven (7) calendar days of any lane closure shall be signed and marked as per Standard 9106 or 9107. However, lane closures that exist for a duration longer than seven (7) calendar days may be signed and marked as per the details in Standard 9121, provided the prior approval of the Engineer is obtained. The approved lane drop shall utilize only the signs and markings shown for the termination end of the lane drop in Standard 9121. All warning signs in the lane drop sequence shall be used. Drums may be substituted for the Type I Crystal Delineators at the same spacing.

5. **Termination Area**
The transition to normal or full width highway at the end of a lane closure shall be a maximum of 150 feet.

D. TRAFFIC PACING METHOD:

1. **Pacing Of Traffic**
With prior approval from the Engineer, traffic may be paced allowing the Contractor up to ten (10) minutes maximum to work in or above all lanes of traffic for the following purposes:

a. Placing bridge members or other bridge work.

b. Placing overhead sign structures.

c. Other work items requiring interruption of traffic.

The Contractor shall provide a uniformed police officer with patrol vehicle and blue flashing light for each direction of pacing. The police officer, Engineer, and flaggers at ramps shall be provided with a radio which will provide continuous contact with the Contractor.

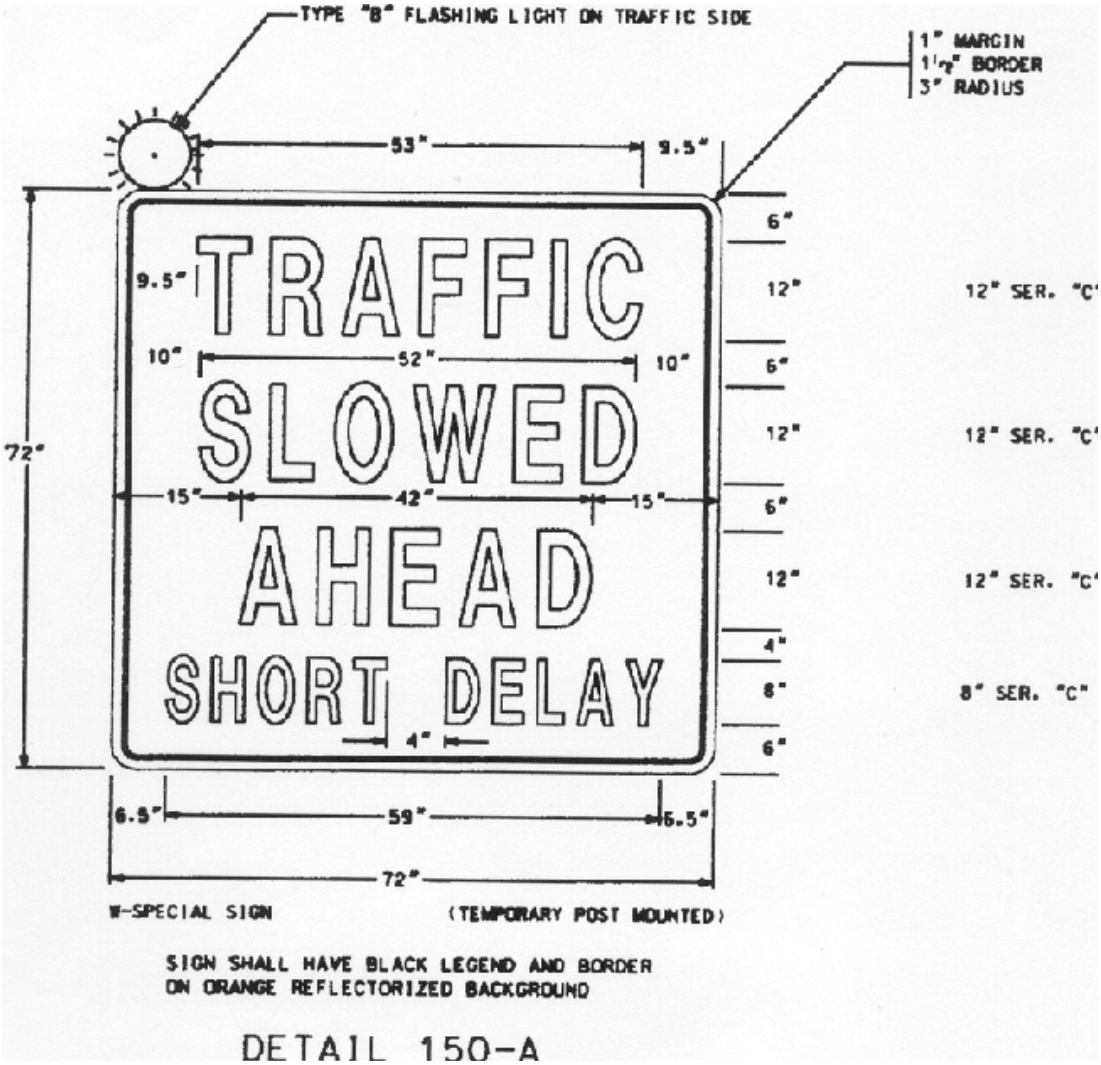
When ready to start the work activity, the police vehicle will act as a pilot vehicle slowing the traffic thereby providing a gap in traffic allowing the Contractor to perform the Work. Any on-ramps between the pace and the work area shall be blocked during pacing of traffic, with a flagger properly dressed and equipped with a Stop/Slow paddle. Each ramp should be opened after the police vehicle has passed.
Pilot vehicles shall travel at a safe pace speed, desirably not less than 20 mph interstate and 10 mph non-interstate. The Contractor shall provide a vehicle to

proceed in front of the police vehicle and behind the other traffic in order to inform the Contractor's work force when all vehicles have cleared the area.

Traffic will not be permitted to stop during pacing except in extreme cases as approved by the Engineer.

2. Methods Of Signing For Traffic Pacing

At a point not less than 1,000 feet in advance of the beginning point of the pace, the Contractor shall erect and cover a W-special sign (72 inch x 72 inch) with a Type "B" flashing light, with the legend "TRAFFIC SLOWED AHEAD SHORT DELAY" (See Detail 150-A). A portable changeable message sign may be used in lieu of the W-special sign. On divided highways this sign shall be double indicated. A worker with a two-way radio shall be posted at the sign, and upon notice that the traffic is to be paced shall turn on the flashing light and reveal the sign. When traffic is not being paced, the flashing light shall be turned off and the sign covered or removed. W-special signs are reflectorized black on orange, Series "C" letter and border of the size specified.



E. CONSTRUCTION VEHICLE TRAFFIC

The Contractor's vehicles shall travel in the direction of normal roadway traffic and shall not reverse direction except at intersections, interchanges, or approved temporary crossings. The Contractor may submit a plan requesting that construction traffic be allowed to travel in the opposite direction of normal traffic when it would be desirable to modify traffic patterns to accommodate specific construction activities.

Prior approval of the Engineer shall be obtained before any construction traffic is allowed to travel in a reverse direction. If the Contractor's submittal is approved the construction traffic shall be separated from normal traffic by appropriate traffic control devices.

F. ENVIRONMENTAL IMPACTS TO THE TEMPORARY TRAFFIC CONTROL (TTC) PLAN

The Contractor shall ensure that dust, mud, and other debris from construction activities do not interfere with normal traffic operations or adjacent properties. All outfall ditches, special ditches, critical storm drain structures, erosion control structures, retention basins, etc. shall be constructed, where possible, prior to the beginning of grading operations so that the best possible drainage and erosion control will be in effect during the grading operations, thereby keeping the roadway areas as dry as possible.

Areas within the limits of the project which are determined by the Engineer to be disturbed or damaged due either directly or indirectly from the progress or the lack of progress of the work shall be cleaned up, redressed, and regrassed. All surplus materials shall be removed and disposed of as required. Surplus materials shall be disposed of in accordance with Section 201 of the Specifications.

G. EXISTING STREET LIGHTS

Existing street lighting shall remain lighted as long as practical and until removal is approved by the Engineer.

H. NIGHTWORK

Adequate temporary lighting shall be provided at all nighttime work sites where workers will be immediately adjacent to traffic.

I. CONSTRUCTION VEHICLES IN THE WORKZONE

The parking of Contractor's and/or workers personal vehicles within the work area or adjacent to traffic is prohibited. It shall be the responsibility of the Worksite Traffic Control Supervisor to ensure that any vehicle present at the worksite is necessary for the completion of the work.

J. ENCROACHMENTS ON THE TRAVELED-WAY

The Worksite Traffic Control Supervisor (WTCS) shall monitor the work to ensure that all the rocks, boulders, construction debris, stockpiled materials, equipment, tools and other potential hazards are kept clear of the travelway. These items shall be stored in a location, in so far as practical, where they will not be subject to a vehicle running off the road and striking them.

K. PEDESTRIAN CONSIDERATIONS

All existing pedestrian facilities, including access to transit stops, shall be maintained. Where pedestrian routes are closed, alternate routes shall be provided. Closures of existing, interim and final pedestrian facilities shall have the prior written approval of the Engineer. When existing pedestrian facilities are disrupted, closed or relocated in a TTC zone, the temporary facilities shall be detectable and shall include accessibility features consistent with the features present in the existing pedestrian facility. Pedestrian facilities are considered improvements and provisions made to accommodate or encourage walking. Whenever a sidewalk is to be closed, the Engineer shall notify the maintaining agency two (2) weeks prior to the closure. Prior to closure, detectable barriers (that are detectable by a person with a visual disability traveling with the aid of a long cane), as described by the MUTCD, shall be placed across the full width of the closed sidewalk. Barriers and channelizing devices used along a temporary pedestrian route shall be in compliance with the MUTCD.

Temporary Traffic Control devices used to delineate a Temporary Traffic Control zone pedestrian walkway shall be in compliance with Subsection 150.01.E. Temporary Traffic Control devices and construction material shall not intrude into the usable width of the pedestrian walkway. Signs and other devices shall be placed such that they do not narrow or restrict any pedestrian passage to less than 48 inches.

A pedestrian walkway shall not be severed or relocated for non-construction activities such as parking for construction vehicles and equipment. Movement by construction vehicles and equipment across designated pedestrian walkways should be minimized. When necessary, construction activities shall be controlled by flaggers. Pedestrian walkways shall be kept free of mud, loose gravel or other debris.

When temporary covered walkways are used, they shall be lighted during nighttime hours. When temporary traffic barrier is used to separate pedestrian and vehicular traffic, the temporary barrier shall meet NCHRP-350 Test Level Three. The barrier ends shall be protected in accordance with Georgia Standard 4960. Curbing shall not be used as a substitute for temporary traffic barriers when temporary traffic barriers are required. Tape, rope or plastic chain strung between temporary traffic control devices are not considered as detectable and shall not be used as a control for pedestrian movements.

The WTCS shall inspect the activity area daily to ensure that effective pedestrian TTC is being maintained. The inspection of TTC for pedestrian traffic shall be included as part of the TC-1 report.

1. **Temporary Pedestrian Facilities**
   Temporary pedestrian facilities shall be detectable and include accessibility features consistent with the features present in the existing pedestrian facility. The geometry, alignment and construction of the facility should meet the applicable requirements of the "Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)".

   a. Temporary Walkways with Detectable Edging
      A smooth, continuous hard surface (firm, stable and slip resistant) shall be provided throughout the entire length of the temporary pedestrian facility. Compacted soils, sand, crushed stone or asphaltic pavement millings shall not be used as a surface course for walkways.

      Temporary walkways shall include detectable edging as defined in the MUTCD. When temporary traffic barrier is included as a pay item in the contract and where locations identified on the plans for positive protection will also allow them to serve as pedestrian detectable edging, payment will be made for the temporary traffic barrier in accordance with Section 622. No payment will be made for temporary walkways with Detectable Edging where existing pavements or existing edging (that meets the requirements of MUTCD) are utilized as temporary walkways. Payment for temporary detectable edging, including approved barriers and channelizing devices, installed on existing pavements shall be included in Traffic Control-Lump Sum.

      Regardless of the materials used, temporary walkways shall be constructed of sufficient thickness and durability to withstand the intended use for the duration of the construction project. If concrete or asphalt is used as the surface course for the walkway, it shall be a minimum of one and one-half inches (1-1/2") thick. Temporary walkways constructed across unimproved streets and drives shall be a minimum thickness of four inches (4") for concrete and three inches (3") for asphalt. Joints formed in concrete sidewalks shall be in accordance with Section 441. Concrete surfaces shall have a broom finish.

      If plywood is used as a walkway, it must be a minimum of three quarters of an inch (3/4") thick pressure treated and supported with pressure treated longitudinal joists spaced a maximum of sixteen inches (16") on center. The plywood shall be secured to the joist with galvanized nails or galvanized deck screws. Nails and screws shall be countersunk to prevent snagging or tripping the pedestrians. A slip resistant friction course shall be applied to any plywood surface that is used as a walkway. Any slip resistant material used shall have the prior written approval of the engineer.

      The contractor may propose alternate types of Temporary Walkways provided the contractor can document that the proposed walkway meets the requirements of the "Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)". Alternate types of Temporary Walkways shall have the prior written approval of the engineer.

Temporary walkways shall be constructed and maintained so there are no abrupt changes in grade or terrain that could cause a tripping hazard or could be a barrier to wheelchair use. The contractor shall construct and maintain the walkway to ensure that joints in the walkway have a vertical difference in elevation of no more than one quarter (1/4") of an inch and that the horizontal joints have gaps no greater than one half (1/2") of an inch. The grade of the temporary walkway should parallel the grade of the existing walkway or roadway and the cross slope should be no greater than 2%.

A width of sixty (60") inches, if practical, should be provided throughout the entire length of any temporary walkway. The temporary walkway shall be a minimum width of forty eight inches (48"). When it is not possible to maintain a minimum width of sixty inches (60") throughout the entire length of temporary walkway, a sixty inch (60") by sixty inch (60") passing space should be provided at least every two hundred feet (200 Ft.), to allow individuals in wheelchairs to pass.

Temporary walkways shall be constructed on firm subgrade. Compact the subgrade according to Section 209. Furnish and install any needed temporary pipes prior to constructing any walkway to ensure positive drainage away from or beneath the temporary walkway. Once the walkway is no longer required, remove any temporary materials and restore the area to the original conditions or as shown in the plans.

b. Temporary Curb Cut Wheelchair Ramps

Temporary curb cut wheelchair ramps shall be constructed in accordance with Section 441 and Detail A-3. Ramps shall also include a detectable warning surface in accordance with Detail A-4. Other types of material for the construction of the temporary curb cut wheelchair ramps, including the detectable warning surface, may be used provided the contractor can provide documentation that the material to be used meets the requirements of the "Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)". When a wheelchair ramp is no longer required, remove the temporary materials and restore the area to existing conditions or as shown in the plans. For the items required to restore the area to original conditions or as shown in the plans, measures for payment shall be covered by contract pay items. If pay items are not included in the contract, then payment for these items shall be included in Traffic Control-Lump Sum.

c. Temporary Audible Information Device

Temporary audible information devices, when shown in the plans, shall be installed in compliance with the "Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)". The devices shall be installed in accordance with the manufacturer's recommendations. Prior to installation, the contractor shall provide the engineer with a set of manufacturer's drawings detailing the proper installation procedures for each device. When no longer required, the devices shall remain the property of the contractor.

L. TRAFFIC SIGNALS

If the sequence of operations, staging, or the temporary traffic control plan requires the relocation or shifting of any components of an existing traffic signal system then any work on these traffic signals will be considered as part of Lump Sum- Traffic Control. The contractor becomes responsible for the maintenance of these traffic signals from the time that the system is modified until final acceptance. The maintenance of traffic signals that are not a part of the work and are not in conflict with any portion of the work shall not be the responsibility of the contractor.

When construction operations necessitate an existing traffic signal to be out of service, the Contractor shall furnish off-duty police officers to regulate and maintain traffic control at the site. Off-duty police officers should be used to regulate and maintain traffic control at signal sites when lane closures or traffic shifts block or restrict movements causing interference with normal road user flows and will not allow the activated traffic signal to guide the traffic through the signal site.

M. REMOVAL/REINSTALLATION OF MISCELLANEOUS ITEMS

In the prosecution of the Work, if it becomes necessary to remove any existing signs, markers, guardrail, etc. not covered by specific pay item, they shall be removed, stored and reinstalled, when directed by the Engineer, to line and grade, and in the same condition as when removed.

N. Signalized Intersections

Off duty police officers shall be used to regulate and maintain traffic control at functioning signalized intersections when lane closures or traffic shifts block or restrict movements causing interference with road user flows and will not allow the activated traffic signal to guide the traffic through the signal site. This work is considered incidental and shall be included in the overall price bid for traffic control.

150.03 SIGNS:

A. SIGNING REQUIREMENTS OF THE TEMPORARY TRAFFIC CONTROL (TTC) PLAN

When existing regulatory, warning or guide signs are required for proper traffic and pedestrian control the Contractor shall maintain these signs in accordance with the temporary traffic control (TTC) plan. The Contractor shall review the status of all existing signs, interim signs added to the work, and permanent sign installations that are part of the work to eliminate any conflicting or non-applicable signage in the TTC Plan. The Contractor's review of all signs in the TTC Plan shall establish compliance with the requirements of the MUTCD and Section 150. Any conflicts shall be

reported to the Engineer immediately and the WTCS shall take the necessary measures to eliminate the conflict.

The Contractor shall make every effort to eliminate the use of interim signs as soon as the Work allows for the installation of permanent signs.

All existing illuminated signs shall remain lighted and be maintained by the Contractor.

Existing street name signs shall be maintained at street intersections.

B. CONFLICTING OR NON-APPLICABLE SIGNS

Any sign(s) or portions of a sign(s) that are not applicable to the TTC plan shall be covered so as not to be visible to traffic or shall be removed from the roadway when not in use. The WTCS shall review all traffic shifts and changes in the traffic patterns to ensure that all conflicting signs have been removed. The review shall confirm that the highest priority signs have been installed and that signs of lesser significance are not interfering with the visibility of the high priority signs. High priority signs include signs for road closures, shifts, detours, lane closures and curves. Any signs, such as speed zones and speed limits, passing zones, littering fines and litter pick up, that reference activities that are not applicable due to the presence of the Work shall be removed, stored and reinstalled when the Work is completed.

Failure to promptly eliminate conflicting or non-applicable signs shall be considered as non-performance under Section 150.08.

C. REMOVAL OF EXISTING SIGNS AND SUPPORTS

The Contractor shall not remove any existing signs and supports without prior approval from the Engineer. All existing signs and supports which are to be removed shall be stored and protected if this material will be required later in the work as part of the TTC plan. If the signs are not to be utilized in the work then the signs will become the property of the Contractor unless otherwise specified in the contract documents.

D. INTERIM GUIDE, WARNING AND REGULATORY SIGNS

Interim guide, warning, or regulatory signs required to direct traffic and pedestrians shall be furnished, installed, reused, and maintained by the Contractor in accordance with the MUTCD, the Plans, Special Provisions, Special Conditions, or as directed by the Engineer. These signs shall remain the property of the Contractor. The bottom of all interim signs shall be mounted at least seven (7') feet above the level of the pavement edge when the signs are used for long-term stationary operations as defined by Section 6G.02 of the MUTCD. Special Conditions under Subsection 150.11 may modify this requirement.

Portable signs may be used when the duration of the work is less than three (3) days or as allowed by the special conditions in Subsection 150.11. Portable signs shall be used for all punchlist work. All portable signs and sign mounting devices utilized in work shall be NCHRP 350 compliant. Portable interim signs shall be mounted a minimum of one (1') foot above the level of the pavement edge for directional traffic of two (2) lanes or less and a minimum of seven (7') feet for directional traffic of three (3) or more lanes. Signs shall be mounted at the height recommended by the manufacturer's crashworthy testing requirements. Portable interim signs which are mounted at less than seven (7') feet in height may have two 18 inch x 18 inch fluorescent red-orange or orange-red warning flags mounted on each sign.

All regulatory sign blanks shall be rigid whether the sign is mounted as a portable sign, on a Type III barricade or as a permanent mount height sign.

Any permanent mount height interim sign that is designed to fold in half to cover a non-applicable message on the sign shall have reflectorized material on the folded over portion of the sign. The reflectorized material shall be orange in color with a minimum of ASTM Type I engineering grade sheeting with a minimum area of six inches by six inches (6" x 6") facing the direction of traffic at all times when the sign is folded.

Interim signs may be either English or metric dimensions.

E. EXISTING SPECIAL GUIDE SIGNS

Existing special guide signs on the Project shall be maintained until conditions require a change in location or legend content. When change is required, existing signs shall be modified and continued in use if the required modification can be made within existing sign borders using design requirements (legend, letter size, spacing, border, etc.) equal to that of the existing signs, or of Subsection 150.03.E.2. Differing legend designs shall not be mixed in the same sign.

1. Special Guide Signs

Special guide signs are those expressway or freeway guide signs that are designed with a message content (legend) that applies to a particular roadway location. When an existing special guide sign is in conflict with work to be performed, the Contractor shall remove the conflicting sign and reset it in a new, non-conflicting location which has been approved by the Engineer.

2. Interim Special Guide Signs

When it is not possible to utilize existing signs, either in place or relocated, the Contractor shall furnish, erect, maintain, modify, relocate, and remove new interim special guide signs in accordance with the Plans or as directed by the Engineer. Interim special guide signs that may be required in addition to, or a replacement for, existing expressway and freeway (interstate) signs shall be designed and fabricated in compliance with the minimum requirements for guide signing contained in Part 2E "Guide Signs Expressway" and Part 2F "Guide Signs Freeways" of the MUTCD, except that the minimum size of all letters and numerals in the names and places, streets and highways on all signs shall be 16 inches Series "E" initial upper-case and 12 inches lower-case. All interstate

shields on these signs shall be 48 inches and 60 inches for two-numeral and three-numeral routes, respectively.

The road name of the exit or route shield shall be placed on the exit gore sign.

3. Interim Overhead Guide Sign Structures

Interim overhead special guide sign structures are not required to be lighted unless specifically required by the Plans. If lighting is required the sign shall be lighted as soon as erected and shall remain lighted, during the hours of darkness, until the interim sign is no longer required. The Contractor shall notify the Power Company at least thirty (30) days prior to desired connection to the power source.

4. Permanent Special Guide Signs

The installation of new permanent special guide signs and the permanent modification or resetting of existing special guide signs, when included in the contract, shall be accomplished as soon as practical to minimize the use of interim special guide signs. If lighting is required by the Plans, all new permanent overhead special guide signs shall be lighted as soon as erected.

F. MATERIALS- INTERIM SIGNS:

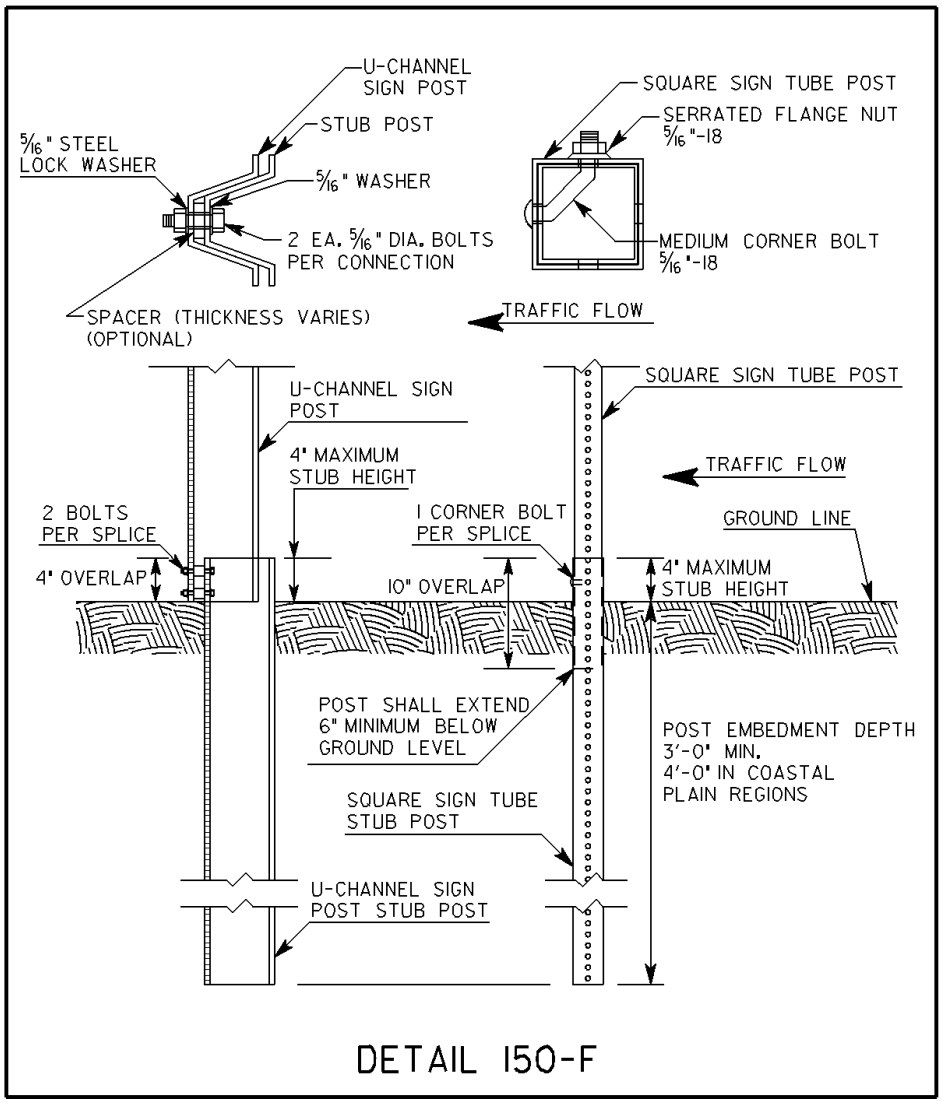
1. Posts

Permanent mounting height of seven (7') feet- Posts for all interim signs shall meet the requirements of Section 911 except that green or silver paint may be used in lieu of galvanization for steel posts or structural shape posts. Within the limits of a single project, all metal posts shall be the same color. Wood posts are not required to be pressure treated. Ground mounted sign(s) greater than nine (9) square feet shall be mounted on two posts.

Interim posts may be either metric or English in dimensions.

Posts for all interim signs shall be constructed to yield upon impact unless the posts are protected by guardrail, portable barrier, impact attenuator or other type of positive barrier protection. Unprotected posts shall meet the breakaway requirements of the "1994 AASHTO Standard Specifications for Structural Support for Highway Signs, Luminaries and Traffic Signals". Unprotected interim posts shall be spliced as shown in Detail 150-F unless full length unspliced posts are used.

Unprotected post splices will not be permitted any higher than four inches above the ground line to lessen the possibility of affecting the undercarriage of a vehicle. Installation of posts may require establishment of openings in existing pavements, islands, shoulders etc.


U-CHANNEL SIGN POST
STUB POST
5/16" STEEL LOCK WASHER
5/16" WASHER
2 EA. 5/16" DIA. BOLTS PER CONNECTION
SPACER (THICKNESS VARIES) (OPTIONAL)
SQUARE SIGN TUBE POST
SERRATED FLANGE NUT 5/16"-18
MEDIUM CORNER BOLT 5/16"-18
TRAFFIC FLOW
U-CHANNEL SIGN POST
4" MAXIMUM STUB HEIGHT
2 BOLTS PER SPLICE
4" OVERLAP
1 CORNER BOLT PER SPLICE
10" OVERLAP
SQUARE SIGN TUBE POST
TRAFFIC FLOW
GROUND LINE
4" MAXIMUM STUB HEIGHT
POST SHALL EXTEND 6" MINIMUM BELOW GROUND LEVEL
POST EMBEDMENT DEPTH 3'-0" MIN. 4'-0" IN COASTAL PLAIN REGIONS
SQUARE SIGN TUBE STUB POST
U-CHANNEL SIGN POST STUB POST

DETAIL 150-F

2. **Sign Blanks And Panels- Permanent mounting height of seven (7') feet-**
All sign blanks and panels shall conform to Section 912 of the Specifications except that blanks and panels may be ferrous based or other metal alloys. Type 1 and Type 2 sign blanks shall have a minimum thickness of 0.08 inches regardless of the sign type used. Alternative sign blank materials (composites, poly carbonates, fiberglass reinforced plastics, recycled plastics, etc.) shall have a letter of approval from the Office of Materials and Research for use as interim construction signs before these materials are allowed to be incorporated into the work unless these rigid sign blanks are currently approved as a crashworthy sign blank material under QPL 34. The back side of sign panels shall be painted orange to prevent rust if other metals are used in lieu of aluminum. Plywood blanks or panels will not be permitted. The use of flexible signs will not be permitted for permanent mount height signs.

   Interim blanks and panels may be either metric or English in dimensions.

3. **Portable Sign Mounting Devices, Portable Sign Blanks-**
All portable sign mounting devices and sign blanks utilized in the work shall be NCHRP 350 Test Level III compliant. All portable sign mounting devices and sign blanks shall be from the Qualified Products List. Any sign or sign mounting device shall have an identifying decal, logo, or manufacturer's stamping that clearly identifies the device as NCHRP 350 compliant. The required decal, logo or manufacturer's stamping shall not be displayed on the message face of the sign. The Contractor may be required to provide certification from the Manufacturer as proof of NCHRP 350 compliance. All portable signs shall be mounted according to height requirements of Subsection 150.03.D.

G. SIGN VISIBILITY AND OFFSETS

All existing, interim and new permanent signs shall be installed so as to be completely visible for an advance distance in compliance with the MUTCD. Any clearing required for maintaining the line of sight to existing, interim or permanent signs shall be done as part of the requirements of the TTC plan. The clearing shall include any advance warning signs, both interim and permanent, that are installed as a part of the work including advance warning signs that are installed outside the limits of the project. Any sign installed behind W-beam or T-beam guardrail with non-breakaway posts shall be installed with the leading edge of the sign a minimum of four feet and three inches (4'3") behind the face of the guardrail with five feet (5') of clearance being desirable. Limbs, brush, construction equipment and materials shall be kept clear of the driver's line of sight to all signs that are part of the TTC plan.

H. ADVANCE WARNING SIGNS:

1. **All Type Of Highways**
Advance warning signs shall be placed ahead of the work area in accordance with Part VI of the MUTCD and shall include a series of at least three advance road work (W20-1) signs placed at the termini of the project. The series shall have the legend ROAD WORK (1500 FEET, 1000 FEET, AND 500 FEET).

At grade intersecting roadways and on-ramps shall be signed with a minimum of one ROAD WORK AHEAD sign.

When work terminates at a "T" intersection, a minimum of one "ROAD WORK AHEAD" sign shall be placed in advance of the intersection and one "END ROAD WORK" sign shall be placed at the termination end of the intersection. Field conditions may require the use of additional warning signage.

Advanced Warning Signs on State Routes shall be a minimum dimension of 48 inches x 48 inches. When a State Route intersects a project which consists of adding travel lanes, reconstructing an existing roadway or new location work, the State Route approaches shall have a minimum of three (W20-1) advanced warning signs (1500 ft., 1000 ft., 500 ft.). The termination end of an intersecting State Route shall have END ROAD WORK signage.

The W20-1 signs shall be placed at the termini of the project or sufficiently in advance of the termini to allow for lane shifts, lane closures and other activities which may also require advanced warning signs. The advanced warning signs for the project should not overlap with the advanced warning signs for lane shifts, lane closures, etc.

The length of a workzone should be held to the minimum length required to accomplish the work. If a project has multiple individual worksites within the overall limits of the project, each site should be signed individually if the advance warning signs for each site can be installed without overlapping an adjacent worksite. As soon as the work is completed at any individual site the warning signs shall be removed from that site. Clean-up work and punchlist work shall be performed with portable signage.

Project mileage indicated on the G20-1 sign shall be the actual project mileage rounded up to the nearest whole mile. Projects less than two (2) miles in length or individual worksites that are part of a multiple worksite project may delete this sign. The G20-1 sign shall be 60" X 36" and the G20-2 sign shall be 48" X 24".

2. Interstate, Limited Access And Multilane Divided Highways

In addition to the W20-1 signs required at 500 ft., 1000 ft. and 1500 ft., multi-lane divided highways shall also have additional advanced warning signs installed with the legend "ROAD WORK (2 MILES, 1 MILE and 1/2 MILE). All construction warning signs on divided highways shall be double indicated (i.e., on the left and right sides of the roadway.) If the use of the ½ mile, 1 mile and 2 mile advanced warning signs cause an overlap with other work or do not benefit field conditions then the Engineer may review the use of these signs and eliminate their installation. When the posted speed limit is 50 MPH or less, the ½ mile, 1 mile and 2 mile signs should be eliminated especially in urban areas.

The W20-1 advance warning signs for ROAD WORK 500 FEET; 1000 FEET; and 1500 FEET shall be temporarily covered when work involving the advanced warning signs for lane shifts and lane closures overlap these signs. The ROAD WORK ½ MILE, ROAD WORK 1 MILE, and ROAD WORK 2 MILES shall be in place when the 500, 1000 and 1500 feet signs are temporarily covered.

When the temporary traffic control zone already has advanced warning (W20-1) signs installed the W20-1 signs required for lane closures under Standard 9106 should be eliminated.

RAMP WORK ON LIMITED ACCESS HIGHWAYS: The workzone shall not be signed for the entire length of the mainline of a limited access highway when only short individual worksites, interchange or ramp work is being performed.

When work is restricted to ramp reconstruction or widening activities, the advance warning signs on the mainline section of the limited access highway shall be limited to the use of portable advance warning signs. These portable advance warning signs shall only be utilized when work activity is within the gore point of the ramp and the mainline traveled way or work is active in the accel/decel lane adjacent to the mainline traveled way. Portable advance warning signs (W20-1; 1500ft. /1000 ft. /500ft.) shall be installed on the traveled way of the limited access highway when the above conditions are present. The advance warning signs shall be installed only in one direction where work is active. All portable signs shall be double indicated. When work is not active, the ramp work shall be advanced warned by the use of a single 48 inch X 48 inch "RAMP WORK AHEAD" sign along the right shoulder of the mainline traveled way prior to the beginning of the taper for the decel lane. The "RAMP WORK AHEAD" sign shall be mounted at seven (7') feet in height. Differences in elevation shall be in compliance with the requirements of Subsection 150.06 prior to the removal of the portable (W20-1) advanced warning signs from the mainline.

The G20-1 sign shall be eliminated on limited access highways when the work involves only ramp work, bridge reconstruction, bridge painting, bridge joint repairs, guardrail and anchor replacement or other site specific work which is confined to a short section of limited access highway.

I. PORTABLE CHANGEABLE MESSAGE SIGN

Unless specified as a paid item in the contract the use of a portable changeable message sign will not be required. When specified, a portable changeable message sign (PCMS) shall meet the minimum requirements of Section 632 and the MUTCD. The maximum amount of messages allowed to be flashed on one PCMS is two phases (flashes). The language and the timing of the messages shall comply with the MUTCD and Section 632.
When used as an advanced device the PCMS should typically be placed ahead of the construction activities. If the PCMS is used as a substitute for another device then the requirements for the other device apply.

J. FLASHING BEACON

The flashing beacon assembly, when specified, shall be used in conjunction with construction warning signs, regulatory, or guide signs to inform traffic of special road conditions which require additional driver attention. The flashing beacon assembly shall be installed in accordance with the requirements of Section 647.

K. RUMBLE STRIP SIGNAGE

Signage for rumble strips located in the travelway shall be as required in Subsection 150.01.C and Subsection 150.02.A.9.

L. LOW/SOFT SHOULDER SIGNAGE

Low or soft shoulder signs shall be utilized in accordance with the following conditions:

CONSTRUCTION/RECONSTRUCTION PROJECTS:

"LOW/SOFT SHOULDER" signs shall be erected when a difference in elevation exceeds one (1") inch but does not exceed three (3") inches between the travelway and any type of shoulder unless the difference in elevation is four (4') feet or greater from the edge of the traveled way.

The spacing of the signs shall not exceed one (1) mile and the signs shall be placed immediately past each crossroad intersection. The "Low/Soft" signs shall remain in place until the difference in elevation is eliminated and the shoulder has been dressed and permanently grassed for a minimum of thirty (30) calendar days. These signs shall be furnished, installed, maintained and removed by the Contractor as part of Traffic Control-Lump Sum. These signs shall be orange with black borders and meet the reflectorization requirements of Subsection 150.01.D.

"SHOULDER DROP-OFF" (W8-9a) signs shall be used when a difference in elevation, less than four (4') feet from the traveled way, exceeds three (3") inches and is not protected by positive barrier protection. These warning signs shall be placed in advance of the drop-off.
For a continuous drop-off condition, the W8-9a) signs shall, as a minimum, be spaced in accordance with the above requirements for "Low/soft shoulder" signs.

PROJECTS CONSISTING PRIMARILY OF ASPHALTIC CONCRETE RESURFACING ITEMS:

"LOW/SOFT SHOULDER" signs shall be erected when a difference in elevation exceeds one (1") inch but does not exceed three (3") inches between the travelway and any type of shoulder unless the difference in elevation is four (4') feet or greater from the edge of the traveled way.

SHOULDER BUILDING INCLUDED IN THE CONTRACT: "Low/Soft Shoulder" signs shall be erected as per the requirement of Standards 9102, 9106, and 9107. "Shoulder Drop-off" signs (W8-9a) shall be erected as per the requirements of the MUTCD. These signs shall be maintained until the conditions requiring their installation have been eliminated. The Contractor shall remove all interim warning signs before final acceptance.

SHOULDER BUILDING NOT INCLUDED IN THE CONTRACT: The Department will furnish the "Low/Soft Shoulder" signs, "Shoulder Drop-off" signs and the posts. The signs shall be erected to meet the minimum requirements of Subsection 150.03. The Contractor shall include the cost of furnishing installation hardware (bolts, nuts, and

washers), erection and maintenance of the signs in the bid price for Traffic Control-Lump Sum. The Contractor shall maintain the signs until final acceptance. The Department will remove the signs.

LAU/LAR PROJECTS SHOULDER BUILDING NOT INCLUDED IN THE CONTRACT: The Contractor will furnish, install and maintain LOW/SOFT SHOULDER signs (yellow with black borders, ASTM Type III or IV) at the appropriate spacing, until Final Acceptance of the project by the Department. After Final Acceptance by the Department the signs will become the property and responsibility of the local government.

M. BUMP SIGNAGE:

MULTI-LANE DIVIDED HIGHWAYS: A bump sign (W8-1) shall be utilized when a transverse joint in the pavement structure has a vertical difference in elevation of three quarters (3/4") of an inch or greater in depth with no horizontal taper to ramp the traffic from one elevation to the other. This condition typically occurs at approach slabs during pavement milling operations and at transverse joints in asphaltic pavement lifts.

TWO-LANE TWO-WAY HIGHWAYS: A bump sign (W8-1) shall be utilized when a transverse joint in the pavement structure has a vertical difference in elevation that exceeds one and three quarters (1-3/4") inches in depth with no horizontal taper to ramp the traffic from one elevation to the other. This includes utility and storm drainage repairs that require concrete placement for patching and/or steel plating.

The (W8-1) sign shall be placed sufficiently in advance to warn the motorist of the condition.

N. PEDESTRIAN SIGNAGE:

Appropriate signs as described in the MUTCD shall be maintained to allow safe passage of pedestrian traffic or to advise pedestrians of walkway closures (Refer to MUTCD Figures TA-28 and TA-29 for guidance). Advance closure signing should be placed at intersections rather than midblock locations so that pedestrians are not confronted with midblock work sites that will induce them to attempt skirting the work site or making a midblock crossing. Signs and other devices mounted lower than seven (7) feet above the temporary pedestrian walkway shall not project more than four (4) inches into the accessible pedestrian facilities. Signs and other devices shall be placed such that they do not narrow any pedestrian passage to less than 48 inches.

150.04 PAVEMENT MARKINGS

A. GENERAL

Full pattern pavement markings in accordance with Section 652 and in conformance with Section 3A and 3B, except 3B.02, of the MUTCD are required on all courses before the roadway is opened to traffic. No passing zones shall be marked to conform to Subsection 150.04.E. During construction and maintenance activities on all highways open to traffic, both existing markings and markings applied under this Section shall be fully maintained until Final Acceptance. If the pavement markings are, or become, unsatisfactory in the judgement of the Engineer due to wear, weathering, or construction activities, they shall be restored immediately.

1. Resurfacing Projects

Pavement markings shall be provided on all surfaces that are placed over existing markings. Interim and final markings shall conform in type and location to the markings that existed prior to resurfacing unless changes or additions are noted in the Contract. The replacement of parking spaces will not be required unless a specific item or note has been included in the Contract. Any work to make additions to the markings that existed prior to resurfacing is to be considered as extra work.

2. Widening And Reconstruction Projects

If the lane configuration is altered from the preconstruction layout then pavement markings will be as required by the plans or the Engineer.

3. New Location Construction Projects

Pavement marking plans will be provided.

B. MATERIALS

All traffic striping applied under this Section shall be a minimum four inches in width or as shown in plans and shall conform to the requirements of Section 652, except as modified herein. Raised pavement markers (RPMs) shall meet the requirements of Section 654. Markings on the final surface course, which must be removed, shall be a removable type. The Contractor will be permitted to use paint, thermoplastic, or tape on pavement which is to be overlaid as part of the project, unless otherwise directed by the Engineer. Partial (skip) reflectorization (i.e. reflectorizing only a portion of a stripe) will not be allowed.

C. INSTALLATION AND REMOVAL OF PAVEMENT MARKINGS:

INSTALLATION: All pavement markings, both interim and permanent, shall be applied to a clean surface. The Contractor shall furnish the layout and preline the roadway surface for the placement of pavement markings applied as part of the temporary traffic control plan. All interim marking tape and RPM's on the final surface shall be removed prior to the placement of the final markings.

The Contractor shall sequence the work in such a manner as to allow the installation of markings in the final lane configuration at the earliest possible stage of the work.

REMOVAL: Markings no longer applicable shall be removed in accordance with Subsection 656.3.05.

THE ELIMINATION OF CONFLICTING PAVEMENT MARKINGS BY OVERPAINTING WITH UNAPPROVED PAINT OR ANY TYPE OF LIQUID ASPHALT IS NOT ACCEPTABLE.

INTERMEDIATE SURFACE: Interim markings shall be removed by methods that will cause minimal damage to the pavement surface while also ensuring that traveling public will not be confused or misdirected by any residual markings remaining on the intermediate surface. The use of approved black-out tape and black-out paint (manufactured for the sole purpose of covering existing pavement markings) may be permitted on some interim surfaces, provided the results are satisfactory to the Engineer.

FINAL SURFACE: No interim paint or thermoplastic markings will be permitted on any final surface unless the interim markings are in alignment with the location of the permanent markings and the interim marking will not interfere or adversely affect placement of the permanent markings. The proposed method of removal for layout errors that require markings to be removed from the final surface shall have the prior approval of the Engineer. Any damage to the final pavement surface caused by the pavement marking removal process shall be repaired at the Contractor's expense by methods acceptable and approved by the Engineer. Subsection 400.3.06.C shall apply when corrective measures are required. The use of black-out tape or black-out paint will not be permitted under any circumstance to correct layout errors on any final surface.

Traffic shifts that are done on the final surface shall be accomplished using interim traffic marking tape that can be removed without any blemishing of the final surface. Interim traffic marking tape shall be used on any of the following final surfaces; asphaltic concrete, Portland cement concrete, and bridge deck surfaces. The contractor may propose alternate traffic markings and removal methods on the final surface. Submitted proposals shall include the type of material, method of removal and a cost comparison to the traffic marking tape method. Prior to any approval, the contractor shall field demonstrate to the satisfaction of the Engineer that the proposed traffic markings can be removed without any blemishing of the final surface. If the proposal is determined to be acceptable, a supplemental agreement will be executed prior to the installation of the proposed alternate traffic markings. The supplemental agreement shall denote the type of traffic marking materials, method of removal and any cost and/or time savings to the Department. The Department will not consider or participate in any cost increase that may result from implementing the proposed alternate method.

PAY FACTOR REDUCTION FOR ASPHALTIC CONCRETE FINAL SURFACES: When the correction of an error in the layout of the final pavement markings requires the final surface to be grounded, blemished, scarred, or polished the pay factor shall be reduced to 0.95 for the entire surface area of the final topping that has a blemish, polished or a scarred surface. The reduced pay factor shall not be confined to only the width and length of the stripe or the dimensions of the blemished areas, the whole roadway surface shall have the reduced pay factor applied. The area of the

reduced pay factor shall be determined by the total length and the total width of the roadway affected. If the affected area is not corrected, the reduction in pay shall be deducted from the final payment for the topping layer of asphaltic concrete. The Engineer shall make the final determination whether correction or a reduced pay factor is acceptable.

The eradication of pavement markings on intermediate and final concrete surfaces shall be accomplished by a method that does not grind, polish, or blemish the surface of the concrete. The method used for the removal of the interim markings shall not spall chip the joints in the concrete and shall not damage the sealant in the joints. Any joint or sealant repairs shall be included in the bid price for Traffic Control-Lump Sum. The proposed method of removal shall have the prior approval of the Engineer.

Failure to promptly remove conflicting or non-applicable pavement markings shall be considered as non-performance under Subsection 150.08.

PREPARATION AND PLANNING FOR TRAFFIC SHIFTS: When shifting of traffic necessitates removal of centerline, lane lines, or edge lines, all such lines shall be removed prior to, during, or immediately after any change so as to present the least interference with traffic. Interim traffic marking tape shall be used as a temporary substitute for the traffic markings being removed.

Before any change in traffic lane(s) alignment, marking removal equipment shall be present on the project for immediate use. If marking removal equipment failures occur, the equipment shall be repaired or replaced (including leasing equipment if necessary), so that the removal can be accomplished without delay.

Except for the final surface, markings on asphaltic concrete may be obliterated by an overlay course, when approved by the Engineer. When an asphaltic concrete overlay is placed for the sole purpose of eliminating conflicting markings and the in place asphaltic concrete section will allow, said overlay will be eligible for payment only if designated in the Plans. Overlays to obliterate lines will be paid for only once and further traffic shifts in the same area shall be accomplished with removable markings. Only the minimum asphaltic concrete thickness required to cover lines will be allowed. Excessive build-up will not be permitted. When an overlay for the sole purpose of eliminating conflicting markings is not allowed, the markings no longer applicable shall be removed in accordance with Subsection 656.3.05.

D. RAISED PAVEMENT MARKERS

Raised pavement markers (RPMs) are required as listed below for all asphaltic concrete pavements before the roadway is open to traffic. On the final surface, RPM's shall be placed according to the timeframes specified in 150.04 E. for full pattern pavement markings except Interstate Highways where RPM's shall be placed and/or maintained when the roadway is open to traffic. When Portland Cement Concrete is an intermediate or final surface and is open to traffic, one calendar day is allowed for cleaning and drying before the installation of RPMs is required.

Raised pavement markers are <u>not</u> allowed on the right edge lines under any situation.

1. **Interstate Highways**
   Retro-reflective raised pavement markers (RPM's) shall be placed and/or maintained on intermediate pavements surfaces on all interstate highways that are open to traffic. This includes all resurfacing projects along with widening and reconstruction projects. The spacing and placement shall be as required for MULTI-LANE DIVIDED HIGHWAYS.

2. **Multi-Lane Divided Highways**
   Retro-reflective raised pavement markers (RPMs) shall be placed and/or maintained on intermediate pavement surfaces on all multi-lane divided highways that are opened to traffic when these roadways are being widened or reconstructed. Two lane-two way roadways that are being widened to a multi-lane facility, whether divided or undivided, are included in this provision. Projects consisting primarily of asphalt resurfacing items or shoulder widening items are excluded from this requirement. The RPMs shall be placed as follows:

   a. SUPPLEMENTING LANE LINES

      80 foot center on skip lines with curvature less than three degrees. (Includes tangents)

      40 foot centers on solid lines and all lines with curvature between three degrees and six degrees.

      20 foot centers on curves over six degrees.

      20 foot centers on lane transitions or shifts.

   b. SUPPLEMENTING RAMP GORE LINES

      20 foot centers, two each, placed side by side.

   c. OTHER LINES

      As shown on the plans or directed by the Engineer.

3. **Other Highways**
   On other highways under construction RPMs shall be used and/or maintained on intermediate pavement surfaces as follows:

   a. SUPPLEMENTING LANE LINES AND SOLID LINES

      40 foot centers except on lane shifts. (When required in the Plans or Contract.)

      20 foot centers on lane shifts. (Required in all cases.)

b. SUPPLEMENTING DOUBLE SOLID LINES

40 foot centers (one each beside each line) except on lane shifts. (When required in the Plans or Contract.)

20 foot centers on lane shifts. (Required in all cases.)

E. EXCEPTIONS FOR INTERIM MARKINGS

Some exceptions to the time of placement and pattern of markings are permitted as noted below; however, full pattern pavement markings are required for the completed project.

1. Two-Lane, Two-Way Roadways

a. SKIP LINES
All interim skip (broken) stripe shall conform to Section 652 except that stripes shall be at least two feet long with a maximum gap of 38 feet. On curves greater than six degrees, a one-foot stripe with a maximum gap of 19 feet shall be used. In lane shift areas solid lines will be required. Interim skip lines shall be replaced with markings in full compliance with Section 652 prior to expiration of the 14 calendar day period.

Interim raised pavement markers may be substituted for the interim skip (broken) stripes. If raised pavement markers are substituted for the two foot interim skip stripe, three markers spaced at equal intervals over a two feet distance will be required. No separate payment will be made if the interim raised pavement markers are substituted for interim skip lines.

Interim raised pavement markers shall be retro-reflective, shall be the same color as the pavement markers for which they are substituted, and shall be visible during daytime.

The type of interim marker and method of attachment to the pavement shall be approved by the Office of Materials and Research but in no case will the markers be attached by the use of nails. Flexible reflective markers, Type 14 or Type 15, may be used for a maximum of fourteen (14) calendar days as an interim marker. Any flexible reflective markers in use shall be from the qualified products list (QPL).

The interim raised pavement markers shall be maintained until the full pattern pavement markings are applied. At the time full pattern markings are applied the interim raised markers shall be removed in a manner that will not interfere with application of the full pattern pavement markings.

b. NO PASSING ZONES-TWO-LANE, TWO-WAY ROADWAYS
Passing zones shall be re-established in the locations existing prior to resurfacing. No changes to the location of passing zones shall be done without the written approval of the Engineer. For periods not to exceed three calendar days where interim skip centerlines are in place, no-passing

zones shall be identified by using post or portable mounted DO NOT PASS regulatory signs (R4-1 24" x 30") at the beginning and at intervals not to exceed ½ mile within each no-passing zone. A post or portable mounted PASS WITH CARE regulatory sign (R4-1 24" x 30") shall be placed at the end of each no-passing zone. Post mounted signs shall be placed in accordance with the MUTCD. Portable signs shall conform to the requirements of the MUTCD and shall be NCHRP 350 compliant. Portable signs shall be secured in such a manner to prevent misalignment and minimize the possibility of being blown over by weather conditions or traffic.

On new location projects and on projects where either horizontal or vertical alignments has been modified, the location of No-Passing Zones will be identified by the Engineer.

c. EDGELINES

1) Bituminous Surface Treatment Paving
Edgelines will not be required on intermediate surfaces (including asphaltic concrete leveling for bituminous surface treatment paving) that are in use for a period of less than 60 calendar days except at bridge approaches, on lane transitions, lane shifts, and in such other areas as determined by the Engineer. On the final surface, edgelines shall be placed within 30 calendar days of the time that the final surface was placed.

2) All Other Types of Pavement
Edgelines will not be required on intermediate surfaces that are in use for a period of less than 30 calendar days except at bridge approaches, on lane transitions, lane shifts, and in such other areas as determined by the Engineer. On the final surface, edgelines shall be placed within 14 calendar days of the time that the surface was placed.

2. Multi-Lane Highways – With No Paved Shoulder(S) Or Paved Shoulder(S) Four Feet Or Less

a. UNDIVIDED HIGHWAYS (INCLUDES PAVED CENTER TURN LANE)

1) Centerlines and No-Passing Barrier-Full Pattern centerlines and no-passing barriers shall be restored before opening to traffic.

2) Lanelines- Interim skip (broken) stripe as described in Subsection 150.04E.1.a. may be used for periods not to exceed three calendar days. Skiplines are not permitted in lane shift areas. Solid lines shall be used.

3) Edgelines- Edgelines shall be placed on intermediate and final surfaces within three calendar days of obliteration.

b. DIVIDED HIGHWAYS (GRASS OR RAISED MEDIAN)

1) Lanelines- Full pattern skip stripe shall be restored before opening to traffic. Skip lines are not permitted in lane shift areas. Solid lines shall be required.

2) Centerline/Edgeline- Solid lines shall be placed on intermediate and final surfaces within three calendar days of obliteration.

3. Limited Access Roadways And Roadways With Paved Shoulders Greater Than Four Feet

a. Same as Subsection 150.04.E.2 except as noted in (b) below.

b. EDGELINES-

1) Asphaltic Concrete Pavement- Edgelines shall be placed on intermediate and final surfaces prior to opening to traffic.

2) Portland Cement Concrete Pavement- Edgelines shall be placed on any surface open to traffic no later than one calendar day after work is completed on a section of roadway. All water and residue shall be removed prior to daily striping.

4. Ramps For Multi-Lane Divided Highways

A minimum of one solid line edge stripe shall be placed on any intermediate surface of a ramp prior to opening the ramp to traffic. The other edge stripe may be omitted for a maximum period of three (3) calendar days on an intermediate surface. Appropriate channelization devices shall be spaced at a maximum of twenty-five (25') feet intervals until the other stripe has been installed.

The final surface shall have both stripes placed prior to opening the ramp to traffic.

5. MISCELLANEOUS PAVEMENT MARKINGS:

FINAL SURFACE: School zones, railroads, stop bars, symbols, words and other similar markings shall be placed on final surfaces conforming to Section 652 within fourteen (14) calendar days of completion of the final surface. Final markings shall conform to the type of pay item in the plans. When no pay item exists in the plans the final markings shall conform to Section 652 for painted markings.

INTERMEDIATE SURFACE: Intermediate surfaces that will be in use for more than forty-five (45) calendar days shall have the miscellaneous pavement markings installed to conform to the requirement of Section 652. Under Subsection 150.11, Special Conditions, or as directed by the Engineer these markings may be eliminated.

F. MOBILE OPERATIONS

When pavement markings (centerlines, lane lines, and edgelines) are applied in a continuous operation by moving vehicles and equipment, the following minimum equipment and warning devices shall be required. These devices and equipment are in addition to the minimum requirements of the MUTCD.

1. All Roadways

All vehicles shall be equipped with the official slow moving vehicle symbol sign. All vehicles shall have a minimum of two flashing or rotating beacons visible in all directions. All protection vehicles shall have an arrow panel mounted on the rear. All vehicles requiring an arrow panel shall have, as a minimum, a Type B panel. All vehicle mounted signs shall be mounted with the bottom of the sign a minimum height of forty-eight inches (48") above the pavement. All sign legends shall be covered or removed from view when work is not in progress.

2. Two-Lane Two-Way Roadways

a. Lead Vehicles
The lead vehicle may be a separate vehicle or the work vehicle applying the pavement markings may be used as the lead vehicle. The lead vehicle shall have an arrow panel mounted so that the panel is easily visible to oncoming (approaching) traffic. The arrow panel should typically operate in the caution mode.

b. Work Vehicles
The work vehicle(s) applying markings shall have an arrow panel mounted on the rear. The arrow panel should typically operate in the caution mode. The work vehicle placing cones shall follow directly behind the work vehicle applying the markings.

c. Protection Vehicles
A protection vehicle may follow the cone work vehicle when the cones are being placed and may follow when the cones are being removed.

3. MULTI-LANE ROADWAYS

A lead vehicle may be used but is not required. The work vehicle placing cones shall follow directly behind the work vehicle applying the markings. A protection vehicle that does not function as a work vehicle should follow the cone work vehicle when traffic cones are being placed. A protection vehicle should follow the cone work vehicle when the cones are being removed from the roadway. Protection vehicles shall display a sign on the rear of the vehicle with the legend PASS ON LEFT (RIGHT).

INTERSTATES AND LIMITED ACCESS ROADWAYS: A protection vehicle shall follow the last work vehicle at all times and shall be equipped with a truck mounted attenuator that is certified for impacts not less than 62 mph in accordance with NCHRP350 Test Level Three (3).

150.05 CHANNELIZATION

A. GENERAL

Channelization shall clearly delineate the travelway through the work zone and alert drivers and pedestrians to conditions created by work activities in or near the travelway. Channelization shall be done in accordance with the plans and specifications, the MUTCD, and the following requirements.
All Channelization Devices utilized on any project shall be NCHRP 350 compliant. Any device used on the Work shall be from the Qualified Products List. All devices utilized on the work shall have a decal, logo, or manufacturer's stamping that clearly identifies the device as NCHRP 350 compliant. The Contractor may be required to furnish certification from the Manufacturer for any device to prove NCHRP 350 compliance.

1. Types of Devices Permitted for Channelization in Construction Work Zones:

a. DRUMS:

1) DESIGN: Drums shall meet the minimum requirement of the MUTCD and shall be reflectorized as required in Subsection 150.01.D. The upper edge of the top reflectorized stripe on the drum shall be located a minimum of 33 inches above the surface of the roadway. A minimum drum diameter of 18 inches shall be maintained for a minimum of 34 inches above the roadway.

2) APPLICATION: Drums shall be used as the required channelizing device to delineate the full length of a lane closure, shift, or encroachment, except as modified by this Subsection.

3) TRANSITION TAPERS FOR LANE CLOSURES: Drums shall be used on all transition tapers. The minimum length for a merging taper for a lane closure on the travelway shall be as shown in Table 150-1:

TABLE 150-1

Posted Speed Limit, MPH	Lane Width 9 Feet	Lane Width 10 Feet	Lane Width 11 Feet	Lane Width 12 Feet	Maximum Drum Spacing in Tapers, (Feet)
	Minimum Taper Length (L) in Feet				
20	60	70	75	80	20
25	95	105	115	125	25
30	135	150	165	180	30
35	185	205	225	245	35
40	240	270	295	320	40
45	405	450	495	540	45
50	450	500	550	600	50
55	495	550	605	660	55
60	540	600	660	720	60
65	585	650	715	780	65
70	630	700	770	840	70
75	675	750	825	900	75

If site conditions require a longer taper then the taper shall be lengthened to fit particular individual situations.

The length of shifting tapers should be at least ½ L.

The length of a closed lane or lanes, excluding the transition taper(s), shall be limited to a total of two (2) miles. Prior approval must be obtained from the Engineer before this length can be increased.

Night time conditions: When a merge taper exists into the night all drums located in the taper shall have, for the length of the taper only, a six (6") inch fluorescent orange (ASTM Type VI, VII, VIII, IX or X) reflectorized top stripe on each drum. The top six-inch stripe may be temporarily attached to the drum while in use in a taper. The Engineer may allow the fluorescent orange reflectorized six (6") inch top stripe on each drum in a merging taper to remain in place during daylight hours provided there is a lane closure(s) with a continuous operation that begins during one nighttime period and ends during another nighttime period. All drums that have the six-inch top stripe permanently attached shall not be used for any other conditions.

Multiple Lane Closures:

(a) A maximum of one lane at a time shall be closed with each merge taper.

(b) A minimum tangent length of 2 L shall be installed between each individual lane closure taper.

4) LONGITUDINAL CHANNELIZATION: Drums shall be spaced as listed below for various roadside work conditions except as modified by

Subsection 150.06. Spacing shall be used for situations meeting any of the conditions listed as follows:

(a) 40 FOOT SPACING MAXIMUM

(1) For difference in elevation exceeding two inches.

(2) For healed sections no steeper than 4:1 as shown in Subsection 150.06, Detail 150-E.

(b) 80 FOOT SPACING MAXIMUM

(1) For difference in elevation of two inches or less.

(2) Flush areas where equipment or workers are within ten feet of the travel lane.

(c) 200 FOOT SPACING MAXIMUM: Where equipment or workers are more than ten feet from travel lane. Lateral offset clearance to be four feet from the travel lane.

(1) For paved areas eight feet or greater in width that are paved flush with a standard width travel lane.

(2) For disturbed shoulder areas not completed to typical section that are flush to the travel lane and considered a usable shoulder.

REMOVAL OF DRUMS: Drums may be removed after shoulders are completed to typical section and grassed. Guardrail and other safety devices shall be installed and appropriate signs advising of conditions such as soft or low shoulder shall be posted before the drums are removed.

b. VERTICAL PANELS

1) DESGN: All vertical panels shall meet the minimum requirements of the MUTCD. All vertical panels shall have a minimum of 270 square inches of retro-reflective area facing the traffic and shall be mounted with the top of the reflective panel a minimum of 36” above the roadway.

2) APPLICATION: Lane encroachment by the drum on the travelway should permit a remaining lane width of ten feet. When encroachment reduces the travelway to less than ten feet, vertical panels shall be used to restore the travelway to ten feet or greater. No other application of vertical panels will be permitted.

c. CONES

1) DESIGN: All cones shall be a minimum of 28 inches in height regardless of application and shall meet the requirement of the MUTCD. Reflectorization may be deleted from all cones.

2) APPLICATION: For longitudinal channelizing only, cones will be permitted for daylight closures or minor shifts. (Drums are required for all tapers.) The use of cones for nighttime work will not be permitted. Cones shall not be stored or allowed to be visible on the worksite during nighttime hours.

d. BARRICADES

DESIGN: Type III barricades shall meet the minimum requirements of the MUTCD and shall be reflectorized as required in Subsection 150.01.D. The Contractor has the option of choosing Type III barricades from the Qualified Products List or the Contractor may utilize generic barricades that are approved by the Federal Highway Administration (FHWA). When barricades have been specifically crash tested with signs attached, the contractor has the responsibility to attach the signs as per the manufacturer's recommendations to ensure crashworthiness. If signs are attached to generic barricades or to barricades from the Qualified Products List (QPL) that have not been crash tested with signs attached then the responsibility for crashworthiness and the liability for mounting these signs to the barricades are assumed by the Contractor and the Contractor shall certify that the barricades are crashworthy under FHWA workzone guidelines for NCHRP 350 crashworthy compliance. Any generic barricades used in the work shall be stamped or stenciled to show compliance with NCHRP 350. The use of Type I and Type II barricades will not be permitted.

1) APPLICATION: Type III barricades shall be placed as required by the plans, the Standards, and as directed by the Engineer. All signs mounted on barricades shall be mounted to comply with the requirements of the MUTCD and NCHRP 350 Test Level III. NCHRP 350 crashworthy compliance may require that rigid signs be mounted separate from the Type III barricade.

When a barricade is placed so that it is subject to side impact from a vehicle, a drum shall be placed at the side of the barricade to add target value to the barricade.

e. WARNING LIGHTS:

1) DESIGN: All warning lights shall meet the requirements of the MUTCD.

2) APPLICATION

(a) Type A low-intensity flashing lights shall be used as shown in the Plans, the Standards, and as directed by the Engineer. Flashing lights are not required for advance warning signs in Subsection 150.03.H.

(b) Type C Steady-Burn lights shall be used as shown in the Plans, the Standards, and as directed by the Engineer. Steady-burn lights are not required on drums for merging tapers that exist into the night.

f. TEMPORARY BARRIERS

1) DESIGN: Temporary barriers shall meet the requirements of Sections 620.

2) APPLICATION: Temporary barriers shall be placed as required by the plans, standards, and as directed by the Engineer. When Temporary barrier is located 20 feet or less from a travel lane, yellow reflectors shall be fixed to the top of the barrier at intervals not greater than 40 feet in the longitudinal section and 20 feet in the taper section and shall be mounted approximately two inches above the barrier. If both lanes of a two-lane two-way roadway are within 20 feet or less of the barrier then the reflectors shall be installed for both directions of traffic.

The reflectors shall be 100 square inches (ASTM Type VII or VIII) reflective sheeting mounted on flat-sheet blanks. The reflectors shall be mounted approximately two inches above the top of the barrier. The reflectors shall be attached to the barrier with adhesive or by a drilled-in anchor type device. The reflectors shall not be attached to a post or board that is placed between the gap in the barrier sections.

Approach end of Temporary barrier shall be flared or protected by an impact attenuator (crash cushion) or other approved treatment in accordance with Construction Details/Standards and Standard Specifications.

On interstate or other controlled access highways where lane shifts or crossovers cause opposing traffic to be separated by less than 40 ft., portable barrier shall be used as a separator.

B. PORTABLE IMPACT ATTENUATORS:

1. DESCRIPTION

This work consists of the furnishing (including spare parts), installation, maintenance, relocation, reuse as required, and removal of Portable Impact Attenuator Units/Arrays.

2. MATERIALS

Materials used in the Attenuator shall meet the requirements of Section 648 for Portable Impact Attenuators.

3. CONSTRUCTION

Portable Impact Attenuator Unit/Arrays installation shall conform to the requirements of Section 648, Manufacturer's recommendations and Georgia Standard 4960 and shall be installed at locations designated by the Engineer, and/or as shown on the plans.

C. TEMPORARY GUARDRAIL ANCHORAGE- Type 12:

1. DESCRIPTION

This work consists of the furnishing, installation, maintenance and removal or Temporary Guardrail Anchorage- Type 12 used for Portable Barrier or temporary guardrail end treatment.

2. MATERIALS

Materials used in the Temporary Guardrail Anchorage- Type 12 shall meet the requirements of Subsection 641.2 of the Specifications and current Georgia Standards and may be new or used. Materials salvaged from the Project which meet the requirements of Standards may be utilized if available. The use of any salvaged materials will require prior approval of the Engineer.

3. CONSTRUCTION

Installation of the Temporary Guardrail Anchorage- Type 12 shall conform to the requirements of the Plans, current Georgia Standards and Subsection 641.3 of the Specifications. Installation shall also include sufficient additional guardrail and appurtenances to effect the transition and connection to Temporary Concrete Barrier as required by the details in Georgia Standard 4960.

150.06 DIFFERENCES IN ELEVATION BETWEEN TRAVEL LANES AND SHOULDERS (SEE SUBSECTION 150.06.G FOR PROJECTS CONSISTING PRIMARILY OF ASPHALTIC CONCRETE RESURFACING ITEMS)

Any type of work such as paving, grinding, trenching, or excavation that creates a difference in elevation between travel lanes or between the travelway and the shoulder shall not begin until the Contractor is prepared and able to continuously place the required typical section to within two inches (2") of the existing pavement elevation. For any areas that the two inches minimum difference in elevation cannot be accomplished the section shall be healed as shown in Detail 150-E. If crushed stone materials are used to provide a healed section no separate payment will be made for the material used to heal any section. The Contractor may submit a plan to utilize existing pay items for crushed stone provided the plan clearly demonstrates that the materials used to heal an area will be incorporated into the work with minimal waste. Handling and hauling of any crushed stone used to heal shall be kept to a minimum. The Engineer shall determine if the crushed stone used to heal meets the specifications for gradation and quality when the material is placed in the final location.

A maximum of sixty (60) calendar days shall be allowed for conditions to exist that require any section or segment of the roadway or ramp to continue to require a healed section as described by Detail 150-E. Failure to meet this requirement shall be considered as non-performance of Work under Subsection 150.08.

When trenching or excavation for minor roadway or shoulder widening is required, all operations at one site shall be completed to the level of the existing pavement in the same work day.

Any channelization devices utilized in the work shall conform to the requirements of Subsection 150.05 and to the placement and spacing requirements in Details 150-B, 150-C, 150-D, and 150-E shown in this section.

Any construction activity that reduces the width of a travel lane shall require the use of a W-20 sign with the legend "LEFT/RIGHT LANE NARROWS". Two 24" x 24" red or red/orange flags may be mounted above the W-20 sign. The W-20 sign shall be located on the side of the travelway that has been reduced in width just off the travelway edge of pavement. The W-20 sign shall be a minimum of 500 feet in advance of any channelization devices that encroach on the surface of travelway. A portable changeable message sign may be used in lieu of the W-20 sign.

GENERAL/TIME RESTRICTIONS:

A. STONE BASES, SOIL AGGREGATE BASE AND SOIL BASES

1. All Highways

Differences in elevation of more than two inches between surfaces carrying or adjacent to traffic will not be allowed for more than a 24-hour period. A single length of excavated area that does not exceed 1000 feet in total length may be left open as a start up area for periods not to exceed 48 hours provided the Contractor can demonstrate the ability to continuously excavate and backfill in a proficient manner. Prior approval of the Engineer shall be obtained before any startup area may be allowed.

2. LIMITED ACCESS HIGHWAY RAMPS (INTERSTATES):

On projects that include ramp rehabilitation work, one ramp at a time may be excavated for the entire length of the ramp from the gore point of the ramp with the interstate mainline to the intersection with the crossing highway. This single ramp may remain excavated with a vertical difference in elevation greater than two (2") inches for a maximum of fourteen (14) calendar days with drums spaced at twenty (20') feet intervals as shown in Detail 150-B and a buffer space accepted under Section 150.06.F. After fourteen (14) calendar days the section shall be healed as required for all other highways. This area will be allowed in addition to the 1000 feet allowed for all other highways.

B. ASPHALT BASES, BINDERS AND TOPPINGS

1. DIFFERENCES IN ELEVATION BETWEEN THE SURFACES OF ADJACENT TRAVELWAYS

Travel lanes shall be paved with a plan that minimizes any difference in elevation between adjacent travel lanes. The following limitations will be required on all work:

a. Differences of two inches (2") or less may remain for a maximum period of fourteen (14) calendar days.

b. Differences of greater than two inches (2") shall be permitted for continuous operations only.

EMERGENCY SITUATIONS: Inclement weather, traffic accidents, and other events beyond the control of the Contractor may prevent the work from being completed as required above. The Contractor shall notify the Engineer in writing stating the conditions and reasons that have prevented the Contractor from complying with the time limitations. The Contractor shall also outline a plan detailing immediate steps to complete the work. Failure to correct these conditions on the first calendar day that conditions will allow corrective work shall be considered as non-performance of Work under Subsection 150.08.

2. Differences in Elevation Between Asphalt Travelway and Paved Shoulders

Differences in elevation between the asphalt travelway and asphalt paved shoulders shall not be allowed to exist beyond the maximum durations outlined below for the conditions shown in Details 150-B, 150-C, 150-D, and 150-E:

Detail 150-B conditions shall not be allowed for more than 24 hours. A single length that does not exceed 1000 feet in total length may be left open for periods not to exceed 48 hours provided the Contractor can demonstrate the ability to continuously pave in a proficient manner. Prior approval of the Engineer shall be obtained before any section is allowed to exceed 24 hours. Any other disturbed shoulder areas shall be healed as in Detail 150-E.

Detail 150-C conditions will not be allowed for more than 48 hours.

Detail 150-D conditions will not be allowed for more than 30 calendar days.

Detail 150-E conditions will not be allowed for more than 60 calendar days.

Failure to meet these requirements shall be considered as non-performance of Work under Subsection 150.08.

C. PORTLAND CEMENT CONCRETE

Work adjacent to a Portland Cement Concrete traveled way which involves the following types of base and shoulders shall be accomplished according to the time restrictions outlined for each type of base or shoulder. Traffic control devices shall be in accordance with Subsection 150.05.

1. Cement Stabilized Base

Work adjacent to the traveled way shall be healed as per Detail 150-E within forty-eight (48) hours after the seven (7) calendar day curing period is complete for each section placed. During the placement and curing period, traffic control shall be in accordance Detail 150-B.

2. Asphaltic Concrete Base

When an asphaltic concrete base is utilized in lieu of a cement stabilized base the asphaltic concrete base shall be healed as per Detail 150-E within forty-eight (48) hours after the placement of each section of asphaltic concrete base. For the first forty eight hours traffic control shall be in compliance with Detail 150-B.

3. Concrete Paved Shoulders

Concrete paved shoulders shall be placed within sixty (60) calendar days after the removal of each section of existing shoulder regardless of the type of base materials being placed on the shoulders. During the placement period, traffic control devices shall be in accordance with the appropriate detail based on the depth of the change in elevation. Differences in elevation of more than two inches between the travel way and the shoulder will not be allowed for more than a 24-hour period. A single length of excavated area that does not exceed 1000 feet in total length may be left open as a start up area for periods not to exceed 48 hours provided the Contractor can demonstrate the ability to continuously excavate and backfill in a proficient manner. Prior approval of the Engineer shall be obtained before any startup area may be allowed. Any other disturbed shoulder areas shall be healed as in Detail 150-E.

4. Asphaltic Concrete Shoulders

A difference in elevation that meets the requirements of Detail 150-B shall not be allowed to exist for a period greater than forty-eight (48) hours. After the removal of the existing shoulder the section or segment of travelway may be healed with stone as per Detail 150-E for a maximum of fourteen (14) calendar days. Asphaltic concrete shoulders shall be placed within two (2") inches or less of the traveled way surface within fourteen (14) calendar days after the removal of the stone healed section or the removal of each section of the existing shoulder. The two (2") inches or less difference in elevation shall not remain in existence for a period that exceeds thirty (30) calendar days unless the paved shoulder is utilized as a detour for the traveled way. During the placement period, traffic control shall be in accordance with the appropriate detail based on the depth of the change in elevation.

The Contractor may propose an alternate plan based on Subsection 150.06.F. Failure to meet the above requirements and time restrictions shall be considered as non-performance of Work under Subsection 150.08.

D. MISCELLANEOUS ELEVATION DIFFERENTIALS FOR EXCAVATIONS ADJACENT TO THE TRAVELWAY

Drainage structures, utility facilities, or any other work which results in a difference in elevation adjacent to the travelway shall be planned and coordinated to be performed in such a manner to minimize the time traffic is exposed to this condition. The excavation should be back filled to the minimum requirements of Detail 150-E as soon as practical. Stage construction such as plating or backfilling the incomplete work may be required. The difference in elevation shall not be allowed to exist for more than five (5) calendar days under

any circumstances. Failure to correct this condition shall be considered as non-performance of Work under Subsection 150.08.

E. CONDUIT INSTALLATION IN PAVED AND DIRT SHOULDERS

The installation of conduit and conduit systems along the shoulders of a traveled way shall be planned and installed in a manner to minimize the length of time that traffic is exposed to a difference in elevation condition. The following restrictions and limitations shall apply:

1. **Differences in Elevation of Two (2") Inches or Less**
   The shoulder may remain open when workers are not present. When workers are present the shoulder shall be closed and the channelization devices shall meet the requirements of Subsection 150.05. The difference in elevation on the shoulder shall remain for a maximum period of fourteen (14) calendar days.

2. **Differences in Elevation Greater Than Two (2") Inches**
   The shoulder shall be closed. The shoulder closure shall not exceed twenty-four (24) hours in duration unless the Special Conditions in Subsection 150.11 modifies this restriction or the Engineer allows the work to be considered as a continuous operation.

   Failure to meet these requirements shall be considered as non-performance of Work under Subsection 150.08.

F. MODIFICATIONS TO TIME RESTRICTIONS

The Contractor may propose any alternate temporary traffic control plan that utilizes a portion of the travel lane as a "buffer space". This buffer space may allow for an enhanced work area that will allow for the placement of materials to proceed at a pace that could not be achieved with the time restriction requirements outlined in Section 150.06.A, 150.06.B, and 150.06.C. The Contractor may propose modified time restrictions based on the use of the buffer space. Any proposed modifications in the time duration allowed for the differences in elevations to exist shall be reviewed by the Engineer as a component of the overall TTC plan. No modifications shall be made until the proposed plan is accepted by the Engineer. The Engineer shall have no obligation to consider any proposal which results in an increase in cost to the Department.

For the travel lane described in each of the details 150-B, 150-C, 150-D and 150-E it is presumed that the pavement marking edgeline (yellow or white solid stripe) is located at the very edge of the travel lane surface. A buffer space (temporary paved shoulder) that utilizes a portion of the travel lane should be six (6') feet in width desirable but shall not be less than four (4') feet in width. Any remaining travel lane(s) shall not be less than ten (10') feet in width. Modifications to drum spacing shown in the details above will not be allowed.

If the proposed shifting of the traffic to obtain a buffer space and maintain a minimum travel lane(s) of ten (10') feet requires the use of any existing paved shoulders then the cost of maintenance and repair of the existing paved shoulder(s) shall be the responsibility of the Contractor. The Contractor is responsible for the costs of maintenance and repairs even if the existing paved shoulder(s) is to be removed in a later stage of the work. Existing shoulders that have rumble strips shall have the rumble strips removed before the shoulder can be utilized as part of the travel lane. The cost of the removal of the rumble strips shall be done at no cost to the Department even if the shoulder is to be removed in a later stage of the work.

Any modifications to the staging and time restrictions that are approved as part of the TTC plan shall be agreed to in writing. Failure to meet these modifications shall be considered as non-performance of the Work under Subsection 150.08.

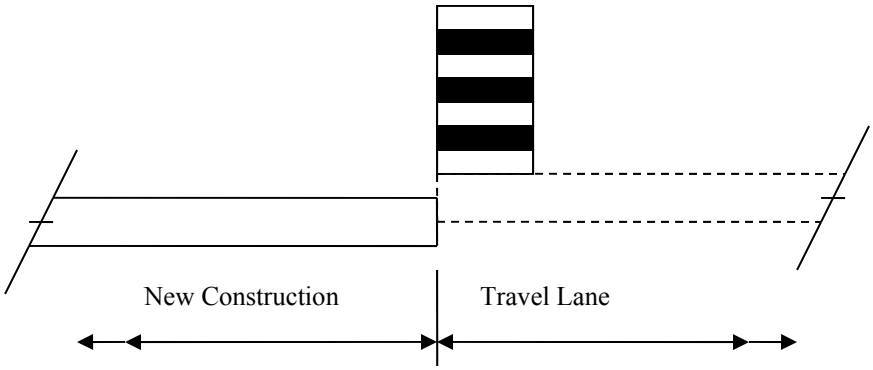
G. ASPHALTIC CONCRETE RESURFACING PROJECTS

SHOULDER CONSTRUCTION INCLUDED AS A PART OF THE CONTRACT: When the placement of asphaltic concrete materials creates a difference in elevation greater than two (2") inches between the earth shoulder (grassed or un-grassed) and the edge of travelway or between the earth shoulder and a paved shoulder that is less than four (4') feet in width, the Contractor shall place and maintain drums in accordance with the requirements of Subsection 150.05A.1.a.4). When the edge of the paved surface is tapered with a 30-45 degree wedge, drums may be spaced at 2.0 times the speed limit in MPH. Drums shall remain in place and be maintained until the difference in elevation has been eliminated by the placement of the appropriate shoulder materials.

SHOULDER CONSTRUCTION NOT INCLUDED AS A PART OF THE CONTRACT: When the placement of asphaltic concrete materials creates a difference in elevation greater than two (2") inches between the earth shoulder (grassed or un-grassed) and the edge of travelway or between the earth shoulder and a paved shoulder that is less than four (4') feet in width, the Contractor shall notify the Engineer, in writing, when the resurfacing work including all punchlist items has been completed.

See Subsection 150.03.L for the requirements for "LOW/SOFT SHOULDERS" and "SHOULDER DROP-OFF" signage.

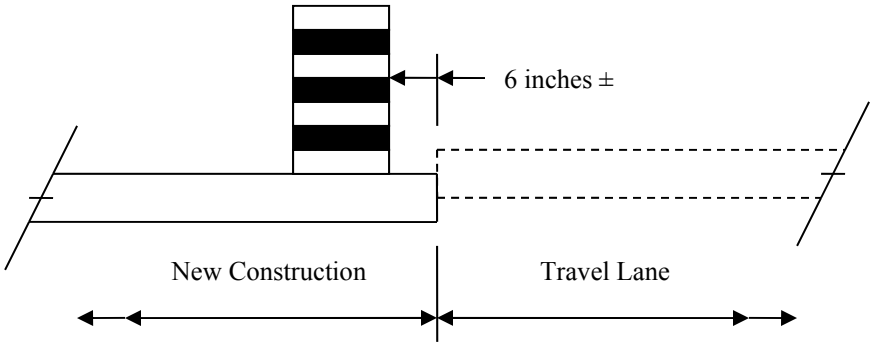
Location of drums when Elevation Difference exceeds 4 inches. Drums spaced at 20 foot intervals. **Note**: If the travel way width is reduced to less than 10 feet by the use of drums, vertical panels shall be used in lieu of drums.	



ELEVATION DIFFERENCE GREATER THAN 4 INCHES

DETAIL 150-B

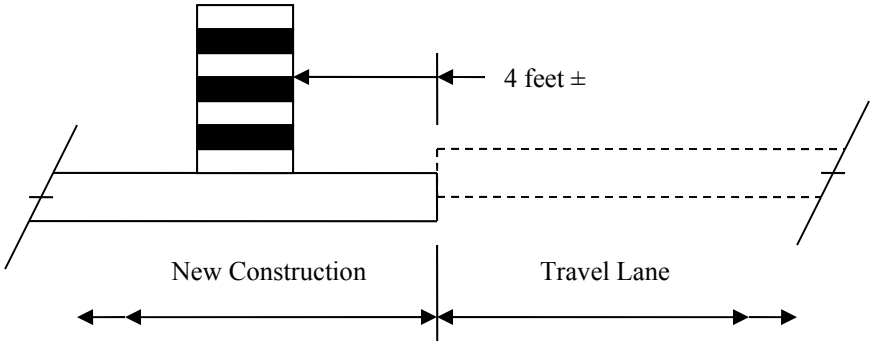
Drums spaced at 40 foot intervals.	Location of drums when Elevation Difference is 2+ inches to 4 inches.



ELEVATION DIFFERENCE 2+ to 4 inches

DETAIL 150-C

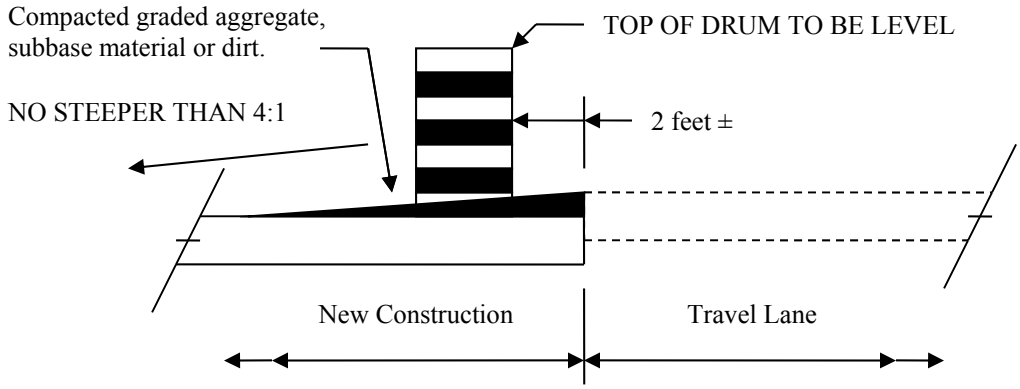
Drums spaced at 80 foot intervals.	Location of drums when Elevation Difference is 2 inches or less.



ELEVATION DIFFERENCE OF 2 INCHES OR LESS

DETAIL 150-D

	Location of drums immediately after completion of healed sections spaced at 40 foot intervals.



HEALED SECTION

DETAIL 150-E

150.07 FLAGGING AND PILOT CARS:

A. FLAGGERS

Flaggers shall be provided as required to handle traffic, as specified in the Plans or Special Provisions, and as required by the Engineer.

B. FLAGGER CERTIFICATION

All flaggers shall meet the requirements of the MUTCD and shall have received training and a certificate upon completion of the training from one of the following organizations:

National Safety Council
Southern Safety Services
Construction Safety Consultants
Ivey Consultants
American Traffic Safety Services Association (ATSSA)

Certifications from other agencies will be accepted only if their training program has been approved by any one of the organizations listed above.

Failure to provide certified flaggers as required above shall be reason for the Engineer suspending work involving the flagger(s) until the Contractor provides the certified flagger(s). Flaggers shall have proof of certification and valid identification (photo I.D.) available any time they are performing flagger duties.

C. FLAGGER APPEARANCE AND EQUIPMENT

Flaggers shall wear high-visibility clothing in compliance with Subsection 150.01.A. The apparel background (outer) material color shall be fluorescent orange-red, fluorescent yellow-green, or a combination of the two as defined in the ANSI standard. The retroreflective material shall be orange, yellow, white, silver, yellow-green, or a fluorescent version of these colors, and shall be visible at a minimum distance of one thousand (1000) feet. The retroreflective safety apparel shall be designed to clearly identify the wearer as a person. They shall use a Stop/Slow paddle meeting the requirements of the MUTCD for controlling traffic. The Stop/Slow paddles shall have a shaft length of seven (7) feet minimum. The Stop/Slow paddle shall be retro-reflectorized for both day and night usage. In addition to the Stop/Slow paddle, a flagger may use a flag as an additional device to attract attention. This flag shall meet the minimum requirements of the MUTCD. The flag shall, as a minimum, be 24" inches square and red or red/orange in color. For night work, the vest shall have reflectorized stripes which meet the requirements of the MUTCD.

D. FLAGGER WARNING SIGNS

Signs for flagger traffic control shall be placed in advance of the flagging operation in accordance with the MUTCD. In addition to the signs required by the MUTCD, signs at regular intervals, warning of the presence of the flagger shall be placed beyond

the point where traffic can reasonably be expected to stop under the most severe conditions for that day's work.

E. PILOT VEHICLE REQUIREMENTS

Pilot vehicles will be required during placement of bituminous surface treatment or asphaltic concrete on two-lane roadways unless otherwise specified. Pilot vehicles shall meet the requirements of the MUTCD.

F. PORTABLE TEMPORARY TRAFFIC CONTROL SIGNALS

The Contractor may request, in writing, the substitution of portable temporary traffic control signals for flaggers on two-lane two-way roadways provided the temporary signals meets the requirements of the MUTCD, Section 647, and Subsection 150.02.A.8. As a part of this request, the Contractor shall also submit an alternate temporary traffic control plan in the event of a failure of the signals. Any alternate plan that requires the use of flaggers shall include the use of certified flaggers. The Contractor shall obtain the approval of the Engineer before the use of any portable temporary traffic control signals will be permitted.

150.08 ENFORCEMENT

The safe passage of pedestrians and traffic through and around the temporary traffic control zone, while minimizing confusion and disruption to traffic flow, shall have priority over all other Contractor activities. Continued failure of the Contractor to comply with the requirements of Section 150 (TRAFFIC CONTROL) will result in non-refundable deductions of monies from the Contract as shown in this Subsection for non-performance of Work.

Failure of the Contractor to comply with this Specification shall be reason for the Engineer suspending all other work on the Project, except erosion control and traffic control, taking corrective action as specified in Subsection 105.15, and/or withholding payment of monies due to the Contractor for any work on the Project until traffic control deficiencies are corrected. These other actions shall be in addition to the deductions for non-performance of traffic control.

SCHEDULE OF DEDUCTIONS FOR EACH CALENDAR DAY OF DEFICIENCIES OF TRAFFIC CONTROL INSTALLATION AND/OR MAINTENANCE		
ORIGINAL TOTAL CONTRACT AMOUNT		
From More Than	**To and Including**	**Daily Charge**
$0	$100,000	$200
$100,000	$1,000,000	$500
$1,000,000	$5,000,000	$1,000
$5,000,000	$20,000,000	$1,500
$20,000,000	$40,000,000	$2,000
$40,000,000	$----------	$3,000

150.09 MEASUREMENT

A. TRAFFIC CONTROL

When listed as a pay item in the Proposal, payment will be made at the Lump Sum price bid, which will include all traffic control not paid for separately, and will be paid as follows:

When the first Construction Report is submitted, a payment of 25 (twenty-five) percent of the Lump Sum price will be made. For each progress payment thereafter, the total of the Project percent complete shown on the last pay statement plus 25 (twenty-five) percent will be paid (less previous payments), not to exceed one hundred (100) percent.

When no payment item for *Traffic Control-Lump Sum* is shown in the Proposal, all of the requirements of Section 150 and the Temporary Traffic Control Plan shall be in full force and effect. The cost of complying with these requirements will not be paid for separately, but shall be included in the overall bid submittal.

B. SIGNS

When shown as a pay item in the contract, interim special guide signs will be paid for as listed below. All other regulatory, warning, and guide signs, as required by the Contract, will be paid for under Traffic Control Lump Sum or included in the overall bid submitted.

1. Interim ground mounted or interim overhead special guide signs will be measured for payment by the square foot. This payment shall be full compensation for furnishing the signs, including supports as required, erecting,

illuminating overhead signs, maintaining, removing, re-erecting, and final removal from the Project. Payment will be made only one time regardless of the number of moves required.

2. Remove and reset existing special guide signs, ground mount or overhead, complete, in place, will be measured for payment per each. Payment will be made only one time regardless of the number of moves required.

3. Modify special guide signs, ground mount or overhead, will be measured for payment by the square foot. The area measured shall include only that portion of the sign modified. Payment shall include materials, removal from posts or supports when necessary, and remounting as required.

C. TEMPORARY BARRIER

Temporary Barrier shall be measured as specified in Sections 622.

D. CHANGEABLE MESSAGE SIGN, PORTABLE

Changeable Message Sign, Portable will be measured as specified in Section 632.

E. TEMPORARY GUARDRAIL ANCHORAGE, Type 12

Temporary Guardrail Anchorage- Type 12 will be measured by each assembly, complete in place and accepted according to the details shown in the plans, which shall also include the additional guardrail and appurtenances necessary for transition and connection to Temporary Concrete Barrier. Payment shall include all necessary materials, equipment, labor, site preparation, maintenance and removal.

F. TRAFFIC SIGNAL INSTALLATION- TEMPORARY

Traffic Signal Installation- Temporary will be measured as specified in Section 647.

G. FLASHING BEACON ASSEMBLY

Flashing Beacon Assemblies will be measured as specified in Section 647.

H. PORTABLE IMPACT ATTENUATORS

Each Portable Impact Attenuator will be measured by the unit/array which shall include all material components, hardware, incidentals, labor, site preparation, and maintenance, including spare parts recommended by the manufacturer for repairing accident damage. Each unit will be measured only once regardless of the number of locations installed, moves required, or number of repairs necessary because of traffic damage. Upon completion of the project, the units shall be removed and retained by the Contractor.

I. PAVEMENT MARKINGS

Pavement markings will be measured as specified in Section 150.

J. TEMPORARY WALKWAYS WITH DETECTABLE EDGING

Temporary walkways with detectable edging will be measured in linear feet (meters), complete in place and accepted, which shall include all necessary materials, equipment, labor, site preparation, temporary pipes, passing spaces, maintenance and removal. Excavation and backfill are not measured separately for payment. No payment will be made for temporary walkways where existing pavements or existing edging (that meets the requirements of MUTCD) are utilized for the temporary walkway. Payment for temporary detectable edging, including approved barriers and channelizing devices, installed on existing pavement shall be included in Traffic Control-Lump Sum.

K. TEMPORARY CURB CUT WHEELCHAIR RAMPS

Temporary curb cut wheelchair ramps are measured as the actual number formed and poured, complete and accepted, which shall include all necessary materials, equipment, labor, site preparation, maintenance and removal. No additional payment will be made for sawing existing sidewalk and removal and disposal of removed material for temporary wheelchair ramp construction. No additional payment will be made for constructing the detectable warning surface.

L. TEMPORARY AUDIBLE INFORMATION DEVICE

Temporary audible information devices are measured as the actual number furnished and installed in accordance with the manufacturer's recommendations, which shall include all necessary materials, equipment, labor, site preparation, maintenance and removal. Each temporary audible information device will be paid for only one time regardless of the number of times it's reused during the duration of The Work. These devices shall remain the property of the Contractor.

150.10 PAYMENT:

When shown in the Schedule of Items in the Proposal, the following items will be paid for separately.

Item No. 150. Traffic Control	Lump Sum
Item No. 150. Traffic Control, Solid Traffic Stripe _ Inch, (Color)....	per Linear Mile
Item No. 150. Traffic Control, Skip Traffic Stripe _ Inch, (Color)	per Linear mile
Item No. 150. Traffic Control, Solid Traffic Stripe, Thermoplastic ____ Inch, (Color)	per Linear Mile
Item No. 150. Traffic Control, Skip Traffic Stripe, Thermoplastic _____ Inch, (Color)	per Linear Mile
Item No. 150. Traffic Control, Pavement Arrow with Raised Reflectors	per Each
Item No. 150. Traffic Control, Raised Pavement Markers-All Types.	per Each

Item No. 150. Interim Ground Mounted Special Guide Signs ..... per Square Foot

Item No. 150. Interim Overhead Special Guide Signs ..... per Square Foot

Item No. 150. Remove & Reset Existing Special Guide Signs, Ground Mount, Complete in Place ..... per Each

Item No. 150. Remove & Reset, Existing Special Guide Signs, Overhead, Complete in Place ..... per Each

Item No. 150. Traffic Control, Portable Impact Attenuator..... per Each

Item No. 150. Traffic Control, Pavement Markers, Words and Symbols ..... per Square Foot

Item No. 150. Traffic Control, Pavement Arrow (Painted) with Raised Reflectors ..... per Each

Item No. 150. Traffic Control, Workzone Law Enforcement..... per Hour

Item No. 150. Modify Special Guide Sign, Ground Mount..... per Square Foot

Item No. 150. Modify Special Guide Sign, Overhead..... per Square Foot

Item No. 150. Temporary Walkways With Detectable Edging..... per Linear foot

Item No. 150. Temporary Curb Cut Wheelchair Ramps..... per Each

Item No. 150. Temporary Audible Information Device..... per Each

Item No. 620. Temporary Barrier..... per Linear Foot

Item No. 632. Changeable Message Sign, Portable ..... per Each

Item No. 641. Temporary Guardrail Anchorage, Type 12 ..... per Each

Item No. 647. Traffic Signal Installation, Temp ..... Lump Sum

Item No. 647. Flashing Beacon Assembly, Structure Mounted ..... per Each

Item No. 647. Flashing Beacon Assembly, Cable Supported ..... per Each

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

Section 153 – Field Engineer's Office

Delete Subsection 153.3.05.C.13 and substitute the following:

13. Provide one Mobile Broadband Router and Accessories:

a. **Hardware:**
CradlePoint MBR 1200B Mobile Broadband Router or equal approved by GDOT IT Infrastructure

b. **Accessories**
Modem Security Enclosure for CradlePoint MBR 1200B Mobile Broadband Router or equal approved by GDOT IT Infrastructure

c. **Printers:**

HP Officejet Pro 8600 All-in-One Printer, Fax, Scanner, Copier or approved equal approved by GDOT IT Infrastructure , connected so that all functions including fax capability are active. Furnish all consumable and non-consumable supplies for the life of the Project.

d. **Uninterruptible Power Supply:**

American Power Conversion Corporation Back-UPS 750 or Newpoint 750 VA Battery Backup or Equal approved by GDOT IT Infrastructure (minimum 5 Receptacles)

e. **Cable, 4G/LTE Broadband, or DSL Internet Service**

Provide Cable, 4G/LTE Broadband, or DSL Internet Service with static IP address as approved by GDOT IT Infrastructure. If Cable or 4G/LTE Internet Service is used, the third telephone line shall be used for the fax mode of the printer. 4G/LTE modem must be compatible with Mobile Broadband Router.

Revised November 8, 2005
Revised November 7, 2006
Revised July 15, 2008

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

Section 161—Control of Soil Erosion and Sedimentation

Add the following:

161.1 General Description

This Work includes using control measures shown on the Plans, ordered by the Engineer, or as required during the life of the Contract to control soil erosion and sedimentation through the use of any of the devices or methods referred to in this Section.

161.1.01 Definitions

Certified Personnel— certified personnel are defined as persons who have successfully completed the Level IA certification course approved by the Georgia Soil and Water Conservation Commission. For Department projects the certified person must also have successfully completed the Department's WECS certification course.

Design Professional as defined in the current GAR100002 NPDES permit.

161.1.02 Related References

A. Standard Specifications

Section 105—Control of Work

Section 106—Control of Materials

Section 107—Legal Regulations and Responsibility to the Public

Section 109—Measurement and Payment

Section 160—Reclamation of Material Pits and Waste Areas

Section 162—Erosion Control Check Dams

Section 163—Miscellaneous Erosion Control Items

Section 166—Restoration or Alteration of Lakes and Ponds

Section 170—Silt Retention Barrier

Section 171—Temporary Silt Fence

Section 205—Roadway Excavation

Section 434—Sand Asphalt Paved Ditches

Section 441—Miscellaneous Concrete

Section 603—Rip Rap

Section 700—Grassing

Section 710—Permanent Soil Reinforcing Mat

Section 715—Bituminous Treated Roving

Section 716—Erosion Control Mats (Blankets)

Erosion control measures contained in the Specifications include:

Erosion Control Measure	Section
Temporary Check Dams	163.3.05.J
Bituminous Treated Mulch	700.3.05.G
Concrete Paved Ditches	441
Bituminous Treated Roving	715
Erosion Control Mats (Blankets)	716
Erosion Control Check Dams	162
Grassing	700
Maintenance of Temporary Erosion Control Devices	165
Permanent Soil Reinforcing Mat	710
Reclamation of Material Pits and Waste Areas	160
Rip Rap	603
Restoration or Alteration of Lakes and Ponds	166
Sand-Asphalt Ditch Paving	434
Sediment Basin	163.3.05.C
Silt Control Gate	163.3.05.A
Silt Retention Barrier	170
Sod	700.3.05.H & 700.3.05.I
Mulch	163
Temporary Grassing	163.3.05.F
Temporary Silt Fence	171
Temporary Slope Drains	163.3.05.B
Triangular Sediment Barrier	720
Silt Filter Bag	719
Organic & Synthetic Material Fiber Blanket	713

B. Referenced Documents

Erosion and Sedimentation Pollution Control Plans (ESPCP)

161.1.03 Submittals

A. Status of Erosion Control Devices

The Worksite Erosion Control Supervisor (WECS) or certified personnel will inspect the installation and maintenance of the Erosion Control Devices according to Subsection 167.3.05.B and the ESPCP.

1. Submit all reports to the Engineer within 24 hours of the inspection. Refer to Subsection 167.3.05.C for report requirements.

2. The Engineer will review the reports and inspect the Project for compliance and concurrence with the submitted reports.
3. The Engineer will notify the WECS or certified personnel of any additional items that should be added to the reports.
4. Items listed in the report requiring maintenance or correction shall be completed within 72 hours.

B. Erosion and Sedimentation Pollution Control Plan

1. Project Plans

   An erosion and sedimentation pollution control plan (ESPCP) for the construction of the project will be provided by the Department. The ESPCP will be prepared for the various stages of construction necessary to complete the project.

   If the Contractor elects to alter the stage construction from that shown in the plans, it will be the responsibility of the Contractor to have the plans revised and prepared in accordance with the current GAR100002 NPDES permit by a Design Professional to reflect all changes in Staging. This will also include any revisions to erosion and sedimentation control item quantities. If the changes affect the Comprehensive Monitoring Program (CMP), the Contractor will be responsible for any revisions to the CMP as well. Submit revised plans and quantities to the Engineer for review prior to land disturbing activities.

2. Haul Roads, Borrow Pits, Excess Material Pits, etc.

   The Contractor is responsible for preparing erosion and sedimentation control plans for construction access roads and or haul roads borrow pits, excess material pits, etc (inside the Right of Way). Prepare these plans for all stages of construction and include the appropriate items and quantities. Submit these plans to the Engineer for review prior to land disturbing activities. These plans are to be prepared by a Design Professional.

   If construction of access roads, haul roads, borrow pits, excess material pits, etc., (inside the Right of Way) encroach within the 25 foot (7.6 m) buffer along the banks of all state waters or within the 50 ft. (15 m) buffer along the banks of any state waters classified as a “trout stream”, a state water buffer variance must be obtained by the Contractor prior to beginning any land disturbing activity in the stream buffer.

3. Erosion Control for Borrow and Excess Material Pits Outside the Right-of-Way

   Erosion control for borrow pits and excess material pits outside the right of way is the responsibility of the Contractor. If borrow or excess material pits require coverage under the National Pollutant Discharge Elimination System permit (NPDES) or other permits or variances are required, submit a copy of all documentation required by the permitting agency to the Engineer. All costs associated with complying with local, state, and federal laws and regulations are the responsibility of the Contractor.

4. Culverts and Pipes

   The ESPCP does not contain approved methods to construct a stream diversion or stream diversion channel. The Contractor shall prepare a diversion plan utilizing a Design Professional as defined in the current NPDES permit. See 161.3.05 G for additional information.

5. Temporary Asphalt or Concrete Batch Plants

   In addition to the requirements of any applicable specifications, if the Department authorizes the temporary installation and use of any asphalt, concrete or similar batch plants within its right of way, the contractor shall submit an NOI to the Georgia Environmental Protection Division for coverage under the following NPDES permits; The Infrastructure permit for the construction of the plant, and the Industrial permit for the operation of, such a plant. The contractor shall submit the NOIs as both the Owner and the Operator.

161.2 Materials

General Provisions 101 through 150.

161.2.01 Delivery, Storage, and Handling

General Provisions 101 through 150.

161.3 Construction Requirements

161.3.01 Personnel

A. Duties of the Worksite Erosion Control Supervisor

Before beginning Work, designate a Worksite Erosion Control Supervisor (WECS) to initiate, install, maintain, inspect, and report the condition of all erosion control devices as described in Sections 160 through 171 or in the Contract and ESPCP documents. The designee shall submit their qualifications on the Department provided resume form for consideration and approval. The contractor may utilize additional persons having WECS qualifications to facilitate compliance however, only one WECS shall be designated at a time.

The WECS and alternates shall:

- Be an employee of the Prime Contractor.
- Have at least one year of experience in erosion and sediment control, including the installation, inspection, maintenance and reporting of BMPs.
- Successfully completed the Georgia Soil and Water Conservation Commission Certification Course Level IA and the Department's WECS Certification Course.
- Provide phone numbers where the WECS can be located 24 hours a day.

The WECS' duties include the following:

1. Be available or have an approved representative available 24 hours a day and have access to the equipment, personnel, and materials needed to maintain erosion control and flooding control.
2. Inform the Engineer in writing whenever the alternate WECS assumes project responsibilities.
3. Ensure that erosion control deficiencies are corrected within seventy two (72) hours or immediately during emergencies. Deficiencies that interfere with traffic flow, safety or downstream turbidity are to be corrected immediately.
4. During heavy rain, have the construction area patrolled day or night, any day of the week to quickly detect and correct erosion or flooding problems before they interfere with traffic flow, safety, or downstream turbidity.
5. Be on the site within three (3) hours after receiving notification of an emergency prepared to positively respond to the conditions encountered. The Department may handle emergencies without notifying the Contractor. The Department will recover costs for emergency maintenance work according to Subsection 105.15, "Failure to Maintain Roadway or Structures."
6. Maintain and submit for project record, "As-built" Erosion and Sedimentation Control Plans that supplement and graphically depict EC-1 reported additions and deletions of BMPs. The As-Built plans are to be accessed and retained at a Department facility at all times.
7. Ensure that both the WECS and the alternate meet the criteria of this Subsection.
8. The WECS shall maintain a current certification card for the duration of the project. Recertification of the WECS will be required prior to the expiration date shown on the Certification card in order to remain as Certified Personnel and the WECS for the project.

Failure of the WECS or alternate to perform the duties specified in the Contract, or whose performance, has resulted in a citation being received from a State or Federal Regulatory Agency, e.g. the Georgia Environmental Protection Division, shall result in one or more of the following;

- Suspension of the WECS' certification for a period of not less than 30 days
- Removal of the Contractor's project superintendent in accordance with Sections 105.05 and 108.05 for a period not less than 14 days
- Department wide revocation of the WECS certification for a period of 12 months
- Removal of the Contractor's project superintendent in accordance with Sections 105.05 and 108.05

161.3.02 Equipment

General Provisions 101 through 150.

161.3.03 Preparation

General Provisions 101 through 150.

161.3.04 Fabrication

General Provisions 101 through 150.

161.3.05 Construction

Coordinate the temporary and permanent erosion control provisions in this Specification with the permanent erosion control provisions in the Contract to ensure economical, effective, and continuous erosion control throughout the construction and post-construction periods.

At all times that land disturbing activity is underway, a person meeting the requirements of, "certified person" by the GSWCC (Level IA) must be on the project.

A. Control Dust Pollution

The contractor shall keep dust pollution to a minimum during any of the activities performed on the project. It may be necessary to apply water or other BMPs to roadways or other areas reduce pollution.

B. Perform Permanent or Temporary Grassing

Perform permanent grassing, temporary grassing, or mulching on cut and fill slopes weekly (unless a shorter period is required by Subsection 107.23) during grading operations. When conditions warrant, the Engineer may require more frequent intervals.

Under no circumstances shall the grading (height of cut) exceed the height operating range of the grassing equipment. It is extremely important to obtain a cover, whether it is mulch, temporary grass or permanent grass. Adequate mulch is a must.

When grading operations or other soil disturbing activities have stopped, perform grassing or erosion control as shown in the Plans, as shown in an approved Plan submitted by the Contractor, or as directed by the Engineer.

C. Seed and Mulch

Refer to Subsection 161.3.05.B, "Perform Permanent or Temporary Grassing".

D. Implement Permanent or Temporary Erosion Control

1. Silt fence shown along the perimeter, e.g. right of way, and sediment containment devices, e.g. sediment basins, shall be installed prior to or concurrently with clearing and grubbing operations.
2. Incorporate permanent erosion control features into the Project at the earliest practicable time, e.g. velocity dissipation, permanent ditch protection.
3. Use temporary erosion control measures to address conditions that develop during construction but were unforeseen during the design stage.
4. Use temporary erosion control measures when installation of permanent erosion control features cannot be accomplished.

The Engineer has the authority to:

- Limit the surface area of erodible earth material exposed by clearing and grubbing.
- Limit the surface area of erodible earth material exposed by excavation and borrow and fill operations.
- Limit the area of excavation, and embankment operations in progress to correspond with the Contractor's ability to keep the finish grading, mulching, seeding, and other permanent erosion control measures current.
- Direct the Contractor to provide immediate permanent or temporary erosion control to prevent contamination of adjacent streams or water courses, lakes, ponds, or other areas of water impoundment.

Such Work may include constructing items listed in the table in Subsection 161.1.02.A, "Related References" or other control devices or methods to control erosion.

E. Erodible Area

NOTE: Never allow the surface area of erodible earth material exposed at one time to exceed 17 acres (7 ha) except as approved by the State Construction Engineer.

The maximum of 17 acres (7 ha) of exposed erodible earth applies to the entire Project and to all of its combined operations as a whole, not to the exposed erodible earth of each individual operation.

Upon receipt of a written request from the contractor the State Construction Engineer, or his designee, will review; the request, any justifications and the Project conditions for waiver of the 17 acres (7 ha) limitation.

If the 17 acre limitation is increased by the State Construction Engineer, the WECS shall not be assigned to another project in that capacity and should remain on site each work day that the exposed acreage exceeds 17 acres.

After installing temporary erosion control devices, e.g., grassing, mulching, stabilizing an area, and having it approved by the Engineer, that area will be released from the 17 acres (7 ha) limit.

F. Perform Grading Operations

Perform the following grading operations:

1. Complete each roadway cut and embankment continuously, unless otherwise specified in the Contract or ordered by the Engineer.
2. Maintain the top of the earthwork in roadway sections throughout the construction stages to allow water to run off to the outer edges. .
3. Provide temporary slope drain facilities with inlets and velocity dissipaters (straw bales, silt fence, aprons, etc.) to carry the runoff water to the bottom of the slopes. Place drains at intervals to handle the accumulated water.
4. Continue temporary erosion control measures until permanent drainage facilities have been constructed, pavement placed, and the grass on planted slopes stabilized to deter erosion.

G. Perform Construction in Rivers and Streams

Perform construction in river and stream beds as follows:

1. Unless otherwise agreed to in writing by the Engineer, restrict construction operations in rivers, streams, and impoundments to:
    - Areas where channel changes or access for construction are shown on the Plans to construct temporary or permanent structures.
2. If channel changes or diversions are not shown on the Plans, the Contractor shall develop diversion plans prepared in accordance with the current GAR100002 NPDES Infrastructure Construction permit utilizing a design professional as defined within the permit. The Engineer will review prepared diversion plans for content only and accepts no responsibility for design errors or omissions. Amendments will be made part of the project plans by attachment. Include any associated costs in the price bid for the overall contract. Any contract time associated with the submittal or its review and subsequent response will not be considered for an extension of Contract time. All time associated with this subsection shall be considered incidental.
3. If additional access for construction or removal of work bridges, temporary roads/access or work platforms is necessary, and will require additional encroachment upon river or stream banks and bottoms, the contractor shall prepare a plan in accordance with the current GAR100002 NPDES Infrastructure Construction permit utilizing a design professional as defined within the permit. Plans should be submitted at least 12 weeks prior to the date the associated work is expected to begin. If necessary, the plan will be provided to the appropriate regulating authority, e.g. United States Army Corps of Engineers by the Department for consideration and approval. No work that impacts areas beyond what has been shown in the approved plans will be allowed to begin until written approval of the submitted plan has been provided by the Department. Approved plan amendments will be made part of the project plans by attachment. Include any associated costs in the price bid for the overall contract. Any contract time associated with the submittal or its review and subsequent response will not be considered for an extension of Contract time. All time associated with this subsection shall be considered incidental.
4. Clear rivers, streams, and impoundments of the following as soon as conditions permit:
    - Falsework
    - Piling that is to be removed
    - Debris
    - Other obstructions placed or caused by construction operations
5. Do not ford live streams with construction equipment.
6. Use temporary bridges or other structures that are adequate for a 25-year storm for stream crossings. Include costs in the price bid for the overall contract.
7. Do not operate mechanized equipment in live streams except to construct channel changes or temporary or permanent structures, and to remove temporary structures, unless otherwise approved in writing by the Engineer.

H. State Water Buffers and Environmental Restrictions

1 The WECS shall review the plans and contract documents for environmental restrictions, Environmentally Sensitive Areas (ESA), e.g. buffers, etc prior to performing land disturbing activities.

2. The WECS shall ensure all parties performing land disturbing activities within the project limits are aware of all environmental restrictions.

3. Buffer delineation shall be performed prior to clearing, or any other land disturbing activities. Site conditions may require temporary delineation measures are implemented prior to the installation of orange barrier/safety fencing. The means of temporary delineation shall have the Engineer's prior approval.

4. The WECS shall allow the Engineer to review the buffer delineation prior to performing any land disturbing activities, including but not limited to clearing, grubbing and thinning of vegetation. Any removal and relocation of buffer delineation based upon the Engineer's review will not be measured for separate payment.

5. The WECS shall advise the Engineer of any surface water(s) encountered that are not shown in the plans. The WECS shall prevent land disturbing activities from occurring within surface water buffers until the Engineer provides approval to proceed.

I. General Requirements

Projects that consist of asphalt resurfacing, shoulder reconstruction and/or shoulder widening; schedule and perform the construction of the project to comply with the following:

After temporary and permanent erosion control devices are installed and the area permanently stabilized (temporary or permanent) and approved by the Engineer, the area may be released from the 1 acre (0.4 ha) limit.

The maximum of 1 acre (0.4 ha) of erodible earth applies to the entire project and to all combined operations, including borrow and excess material operations that are within the right of way, not 1 acre (0.4 ha) of exposed erodible earth for each operation.

NOTE: Never allow the surface area of erodible earth material exposed at one time to exceed 1 acre (0.4 ha).

1. Do not allow the disturbed exposed erodible area to exceed 1 acres (0.4 ha). This 1 acre (0.4 ha) limit includes all disturbed areas relating to the construction of the project including but not limited to slope and shoulder construction.

2. At the end of each working day, permanently stabilize all of the area disturbed by slope and shoulder reconstruction to prevent any contamination of adjacent streams or other watercourses, lakes, ponds or other areas of water impoundment. For purposes of this Specification, the end of the working day is defined as when the construction operations cease. For example, 6:00 a.m. is the end of the working day on a project that allows work only between 9:00 p.m. and 6:00 a.m.)

3. Stabilize the cut and fill slopes and shoulder with permanent or temporary grassing and a Wood Fiber Blanket (Section 713,Type II). Mulching is not allowed. Borrow pits, soil disposal sites and haul roads will not require daily applications of wood fiber blanket. The application rate for the Wood Fiber Blanket on shoulder reconstruction is the rate specified for Shoulders. For shoulder reconstruction, the ground preparation requirements of Subsection 700.3.05.A.1 are waived. Preparation consists of scarifying the existing shoulders 4 to 6 in (100 to 150 mm) deep and leaving the area in a smooth uniform condition free from stones, lumps, roots or other material.

4. If a sudden rain event occurs that would not allow the Contractor to apply the Type II Wood Fiber Blanket per Section 713, install Wood Fiber Blanket Type I per Section 713 if directed by the Engineer. Wood Fiber Blanket Type I application is for emergency use only.

Install temporary grass or permanent grass according to seasonal limitations and Specifications. When temporary grass is used, use the overseeding method (Subsection 700.3.05.E.4) when planting permanent grass.

3. Remove and dispose of all material excavated for the trench widening operation at an approved soil disposal site by the end of each working day. When shoulder reconstruction is required, this material may be used to reconstruct the graded shoulder after all asphaltic concrete pavement has been placed.

4. Provide immediate permanent and/or temporary erosion control measures for borrow pits, soil disposal sites and haul roads to prevent any contamination of adjacent streams or other watercourses, lakes, ponds or other areas of water impoundment.

5. Place asphalt in the trench the same day as the excavation occurs. Place asphalt or concrete in driveways and side roads being re-graded the same day as the excavation occurs. Stabilize any disturbed or exposed soil that is not covered with asphalt with a Wood Fiber Blanket (and grass seed). Payment will be made for the Wood Fiber Blanket and grass seed only if the shoulder has been constructed to final dimensions and grade and no further grading will be required.

6. Do not allow the grading (height of cut or fill) to exceed the operating range of the grassing equipment.

7. When grading operations or other soil disturbing activities are suspended, regardless of the reason, promptly perform all necessary permanent stabilization and/or erosion control work.

8. Use temporary erosion control measures to:

To correct conditions that develop during construction but were unforeseen during the design stage.

To use as needed before installing permanent erosion control features.

To temporarily control erosion that develops during normal construction practices but are not associated with permanent control features on the Project.

9. When conditions warrant, such as unfavorable weather (rain event), the Engineer may require more frequent intervals for this work.

161.3.06 Quality Acceptance

Before Final Acceptance of the Work, clean drainage structures within the project limits, both existing and newly constructed, and ensure that they are functioning properly. Costs to accomplish this work are incidental and shall be included in the overall bid for the Contract.

161.3.07 Contractor Warranty and Maintenance

Maintain the erosion control features installed to:

- Contain erosion within the limits of the right-of-way
- Control storm water discharges from disturbed areas

Effectively install and maintain the erosion control features. Ensure these features contain the erosion and sediment within the limits of the rights of way and control the discharges of storm-water from disturbed areas to meet all local, state, and federal requirements on water quality.

If a construction Project has separate contractors, the Prime Contractor shall maintain the erosion control features at grading sites as acceptable to the Engineer until the Contract is accepted. If any erosion control devices are damaged by any contractor either by neglect, by construction methods, or any other reasons, including acts of nature, they shall be repaired within 24 hours by the Prime Contractor at no cost to the Department.

161.4 Measurement

Control of soil erosion and sedimentation is not measured separately for payment.

161.4.01 Limits

General Provisions 101 through 150.

161.5 Payment

When no pay item is shown in the Contract, the requirements of this Specification and the Erosion Control Plan shall be in full effect. The cost of complying with these requirements will not be paid for separately, but shall be included in the overall bid submitted with the exception of inspections performed by qualified personnel which will be included in Section 167.

When listed as a pay item in the Contract, payment will be made at the unit price bid for each particular item.

No payment will be made for erosion control outside the Right-of-Way or construction easements except as provided for by the Plans.

161.5.01 Enforcement and Adjustments

A. Failure to Provide a WECS

If a designated WECS is not maintained or if the Contractor does not comply with this Specification, cease activities except traffic control and erosion control work. Monies that are due or that may become due also may be withheld according to the Specifications

B. Failure to submit reports

A non-refundable deduction will be taken from the schedule below whenever the WECS fails to submit completed reports required by Subsection 167.3.05.C in accordance with the provisions of this specification.

C. Failure to Comply with Specifications

If the Contractor fails to comply with any of the requirements of this Specification, all activities shall cease immediately except traffic control and erosion control related work.

Monies that are currently due or that may become due shall be withheld according to the specifications. In addition, nonrefundable monies shall be deducted from the contract as shown in the Schedule of Deductions table below. These deductions are in addition to any actions taken in the above subsections. Deductions assessed for uncorrected deficiencies shall continue until all corrections are completed to the satisfaction of the Engineer.

D. Receipt of a Consent Order or Notice of Violation, etc

Regulatory enforcement actions will be resolved including at a minimum the following steps;

- The Department will perform an internal review of the alleged violations
- The Department will then meet with the Contractor to review and further determine responsibilities for the alleged violations
- The Department will then arrange to collectively meet with the regulatory agencies to negotiate resolutions and/or settlements.

The Department does not waive any rights of the Contractor to resolve such matters however, in the event that regulatory agency communication is addressed jointly to the Department and to the contractor, the Department reserves the right to coordinate all communications, e.g., written correspondence, and to schedule jointly attended meetings with Regulatory agencies such that timely and accurate responses are known to the Department.

Such Orders or Notices may result in the assessment of Deductions from the table below for each day the condition remains non-compliant following an agreed remedy.

Monetary penalties for which the contractor is obligated for as a result of regulatory enforcement may be withheld from future monies due the contractor.

Schedule of Deductions for Each Calendar Day of Erosion Control Deficiencies Initial Occurrence* Original Total Contract Amount		
From More Than	To and Including	Daily Charge
0	$100,000	$750
$100,000	$1,000,000	$1125
$1,000,000	$5,000,000	$2000
$5,000,000	$15,000,000	$3000
$15,000,000	-	$5000

*Continued non-compliance with the requirements of this specification may result in the doubling of the above tabulated Daily Charge.

Upon written request from the Contractor, the Engineer may allow, limited activities to concurrently proceed once significant portions of the corrective work have been completed. This authorization may be similarly rescinded if in the opinion of the Engineer corrective work is not being diligently pursued.

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SUPPLEMENTAL SPECIFICATION

Section 162—Erosion Control Check Dams

Delete Section 162 in its entirety.

Date: August 19, 2013
First Use Date: November 22, 2013

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

Special Provision

Section 163—Miscellaneous Erosion Control Items

Delete Subsection 163.2 and substitute the following:

163.2 Materials

Provide materials shown on the Plans, such as pipe, spillways, wood baffles, and other accessories including an anti-seep collar, when necessary. The materials shall remain the Contractor's property after removal, unless otherwise shown on the Plans.

Materials may be new or used; however, the Engineer shall approve previously used materials before use.

Materials shall meet the requirements of the following Specifications:

Material	Section
Mulch	893.2.02
Temporary Silt Fence	171
Concrete Aprons and Footings shall be Class A	500
Rip Rap	603
Temporary Grass	700
Triangular Silt Barrier	720
Lumber and Timber	860.2.01
Preservative Treatment of Timber Products	863.1
Corrugated Polyethylene Temporary Slope Drain Pipe	AASHTO M252 or M294

163.2.01 Delivery, Storage, and Handling

General Provisions 101 through 150.

Delete Subsection 163.4.M. and substitute the following:

M. Stone Filter Berms

Stone filter berms are measured for payment per linear foot (meter) required. This includes the entire structure at each location and all the work necessary for construction.

Delete Subsection 163.5.M. and substitute the following:

M. Stone Filter Berms

Stone filter berms are paid for per linear foot (meter). Payment is full compensation for all materials, construction, and removal for each. Clean reused stone Type 3 riprap and #57 stone are paid for on the same basis as new items. Plastic woven filter fabric is required under rock filter berms and is included in the price bid for linear foot (meter).

Revised: May 2, 2014
First Use: September 1, 2014

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SUPPLEMENTAL SPECIFICATION

Section 167—Water Quality Monitoring

Delete Section 167 and substitute the following:

167.1 General Description

This Specification establishes the Contractor's responsibility to meet the requirements of the National Pollutant Discharge Elimination System (NPDES) Infrastructure Permit No. GAR 100002 as it pertains to Part IV. Erosion, Sedimentation and Pollution Control Plan. In the case of differing requirements between this specification and the Permit, whichever is the more stringent requirement shall be adhered to.

167.1.01 Definitions

Certified Personnel— certified personnel are defined as persons who have successfully completed the appropriate certification course approved by the Georgia Soil and Water Conservation Commission. For Department projects the certified person must also have successfully completed the Department's WECS certification course.

Water Quality Sampling – as used within this specification, the term "monitoring" shall be inclusive of the acts of detecting, noting, discerning, observing, etc. for the purpose of gauging compliance with the NPDES General Permit GAR100002.

Qualifying Rainfall Sampling Event—as used within this specification, means that which is defined in the 2013 NPDES General Permit GAR1000002, Part IV.D.6.d(3).

167.1.02 Related References

A. Standard Specifications

Section 161—Control of Soil Erosion and Sedimentation

B. Referenced Documents

NPDES Infrastructure Permit No. GAR100002

GDOT WECS seminar.

Environmental Protection Divisions Rules and Regulations (Chapter 391-3-26) Georgia Soil and Water Conservation Commission

Certification Level IA course. OCGA 12-7

167.1.03 Submittals

General Provisions 101 through 150

167.2 Materials

General Provisions 101 through 150.

167.2.01 Delivery, Storage, and Handling

General Provisions 101 through 150.

167.3 Construction Requirements

167.3.01 Personnel

Use GASWCC level IA certified and WECS certified personnel to perform all monitoring, sampling, inspections, and rainfall data collection.

Use the Contractor-designated WECS or select a prequalified consultant from the Qualified Consultant List (QCL) to perform water quality monitoring, sampling, inspections, and rainfall data collection.

The Contractor is responsible for having a copy of the GAR100002 Permit onsite at all times.

167.3.02 Equipment

Provide equipment necessary to complete the Work or as directed.

167.3.03 Preparation

General Provisions 101 through 150.

167.3.04 Fabrication

General Provisions 101 through 150.

167.3.05 Construction

A. General

Perform inspections, rainfall data collection, testing of samples, and reporting the test results on the project according to the requirements in Part IV of the NPDES Infrastructure Permit and this Specification. Take samples manually or use automatic samplers, according to the GAR100002 Permit GAR100002. Note that GAR100002 requires the use of manual sampling or rising stage sampling for qualifying events that occur after the first instance of the automatic sampler not being activated during a qualifying event. Analyze all samples according to the Permit, regardless of the method used to collect the samples. If samples are analyzed in the field using portable turbidimeters, the monitoring results shall state they are being used and a digital readout of NTUs is what is provided. Submit bench sheets, work sheets, etc., when using portable turbidimeters. There are no exceptions to this requirement. Perform required inspections and submit all reports required by this Specification within the time frames specified. Failure to perform the inspections within the time specified will result in the cessation of all construction activities with the exception of traffic control and erosion control. Failure to submit the required reports within the times specified will result in non-refundable deductions as specified in Subsection 161.5.01.B.

B. Water Quality Inspections

The Department will provide one copy of the required inspection forms for use and duplication. Inspection forms may change during the contract to reflect regulatory agency needs or the need of the Department. Any costs associated with the change of inspection forms shall be considered incidental. Alternate formats of the

provided forms may be created, used and submitted by the Contractor provided the required content and/or data fields and verbatim certification statements from the Department's current forms are included.

The Engineer shall inspect the installation and condition of each erosion control device required by the erosion control plan within seven days after initial installation. This inspection is performed for each stage of construction when new devices are installed. The WECS shall ensure all installation deficiencies reported by the Engineer are corrected within two business days.

Ensure the inspections of the areas listed below are conducted by certified personnel and at the frequencies listed. Document all inspections on the appropriate form provided by the Department.

1. Daily (when any work is occurring):
   a. Petroleum product storage, usage and handling areas for spills or leaks from vehicles or equipment.
   b. All locations where vehicles enter/exit the site for evidence of off-site sediment tracking.

   Continue these inspections until a Notice of Termination (NOT) is submitted.and use the daily inspection forms.

2. Weekly and after Rainfall Events:

   Conduct inspections on these areas every seven calendar days and within twenty-four hours after the end of a rainfall event that is 0.5 in (13 mm) or greater (unless such storm ends after 5:00 PM on any Friday or any non-working Saturday, non-working Sunday or any non-working Federal holiday in which case the inspection shall be completed by the end of the next business day and/or working day, whichever occurs first):
   a. Disturbed areas not permanently stabilized
   b. Material storage areas that are exposed to precipitation
   c. Structural control measures, Best Management Practices (BMPs) to ensure they are operating correctly.
   d. Water quality sampling locations and equipment
   e. Discharge locations or points, e.g., outfalls and drainage structures that are accessible to determine if erosion control measures are effective in preventing significant impacts to receiving waters.

   Continue these inspections until all temporary BMPs are removed and a NOT is submitted and use the EC-1 Form.

3. Monthly:

   Once per month, inspect all areas where final stabilization has been completed. Look for evidence of sediments or pollutants entering the drainage system and or receiving waters. Inspect all permanent erosion control devices remaining in place to verify the maintenance status and that the devices are functioning properly. Inspect discharge locations or points, e.g. outfalls, drainage structures, that are accessible to determine if erosion control measures are effective in preventing significant impacts to receiving waters.

   Continue these inspections until the Notice of Termination is submitted and use the monthly inspection form.

C. Water Quality Sampling

When the sampling location is a receiving water, the upstream and downstream samples are taken for comparison of NTU values. When the sampling location is an outfall, a single sample is taken to be analyzed for its absolute NTU value.

D. Reports

1. Inspection Reports:

   Summarize the results of inspections noted above in writing on the appropriate Daily, Weekly, Monthly, or EC-1form provided by the Department and includes the following information:

   - Date(s) of inspection
   - Name of certified personnel performing inspection
   - Construction phase
   - Status of devices
   - Observations
   - Action taken in accordance with Part IV.D.4.a.(5) of the GAR100002 Permit
   - Signature of personnel performing the inspection
   - Any instance of non-compliance

When the report does not identify any non-compliance instances, the inspection report shall contain a statement that the best management practices are in compliance with the Erosion, Sedimentation and Pollution Control Plan. (See the EC-1 form.)

The reports shall be made and retained at the site or be readily available at a designated alternate location until the entire site or that portion of a construction project that has been phased has undergone final stabilization and a Notice of Termination is submitted to the Georgia Department of Natural Resources Environmental Protection Division (GAEPD). Such reports shall be readily available by the end of the second business day and/or working day and shall identify all incidents of best management practices that have not been properly installed and/or maintained as described in the Plan. The inspection form certification sheet shall be signed by the project WECS and the inspector performing inspections on behalf of the WECS (if not the same person). Submit all inspection reports to the Engineer within twenty-four hours of the inspection. The Engineer will review the submitted reports to determine their accuracy. The Engineer will notify the certified personnel of any additional items that should be added to the inspection report.

Correct any items listed in the inspection report requiring routine maintenance within seventy–two (72) hours of notification or immediately during perimeter BMP failure emergencies. Deficiencies that interfere with traffic flow, safety, or downstream turbidity are to be corrected immediately.

Assume responsibility for all costs associated with additional sampling as specified in Part IV.D.6.d.3.(c) of the NPDES GAR100002 Permit if either of these conditions arise:

- BMPs shown in the Plans are not properly installed and maintained, or
- BMPs designed by the Contractor are not properly designed, installed and maintained.

2. Sampling Reports

   a. All sampling shall be performed in accordance with the requirements of the GAR100002 Permit for the locations identified in the ESPCP approved by the Department.

   b. Report Requirements

Include in all reports, the following certification statement, signed by the WECS or consultant providing sampling on the project:

> "I certify under penalty of law that this report and all attachments were prepared under my direct supervision in accordance with a system designed to assure that certified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

When a rainfall event requires a sample to be taken, submit a report of the sampling results to the Engineer within seven working days of the date the sample was obtained. Include the following information in each report:

1) Date and time of sampling
2) Name of certified person(s) who performed the sampling and analyses.
3) Date the analyses were performed
4) Time the analyses were initiated
4) Rainfall amount on the sampling date (sampling date only)
5) NTU of each sample & analytical method
6) Location where each sample was taken (station number and left or right offset)
7) Identification of whether a sample is a receiving-water sample or an outfall sample
8) Project number and county
9) Whether the samples were taken by automatic sampler, rising-stage sampler, or manually (grab sample)
10) A clear note if a sample exceeds 1000 NTUs by writing "exceeds 1000 NTUs" prominently upon the report.

b. Report Requirements with No Qualifying Rainfall Events

In the event a qualifying rainfall event does not produce a discharge to sample, or sampling is "impossible", as defined in the GAR1000002 Permit, a written justification must be included in the report as required at Part IV.D.4.a.(6) of the GAR100002 Permit.

c. Sampling Results

Provide sampling results to the Project Engineer within 48 hours of the samples being analyzed. This notification may be verbal or written. This notification does not replace the requirement to submit the formal summary to the Engineer within 7 working days of the samples being collected. The Engineer will ensure submission of the sampling report to GAEPD by the 15th of the month following the sampling results as per the GAR100002 Permit. The WECS will be held accountable for delayed delivery to the Department which results in late submissions to EPD resulting in enforcement actions.

3. Rainfall Data Reports:

Record the measurement of rainfall once each twenty-four hour period, except for non-working Saturdays, non-working Sundays and non-working Federal Holidays until a Notice of Termination is submitted. Project rain gauges and those used to trigger the automatic samplers are to be emptied after every rainfall event. This will prevent a cumulative effect and prevent automatic samplers from taking samples even though the rainfall event is not a qualifying event. The daily rainfall data supplied by the WECS to the Engineer will be the official rainfall data for the project.

167.3.06 Quality Acceptance

General Provisions 101 through 150.

167.3.07 Contractor Warranty and Maintenance

General Provisions 101 through 150.

167.4 Measurement

Water Quality Inspections in accordance with the inspection and reports sub-sections will be measured for payment by the month up to the time the Contract Time expires. Required inspections and reports after Contract Time has expired will not be measured for payment unless a time extension is granted.

Water Quality Sampling is measured per each. “Each” means each qualifying rainfall sampling event, not each sampled site.

167.4.01 Limits

General Provisions 101 through 150. Submit the monitoring summary report to the Engineer within 7 working days

167.5 Payment

Payment for Water Quality Inspections and Water Quality Sampling will be made as follows:

Water Quality Inspections will be paid at the Contract Price per month. This is full compensation for performing the requirements of the inspection section of the NPDES Permit and this Specification, any and all necessary incidentals, and providing results of inspections to the Engineer, within the time frame required by the NPDES Infrastructure Permit, and this Specification.

Water Quality Monitoring and Sampling per each qualifying rainfall sampling event is full compensation for meeting the requirements of the monitoring sections of the NPDES Permit and this Specification, obtaining samples, analyzing samples, any and all necessary incidentals, and providing results of turbidity tests to the Engineer, within the time frame required by the NPDES Infrastructure Permit, and this Specification. This item is based on the rainfall events requiring sampling as described in Part IV.D. 6 of the Permit. The Department will not pay for samples taken and analyzed for rainfall events that are not qualifying events as compared to the daily rainfall data supplied by the WECS.

Payment will be made under:

Item No. 167	Water quality inspections	Per month

Water Quality Monitoring and Sampling will be paid per each qualifying rainfall sampling event.

Payment will be made under:

Item No. 167	Water quality monitoring and sampling	Per each

167.5.01 Adjustments

General Provisions 101 through 150.

Revised: March 18, 2013

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

Section 171—Silt Fence

Delete Section 171 and substitute the following:

171.1 General Description

This work includes furnishing, installing, and removing a water permeable filter fabric fence to remove suspended particles from drainage water.

171.1.01 Definitions

General Provisions 101 through 150.

171.1.02 Related References

A. Standard Specifications

Section 163—Miscellaneous Erosion Control Items

Section 700—Grassing

Section 862—Wood Posts and Bracing

Section 881—Fabrics

Section 894—Fencing

B. Referenced Documents

ASTM D 3786

ASTM D 4355

ASTM D 4632

ASTM D 4751

GDT 87

QPL 36

171.1.03 Submittals

General Provisions 101 through 150.

171.2 Materials

Materials shall meet the requirements of the following Specifications:

Material	Section
Filter Fabrics	881
Fencing	894
Wood Posts and Bracing	862

Conditions during Project construction will affect the quantity of the silt fence to be installed.

The Engineer may increase, decrease, or eliminate the quantity at his or her direction. Variations in quantity are not changes in details of construction or in the character of the work.

For Type A, B, and C fences, use fabric as specified in Subsection 881.2.07, "Silt Fence Filter Fabric."

171.2.01 Delivery, Storage, and Handling

During shipment and storage, wrap the fabric in a heavy-duty covering protecting the cloth from sunlight, mud, dust, dirt, and debris. Do not expose the fabric to temperatures greater than 140 °F (60 °C).

When installed, the Engineer will reject the fabric if it has defects, rips, holes, flaws, deterioration, or damage incurred during manufacture, transportation, or storage.

171.3 Construction Requirements

171.3.01 Personnel

General Provisions 101 through 150.

171.3.02 Equipment

General Provisions 101 through 150.

171.3.03 Preparation

General Provisions 101 through 150.

171.3.04 Fabrication

General Provisions 101 through 150.

171.3.05 Construction

Install the silt fence according to this Specification, as shown on the Plans, or as directed by the Engineer

A. Install Silt Fence

1. Install silt fence by either of the following methods:
   a. Excavated Trench Method
      Excavate a trench 4 to 6 in (100 to 150 mm) deep using equipment such as a trenching machine or motor grader. If equipment cannot be operated on the site, excavate the trench by hand.
   b. Soil Slicing Method
      Create a mechanical slice in the soil 8 to 12 in (200 to 300 mm) deep to receive the silt fence. Ensure the width of the slice is not more than 3 in (75 mm). Mechanically insert the silt fence fabric into the slice in a simultaneous operation with the slicing ensuring consistent depth and placement.
2. Install the first post at the center of the low point (if applicable). Space the remaining posts a maximum of 6 ft (1.8 m) apart for Types A and B fence and 4 ft (1.2 m) apart for Type C fence.
3. Bury the posts at least 18 in (450 mm) into the ground. If this depth cannot be attained, secure the posts enough to prevent the fence from overturning from sediment loading.
4. Attach the filter fabric to the post using wire, cord, staples, nails, pockets, or other acceptable means.
   a. Staples and Nails (Wood Posts): Evenly space staples or nails with at least five per post for Type A fence and four per post for Type B fence.
   b. Pockets: If using pockets and they are not closed at the top, attach the fabric to a wood post using at least one additional staple or nail, or to a steel post using wire. Ensure the additional attachment is within the top 6 in (150 mm) of the fabric.
   c. Install the filter fabric so 6 to 8 in (150 to 200 mm) of fabric is left at the bottom to be buried. Provide a minimum overlap of 18 in (450 mm) at all splice joints.
   d. For Type C fence:
      1) Woven Wire Supported
         - Steel Post: Use wire to attach the fabric to the top of the woven wire support fence at the midpoint between posts. Also, use wire to attach the fabric to the post.
      2) Polypropylene Mesh Supported
         - Wood Post: Use at least six staples per post. Use two staples in a crisscross or parallel pattern to secure the top portion of the fence. Evenly space the remaining staples down the post.
         - Steel Post: Use wire to attach the fabric and polypropylene mesh to the post.

5. Install the fabric in the trench so 4 to 6 in (100 to 150 mm) of fabric is against the side of the trench with 2 to 4 in (50 to 100 mm) of fabric across the bottom in the upstream direction.
6. Backfill and compact the trench to ensure flow cannot pass under the barrier. When the slice method is used, compact the soil disturbed by the slice on the upstream side of the silt fence first, and then compact the downstream side.
7. When installing a silt fence across a waterway producing significant runoff, place a settling basin in front of the fence to handle the sediment load, if required. Construct a suitable sump hole or storage area according to Section 163.

B. Remove the Silt Fence

1. Keep all silt fence in place unless or until the Engineer directs it to be removed. A removed silt fence may be used at other locations if the Engineer approves of its condition.
2. After removing the silt fence, dress-the area to natural ground, grass-and mulch the area according to Section 700.
3. The silt fence shall remain until the Project is accepted or until the fence is removed. Also, remove and dispose of the silt accumulations at the silt fence.
4. Remove and replace any deteriorated filter fabric reducing the effectiveness of the silt fence.
5. Repair or replace any undermined silt fence at no additional cost to the Department.

171.3.06 Quality Acceptance

Approved silt fence is listed in QPL 36. Approved fabrics must consistently exceed the minimum requirements of this Specification as verified by the Office of Materials and Research. The Office of Materials and Research will remove fabric failing to meet the minimum requirements of this specification from the QPL until the products' acceptability has been reestablished to the Department's satisfaction.

At the time of installation, the Engineer will reject the fabric if it has defects, rips, holes, flaws, deterioration, or damage incurred during manufacture, transportation, or storage.

171.3.07 Contractor Warranty

The silt fence shall remain until the Project is accepted or until the fence is removed. Also, remove and dispose of the silt accumulations at the silt fence.

Remove and replace any deteriorated filter fabric that reduces the effectiveness of the silt fence.

Repair or replace any undermined silt fence at no additional cost to the Department.

171.4 Measurement

The quantity of silt fence to be paid for is the actual number of linear feet (meters) of silt fence, measured in place from end post to end post of each separate installation. The silt fence must be complete and accepted.

171.4.01 Limits

General Provisions 101 through 150.

171.5 Payment

Silt fence Type A, B, or C measured as defined in Subsection 171.4, "Measurement," is paid for at the Contract Unit Price bid per linear foot (meter).

Payment is full compensation for the following:

- Furnishing materials
- Erecting the fence
- Dressing and grassing, when required
- Removing the fence, when required

Payment for this Item is made as follows:

- Seventy-five percent of the Contract Price bid per linear foot (meter) is paid when each fence is complete in place.
- Twenty-five percent is paid at removal or acceptance.

If the silt fence must be repaired or removed, as the result of neglect or damage, perform the work at no additional cost to the Department.

Payment will be made under:

Item No. 171	Silt fence, type__	Per linear foot (meter)

171.5.01 Adjustments

General Provisions 101 through 150.

Office of Design Policy and Support

October 3, 2012
Revised: October 5, 2012

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

Section 201 – Clearing and Grubbing Right of Way

Delete Subsection 201.3.05.E.3 and substitute the following:

3. Solid Waste Material

a. Nonregulated Material

1) Common fill is defined as soil, rock, brick, concrete without reinforcement, concrete with reinforcement where the reinforcement has been removed flush with the surface of the concrete and cured asphalt, provided that such material does not contain hazardous waste constituents above background levels and the material results from Department funded construction contracts. Such fill is not subject to the Georgia Comprehensive Solid Waste Management Act of 1990 and the Solid Waste Management Rules when used as fill material on Department funded construction contracts or Department property or when used as fill material on property not owned by the Department when all requirements of this specification are fully met. Common fill meeting this definition may be placed as follows:

a. At a permitted municipal, construction and demolition materials or inert landfill fully meeting all requirements of the Solid Waste Rules and Act and any other applicable laws or ordinances.

b. At an off-site engineered fill location in accordance with the following requirements;

- Place the material in uniform layers 3 ft thick or less and distributed to avoid the formation of large voids or pockets.
- Fill voids with finer material.
- Cover the last layer of fill with at least 2 ft of soil.
- Construct the fill according to Section 208, except compact it to at least 90 percent of the maximum laboratory dry density.
- A Georgia registered professional engineer shall document, certify and submit the following information on behalf of the Contractor to the Department; compaction rates, waste

description including average particle size, and the depth of clean earthen fill lying above the engineered fill.

c. On site as compacted fill if prior written approval has been granted by the Engineer and in accordance with the following requirements:

- As compacted fill incorporated into embankment only. No area shall be excavated for the sole purpose of disposing of common fill.
- Place the material in uniform layers 3 ft thick or less and distributed to avoid the formation of large voids or pockets.
- Fill voids with finer material.
- Cover the last layer of fill with at least 2 ft of soil.
- Construct the fill according to Section 208, except compact it to at least 90 percent of the maximum laboratory dry density.
- Records of the exact location by station and offsets, amount disposed per location in cubic yards, waste description including average particle size, compaction rates and depth of clean earthen fill lying above the composite materials shall be kept by the Engineer.

d. Materials that may be recycled or reused such as asphaltic concrete, Portland cement concrete, plastic, metal and materials that qualify under EPD regulations for sale or use may be reclaimed by the Contractor.

b. Regulated Material

1) Inert waste is defined as organic debris such as stumps, limbs and leaves, cured asphalt and any of the aforementioned common fill items that do not meet the compaction requirements when placed in an excess materials pit. An inert waste landfill permit shall be obtained in accordance with GDNR/EPD Rules to properly record the disposal of inert waste when compaction requirements are not met at an excess materials pit. If disposed of at a landfill, inert waste may only be disposed at a permitted municipal, construction and demolition materials or inert landfill fully meeting all requirements of the Solid Waste Rules and Act and any other applicable laws or ordinances.

2) Construction and demolition waste is defined as construction forms, barrels, scrap metal, and other such by-products of construction not specifically listed above as either common fill or inert waste. Construction and or demolition waste must be disposed of at a permitted municipal, construction and demolition materials, or inert landfill fully meeting all requirements of the Solid Waste Rules and Act and any other applicable laws or ordinances.

3) Dispose of oils, solvents, fuels, untreated lead paint residue, and other solid hazardous waste through a properly licensed hazardous waste disposal facility.

4) Remove municipal solid waste discovered during construction or shown on the Plans according to Section 215.

c. Solid Waste Handling and Disposal Documentation Requirements:

1) Waste disposed at a permitted municipal or construction and demolition landfill – all tipping receipts generated by the receiving landfill shall be provided to the Engineer.

2) Waste disposed at inert landfill – a copy of the landfill's Permit By Rule notification, and for landfills exceeding one acre, a copy of the landfill's NPDES General Storm water Permit Notice of Intent (NOI) and any local jurisdiction Land Disturbing Activity Permit, if applicable, shall be provided to the Engineer.

3) Any necessary documentation regarding a disposal site's permit status must be obtained by the Contractor and verified by the Department before any common fill, inert waste, or other solid waste is allowed to leave the site.

4) The documentation listed herein shall be maintained on-site in the project files and at any other location the Department deems necessary until a valid NPDES Notice of Termination is filed.

Recyclable materials must be separated from all waste materials and shall be properly stored in containers when practicable.

Excluding the above allowances, all types of waste shall be handled in full compliance with the following:

- The Georgia Solid Waste Management Rules, as amended (391-3-4)
- Georgia Comprehensive Solid Waste Management Act of 1990, as amended (O.C.G.A. 12-8-20)
- The Georgia Erosion & Sedimentation Act as amended (O.C.G.A. 12-7-1) and any applicable Local and State requirements as well as the General Permits of the Georgia Water Quality Control Act
- Any other applicable Federal, State, or Local rules or laws

DEPARTMENT OF TRANSPORTATION

STATE OF GEORGIA

SUPPLEMENTAL SPECIFICATION

Section 407—Asphalt-Rubber Joint and Crack Seal

Delete Section 407 and substitute the following:

407.1 General Description

This work includes filling (Type M) or sealing (Type S) joints and cracks in existing pavements with rubber asphalt mixtures. A polymer-modified asphalt rubber (PMAR) blend may be used in lieu of both Type M and Type S.

407.1.01 Definitions

Type M: Used to fill joints and cracks in Portland cement concrete or asphaltic concrete pavements when required by the Plans before placing an overlay.

Type S: Used to seal joints and cracks in Portland cement concrete and asphaltic concrete pavements and shoulders when not placing an overlay.

407.1.02 Related References

A. Standard Specifications

Section 820—Asphalt Cement

B. Referenced Documents

AASHTO T51

ASTM D 4

ASTM D 36

ASTM D 5329

ASTM D 7173

GDT-2

SOP 22

QPL 92

407.1.03 Submittals

Provide a Certificate of Analysis certifying each lot of premixed material meets the requirements of this Specification and submit the test results of each lot for each Project. Ensure each sealant lot is delivered in containers with the manufacturer's name or trademark and lot number plainly marked.

When instructed by the Engineer, furnish premixed samples and samples of the individual components of premixed material as follows:

- At least 20 lbs (10 kg) of rubber representative of each lot

- At least 5 gal (18 L) of asphalt containing additives as proportioned
- Proportional quantities of mixing aids or additives not included above
- Packaged premixed sealant material weighing no more than 30 lbs (14 kg)

407.2 Materials

Ensure the sealant material is a premixed, asphalt-rubber sealant mixture evaluated in accordance with SOP 22 and listed on QPLs 92-A, 92-B and/or 92-C . Ensure the mixture is a blend of asphalt cement, aromatic extender oil(s), and recycled or reclaimed tire crumb rubber with rubber contents meeting the requirements specified in Table 2. The blending will be conducted in a closely controlled manufacturing process as detailed in the manufacturer's submitted Quality Control Plan. Produce a mixture with the following properties:

A. Workability

The mixture pours readily and penetrates a 1/4 in (6 mm) pavement joint or crack to a depth of at least 1 in (25 mm) when the application temperature of the fully reacted mixture is 350 ºF (177 ºC) and the air temperature is 35 ºF (2 ºC) or higher.

The mixture, when placed in conventional field installation equipment, readily melts to a pumping consistency after being heated to 400 °F (204 °C) for 2 hours maximum. The mixture remains in a pumping consistency when the temperature of the field installation equipment is reduced to the normal operating temperature range of 300 ºF to 350 ºF (149 ºC to 177 ºC).

B. Curing

The mixture contains no water or volatile solvents and cures immediately when cooled to a sufficient viscosity to prevent tracking caused by traffic.

C. Softening Point, Flexibility and Rubber Content.

When a fully reacted mixture sample of asphalt-rubber has been heated at 350 ºF (177 ºC) for one hour, or when a PMAR blend has been heated at 380 ºF (194 ºC) for one hour, ensure it passes the following laboratory tests:

1. Softening Point

   The minimum softening point by ring and ball described in ASTM D 36 is as follows:

Table 1 – Mininum Softening Point

PMAR	185 ºF (85 ºC)
Type S	135 ºF (57 ºC)
Type M	150 ºF (65 ºC)

2. Flexibility

   Bend a 1/8 in (3 mm) thick x 1 in (25 mm) wide x 6 in (150 mm) long mixture specimen after conditioning to 10 ºF (-12 ºC) at a minimum bending rate of 9 degrees per second(10 seconds maximum for a 90º bend) over a 1 in (25 mm) diameter mandrel without cracking.

3. Rubber Content %

   Type M and Type S minimum rubber content % .

Table 2 – Type S and Type M Minimum Rubber Content

Type S	15% minimum
Type M	15% minimum

D. Separation

Test the PMAR blend for phase separation by pouring two representative samples of the mixture into aluminum tubes measuring 1 in (25 mm) in diameter and 5-1/2 in (140 mm) long as described in ASTM D 7173. Cure the samples at 325 ºF (163 ºC) for 48 hours. Take samples from the top and bottom of each tube and determine softening point as described in ASTM D 36. Average the test results from the top and bottom samples. If there is 4% or more difference between the average test result and either of the top or bottom test results, reject the mixture due to separation.

E. Adhesion

When cooled, the mixture bonds strongly to both asphalt and concrete pavement surfaces. The mixture contains no materials chemically reactive with these surfaces to reduce the short-term and long-term adhesion bonds.

F. Acceptable Recycled or Reclaimed Tire Crumb Rubber

Before the rubber is added, ensure the asphalt cement used in the mixture conforms to the requirements of Section 820.2.01, PG 58-22 or PG 64-22.

Ensure the recycled, reclaimed tire crumb rubber used in the mixture meets the following requirements:

- Obtained from used pneumatic tires (such as automobile, truck, bus, etc.)—not solid tires and non-tire rubber sources
- Produced from an ambient or cryogenic grinding process (crushes, tears, factures or grinds, the used rubber tires and produces rubber particles with a ragged, sponge-like surface). Tire buffings are prohibited.
- Contains recycled, vulcanized crumb rubber and/or reclaimed (devulcanized) rubber
- Contains at least 25 percent natural rubber by weight of the total rubber portion of the mixture
- Contains no more than 0.1 percent fabric
- Free of wire and other contaminating materials, except up to four percent calcium carbonate or talc to prevent rubber particles from sticking
- Contains no rubber particles greater than 1/4 in (6 mm) long
- Meets the following gradation requirements:

Table 3 – Recycled or Reclaimed Tire Crumb Rubber Gradation

Sieve Size	Percent Passing
No. 10 (2.0 mm)	100%
No. 16 (1.18 mm)	95 to 100%
No. 30 (600 µm)	40 to 80%
No. 80 (180 µm)	0 to 5%

G. Polymer-modified Asphalt Rubber

If a PMAR blend is used, ensure it meets the following additional requirements:

Table 4 – Polymer-modified Asphalt Rubber Properties (PMAR)

PROPERTY	SPECIFICATION LIMITS
Cone Penetration, 77 ºF (25 ºC) (ASTM D 5329)	30 - 60 dmm
Resilience, 77 ºF (25 ºC), % Recovery (ASTM D 5329)	30% minimum

Ductility, 77 ºF (25 ºC), 50 mm/minute (ASSHTO T-51)	300 mm minimum
Asphalt Compatibility (ASTM D 5329)	Pass
Bitumen Content (ASTM D 4)	60 – 70 %
Tensile Adhesion (ASTM D 5329)	350 % minimum
Rotational Viscosity (Brookfield), No. 5 spindle, 20 RPM, 400 ºF (205 ºC)	3,000 – 15,000 cp
Rubber Content % (GDT-2)	12% minimum

407.2.01 Delivery, Storage, and Handling

Package the premixed sealant material in units weighing no more than 30 lbs (14 kg) with a maximum of two 30 lb (14 kg) units per shipping container. Ensure the plastic film used to package the units melts at normal application temperatures when placed in the installation equipment.

407.3 Construction Requirements

407.3.01 Personnel

General Provisions 101 through 150.

407.3.02 Equipment

A. Field Installation Equipment

Use field installation equipment that produces or maintains specified temperatures, even if filled to capacity.

Ensure the equipment produces or maintains a homogenous mixture of asphalt and rubber at a uniform temperature without hot or cool spots or rubber and asphalt segregation in the mixture.

B. Crack Filling Equipment

Ensure the equipment for filling the joints and cracks directs the sealant into the crack. Seal large cracks from the bottom up. Provide squeegees as necessary.

C. Air Compressor(s)

Ensure the air compressors are satisfactory to the Engineer.

407.3.03 Preparation

A. Joint and Crack Preparation

Use compressed air to thoroughly clean the joints and cracks to be sealed.

Clean the pavement surface and check the joints and cracks to ensure they are free of vegetation, dirt, dust, moisture, and other foreign material.

407.3.04 Fabrication

General Provisions 101 through 150.

407.3.05 Construction

A. Restrictions

Do not seal joints and cracks if:

- The joint or crack surface to be treated is not thoroughly dry.
- Rain is imminent.

- The air temperature is below 35 ºF (2 ºC).

B. Procedure

Follow this procedure to seal joints and cracks:

1. Place the prepackaged sealant mixture in the field installation equipment.
2. Heat the sealant mixture for the proper time and temperature to provide a full reaction between the asphalt and rubber.
3. Apply the mixture at the specified application temperature according to the manufacturer's recommendations or the laboratory's approval.
4. Carefully fill the joint or cracks, slightly overfull. Strike off the excess with a V-shaped squeegee to feather the sealant out to a width of approximately 2 in (50 mm).

407.3.06 Quality Acceptance

If the packaged units are bonded or stuck together or to the shipping container, or if packaging staples or fasteners cause sealant contamination, the material may be rejected as determined by the Engineer.

The manufacturer must meet the requirements of this Specification and furnish evidence of successful field installation and performance under similar environmental and project conditions.

407.3.07 Contractor Warranty and Maintenance

General Provisions 101 through 150.

407.4 Measurement

Joints and cracks will be measured by the linear foot (meter) by surface measure.

407.4.01 Limits

General Provisions 101 through 150.

407.5 Payment

Joints and cracks sealed according to the Plans and this Specification will be paid for at the Contract Unit Price bid.

Payment is full compensation for furnishing all materials and performing the work.

Payment will be made under:

Item No. 407	Polymer-modified asphalt–rubber joint and crack seal	Per linear foot (meter)
Item No. 407	Asphalt-rubber joint and crack seal, type "S"	Per linear foot (meter)
Item No. 407	Asphalt-rubber joint and crack seal, type "M"	Per linear foot (meter)

407.5.01 Adjustments

General Provisions 101 through 150.

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SUPPLEMENTAL SPECIFICATION

Add the following:

Section 572—Slope Underdrains

572.1 General Description

This Work consists of the construction of slope underdrains, including placement of Geogrid reinforcement, Geocomposite wall drains, plastic filter fabric and other materials in slope excavations or fills where encountering high groundwater. Perform this Work in accordance with the Specifications and details, lines and grades shown on the Plans, or as directed by the Engineer.

572.1.01 Definitions

General Provisions 101 through 150.

572.1.02 Related References

A. Standard Specifications

General Provisions 101 through 150.

Section 500—Concrete Structures

Section 603—Sand-cement Bag Rip Rap

Section 806—Aggregate for Drainage

Section 809—Geogrid Materials

Section 839—Corrugated Polyethylene Underdrain Pipe

Section 853—Reinforcement and Tensioning Steel

Section 881—Fabrics

B. Referenced Documents

QPL 28

QPL 47

572.2 Materials

Ensure that materials meet the requirements of the following Specifications:

Material	Section
Concrete	500
Sand-cement Bag Rip Rap	603
Coarse Aggregate for Underdrains	806.2.01
Geogrid	809

Material	Section
Corrugated Polyethylene Underdrain Pipe	839
Reinforcing Steel	853
Woven Plastic Filter Fabric	881.2.05

Use approved geocomposite wall drain listed on QPL 47.

See QPL 28 for acceptable woven fabrics that meet the requirements of this Specification.

572.3 Construction Requirements

572.3.01 Personnel

General Provisions 101 through 150.

572.3.02 Equipment

General Provisions 101 through 150.

572.3.03 Preparation

General Provisions 101 through 150.

572.3.04 Fabrication

General Provisions 101 through 150.

572.3.05 Construction

Arrange the work schedule so that the slope underdrain installations will coincide with other operations on the Project in a manner that will prevent damage to completed work or may cause and/or allow soil contamination of materials.

A. Excavation

Excavate in accordance with the details and elevations shown on the Plans or to an additional depth as directed by the Engineer to intercept the water-bearing strata encountered during construction. Begin the excavations with the topmost bench and proceed to the bottom of the slope. Excavate as necessary to provide continuous slope underdrain coverage from the top of the water-bearing strata to the bottom of the slope. When encountering unstable conditions in the bottom of the excavation, remove unstable material as directed by the Engineer and replace with approved granular material and compact so as to provide a stable foundation for the excavation and placement of pipes.

B. Placement of Geocomposite Wall Drains

Place the Geocomposite wall drains the full height and width of the vertical bench cuts and secure the drains with metal staples or wooden stakes. Do not allow any horizontal joints or splices to remain in the drains. Abut adjoining drain strips to make vertical joints between drain strips.

C. Placement of Plastic Filter Fabric

Place plastic filter fabric of sufficient length to cover the drainage aggregate at the bottom of the bench excavation adjacent to the geocomposite wall drain. Overlap the fabric with a minimum of 3 feet (914 mm) of material. Sewing of the fabric will not be required. The fabric may be cut at the locations of the solid underdrain pipe to allow for wrapping around the drainage aggregate.

D. Placement of Pipe and Aggregate

Place perforated pipe continuous with the bench excavation adjacent to the Geocomposite wall drain in accordance with the details shown on the Plans. Place solid pipe at 200-foot (61-meter) intervals with a minimum of 2 solid pipes at each bench excavation, joined to perforated pipe with "T" connections. Connect all joints securely. Place drainage aggregate to a level of 6 inches (152 mm) above the pipes without disturbing the pipe alignment. Wrap the plastic filter fabric over the drainage aggregate prior to backfilling with soil.

E. **Backfilling and Placement of Geogrid Reinforcement**

Place soil to be used as backfill material with the same lift and compaction requirements as normal embankment construction. Do not disturb the pipe alignment. Place layers of Type B geogrid reinforcement 4 feet (1.22 m) long beginning at a level 2 feet (600 mm) above the bottom of each bench, and at 1-foot (300 mm) intervals thereafter as each bench excavation is backfilled.

F. **Markers**

Mark each outlet end of the drainage pipe in accordance with Plan details.

G. **Protection from Contamination**

Protect all materials from contamination by foreign matter. In the event that the drainage aggregates, plastic filter fabric or Geocomposite wall drains become contaminated, remove the contaminated portion and replace with clean material at no additional cost to the Department. Placement of soil backfill over the fabric is incidental to the Work and is not considered to be contamination.

H. **Type B Concrete Flume**

After the slope is backfilled, construct a Type B concrete flume at each solid drain location as indicated on the Plans. Extend each flume from the topmost solid drain pipe to the bottom of the slope.

572.4 Measurement

Slope underdrains will be measured for payment by the linear foot (meter) of accepted perforated underdrain in place at each bench excavation. No separate measurement will be made for bench excavation, drainage aggregate, Geocomposite wall drain, solid drain pipe, connections, geogrid, plastic filter fabric, or backfill required by the Plan Details.

Additional depth bench excavation required beyond the limits of the Plan details and directed by the Engineer will be measured according to Subsection 205.4 of the Specifications.

No separate measurement will be made for disposing of any unsuitable material encountered. Replacement material will not be measured separately.

When the contract includes Item 210-Grading Complete, additional depth bench excavation required beyond the limits of the Plan details, and as directed by the Engineer, will be measured according to Subsection 210.4.C. of the Specifications. No separate measurement will be made for backfilling the additional depth bench excavation.

572.5 Payment

Slope underdrains will be paid for at the Contract Price per linear foot (meter), complete and in place. Payment is full compensation for excavation, furnishing all materials, including drainage aggregate, Geocomposite wall drain, solid drain pipe, perforated drain pipe, connections, geogrid and plastic filter fabric, backfill, placing all materials and for all labor, equipment, tools and incidentals necessary to perform the Work.

Payment for concrete flumes will be according to the Plans.

Additional depth bench excavation required beyond the limits of the Plan details, and as directed by the Engineer, will be paid for at the Contract Price per cubic yard for Unclassified Excavation.

When the contract includes Item 210-Grading Complete, additional depth bench excavation will be paid for according to Subsection 210.5.C, “Undercut Excavation”.

Payment will be made under:

Item No. 572	Slope Underdrains	Per linear foot (meter)

572.5.01 Adjustments

General Provisions 101 through 150.

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

Section 627—Mechanically Stabilized Embankment Retaining Wall-Contractor Design

Delete Subsection 627.2 and substitute the following:

627.2 Materials

Meet the requirements of Subsection 626.2, "Materials" of the Specifications.

Delete Subsection 627.3.03.B and substitute the following:

B. Wall Design

Use the following design criteria for a Contractor designed wall:

1. Provide one of the following wall systems:
   ARES (Tensar Earth Technologies)
   Reinforced Earth Wall (The Reinforced Earth Company)
   Sine Wall MSE Panel Systems (Sine Wall)
   Stabilized Earth Wall (Vistawall Systems)
   Tricon Retained Soil Wall (Tricon Precast)
2. Design the MSE Wall according to the current AASHTO Standard Specifications for Highway Bridges including interims. (Mechanically Stabilized Earth Wall Design – Section 5.8)
3. Design the MSE wall to account for all live load, dead load and wind load from all traffic barrier, lights, overhead signs, sound barriers and other appurtenances located on top and adjacent to the wall. Design MSE walls to account for all external forces. Also, design abutment walls for all horizontal and vertical loads applied by the bridge.
4. Assume responsibility for all temporary shoring that may be necessary for wall construction. Design the shoring using sound engineering principles.
5. Use permanent concrete wall facing panels that are at least 7 in (175 mm) thick.
6. Provide a minimum length of soil reinforcement of 10 feet (3 m) or seven-tenths (0.7) of the wall height, whichever is greater.
7. Ensure that the special wall backfill extends a minimum of 12 in (300 mm) past the end of the soil reinforcement.
8. Use the Architectural treatment of facing panels as indicated on the Department's drawings.
9. Provide internal walls to allow for future widening if shown on the wall envelope. Ensure the internal walls have galvanized wire or concrete facing. Ensure as a minimum that the facing of the internal walls extend to the back limit of the MSE Wall Backfill for the permanent wall.
10. Ensure the maximum panel area does not exceed 35 square feet (3.25 square meters).

11. Design the barrier for a 500 lbs. per linear foot (744 kilograms per linear meter) loading applied horizontally along the top of the barrier. The barrier shall be continuous or have a counterweight slab continuous over not less than four panels.
12. A Foundation Investigation Report may be available from the Geotechnical Engineering Bureau of the Department. The information contained in this report may be used by the Contractor to assist in evaluating existing conditions for design as well as construction. However, the accuracy of the information is not guaranteed and no requests for additional monies or time extensions will be considered as a result of the Contractor relying on the information in this report.
13. Ensure the following requirements are met:

    The gutterline grade on the proposed top of wall submitted matches the gutter elevations required by the plans.

    The top of coping is at or above the top of coping shown on the envelope.

    The leveling pad is at or below the elevation shown on the wall envelope.

    Any changes in wall pay quantities due to changes in the wall envelope are noted in the contractor's plans

    All changes in quantities due to the proposed walls being outside the wall envelope (step locations, ending wall at full panel, etc.) are shown as separate quantities.
14. Ensure the minimum embedment of the wall (top of leveling pad) is at least 2 feet (600 mm). If the soil slopes away from the bottom of the wall, lower the bottom of the wall to provide a minimum horizontal distance of 10 ft (3 m) to the slope. [i.e. a 2:1 slope in front of the wall requires 5 ft (1.5 m) of embedment; a 4:1 slope in front of the wall requires 2.5 ft (750 mm) of embedment]
15. If the Department's review of the submitted plans and calculations results in more than two submittals to the Department by the Contractor, the Contractor will be assessed for all reviews in excess of two submittals. The assessment for these additional reviews will be at the rate of $60.00 per hour of engineering time expended.

Delete Subsection 627.3.04 and substitute the following:

627.3.04 Fabrication

Meet the requirements of Subsection 626.3.04 of the Specifications.

Delete Subsection 627.3.05 and substitute the following:

627.3.05 Construction

Meet the requirements of Subsection 626.3.05 of the Specifications.

Office of Bridge Design

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SUPPLEMENTAL SPECIFICATION

Section 647—Traffic Signal Installation

Delete Section 647 and substitute the following:

647.1 General Description

This work consists of furnishing materials and erecting a traffic signal installation including all traffic signal equipment, poles, bases, wires and miscellaneous materials required for completion of the installation. Ramp Meters are defined as a form of traffic signalization and all general provisions for traffic signalization are applicable unless otherwise noted in the Plans and Specifications.

It also includes all test periods, warranties and guarantees as designated in subsequent sections, and response to maintenance and operational issues as described in subsequent sections.

Apply for, obtain and pay for all utility services, communications services to, and pole attachment permits required by all utility owners that are necessary for the signal installation and operation required in the Plans. The Contractor will be responsible for establishing utility services and ongoing monthly costs related to utility services until final acceptance of the signal project.

Upon completion of a successful "burn in" or operational testing period for the signal installation, the Contractor will be responsible for an orderly and uninterrupted transfer of these services and permits to the local government or other jurisdiction that will be responsible for subsequent maintenance and operation.

647.1.01Definitions

General Provisions 101 through 150.

647.1.02 Related References

A. Standard Specifications

Section 106—Control of Materials

Section 107—Legal Regulations and Responsibility to the Public

Section 108 —Prosecution and Progress

Section 150 —Traffic Control

Section 500—Concrete Structures

Section 501—Steel Structures

Section 535—Painting Structures

Section 615—Jacking or Boring Pipe

Section 631—Changeable Message Signs

Section 636 – Highway Signs

Section 639—Strain Poles for Overhead Sign and Signal Assemblies

Section 645—Repair of Galvanized Coatings

Section 680—Highway Lighting

Section 681—Lighting Standards and Luminaires

Section 682—Electrical Wire, Cable, and Conduit

Section 700—Grassing

Section 755—Electrical Work

Section 800—Coarse Aggregate

Section 801—Fine Aggregate

Section 832—Curing Agents

Section 833—Joint Fillers and Sealers

Section 850—Aluminum Alloy Materials

Section 852—Miscellaneous Steel Materials

Section 853—Reinforcement and Tensioning Steel

Section 854—Castings and Forgings

Section 861—Piling and Round Timber

Section 870—Paint

Section 886—Epoxy Resin Adhesives

Section 910—Sign Fabrication

Section 911—Steel Sign Posts

Section 912—Sign Blanks and Panels

Section 913—Reflectorizing Materials

Section 915—Mast Arm Assemblies

Section 922—Electrical Wire and Cable

Section 923—Electrical Conduit

Section 924—Miscellaneous Electrical Materials

Section 925—Traffic Signal Equipment

Section 926 – Wireless Communication Equipment

Section 927 – Wireless Communication Installation

Section 935—Fiber Optic System

Section 936—CCTV System

Section 937—Video Detection System

Section 939—Communications & Electronic Equipment

Section 940—Navigator Integration

B. Referenced Documents

National Electrical Manufacturers Association (NEMA) Traffic Control Systems Standards No. TS 1

NEMA Traffic Control Systems Standards No. TS 2

AASHTO Roadside Design Guide

The Manual on Uniform Traffic Control Devices (MUTCD), current edition

National Electrical Code

National Electrical Safety Code (NESC)

GDT 7 Determining Maximum Density of Soils

GDT 24a Determining the Theoretical Minimum Dry Density of Soils or Soil Aggregates containing > 45% Retained on the No. 10 Sieve

GDT 24b Determining the Theoretical Minimum Dry Density of Soils or Soil Aggregates containing > 5% Retained on 2-Inch Sieve using a 5.5 Pound Rammer and a 12 Inch Drop

GDT 67 Family of Curves Method for Determining Maximum Density of Soils

647.1.03 Submittals

Use only equipment and materials that are on the Department's Qualified Products List (QPL

These products have been evaluated by the Office of Traffic Operations and have proven their capability of meeting the appropriate Georgia Department of Transportation Specification. Any of these products may be used without sampling or pre-testing. The Contractor shall submit a letter to the Field Engineer, stating which QPL items they will use. Submittal letter shall include QPL number-and product description.. The Field Engineer and/or department designee must ascertain that the construction item is the same material identified on the appropriate QPL and will acknowledge receipt of these items in the project diary or as required by the Construction manual.

Written approval is required from the State Traffic Engineer or District Engineer prior to beginning any work on the traffic signal installation and /or installing the proposed on the work site.

A. Review

For all traffic signal material submittals, the Engineer's review of the material should be completed within forty five (45) days from the date of receipt of the submission unless otherwise specified. The State Traffic Engineer or District Engineer will advise in writing, as to the acceptability of the material submitted.

The State Traffic Engineer or District Engineer may determine that submitted equipment is approved, in which no further action is required. In the event, materials submitted for use are rejected the Contractor is required to re-submit materials, within fifteen (15) days of notification of material failure or rejection. Resubmittal of subsequent materials for review will be considered the start point of a new approval cycle as described.

The Department reserves the right to be reimbursed by the Contractor for reviewing any equipment and/or component submittals after a second submittal of equipment proposed for use on the project.

B. Submittal Costs

No separate measurement or payment will be made for submittal costs. All costs associated with reproduction of submittal material documents, samples and mailing expensed will be the responsibility of the Contractor and are not subject to reimbursement by the Department. All submittal material becomes the property of the Department and will not be returned to the Contractor.

C. Steel Strain Pole, Concrete Strain Pole or Steel Pole Certification

Instruct the supplier or manufacturer of the strain poles or steel poles with traffic signal mast arms to submit a certification, including mill certificates to:

Department of Transportation

Office of Materials and Research

15 Kennedy Drive

Forest Park, Georgia 30297

Include the following in the certification:

- A statement that the items were manufactured according to the Specifications, including the Specification Subsection number
- Project number and P.I. number

Instruct the supplier or manufacturer to send copies of the transmittal letter to the Engineer.

Prepare Shop Drawings and related signal strain pole design calculations with the following criteria, 5% sag and 18 foot signal head height. Provide "bending moment at yield" to determine the foundation size according to the signal strain pole foundation drawings. Submit all Shop Drawings and related signal strain pole design calculations to the Traffic Engineer. The Traffic Engineer will forward to the State Bridge and Structural Design Engineer for review and approval. Obtain written approval prior to pole fabrication and installation. Upon acceptance of the pole certification provide one copy of the design calculations and shop drawings to the agency responsible for maintaining the traffic signal installation.

All pole drawings shall include roadway and pole elevations.

Show all dimensions and material designations of the designs on the Drawings. See Subsection 501.1.03 for the certification procedure for poles and anchor bolts.

D. Signal Item Certification

Only Equipment and/or material on QPL shall be submitted for certification. All others will be rejected. Submit four (4) copies of material catalog product numbers and descriptions to the Engineer. One copy of all submittals is to be provided to the maintaining agency. Reference the project number, P.I. number, and QPL number, for the following traffic signal items:

- Signal heads
- LED Signal Modules
- Mounting hardware
- Controllers
- Cabinet assemblies
- Battery Backup System (BBS)
- Detectors
- Monitors (conflict/IVDS)
- Cable
- Load switches
- Blank-out signs
- Lane use signals

- Preformed cabinet bases
- Other related signal equipment (including but not limited to Conduit, Pull boxes, Ground Rods, Enforcement Indications, etc.)

E. Test Results Submittal

Submit the results of the testing of the following items to the Engineer. A copy of the test result submittals shall be provided to the maintaining agency.

- Loop Detector Testing
- Signal Cable Testing
- Interconnect Cable Testing
- Pre-emption Testing
- Controller and Cabinet Testing from Manufacturer (Including conflict monitor)
- Traffic Signal Monitor
- Any other operational testing required by the Engineer

F. Mast Arm Pole Chart

For locations with mast arm pole installations, submit a "Mast Arm Pole Chart" for review and approval by the State Bridge and Structural Design Engineer. The "Mast Arm Pole Chart" shall also include a sketch on an 8 ½ inch x 11 inch (216 mm x 279 mm) sheet of paper showing the following:

- Curb lines
- Location of mast arm pole based on utility information and field location verified by Contractor. (Final location of mast arm pole must meet the criteria for setback from the road as specified in the Roadside Design Guide by AASHTO and in the Standard Detail Drawings.
- Distance from both adjacent curbs to mast arm pole
- Distance along mast arm from pole to curb and from curb to each proposed signal head
- Directional arrow
- Street names
- Position of Luminaries

Label the sketched distances. Once this pole chart is approved, the Contractor shall use the distances measured to the proposed signal head locations when ordering the mast arm to ensure that the mast arm is fabricated with holes for signal head wiring in the correct locations.

647.2 Materials

647.2.01 Delivery, Storage, and Handling

A. State-supplied Equipment

For projects where traffic signal equipment is to be supplied by the Georgia Department of Transportation, obtain State-supplied traffic signal equipment from the Traffic Signal Electrical Facility (TSEF):

1. Contact the Engineer by phone or correspondence within one week after receiving the Notice to Proceed and arrange for a date, time and location to pick up the signal equipment and materials from the Traffic Signal and Electrical Facilities (TSEF).
2. Sign GDOT's Warehouse Issue Request Form 592 to accept delivery of the State-supplied equipment from GDOT's Traffic Signal Equipment Warehouse. Initial Form 592 if equipment is received from a GDOT District Field Office.

3. Inspect the equipment to ensure that it is operating properly and perform any operational tests within ten (10) calendar days after receiving the equipment.
4. Before installation, and within ten (10) calendar days, certify to the Engineer in writing that the State-supplied equipment was received in good condition.
5. Notify the Engineer in writing if the State-supplied equipment is defective. The State Signal Engineer will replace the defective State-supplied equipment.
6. If no written dissent is received after ten (10) calendar days or if equipment is installed in the field, the Engineer will consider this equipment to be satisfactory and accepted.
7. The Contractor shall supply new in like and kind State approved equipment to replace State-supplied equipment that is damaged or lost.

B. Signal Equipment

See Section 925 for signal equipment specifications.

The signal equipment, components, supplies, or materials used in traffic signal installation may be sampled and tested if not previously approved by the Department.

Test according to the Specifications and the Sampling, Testing, and Inspection Manual using one or more of the following methods:

- Have the Department use their own facilities.
- Have the supplier or manufacturer use their facilities with an authorized Department representative to witness the testing.
- Provide independent laboratory test results indicating compliance with Department Specifications referenced in Subsection 647.1.02, “Related References”, of this document.
- When testing by the Department is required, supply the item to the Department. Acceptance of materials tested does not exclude further testing or waive warranties and guarantees required by the Specifications.

C. Cable

Use cable conforming to Section 680, Section 922, and Section 925 and the appropriate IMSA, NEMA, or UL Specifications for the wire or cable.

Obtain pole attachment permits required by local utility companies or pole owners to allow joint use for signal cable, hardware, or other auxiliary devices.

D. Interconnect Communications Cable

1 Use fiber optic interconnect cable or spread spectrum radio for all new interconnected signal systems. See Section 935 for fiber optic cable or spread spectrum information, specifications, marking and installation and testing techniques.

2 Use copper cable only as directed by the Engineer or where specifically shown in the Plans. Refer to Subsection 647.3.05, “Construction”, of this document for installation.

E. Conduit on Structures

Use galvanized rigid steel materials for all exposed conduit for cabling. Use galvanized rigid steel (GRS) conduit on the exterior of signal poles and other structures and to house signal conductors for the entire length from the weather head on the pole to the interior of the cabinet or to the pull box and ground conduit using an approved grounding bushing.(see Subsection 647.3.05V).

647.3 Construction Requirements

Refer to Subsection 107.07 of the Specifications regarding proper conduct of The Work.

647.3.01 Personnel

For the definition of a qualified electrician, see Subsection 755.1.01.

647.3.02 Equipment

Use machinery such as trucks, derricks, bucket vehicles, saws, trenchers, and other equipment necessary for the work and approved by the Engineer prior to installation operations.

647.3.03 Preparation

Utility Permits

A. Application

Apply for, obtain, and pay for utility services and pole attachment permits for signal operation, traffic signal communications including standard telephone service and signal communications as required in the Plans.

B. Maintenance

The Contractor will be responsible for establishing utility services and ongoing monthly costs related to utility services until Final Acceptance of the signal(s) installation, or in the event of multiple installations, the Contractor will be responsible for utility costs until overall project acceptance. After Final Acceptance, the Contractor will provide an orderly transfer these services and permits to the local government or jurisdiction responsible for maintenance and operation. Ensure that the transfer does not interrupt service.

C. Utility Location

1. Adjustment

   Prior to ordering signal poles, locate utilities and adjust the location of poles, where necessary, to minimize utility conflicts. Obtain approval from the District Traffic Engineer for any deviation from the Plans.

   Determine the final length of mast arms based on any field adjusted pole locations. Final location shall be approved by the District Traffic Engineer.

2. Clearance

   When installing aerial cable of any type, it is the Contractor's responsibility to ensure that overhead clearance and separation requirements conform to local utility company standards, the NEC and the NESC. Refer to the Standard Details Drawings for further information on utility clearances.

3. Pre-emption

   When traffic signal pre-emption is used, coordinate with the railroad, fire department or any other agency that uses pre-emption to obtain pre-emption output and route output cable to the signal controller operating the intersection to be pre-empted. It is the Contractor's responsibility to obtain all permits and approval for crossing at grade or grade separated railroad facilities.

647.3.04 Fabrication

General Provisions 101 through 150.

647.3.05 Construction

A. Acquiring and Disposing of Equipment

Do not modify the signal equipment, design, and operation without the District Traffic Operations Engineer's written approval.

All traffic signal equipment removed or replaced shall be returned to District Traffic Signal Shops unless otherwise noted in the Plans or as directed by the Engineer or District Signal Engineer. Provide an inventory list and arrange a mutually agreeable delivery time with the District Signal Engineer twenty-four (24) hours in advance. All materials not returned to the District Signal shop shall be the responsibility of the Contractor to remove and dispose.

B. Traffic Signal Equipment Modification and Removal

Upon the Department issuance of Notice to Proceed any existing traffic signal equipment, responsibilities for maintenance, operations and response to traffic signal malfunction become the responsibility of the Contractor and provisions of Subsection 647.3.07, "Contractor Warranty and Maintenance", apply.

1. Remove existing signal equipment that is not used in the final installation when the new signal equipment is operational.

   Carefully remove equipment to minimize damage and retain it in its original form. This equipment may include:

   - Strain poles including the foundation down to 3 feet (900 mm) below ground level finished grade
   - Timber poles
   - Traffic signal cabinets including contents, cabinet base and work pads
   - Original signal heads including span wire support
   - Other equipment not retained in the final installation

   Ensure that unused equipment is secured and disposed of in accordance with all Environmental Protection Agency regulations and Department instructions.
2. Replace traffic signal equipment that the District Signal Engineer determines has been damaged or destroyed during installation, modification, or removal of the traffic signal, at no expense to the Department. Replace with new material.
3. If the Engineer finds that the existing material shown in the Plans to be relocated is unsatisfactory, replace with new material. The costs will be paid for as Extra Work.
4. Remove old signal heads by the end of the day that the new signal equipment is placed in operation. Remove all other signal equipment within seven (7) days after operations of the newly installed equipment.

C. Auxiliary Cabinet Equipment

Provide auxiliary cabinet equipment or special purpose equipment with connecting harnesses, if necessary, or as shown in the Plans or Standard Detail Drawings.

1. Install the equipment in its associated cabinet. Extraneous wiring may be necessary to install the equipment. Additional cabling shall be enclosed in NEMA enclosure and neatly secured.
2. Connect the auxiliary equipment to its cable harness, or insert it in premounted racks or sockets.

D. Signal Controllers

Furnish and install approved microprocessor controllers at the locations shown in the Plans or as directed by the Engineer. All equipment furnished shall comply with Section 925,"Traffic Signal Equipment".

1. Identify the controller and other auxiliary equipment by model and revision numbers. These numbers shall agree with previously approved catalog submittals.
2. Assemble the controller, cabinet, and auxiliary equipment to provide the operational sequence shown in the Plans and future operations specified. Ensure the controller functions as a unit with the cabinet assembly.
3. Ensure controller and auxiliary equipment are provided AC power from receptacles marked for controller power.
4. The Department will provide controller firmware. The Contractor shall provide the controller to the Department. The Department will load the firmware into the controller and notify the Contractor that the controller is ready to be picked up. If the controller is purchased with applications firmware, ensure that the firmware provided is the current Department licensed version of firmware including "boot code". Current firmware version shall be at the date of application "turn on".
5. Unless otherwise specified in the Plans or directed by the Engineer, thirty days prior to installation of equipment the Contractor shall deliver the controllers to and pick up the controller from the Traffic Signal Electrical Facility

(TSEF) Atlanta office. The Department shall have 30 work days to load the controller firmware starting from the date the Contractor delivered the controllers to the Department.

6. For 2070 signal controllers used for Ramp Metering ensure the Watchdog Timer "Muzzle Jumper" is selected on the field input/output module. This is required for operating with a 208 monitor.

E. Cabinet Assembly

1. Location

   The cabinet should be located in accordance with the Plan location, however if the cabinet location needs to be moved, choose a location that:

   a. Protects maintenance personnel from vehicles when servicing the equipment
   b. Allows the front panel door of the controller to open away from the intersection for view of signal indications while servicing or performing cabinet work.
   c. Does not block a sidewalk or passageway and complies with Federal regulations for Americans with Disabilities Act (ADA) clearance requirements.
   d. Is located away from the roadway or curb line to prevent vehicular damage to the cabinet.
   e. Is not located within drainage areas or installed in areas likely to collect and hold surface water.
   f. Relocate the cabinet to avoid conflicts from proposed reconstruction projects, commercial driveways, etc. within the right-of-way at the Engineer's discretion.

2. Erection

   Install and level traffic signal controller cabinets at locations shown in the Plans and/or as directed by the Engineer.

   a. Install cabinets to conform to the Standard Detail Drawings. Install pole or base-mounted as indicated in the Plans. Cabinet base shall not extend more than 9 inches above final grade.
   b. Seal base-mounted cabinets to their base using silicone based sealer. Pliable sealant used shall not melt or run at temperatures as high as 212 ºF (100 ºC).
   c. Use prefabricated bases and work pads
   d. Install technician pad in front and rear of the controller cabinet door and if applicable in front of battery backup cabinet door. See Standard Details for pad information.
   e. Close all unused conduit in the controller base with a PVC cap sized appropriately. Do not permanently affix the conduit cap to the conduit. Seal those conduits used for signal cable with a pliable sealant to prevent moisture and insects from entering the cabinet via the conduit.

3. Field Cabinet Wiring

   All wiring shall be neat and secured and comply with NEC, NEMA, and Table 647-1, Table 647-2, Table 647-3 Table 647-4, Table 647-5, and Table 647-6 of this Specification.

   a. Cut field cabinet wiring to the proper length and organize it in the cabinet. Wire lengths should be slack (minimum 10 feet) allowing for future modifications.
      - Use at least No. 6 AWG wire for the conductors between service drop and AC+ and the AC- terminals.
   b. Do not mount electrical meter to the cabinet. Submit "power pedestal" or other method of providing location for mounting to the Engineer.
   c. Label all field terminals and conductors so as to identify the specific field input.
   d. Crimp terminal connections to conductors with a ratchet-type crimping tool that will not release until the crimping operation is completed.
   e. Do not use splices inside the controller cabinet, base, or conduit.
   f. Do not use solid wire, except grounding wire.

g. Supply the cabinets with cabinet wiring diagrams, schematic drawings, pin assignment charts, and manuals for circuits and components. Store these documents in the cabinet in a resealable, weatherproof container.

F. Signal Monitors

Furnish signal monitor equipment as follows,

1. Mount signal monitors in a rack with appropriate connectors to attach to the wiring harness.
2. Program the monitor according to the signal operation indicated in the Signal Plans before placing the installation in flash or stop-and-go operation. Provide any signal monitoring programming tools required to program the monitor to the maintaining agency.
3. Configure and equip the signal monitor to monitor all red signal indications. Ensure that the red output for unused or vacant load bays or output slots is jumpered to 120 V AC+.
4. For ITS Cabinets configure the CMU and AMU.
5. For Ramp Metering Cabinets mount model 208 monitor in rack and provide the necessary programming required for the Ramp Meter operation as shown in the Plans.

G. Power Disconnect

Install a power disconnect box at each intersection as shown in the Standard Detail Sheets. Ensure the power disconnect is installed at the top of the cabinet pole or as indicated on plans. Install service cables from disconnect box and terminate as specified on the controller cabinet-wiring or battery backup diagram.

H. Flashing Beacon

Furnish and install the flashing beacon controller at the locations shown in the Plans and/or as directed by the Engineer. Install it as a complete unit (solid state flasher and cabinet with time clock, if applicable) and ensure that it conforms to this Specification.

I. Loop Detector Systems

Install and test loop detector systems according to NEMA Standards Publication TS 1-1983, Section 15, Inductive Loop Detectors, subsequent revisions (except as shown in the Plans), Details, notes, and this Specification.

Ensure that loop detectors are complete and fully operational before placing the signal in stop-and-go operation.

1. General Installation Requirements

   Each loop must consist of at least two turns of conductor, unless otherwise shown in the Plans or this Specification. Do not place a portion of the loop within 3 feet (1 m) of a conductive material in the pavement such as manhole covers, water valves, grates, etc.

   a. Install pull boxes, condulets, and conduits before beginning loop installation.
   b. Ensure that the ambient pavement surface temperature in the shade is at least 40 ºF (5 ºC) before cutting roadway and placing sealant into saw cuts.

2. Loop Saw Cuts

   a. Outline the loop on the pavement to conform to the specified configuration.
   b. Ensure each loop has a separate saw cut with a minimum distance between saw cuts of 6 inches.
   c. Install the detector loop in a sawed slot in the roadway surface deep enough to provide at least 3 inches (76 mm) of sealant cover.
   d. Ensure that the slot is at least 0.25 inches (6 mm) wide for stranded No. 14 AWG loop wire, THWN, XHHW, or XLPE, and at least 0.31 inches (7 mm) wide for polyethylene or PVC encased No. 14 AWG loop wire.
      1) At the intersection of the slots, drill a 2 inch (51 mm) diameter hole or make miter saw cuts in the pavement. Overlap miter saw cuts at the intersection of saw cuts so that the slots have a full-depth and smooth bottom.

2) Prevent the wire from bending sharply.

3) Do not install detector loop wire unless sawed slots are completely dry and free of debris. Pressure wash the slot to guarantee adhesion of the loop sealant. Use compressed air to thoroughly dry the sawed slot.

4) Install the loop wire starting at the nearest pull box or condulet, around the loop for the specified number of turns, and back to the pull box or condulet.

NOTE: Loop wire from the street is to be spliced in condulets or pull boxes only.

5) Refer to table 647-9 for the number of turns for Quadrupole loops. Refer to table 647-8 for the number of turns for) Bipole loops. Bipole loops require at least three (3) turns.

e. Press the wire in the slot without using sharp objects that may damage the jacket.

f. Hold the loop in place every 5 feet (1.5 m) with 1 inch (25 mm) strips of rubber, neoprene, flexible tubing, or foam backer rod as approved by the Engineer.

g. Leave the hold down strips in place when filling the slot with loop sealant.

h. Where encased loop wire is used, apply a waterproof seal to the ends of the polyethylene tubing that encase the wire to prevent moisture from entering the tube.

i. Where the loop wires cross pavement joints and cracks, protect the loop wires using the method specified in "Traffic Signal Details" in the Plans. When crossing expansion joints drill a 2 inch diameter hole minimum 3 inches deep, or to bottom of saw cut. Do not install loop wires in an expansion joint.

j. Twist Loop Lead-in 3 turns per foot.

3. Loop Sealing

After successfully testing each loop, fill the slots with sealant to fully encase the conductors.

a. Seal the slot within one hour of cutting slot.

b. Ensure that the sealant is at least 3 inches (75 mm) thick above the top conductor in the saw cut.

c. Apply the sealant so that subsequent expansion does not extend the sealant material above the pavement surface.

d. In case of accidental spill, before the sealant sets, remove surplus sealant from the adjacent road surfaces without using solvents or epoxy sealants.

e. When the Engineer determines that the loop sealant can accommodate traffic but the surface is tacky, dust the sealer on the pavement surface with cement dust before opening the roadway to traffic.

f. Dispose of the solvents used to clean loop installation equipment according to the manufacturer's specifications and local, State, and Federal regulations.

4. Loop Connections

Connect loop conductors to a shielded lead-in cable that runs from the pull box adjacent the pavement edge or condulet to the detector hook-up panel in the controller cabinet, unless otherwise specified in the Plans.

a. Use continuous (no splices) shielded lead-in cable from the pull box or condulet to the cabinet input file terminal. Do not ground the shield in the loop lead-in cable at the cabinet.

b. Connect each loop to an individual detector channel as specified in the Plans.

c. If the Plans specify that two or more loops will be operated on the same detector channel or detector amplifier unit, wire them in series to their loop lead-in at the pull box or condulet.

d. Use series-parallel connections when series connections do not meet the manufacturer's specified operating range for the detector amplifier unit.

e. Make weather-tight and waterproof splices as detailed on the Plan Standard Detail Sheets. Make loop splices to loop lead-in cable only after the detector system has been tested and demonstrated under traffic conditions to the Engineer's satisfaction.

5. Loop Maintenance

   Locate all existing loops, determine the operational status of all loop assemblies, and notify the Engineer prior to commencing loop construction activities at the intersection.

   Maintain all existing, operational loops, unless otherwise notified by the Engineer. Repair of an existing loop that is non-operational prior to beginning work will be considered as extra work.

   Locate points of conflict between new loops and existing loops, and install all new loops and saw cuts so as not to cut existing loop lead-ins and loop wires that are to be retained.

   If an existing operational loop that is not scheduled for replacement fails during the construction time frame, notify the Engineer and complete the replacement of the damaged loops immediately.

   The Engineer may grant a twenty-four (24) hour period to repair the loops if their operation is not critical. All costs associated with the replacement of the loops damaged during construction shall be charged and paid for by the Contractor.

J. Pedestrian Push Button

Install the push button with a pedestrian instruction sign as illustrated on the Department's Standard Detail Sheets and according to the Plans.

1. Place the pedestrian buttons as shown on the Signal Plan Sheet and within 10 inches (254 mm) of sidewalk or concrete landing pad. Position the pedestrian button to correspond to the appropriate signal phase. Locate pedestrian buttons perpendicular to the appropriate signal indication and signal phase, and as field conditions require.
2. Place the center of the buttons between 38 inches (0.965 m) and 42 inches (1.05 m) above the sidewalk or ground level.
3. Seal all openings to prevent moisture from entering the pushbutton.

K. Cable

Install and connect electrical cable to the proper equipment to produce an operating traffic signal system. Use stranded copper cable conforming to Section 925.

Install wiring in accordance with IMSA, NEMA, UL, and the Department's Traffic Signal Wiring Standards, shown in Tables 647-1, 647-2, 647-3, 647-4, 647-5, and 647-6 of this Specification.

In addition to the information provided below, see Section 682, Section 922, and Section 925 for cable equipment and installation specifications.

Table 647-1 Vehicular Signals Georgia DOT Wiring Standards						
Signal Indications	**Four Conductor Cable**		**Seven Conductor Cable**		**Ten Conductor Cable**	
	Phases 2, 4, 6, & 8	**Phases 1, 3, 5, & 7**	**Phases 2, 4, 6, & 8**	**Phases 1, 3, 5, & 7**	**Phases 2, 4, 6, & 8**	**Phases 1, 3, 5, & 7**
Red	Red Wire		Red Wire		Red Wire	
Yellow	Black Wire		Orange Wire		Orange Wire	
Green	Green Wire		Green Wire		Green Wire	
Red Arrow		Red Wire		White Wire with Black Tracker		Red Wire with Black Tracker
Yellow Arrow		Black Wire		Black Wire		Orange Wire with Black Tracker
Flashing Yellow Arrow		Green Wire		Orange Wire		Blue Wire
Green Arrow		Green Wire		Blue Wire		Green Wire with Black Tracker
Auxiliary					Black Wire	Black Wire
Neutral	White Wire	White Wire	White Wire	White Wire	White Wire	White Wire
Spare					White Wire with Black Tracker	White Wire with Black Tracker

Table 647-2 Vehicular Loop Detectors Georgia DOT Wiring Standards				
Detectors	**Phases 3, 4, 7, and 8 Presence Loops**		**Phases 2 and 6 Setback Pulse Loops and Phases 1 and 5 Presence Loops**	
	Loop Wires	**Shielded Loop Lead-in Cable, 3 Pair**	**Loop Wires**	**Shielded Loop Lead-in Cable, 3 Pair**
Right Curb Lane	Red Wire	Red/Black Pair (1)	Red Wire	Red/Black Pair (1)
Second Lane	Green Wire	Green Black Pair (1)	Green Wire	Green Black Pair (1)
Third Lane	White Wire	White/Black Pair (1)	White Wire	White/Black Pair (1)
Fourth Lane	Red Wire	Red/Black Pair (2)	Red Wire	Red/Black Pair (2)

Fifth Lane	Green Wire	Green/Black Pair (2)	Green Wire	Green/Black Pair (2)
Sixth Lane	White Wire	White/Black Pair (2)		
First Left-Turn Lane			Red Wire	Red/Black Pair (3)
Second Left-Turn Lane			Green Wire	Green/Black Pair (3)

Table 647-3 Pedestrian Signals Georgia DOT Wiring Standards				
Signal Indications	**Four Conductor Cable**		**Seven and Ten Conductor Cable**	
	Phases 2 and 6	**Phases 4 and 8**	**Phases 2 and 6**	**Phases 4 and 8**
Don't Walk	Red Wire	Red Wire	Red Wire	Orange Wire
Walk	Green Wire	Green Wire	Green Wire	Blue Wire
Neutral	White Wire	White Wire	White Wire	White Wire

Table 647-4 Pedestrian Detectors Georgia DOT Wiring Standards		
Push Buttons	**3 Pair Shielded Cable**	
	Phase 2 and 6	**Phase 4 and 8**
Call	Green and Black Pair	Red and Black Pair

NOTE: Do not use aluminum cable.

Table 647-5 Ramp Meter Signals Georgia DOT Wiring Standards	
Signal Indications	**3-Section Signal Heads Seven Conductor Cable L1,L2,L3**
Red	Red Wire
Yellow	Orange Wire
Green	Blue Wire
Neutral	White Wire

Table 647-6 Ramp Meter Loop Detectors Georgia DOT Wiring Standards				
	Demand Detector Loops		**Queue Detector Loops**	
	Loop Wires	**Shielded Loop Lead-in Cable, 3 Pair**	**Loop Wires**	**Shielded Loop Lead-in Cable, 3 Pair**
Lane 1	Red Wire	Red/Black Pair (2)	Red Wire	Red/Black Pair (1)
Lane 2	Green/Wire	Green Black Pair (2)	Green Wire	Green/Black Pair (1)
Lane 3	White Wire	White/Black Pair (2)	White Wire	White/Black Pair (1)
	Passage Detector Loops		**Mainline Detector Loops (if used)**	
	Loop Wires	**Shielded Loop Lead-in Cable, 3 Pair**	**Loop Wires**	**Shielded Loop Lead-in Cable, 3 Pair**
Lane 1	Red Wire	Red/Black Pair (3)	Red Wire	Red/Black Pair (4)
Lane 2	Green Wire	Green/Black Pair (3)	Green Wire	Green/Black Pair (4)
Lane 3	White Wire	White/Black Pair (3)	White Wire	White/Black Pair (4)

L. Signal Cable for Vehicular Signal Heads and Pedestrian Heads

Install cable for signal heads and pedestrian heads as follows:

1. For vehicle signal heads, install one 7-conductor signal cable for each intersection approach from the controller cabinet to the through-signal head on each approach as directed by the Engineer. From this leftmost signal head, install a 7-conductor signal cable to each of the other signal heads on the same approach in sequence.
2. For pedestrian signal heads, install one 7-conductor signal cable from the controller cabinet to each pedestrian head installation location to operate either one or two pedestrian heads.
3. Make a minimum 1 foot (300 mm) diameter 3 turn weather drip loop as shown in the Standard Detail Drawings in the Plans at the entrance to each signal head.
4. Neatly tie signal cables leaving a structure or weatherhead to enter a signal fixture. Tie the cables to the messenger cable as illustrated in the Standard Detail Drawings.
5. For Ramp Meter signal heads install one 7-conductor signal cable for each lane of the Ramp Meter operation from the controller cabinet.

M. Interconnect Communications Cable

Use fiber optic interconnect cable as specified in the Plans for all new interconnected signal systems. See Section 935 for fiber optic cable information, specifications and installation and testing techniques, and all other signal interconnect methods. Install interconnect communications cable as follows:

1. Provide support for the interconnect cable on new or existing utility poles or signal poles; install underground in conduit.
2. Use fiber optic standoff brackets as needed to prevent damage from poles, trees and other structures.
3. Pull cables with a cable grip that firmly holds the exterior covering of the cable.
4. Pull the cables without dragging them on the ground, pavement or over or around obstructions. The Engineer will inspect and approve the cable prior to installation. Use powdered soapstone, talc, or other approved inert lubricants to pull the cable through the conduit.
5. When using a separate messenger cable, spirally wrap the communications cable with a lashing machine according to the IMSA-20-2 Specifications.
6. Do not splice outside the signal cabinet except at the end of full reels of 5,000 feet (1500 m).
7. Ensure that splice points are near support poles and accessible without closing traffic lanes.
8. Unless drop cable assemblies for communications are used, loop the cable in and out of the control cabinets. Coil and tie 10 feet (3 m) of cable in the controller cabinet foundation. Tape the cable ends to keep moisture out until the terminals are attached.
9. Prevent damage to the cable during storage and installation.

NOTE: Do not allow anyone to step on or run over any cable with vehicles or equipment.

N. Loop Detector Lead-in Cable

Use 3-pair shielded lead-in cable in compliance with Section 925 and manufacturer's recommendations for Detector loop lead-in installed for loop detectors. Ensure the three pair has 3 separate distinguishing colors. Use a shielded lead-in cable connecting the loop to the detector hook-up panel in the controller cabinet, unless otherwise specified in the Plans. Provide a separate 3- pair for each phase or future phase.

1. Splice the loop detector wire to a shielded loop detector lead-in cable in a pull box adjacent to the loop detector installation.

2. Use continuous (no splices) shielded lead-in cable from the pull box or condulet to the cabinet input file terminal. If induced voltage is present, the shield in the loop lead-in cable shall be grounded to cabinet per NEC. Otherwise do not ground the shield in the loop lead-in cable at the cabinet.
3. Connect each loop to an individual detector channel as specified in the Plans.
4. Each detection loop shall be connected to the control cabinet via separate lead-in pair.
5. Set back loops with aerial loop leads to the control cabinet shall be supported by ¼ inch messenger cable with no splices between the control cabinet and the initial point of aerial attachment.
6. Make weather tight and waterproof splices between lead-in and loop wire. Loop installation may be approved only after the detector system has been tested and demonstrated under traffic conditions to the Engineer's satisfaction, during the Operational Test Period.

O. Pedestrian Push Button Lead-in

Use 3-pair shielded lead-in cable compliant with Section 925 for pedestrian push buttons. Install one 3-pair shielded lead-in cable to each pedestrian push button station(s) location to operate either one or two push buttons. Do not ground the shield for the push button lead-in cable at the controller cabinet. Do not use the same 3 pair cable for loop and pedestrian detectors.

P. Messenger Cable, Stranded-Steel

The messenger is used to support signal cable indicated in the Plans as overhead cable. Use devices such as aluminum wrap, aluminum wire ties or lashings to attach the cable.

- Before erecting the messenger strand, determine the suspension strand length to span the distance between the poles.
- Run the messenger strand from structure to structure without splicing.
- The minimum allowable sag is two and one-half percent (2.5%) for timber poles, five (5%) for strain poles of the longest diagonal distance between the signal poles unless pole manufacturers specifications exceed 2.5%.
- Calculate attachment points for the messenger strand at the signal pole according to the Plan Detail Sheet.

Set messenger strands so that the height conforms to the clearances on the Standard Detail Drawings. Attach cables to messenger cable using lashing wire, aluminum ties, or lashing rods (Subsection 925.2.43). If lashing rods are used use lashing rods sized for the cables and messenger strand. Only use lashing rods that are of the same material as the messenger strand. Lashing wire shall only be used to support aerial loop lead-in and fiber optic.

1. Drill wood poles to receive the eye bolts so that the span wire and eyebolt at each connection form a straight angle.
2. Never pull or strain the messenger on the eye bolt to an angle of variance greater than ten degrees (10º).
3. Attach down guy wires to guy hooks. Use a minimum 3/8 inch messenger cable for down guys. Never attach them directly to the eye of an eyebolt.
4. Ensure that messenger strand clearances conform with local utility company Standards.
5. Make stranded messenger cable attachment points with the appropriate size strand vises or 3 bolt clamps. Stranded steel messenger cable is not paid for separately under this Specification.
6. Use minimum ¼ inch messenger cable.
7. Use standoff brackets as needed to prevent damage from poles, trees or other structures.

NOTE: Never splice messenger cable between structures or stand off brackets.

Q. Underground Cable for Signal Circuits

Underground cable for signal circuits includes cable, with conduit, as shown in the Plans. Install cable under existing pavement or surfaced shoulder, according to Subsection 680.3.05.

1. Cable in Conduit

   Pull cable into conduits as follows:

   a. Pull cables into conduits without electrical or mechanical damage. Pull cables by hand only. The use of trucks or other equipment is not permitted, unless approved by the Engineer. If mechanical pulling is approved, do not exceed the manufacturer's tension rating for the cable.

   b. Pull cables with a cable grip that firmly holds the exterior covering of the cable.

   c. Use powdered soapstone, talc, or other inert lubricants to place conductors in conduit according to manufacturer's recommendations.

   d. Handle and install the conductors to prevent kinks, bends, or other distortion that may damage the conductor or outer covering.

   e. Pull all cables in a single conduit at the same time. When pulling cables through hand holes, pole shafts, etc., use a pad of firm rubber or other material between the cable and the opening edges to prevent cable damage.

   f. When installing cable in conduit with existing signal cable circuits remove all existing cables and pull them back into the conduit with the new cables.

   g. The distance between pull boxes in a run of conduit shall not be greater than 100 feet (30 m), unless otherwise shown in the Plans or approved by the Engineer or District Signal Engineer, with the exception of fiber optic cable.

   h. The distance between pull boxes in a run of conduit for fiber optic cable shall not exceed 750 feet (225 m), unless otherwise shown in the Plans or approved by the Engineer. Identification tape and tone detection wire shall be used for fiber optic cable in conduit. All unused conduit shall have a continuous pull cable installed between pull boxes.

2. Splices

   Required splicing shall be performed according to the National Electric Code; use materials compatible with the sheath and insulation of the cable.

   Insulate required splices with electrical insulation putty tape, plastic, pressure sensitive, all-weather 1.5 mil (0.038 mm) electrical tape in accordance to standard details.

   a. Make the spliced joints watertight.

Note: Splice detector wires to shielded loop detector lead-in at pull boxes located immediately after the loop wire leaves the roadway. No splices will be permitted in shielded loop detector lead-in cable from this point to the controller cabinet.

R. Conduit and Fittings

Install conduit by type (GRS, HDPE, PVC) as shown in the Plans and the Standard Detail Drawings. Refer to the NEC, for conduit full percentages.

Separate the power cable to the controller cabinet from all other cables in its own 1in (25 mm) galvanized rigid steel conduit except inside poles. Ensure that conduit conforms to Section 682, Section 923 and Section 925 with the following addition:

- Use flexible conduit only where shown in the Details or as directed to do so in writing by the District Signal Engineer.

Use the conduit size specified in the Plans, unless otherwise directed by the Engineer. Obtain written approval from the Engineer prior to installing conduit other than the size specified in the Plans.

All 2 inch (50 mm) conduit elbows shall be "sweep" type. The minimum radius for the elbow is 18 inches (450 mm), unless otherwise approved by the Engineer.

NOTE: Do not use multi-cell conduit.

Install conduit and fittings as follows:

1. Ensure that exposed conduit on poles are galvanized rigid steel (GRS) conduit.
2. Ream the ends of metallic conduit after cutting the threads. Ream other conduit as necessary.
3. Cut the ends square, and butt them solidly in the joints to form a smooth raceway for cables.
4. Make conduit joints to form a watertight seal.
5. Coat metallic conduit threads with red- or white-lead pipe compound, thermoplastic or Teflon seal. Ensure that they are securely connected.
6. Make plastic conduit joints with materials recommended by the conduit manufacturer.
7. Install bushings in the conduit to protect the conductors. When conduit is installed for future use, properly thread and cap the ends of the metallic conduit runs.
   a. Plug the ends of nonmetallic conduit runs to prevent water or other foreign matter from entering the conduit system.
   b. Seal the exposed conduit ends with a permanently malleable material.
   c. Ensure that empty conduit installed for future wire or cable has a nylon pull string or cord inside that is impervious to moisture and rot and can withstand a load of 50 pounds (23 kg) without breaking. Secure this pull cord at each open end and at each pull box.
8. Ensure that conduit on pole exteriors are mounted with galvanized, two-hole straps or clamps. Place the clamps not more than 3 feet (1 m) from junction boxes, condulets, or weatherheads. Place it at 3 foot (0.9 m) intervals elsewhere.
   a. Fasten the clamps to wood poles with galvanized screws or lag bolts.
   b. Do not install conduit risers on concrete, steel, or mast arm poles unless approved by the Engineer.
9. Install a weatherhead at the end of exterior conduit runs on a pole or other structure to prevent moisture or other matter from entering the conduit.
10. After installation, ensure that the conduit or fitting placement has not warped or distorted any condulet, terminal, control or junction box.
11. Ensure Conduit that is terminated at poles is grounded at the pull box.

S. Underground Conduit

Underground conduit includes encased or direct burial conduit.

1. Install the conduit in a trench excavated to the dimensions and lines specified in the Plans.
   a. Provide at least 18 inches (450 mm) finished cover, unless otherwise specified.
   b. Under pavement, excavate at least 36 inches (900 mm) below the bottom of the pavement.
2. Before excavation, the Contractor is responsible for determining the location of electrical lines, drainage, or utility facilities in the area to prevent damage.
   a. Place the conduit where it will not conflict with proposed guardrail, sign posts, etc.
   b. Change locations of conduit runs, pull boxes, etc., if obstructions are encountered during excavation. Changes are subject to the Engineer's approval.
   c. Where possible, provide at least 12 inches (300 mm) between the finished lines of the conduit runs and utility facilities such as gas lines, water mains, and other underground facilities not associated with the electrical system.
3. When the conduit run is adjacent to concrete walls, piers, footings, etc. maintain at least 4 inches (100 mm) of undisturbed earth or firmly compacted soil between the conduit and adjacent concrete or, when the conduit is

encased, between the encasement and the adjacent concrete. Unless specified in the Plans, do not excavate trenches in existing pavement or surfaced shoulders to install conduit.

4. When placing conduit under an existing pavement, install the conduit by directional boring, or other approved means. See Section 682 for directional boring pipe specifications. Obtain the Engineer's approval prior to installing conduit by means of boring-method.
5. When the Plans allow trench excavation through an existing pavement or surfaced shoulder, restore the pavement shoulder surface, base, and subgrade according to the Specification.
6. Cut trenches for conduit on a slight grade (0.25 percent minimum) for drainage, unless otherwise specified. When the grade cannot be maintained all one way, grade the duct lines from the center, both directions, down to the ends.
7. Avoid moisture pockets or traps. Excavate vertical trench walls.
8. Tamp the bottom of the trench to produce a firm foundation for the conduit.
9. When necessary to prevent damage, sheet and brace the trenches and support pipe and other structures exposed in the trenches.
10. Conduit installed for fiber optic cable installation shall have identification tape and detectable tone wire installed for detection as specified and detailed in the Project Standard Detail Sheets.
11. Install direct burial conduit as shown in the Plans. Use rigid galvanized steel, or polyethylene conduit. Excavate at least 36 inches (900 mm) below the top of the finished ground or 36 inches (900 mm) below the bottom of the pavement.
12. When rock is in the bottom of the trench, install the conduit on a bed of compacted, fine-grain soil at least 4 inches (100 mm) thick.
13. Conduit installed for fiber optic cable installation shall have detectable tone wire installed for detection as specified in Section 682 and detailed in Standard Detail Sheets.

T. Encased Conduit

Place encased conduit in the locations shown in the Plans unless otherwise specified. Construct as follows:

1. Construct the encasement using Class A concrete that meets requirements in Section 500 .
2. Extend the encasement or conduit under roadway pavements or surfaces 6 inches (150 mm) past the outer edge of paved shoulders or sidewalks, or past curbs if no shoulder or sidewalk is present.
3. Extend the conduit at least 3 inches (75 mm) beyond the encasement.
4. Place 3 inches (75 mm) of concrete in the bottom of the trench and place the conduit on top of it.
5. Temporarily plug the ends of the conduit to prevent concrete or foreign materials from entering.
6. Cover the conduit with at least 3 inches (75 mm) of concrete. Wait to encase the conduit with concrete until the Engineer inspects and approves the conduit.
7. Cure the concrete encasement according to Subsection 500.3.05.Z, except curing may be reduced to twenty-four (24) hours. Use a precast encasement if approved by the Engineer.

U. Backfilling

Immediately backfill the conduit after the Engineer's inspection and approval, except for encased conduit, which must complete a twenty-four (24) hour cure period.

1. Backfill with approved material free of rocks or other foreign matter.
2. Backfill in layers no greater than 6 inches (150 mm) loose depth, up to the original ground level.
3. Compact each layer to one hundred percent (100%) of the maximum laboratory dry density as determined by GDT 7, GDT 24a, GDT 24b, or GDT 67 whichever applies.

V. Conduit on Structures

Install conduits, condulets, hangers, expansion fittings, and accessories on structures according to the Plans and, unless otherwise specified, the following:

1. Run the conduit parallel to beams, trusses, supports, pier caps, etc.
2. Install horizontal runs on a slight grade without forming low spots so they may drain properly.
3. Run conduits with smooth, easy bends. Hold the conduit ends in boxes with locknuts and bushings to protect the conductors.
4. When not specified in the Plans or Special Provisions, submit the type and method for attachment to structures to the Engineer for submission to the District Signal Engineer for approval.
5. Ground galvanized rigid steel conduit in pull boxes.

All exposed conduit shall be galvanized, rigid conduit unless otherwise specified.

W. Testing Conduit

After installing the conduit, test it in the presence of the Engineer.

1. Test conduit using a mandrel 2 inches (50 mm) long and 0.25 inches (6 mm) smaller in diameter than the conduit.
2. Repair conduit to the Engineer's satisfaction if the mandrel cannot pass through. If repairs are ineffective, remove and replace the conduit at no additional cost to the Department.
3. Thoroughly clean the conduits. When installing conduit but wiring at a later date:
   a. Perform the mandrel test.
   b. Ream the duct opening to remove burrs or foreign matter.
   c. Thoroughly clean the duct.
   d. Provide and install a weatherproof cap at each open end.
   e. All installed conduit not used or containing cable shall have a continuous nylon pull string installed between junction boxes.

X. Grounding

Ground the cabinets, controller, poles, pull boxes, and conduit to reduce extraneous voltage to protect personnel or equipment.

NOTE: Grounding shall meet the minimum requirements of the NEC.

Provide permanent and continuous grounding circuits with a current-carrying capacity high enough and an impedance low enough to limit the potential above the ground to a safe level.

Perform grounding as follows:

1. Bond the grounding circuits to nonferrous metal driven electrodes. Use electrodes that are at least 0.625 inches (15 mm) in diameter, 8 feet (2.4 m) long, and are driven straight into the ground.
2. Use the shortest possible ground lead that leads directly to a grounding source.
3. Ensure that the maximum resistance between the ground electrode and the earth ground is no greater than twenty five (25) ohms.
4. Connect the ground electrodes and the ground wire with an exothermic weld or ground rod clamp as approved by Signal Engineer.
5. Connect neutral conductors to the cabinet buss-bar and ground them at each terminal point.

6. Ground the cabinet with a No. 6 AWG solid copper wire between the buss-bar to the ground electrode. Bends shall not exceed 4 inch (100 mm) radius bends.
7. Permanently ground the poles by bonding the No. 6 AWG solid copper wire to a separate ground rod.
8. Ground pole-mounted accessories to the pole.
9. Underground metallic conduit or down guys are not acceptable ground electrodes. Do not use Snap-On connections.
10. For extended distances between Ramp Meter and IVDS additional grounding may be required by the manufacturer.

Y. Ground Rod

Install copper clad ground rods adjacent to the traffic signal pole bases, controller cabinet bases, and in pull boxes to shield and protect the grounding system.

When ground rods are not protected, bury them at least 2 inches (50 mm) below the finished ground level.

1. Use 0.625 inch (15 mm) diameter ground rods at least 8 feet (2.4 m) long. Use copper clad ground rods.
2. Drive single ground rods vertically until the top of the rod is no more than 2 inches (50 mm) above the finished ground.
3. Attach a length of No. 6 AWG solid copper wire to the top of the ground rod using an exothermic weld.
4. When controller cabinets are mounted on timber poles, ground them with No. 6 AWG solid copper wire attached to the ground rod. Run the wire inside a minimum 0.75 inch (19 mm) rigid conduit attached to the timber pole and to the chassis ground in the controller cabinet.
5. When ground penetration is not obtained:
   a. Place a horizontal ground rod system of three (3) or more parallel ground rods at least 6 feet (1.8 m) center-to-center and 30 inches (720 mm) below the finished ground.
   b. Ensure that this grounding system produces a resistance of 25 ohms or less.
   c. Join the ground rods and connect them to the grounding buss of the traffic signal cabinet with No. 6 AWG solid copper wire.
6. Install a ground wire on wood poles.
   a. Use at least No. 6 AWG solid copper wire bonded to the grounding electrode and extending upward to a point perpendicular to the uppermost span.
   b. Place wire staples no greater than 2 feet (0.6 m) apart to secure the ground wire to the pole.
   c. Connect the span wire to the pole ground using copper split bolt connectors. Provide a separate ground rod for pole mount cabinets. Do not use the pole ground. Bond the pole ground to the pole cabinet ground rod.
7. Ensure that grounding for signal strain poles conforms to the grounding assembly typical erection Detail Sheet in the Plans.
8. Permanently ground cabinet and cabinet conduits to a multi-terminal main ground buss.
   a. Use a No. 6 AWG solid copper wire bonded between the buss and grounding electrode.
   b. Connect the power company neutral, conduit ground, and grounds of equipment housed in the cabinet to the buss-bar.
   c. Do not ground to a permanent water system instead of the driven ground rod. Ensure that grounding devices conform to the requirements of the NEC and NEMA.
9. When testing for resistance ensure the ground is dry. The Contractor is responsible for submitting the ground test results.

Z. Signal Poles

See Section 501 for signal pole materials certification and Subsection 925.2.27, Subsection 925.2.28, Subsection 925.2.29, Subsection 925.2.30 and Subsection 925.2.31 for traffic signal equipment. Refer to the Plans for pole locations.

Where necessary, adjust pole location to avoid utility conflicts. Provide minimum clearance distances between the signal pole and the roadway as specified in the Plans and on the Standard Detail Drawings.

1. Strain Poles

   Provide signal strain poles that conform to Section 639.

   Provide caissons or foundations that conform to the "Construction Detail for Strain Pole and Mast Arm Pole Foundations" in the Plans.

   Determine the required foundation size based on the manufacturer's specified "bending moment at yield" for each pole.

   Provide strain poles with manufacturer-installed holes for pedestrian heads and push buttons. Seal unused holes with water tight plugs that match the pole finish provided by the manufacturer of the pole. All steel strain pole holes that are used shall have a rubber grommet or weather head.

   Rake the poles during installation to provide a pole that is plumb once the load is applied.

2. Metal Poles

   Install metal poles as follows:

   a. Ensure that anchor bolts, reinforcing bars, and ground rods conform to Section 639 and Section 852 and are placed in the excavation.
   b. Support the anchor bolts with a template to provide the proper bolt circle for the pedestal or pole to be installed. Anchor bolts shall be installed without any modifications. Refer to signal details for proper installation.
   c. Wire the reinforcing bars together or to the anchor bolts.
   d. Wire the conduits in the base to the reinforcing bars for support. Ensure that they are accessible above and beyond the foundation.
   e. Before pouring the foundation concrete, determine that the anchor bolt orientation is correct so that the tensile load is divided between at least two anchor bolts. Pour and vibrate the concrete with the Engineer present.
   f. Ensure that the pole foundations and pedestals with the anchor-type base conform to Section 500 and Section 639. Do not install or locate poles without the Engineer's approval. Ensure the foundation meets AASHTO guidelines.
      1) The Engineer may take a concrete test cylinder as it is being poured.
      2) Cure the cylinder and submit it for testing to the Office of Materials and Research.
   g. If the concrete foundation fails to meet the requirements of the Specifications and is not accepted, replace the foundation upon notification of failure.
   h. After installing poles and applying the load of the signal span, inspect them for plumb and for the proper horizontal position of the mast arm, when applicable. Make sure all threads of the nut are threaded onto the anchor bolt.
   i. Correct deficiencies by using the leveling nuts on the anchor bolts or by adjusting the mast arm.
   j. The Engineer will examine the pedestals and poles for damaged paint or galvanizing. Restore the finish coating where necessary.
   k. After the Engineer approves the pole installation, provide an acceptable method of protecting the area between the pole base and the top of the foundation to prevent the accumulation of debris.

      If the finish or galvanized steel materials is scratched, chipped, or damaged, the material will be rejected. The finish may be replaced as specified under Section 645, with the Engineer's approval.
   l. For poles or arms that need galvanization, thoroughly clean the steel poles and arms and touch up non-galvanized parts with i-d red or original-type primer.

   NOTE: Never add holes or openings to the metal pole or mast arm without approval from the Office of Bridge and Structural Design.

m. Apply the remaining coats according to the System V (Heavy Exposure) Section 535, unless otherwise indicated in the Plans. The entire pole shall be the same color.

n. Install a service bracket and insulator on one pole at each intersection to attach power service wire as specified in the Plan Details. Install a disconnect box on the cabinet pole at each intersection to attach power service where the power service is provided overhead.

o. Install poles to which controller cabinets are attached with mounting plates, bolts, nipples, and at least two, 2.5 inch (64 mm) threaded openings at the top and at least two (2) 2 inch (50 mm) at the bottom of the pole.

p. Attach the fittings to the poles as specified by the manufacturer in the Plans or as the Engineer directs. The fittings may include:

- Cast aluminum cap
- Pole clamp hardware for span wire attachment
- Weatherhead with chase nipples and couplings
- Galvanized elbow with bushing installed by cutting the pole and welding in place around the entire circumference

q. The Office of Materials and Research will inspect the anchor bolts. If approved, the Office of Materials and Research will display the inspector's hammer stamp mark on the top of the bolt.

3. Concrete Strain Poles

a. Ensure that concrete strain poles meet the requirements of Section 639 and detailed construction drawings.

b. Install concrete strain poles so that the angle of variance between the eye bolt on the pole and the span wire is less than ten degrees (10º).

c. Verify pole hole orientations for pedestrian heads, pedestrian push button stations, luminaries arms, etc., with the Engineer prior to proceeding with traffic signal installation. For poles at cabinet location provide at least two 2.5 inch (64 mm) openings at the top of pole and at least two 2.0 inch (50 mm) threaded openings at the bottom.

d. Plug all unused holes. Use Grout or threaded fittings. Match the finish of the pole.

4. Mast Arms

Install mast arms that can accommodate traffic signal mounting hardware and that adhere to the manufacturer's recommended procedures and Section 925 and Section 915. Do not add holes.

a. Seal the openings in the mast arms to prevent pests from entering.

b. Align the mast arm to allow the signal heads to hang plumb at the correct height without using extensions.

c. All Mast arms are to be galvanized unless indicated otherwise in the Plans.

NOTE: The Contractor shall submit a "Mast Arm Pole Chart" to the Engineer and the Office of Bridge and Structural Design for review and approval as described in Subsection 647.1.03.F **of this Specification.**

Verify pole hole orientations for pedestrian heads, pedestrian push button stations, luminaries arms, etc., with the Engineer prior to proceeding with traffic signal installation.

5. Aluminum Pedestrian Pedestals Poles

Install aluminum pedestal poles, which adhere to Section 850 on breakaway aluminum bases that meet the requirements for breakaway construction. See Section 925 for breakaway base requirements. See the Standard Detail Drawings for Pole and Foundation Details.

a. Secure at least four anchor bolts in a concrete foundation as shown in the construction Detail.

b. As an alternate to a concrete foundation install a Pedestal Foundation Anchor Assembly (Subsection 925.2.29). Install the foundation until the top of the base plate is level with the ground. Slide bolt heads through the

keyhole and under the base plate against the bolt head keepers with threads up. Bolt the pole base to the foundation. Adhere to the manufacturers instructions for installation.

1) Use a Universal Driving Tool with the correct kelly bar adaptor and bolts supplied with the tool.
2) Attach driving tool assembly to the foundation base plate using the bolts provided with each foundation. Be sure to align the tool soothe holes in the tool line up with the proper bolt circle on the foundation.
3) Stand the foundation, with the attached drive tool assembly, upright and attach the drive-tool-foundation to the kelly bar.
4) Raise the kelly bar until the foundation swings free of the ground. Maneuver the kelly bar until the point of the foundation is over the marked installation location.
5) Lower the kelly bar until the point of the foundation is forced into the ground and the helix is flush with the ground surface.
6) Ensure the shaft of the foundation is plumb by checking the shaft with a level on two sides that are at least 90 degrees from each other. Recheck the shaft to be sure it is plumb when the foundation has penetrated 1 foot into the ground.
7) When the base plate of the foundation is 1 (25 mm) to 2 (50 mm) inches above the ground line remove driving tool.

c. Contain the wiring inside the pole or in approved hardware. Do not allow conduit outside the pole.

d. Position the pedestal pole plumb and high enough to clear the pedestrian's head as shown in the Plans. Ensure that the bottom of the pedestrian signal housing including brackets is not less than 10 feet (3 m) from the ground line. If using a vehicle signal housing ensure pole is adequate to give signal head a height of 12 feet (3.6 m)

e. Instruct the supplier to furnish a mill certificate that shows the alloy and physical properties of the steel used in fabricating the anchor bolts. The bolts may be subjected to a tensile and shear strength test.

6. Timber Poles

Timber poles do not require the use of concrete for filling the cavity around the pole base.

Use timber poles that meet the requirements of Section 861 and Section 639. Use Class II for all signal support poles. Use Class IV for aerial loop lead-in or communication cable if approved by the Engineer. Poles shall be inspected and include AWW stamp.

Drill wood poles to receive the eye bolt so that the angle of variance between the eye bolt and span wire at each connection is less than ten degrees (10º). See the Standard Detail Drawings for additional information.

Guy timber poles use single or double guy wires as shown in the Plans and as directed by the Engineer. Guy helper cables with separate guy wires when helper signal span cables are indicated in the Plans.

NOTE: Never attach down guy wires to eye bolts. Attach down guy wires to angle guy attachment only and install insulating rods on all down guy installations as detailed on Standard Detail Sheets.

AA. Pull Boxes

Ensure that pull boxes conform to the Standard Detail Drawings or Plan Detail Sheet. Install pull boxes as required by the Specifications and Plans.

1. Include provisions for drains in pull box excavations as specified.
2. Do not place the aggregate for the drain until the Engineer approves the excavation.
3. Do not set the pull box until the aggregate is in place.
4. Set the pull boxes in place, level, and install conduits as required. Conduit entrance shall be through the open bottom in Types 1, 2, 3, 4S and 5S. Conduit entrance shall be directly through cored holes in the side walls in Types 4 and 5. Conduit entrance shall be through the conduit terminators in Types 6 and 7.

Adjust the location of the pull box if necessary to avoid obstacles.

Where conduit entrance will be through the side wall in Types 4 and 5, or for conduit other than the terminator size provided in Types 6 and 7, use field cored conduit entrance holes in the side wall of the box. All field coring shall be made with a diamond-tipped masonry hole saw and according to the pull box manufacturer's recommendations.

Use an approved HDPE to EPVC coupling or an underground-type conduit adhesive where joining conduit or conduit bodies of dissimilar materials, such as HDPE-to-EPVC sweeps into pull boxes or installing into pull box conduit terminators.

- Do not locate pull boxes on the curb side of the signal pole in the intersection radius return
- Install pull boxes so that the long dimension is parallel to the adjacent roadway
- Install the pull box at a location that is level with the surrounding ground or pavement. Do not place a pull box in a ditch or depression. Unless otherwise shown in the Plans, when installed either in a sidewalk or in the ground, the top of the pull box shall be level with the sidewalk or ground surface.

5. Obtain the Engineer's approval, and begin backfilling and installing the frame and cover. Ground metal lids or covers.

BB. Span Wire and Span Wire Assemblies

Use span wire to support signal heads, cable, and other hardware only. Use messenger cable to support the aerial cable plant. Install span wire and messenger wire where specified in the Plans and in accordance with the Standard Detail Drawings. See Section 925 for information on span wire and messenger cable.

1. Install signal span wire not to exceed the sag specified by the pole manufacturer. Span wire used with timber pole installation shall have a minimum 2.5% sag. Span wire used with strain pole installation shall have a minimum 5% sag.
2. Use helper cables where specified in the Plans and on the Standard Detail Drawings.
3. For construction of a box or modified box span, use bullrings. Be consistent throughout the intersection in use of bull rings or strandvises. If bull rings are not used, standvises shall be interlocked.
4. Install 12 inch (300 mm) diameter drip loop wrapped three times at the cable entrance to signal heads. Arrange cable so that it enters the structure from the bottom of the drip loop. Use a 24 inch (600 mm) diameter drip loop where cables enter a weatherhead and use 24 inch (600 mm) sag at corners of a span.
5. Use aluminum ties, lashing rods, or aluminum wrap to attach cables to span wire. When using aluminum wrap or aluminum ties spaced at 6 inch (150 mm) increments. Aluminum wrap shall have at least three turns of wrap. Do not use lashing wire on span wire.
6. Ground all span wire and down guy assemblies as shown on Standard Detail Sheets. Bond all span wire together and bond to ground at every pole.

CC. Traffic Signal Heads

Place traffic signal heads according to the signal design and Plan Detail Drawings. Deviation from the Plans must be according to the MUTCD, current edition and at the Engineer's approval. Ensure all Traffic Signal Heads at an installation have the same appearance for the signal heads and the LED Modules. The Ramp Metering enforcement device shall be mounted on the back of one signal per lane and wired to the red display. The enforcement device shall be able to be viewed from downstream on the ramp.

1. Install traffic signal heads at least 17 feet (5.1 m), but no greater than 19 feet (5.7 m) over the roadway. All vertically attached signal head assemblies shall have a metal support plate installed within the top section (RED) indication of the signal head for additional support and stability. Install Ramp Metering traffic signal heads as shown on the Plans Detail Drawings.
2. Adjust signal heads on the same approach to have the same vertical clearance.
   a. Measure the clearance from the pavement to the lowest part of the assembly, including brackets and back plates.

b. Mount traffic signals on poles with a clearance of at least 12 feet (3.6 m) but no more than 19 feet (5.8m) above the sidewalk or pavement grade of the center of the highway, whichever grade is higher.

c. Mount and adjust Ramp Metering traffic signals as per the Plan Detail Drawings.

d. Mount and adjust Ramp Meter enforcement device (head) as per the Plan Detail Drawings.

3. Connect the signal cable to the wire in each signal head to provide the correct signal indication when the cables are connected to the controller cabinet back panels. Do not splice cables. Use wire nuts to make the connections to the LED signal modules leadin. Make all connections in the top section. Ensure that the black jacket is pulled into the signal head 6 inches (150 mm).
4. Install optically programmable (OP) signal heads as shown in the Plans and Standard Detail Sheet and as directed by the manufacturer.
5. Mount OP heads securely or tether them to limit movement.
6. Mask the OP lamp for directing visibility under the Engineer's supervision.
7. Tether signal heads that have tunnel visors longer than 12 inches (300 mm), at the discretion of the Engineer.
8. Attach signal heads to mast arms using rigid mounting brackets. See Section 925 for equipment information. Adjust signal heads on mast arms so that all red indications on the same mast arm are at the same elevation.
9. Install lane control heads for reversible lane systems and Ramp Metering heads as shown in the Plans and the Standard Detail Drawings. Center each signal over the lane or lanes under signal control.
10. Leave a vertical clearance for blank-out signs as shown on the Standard Detail Drawings. Use a spirit level to ensure that the bottom edge of each sign is horizontal.
11. All LED modules shall be labeled with their turn on date on the backside of the LED insert.

DD. Pedestrian Signal Heads

Install pedestrian signal heads on wood, concrete, steel strain poles, wood or steel auxiliary poles, or metal pedestal poles. Do not mix pole mount methods at the same intersection installation.

Install the pedestrian signal heads as shown on the Standard Detail Drawings and the intersection Plan Sheets and Drawings.

Leave a vertical clearance from the bottom of the head to the ground level of least 10 feet (3 m) unless specified by the Engineer.

1. Pedestal Mounts

   Make pedestal mounts with a lower supporting assembly consisting of:

   a. A 4 inch (100 mm) slip-fitter bracket

   b. Hollow aluminum arms with a minimum inside cross-sectional area equal to a 1.5 inch (38 mm) pipe

   Use serrated locking devices that firmly hold the signal heads in the required alignment.

   c. For Pedestal Mounts using side hinge "clamshell". Secure "clamshell" to pedestal using 0.75 inch (19 mm) wide and 0.30 inch (0.75 mm) thick stainless steel bands.

2. Pole Mounts (Side of Pole)

   For Metal poles, use side hinge "clamshell" mounting hardware or hardware as described in Wood Pole, Metal Pole alternate, or pedestrian pole.

   a. Side Hinge "Clamshell"

      - Secure the hubs to metal or concrete poles using 0.75 inch (10 mm) wide and 0.030 inch (0.75 mm) thick stainless steel bands. Secure the hubs to wood poles using lag bolts.

   b. Wood Pole or Metal Pole alternate:

      Make pole mounts with the upper and lower assembly consisting of:

- A post arm with a minimum cross-sectional area equal to a 1.5 inch (38 mm) pipe
- A post hub plate that matches the outside pole contour
- Secure the hubs to metal or concrete poles using 0.75 inch (19 mm) wide and 0.030 inch (0.75mm) thick stainless steel bands. Secure the hubs to wood poles using lag bolts, or banding.

Space the junctions so that each pedestrian signal head can be directed toward approaching traffic as needed.

Use serrated locking devices that hold the pedestrian signal heads in alignment.

EE. Blank-out Signs

Install blank-out signs as shown on Plans or as follows:

1. Securely fasten the signs to a stationary structure or to a messenger strand support system.
2. Center each sign over the lane or lanes under sign control, where applicable.
3. Leave a vertical clearance for blank-out signs as shown in the Plans or in Subsection 647.3.05.EE, "Traffic Signal Heads." Use a spirit level to ensure that the bottom edge of each sign is horizontal.
4. Use terminal strips to connect each sign electrically to the external control box or cabinet.

FF. Battery Backup System (BBS)

Install Battery Backup System (BBS) if indicated on the Plans. Install in accordance with the option as indicated on the Plans and as directed by the Engineer.

With the Battery Backup submittal provide calculations for determining the size of the inverter and batteries based on the actual power requirements for the intersection installation. Ensure that all auxiliary items are included in the calculations. Ensure the submittal specifies the model number and the firmware revision that is being supplied.

Ensure that the external cabinet supplied meets the Section 925 Specifications and is base mounted next to the 332A cabinet as specified. Do not attach the battery external cabinet to the 332A cabinet unless otherwise specified. The external cabinet option allows for 2 separate configurations. Ensure that the correct configuration is installed in accordance with the Plans. Make all connections to the 332A cabinet through the base of the cabinets.

Provide date of manufacture of all batteries provided.

Ensure the BBS functions as required by the specifications. Ensure the "ON BATTERY" relay provides an input into the controller Alarm 2. Install the two hour run time circuitry from the normally open contacts in the BBS controller to the AC+ and the mercury coil terminal in the traffic signal cabinet.

Ensure that the BBS is enabled to communicate via Ethernet connection.

Provide copy of all documentation (Operation and Maintenance Manual) for items supplied. Include with documentation any communications firmware and cable required to interrogate the unit for status, setup or logs.

GG. Power Meters

Install Power Meters per GDOT Standard Drawings and Utility Provider's Specifications.

647.3.06 Quality Acceptance

A. Testing Loop Detector Installation

Test each loop after installing the conductors in the slots cut in the pavement and before sealing.

- Perform a test where the loop wire is spliced to the shielded lead-in wire and where the shielded lead-in wire enters the controller cabinet
- If there are no splice points, such as in direct entry to the controller cabinet, only perform the tests at the controller

- Record the test results on the Loop Installation Data Sheet in Table 647-10, as shown in this section. Make copies of the data sheet as needed.
- Include the data sheets in the records, and place a copy in the controller cabinet.

Conduct the following five (5) tests to evaluate each loop installation for acceptance before sealing the loop in the pavement:

1. Induced AC Voltage Test

   Read 0.05 V AC or less on a digital voltmeter or no deflection on the pointer of an analog meter.

2. Inductance

   Inductance (I) is measured in microhenries (mH), and the total inductance is equal to the inductance of loop plus inductance of the loop lead-in.

   Acceptable inductance is within 10 percent (10%) of the calculated value for a single loop with the design criteria listed in Table 647-8 and Table 647-9:

Table 647-8 Standard (Bi-Pole) Loops	
6 ft x 6 ft (3 turns) [1.8 m x 1.8 m (3 turns)]	I = 76 mH + 23 mH per 100 feet of loop lead-in cable I = 76 mH + 23 mH per 30 m of loop lead-in cable
6 ft x 30 ft (2 turns) [1.8 m x 9 m (2 turns)]	I = 126 mH + 23 mH per 100 feet of loop lead-in cable I = 126 mH + 23 mH per 30 m of loop lead-in cable
6 ft x 40 ft (2 turns) [1.8 m x 12 m (2 turns)]	I = 165 mH + 23 mH per 100 feet of loop lead-in cable I = 165 mH + 23 mH per 30 m of loop lead-in cable
6 ft x 50 ft (2 turns) [1.8 m x 15 m (2 turns)]	I = 205 mH + 23 mH per 100 feet of loop lead-in cable I = 205 mH + 23 mH per 30 m of loop lead-in cable
6 ft x 70 ft (2 turns) [1.8 m x 21 m (2 turns)]	I = 285 mH + 23 mH per 100 feet of loop lead-in cable I = 285 mH + 23 mH per 30 m of loop lead-in cable

Table 647-9 Quadrupole (QP) Loops	
6 ft x 30 ft (2, 4, 2 turns) [1.8 m x 9 m (2, 4, 2, turns)]	I = 269 mH + 23 mH per 100 feet of loop lead-in cable I = 269 mH + 23 mH per 30 m of loop lead-in cable
6 ft x 40 ft (2, 4, 2 turns) [1.8 m x 12 m (2, 4, 2 turns)]	I = 349 mH + 23 mH per 100 feet of loop lead-in cable I = 349 mH + 23 mH per 30 m of loop lead-in cable
6 ft x 50 ft (2, 4, 2 turns) [1.8 m x 15 m (2, 4, 2, turns)]	I = 429 mH + 23 mH per 100 feet of loop lead-in cable I = 429 mH + 23 mH per 30 m of loop lead-in cable
6 ft x 60 ft (2, 4, 2 turns) [1.8 m x 18 m (2, 4, 2, turns)]	I = 509 mH + 23 mH per 100 feet of loop lead-in cable I = 509 mH + 23 mH per 30 m of loop lead-in cable
6 ft x 70 ft (2, 4, 2 turns) [1.8 m x 21 m (2, 4, 2, turns)]	I = 589 mH + 23 mH per 100 feet of loop lead-in cable I = 589 mH + 23 mH per 30 m of loop lead-in cable

3. Leakage Resistance to Ground

   The resistance to ground shall be 5 Mohm or more.

4. Loop Resistance

The resistance reading on an ohmmeter is approximately within ten percent (10%) of the calculated value:

- Acceptable Resistance @ (dc @ 68 ºF [20 ºC]):ohms(μ)
- No. 18 AWG wire: R = 29.4μ/mile (or) R = 5.5 x 10^{-3}μ/ft. Approximately 5.5 ohms per 1,000 feet of No. 18 AWG wire)[R = 18.3μ/km (or) R=18.3 x 10^{-3}μ/m]
- No. 14 AWG wire: R = 13.32μ/mile (or) R = 2.523 x 10^{-3}μ/ft. Approximately 2.52 ohms per 1,000 feet of No. 14 AWG wire)[R = 8.3μ/km (or) R=8.3 x 10^{-3}μ/m]
- No. 12 AWG wire: R = 5.2μ/mile (or) R = 9.85 x 10^{-4}μ/ft. Approximately 0.98 ohms per 1,000 feet of No. 12 AWG wire [R = 3.24μ/km (or) R = 3.24 x 10^{-3}μ/m]

5. Loop Q

   Q at 50 kHz is greater than 5.

   Report to the Engineer an out-of-range reading on any of the above tests. If a test is found unacceptable, remove the loop, install new wire, and repeat the test procedure.

   Include in the test results:

   - Type and model number of the equipment used (must be ohmmeter having a high resistance scale of R x 10 KW or greater)
   - The last calibration date of the equipment and the scale used

   Check the loop using an impedance tester to determine the natural operating frequency and impedance. Ensure that the completed units detect all motor vehicles. If the loop detection system does not meet the above test requirements, payment will not be made for work on the signal installation until corrections are completed.

Table 647-10 Loop Installation Data Sheet	
Conditions	
Project Number:	
Date:	
Contractor:	
Weather:	
Temperature:	
Pavement Condition - Wet ( ) or Dry ( )	
Location	
City or County:	Phase:
Intersection Name or Number:	Function:
Route Number(s) or Name (s):	Lane Location:
Installation or Plan Sheet Number:	No. of Turns:
Size and Type of Loop:	Downstream/Upstream: Down ( ) Up ( )
Distance from Stop Bar:	Distance E.O.P/Curb to Lead-in:
Distance Lead-in Cable:	
Material	
Loop Wire Color/Insulation Type/Gauge:	
Loop Lead-In Wire Color/Insulation Type/Gauge:	
Splice Point:	
Conduit Length from Curb/E.O.P. to Splice Point:	
Conduit Length from Splice Point to Cabinet:	
Sealant Type and Part Number:	
Sealant Manufacturer and Lot No.:	
Interconnect Wire Type and Length:	
Loop Tests	
1. Induced Voltage _____2. Inductance _____ microhenries 3. Leakage Resistance to Ground _____ megohoms 4. Loop Resistance _____ ohms 5. Loop Q (Quality) _____ Q	
Comments	
Inspector's Name, and Title	

B. Field Tests

In addition to performing tests during installation and before turning on the equipment, perform the following tests on traffic signal circuits in the presence of the Engineer:

- Test each circuit for continuity

Test each circuit for grounds. If a test fails, repair the circuit immediately. New signals shall operate in the flash mode for three (3) days prior to beginning stop-and-go operation unless otherwise directed by the Traffic Engineer.

For Ramp Metering:

The Contractor shall submit to and obtain approval from the Engineer for Ramp Metering testing procedures for each specific Ramp Meter location. The testing procedure shall demonstrate that all components: hardware, cable, and connections furnished and installed by the Contractor operates correctly and that all functions are in conformance with the specifications.

At a minimum, the Contractor shall demonstrate to the Engineer:

- The IVDS and loop detectors at each location are functioning properly with expected accuracy as specified. IVDS burn-in period shall only be in conjunction with the Ramp Meter signal burn-in periodof 30 days.
- The Ramp Meter signals function properly at all stages, including non-metering, startup, metering, and shutdown.
- In multi-lane configurations, the Ramp Meter can operate a simultaneous release of vehicles from all lanes and as well as an alternating or staggered release of vehicles from the two (or three) lanes.~~.~~
- Queue detectors are functioning as specified, including both queue detection and queue override.
- The Ramp Meter functions properly for both local traffic responsive and time of day operations.
- The advance warning sign can be clearly seen and can be activated and deactivated properly.
- The Ramp Meter can communicate properly with the hub/TMC.
- The traffic enforcement heads are operating as per the Plans and can be seen by enforcement personnel.

The Contractor shall coordinate closely with Engineer for conducting Ramp Meter field operational tests. Note: Pretest should be performed prior to calling the Engineer for formal field tests inspection. Pretest shall be defined as conducting all field tests in accordance with the Ramp Metering field testing procedures submitted and approved. Results of pretests shall be recorded and submitted to the Engineer. The Engineer may require the Contractor to address particular items noted in the pretest before beginning the actual field tests.

Operational test shall not begin until the field tests are accepted by the engineer~~-~~that will be performed during the Engineer's inspection. Begin operational tests after the Engineer is satisfied that all work has been completed. After the Ramp Meter has been placed in operation, the Contractor, in coordination with the system integrator, shall demonstrate that all equipment furnished and installed by the Contractor operates with all software and firmware as specified.

After successful completion of the test procedure, each Ramp Meter assembly shall go through a burn-in period for 30 consecutive days of normal Ramp Metering operations. During the burn-in period, the Contractor shall ensure that all Contractor-supplied equipment operates without failures of any type. If any equipment component malfunctions or fails to provide the specified functionality during the 30-day burn-in period, the Contractor shall replace or repair the defective equipment within 48 hours of notification by the Engineer.

After the malfunctioning component(s) have been repaired or replaced to the satisfaction of the Engineer, the Contractor shall begin a new 30-day burn-in period. The new 30-day burn-in period shall apply only to equipment components supplied by the Contractor. In the event of a failure or malfunctioning of equipment furnished by others which prevents the 30-day burn-in test from continuing, the Engineer will suspend the burn-in test and resume when the other equipment failures are corrected.

C. Operational Tests and Equipment Activation

After the equipment is installed and the field tests are completed successfully the Contractor shall request an initial equipment inspection. The Engineer shall notify in writing the District Signal Engineer a minimum of 14 working days

prior to the inspection. The District Signal Engineer shall provide an in depth inspection and provide a written punch list of items for the Contractor to correct. Within fourteen days of the notification the Contractor shall correct the items noted.

Prior to activating new equipment and before removal of any existing intersection control or equipment, test and ensure any communications equipment is functional.

In the event that programming of the controller application is not a pay item for the contract the Engineer will notify the District Signal Engineer a minimum of 14 working days prior to activating the equipment.

Prior to activating equipment all Inductance loop, video detection equipment and detection zones shall be functional and operational.

When defects are resolved, the District Signal Engineer will begin the Contractor's operational test period to demonstrate that every part of the system functions as specified. The operational test shall be concurrent for the entire project.

1. The operational test for the traffic signal and Ramp Metering projects shall be at least thirty (30) days of continuous, satisfactory operation.
2. If a component or system fails or shows unsatisfactory performance, the condition must be corrected and the test repeated until thirty (30) days of continuous satisfactory operation is obtained.
3. The District Traffic Engineer will send the Engineer and Construction Office a letter showing the start, termination, suspension, or successful completion of the operational test period.
4. The District Engineer may recommend payment only after the successful completion of the test period.
5. The Contractor shall obtain written acceptance of the signal installation from the District Traffic Operations Engineer before Final Acceptance.

Costs incurred during operational tests, including power consumption, shall be at the Contractor's expense and included in the price bid for Contract Items.

647.3.07 Contractor Warranty and Maintenance

A. Traffic Signal Equipment Maintenance

See Section 150.

If a signal that is the responsibility of the contractor is not functioning properly:

1. Non-Emergency

   Commence work on this signal within three (3) days of the written notice from the Engineer. Failure to respond shall result in a per calendar day charged against monies due or that may become due until the maintenance work is started. See Section 108.

   The Contractor shall be responsible for all materials, equipment and expertise necessary to correct signal malfunction or repair.

   The Department or local municipality will not be held responsible or liable for any alleged damage to the signal or as a result of the signal malfunction due to problems that may occur after the Department or local municipality forces make repairs.

   Upon Notice to Proceed, The Contractor shall check and make any needed adjustments to time clocks on a monthly basis. No additional payment shall be made for this requirement.
2. Emergency

If the Engineer determines that the signal malfunction or failure is an operational hazard, the Contractor is to take corrective action within three (3) hours of the first attempt of notification. Response shall be considered only when qualified personnel and equipment are provided.

Failure to respond within three (3) hours will result in a non-refundable deduction of money of $1,000.00 with an additional charge of $500.00 per hour after the first three (3) hours until qualified personnel and equipment arrives on site and begins corrective action.

In addition, the cost of labor and material will be charged by the Department if the Department takes corrective action using its own forces or local municipality forces.

Total charges will not exceed $5,000.00 (per emergency call) in addition to the material cost and labor incurred to make repairs by the Department or local municipality forces responding to the malfunction.

The Department will not be held responsible or liable for any alleged damage to the signal or as a result of the signal malfunction due to problems that may occur after Department or local municipality forces make emergency repairs.

The Contractor shall be responsible for all materials and equipment necessary to correct signal malfunction or repair.

Final Acceptance will not be given until payment for such work is received.

B. Warranties

Provide manufacturer's warranties or guarantees on electrical, electronic, or mechanical equipment furnished, except state-supplied equipment.

Ensure that warranties and/or guarantees are consistent with those provided as customary trade and industry standard practices; or as otherwise specified in the Plans, Standard Specifications, or Special Provisions.

Upon Final Acceptance, transfer the manufacturer and Contractor warranties or guarantees to the Engineer. Ensure that warranties are continuous and state that they are subject to transfer.

Acceptance or approval of the Work does not waiver warranties or guarantees where required by the Specifications. Final Acceptance will not be granted until all warranties and guarantees are received.

C. Guarantees

Repair and/or replace all equipment and material supplied under these Contract Documents which has been determined by the Engineer to not meet Specifications.

The Engineer reserves the sole right to determine suitability or unsuitability of the supplied equipment and material. The Contractor shall bear the total cost of delivery and transportation related to the repair and replacement of equipment and material throughout the duration of the Contract unless otherwise approved by the Engineer.

Transfer to the Engineer any warranties and guarantees remaining on all items after Final Acceptance. Perform transfer at 12:01 AM of the day following Final Acceptance.

647.4 Measurement

647.4.01 General

Traffic signal items complete, in place, and accepted of the kind, size, and type specified are measured as follows:

A. Traffic Signal Installation

Signal installation will be paid for by lump sum, including furnishing labor, materials, tools, equipment, and incidentals required to complete the work unless otherwise specified in this Subsection.

B. Communications Wire, Fiber Optic Cable

The number of feet (meters) of communications cable, wire or fiber optic cable is the actual number of linear feet (meters) of the size installed and accepted. Communications cable shall be paid for under Section 935.

B. Strain Poles, Traffic Signs

Highway signs are measured and paid for under Section 636. Strain poles are measured and paid for under Section 639.

C. Type 4, 4S, 5, 5S, 6 and 7 Pull Boxes

The number of pull boxes will be the actual number of pull boxes installed and accepted.

D. Loop Detector – Maintenance Milling and Resurfacing Projects

The number of loop detectors will be the actual number of loop detectors installed as specified in the Plans or as directed by the Engineer and accepted. Loop detector lead-in cable will not be measured separately for payment but will be included in the price submitted for Loop Detectors.

647.4.02 Limits

General Provisions 101 through 150.

647.5 Payment

647.5.01 General

The lump price bid for Traffic Signal and/or Ramp Meter Installation covers all Items of work in this Specification including furnishing labor, materials, tools, equipment, and incidentals required to complete the work.

Costs for installation, operation, maintenance, and removal of the traffic signal equipment are included under this Item.

Include payment for removal; disposal of existing pavement, shoulder surface, base and sub-grade; and restoration to original condition in the Contract Price for the items to which they pertain. They will not be paid for separately.

Furnishing, installing, and removing sheeting, bracing, and supports will not be paid for separately, but is included in the Contract Prices for other items.

No additional payment will be made for testing and storing State-supplied or Contractor-furnished traffic signal equipment.

No payment will be made for individual items unless a pay item is included in the Plans for the specific item.

Type 4, 4S, 5, 5S, 6, and 7 pull boxes will be paid for per each. Loop Detector will be paid for per each.

Payment will be made under:

Item No. 647	Traffic signal installation no-	Per lump sum
Item No. 647	Pull Box PB4	Per each
Item No. 647	Pull Box PB4S	Per each
Item No. 647	Pull Box PB5	Per each
Item No. 647	Pull Box PB5S	Per each
Item No. 647	Pull Box PB6	Per each
Item No. 647	Pull Box PB7	Per each
Item No. 647	Loop Detector	Per each

Payment for various elements of traffic signals will be as shown on the Plans.

A. Partial Payment

The Contractor may initiate a partial payment process for the lump sum traffic signal Items by submitting a written request to the Engineer. If the Engineer approves this request, payment will be made as follows:

Underground (loops, pull boxes, and conduits)	20%
Overhead (span, heads, poles, push buttons)	30%
Cabinet, contents, and base	20%
Successful completion of operational test	10%

B. Additional Items

Payment Items related to Section 647 are described in the following sections:

Strain Poles	Section 639
Highway Lighting	Section 680
Lighting Standards and Luminaries	Section 681
Electrical Wire, Cable, and Conduit*	Section 682
Grassing	Section 700
Timber Poles	Section 639 and Subsection 861.2.02
Sign Blanks	Section 912
Reflectorization Materials	Section 913
Traffic Signal Equipment/Ramp Metering Equip.	Section 925
* Payment for conduit installation shall be as described in Section 682 unless conduit installation is performed as part of a traffic signal installation, in which case measurement and payment is a part of the complete traffic signal installation. Payment is Lump Sum, unless listed as a separate pay item.	

647.5.02 Adjustments

General Provisions 101 through 150.

Office of Traffic Operations

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SUPPLEMENTAL SPECIFICATION

Section 659—Hot Applied Preformed Plastic Pavement Markings

Delete Section 659 and substitute the following:

659.1 General Description

This work includes furnishing and placing hot applied preformed plastic pavement markings according to these Specifications and at locations shown in the Plans or as otherwise directed. Use applied markings that are very durable, impervious to oil and grease, and provide immediate and continuing retroreflectivity. Use hot applied preformed plastic pavement markings compatible with existing alkyd and hydrocarbon thermoplastic material.

659.1.01 Definitions

General Provisions 101 through 150.

659.1.02 Related References

A. Standard Specifications

General Provisions 101 through 150.

B. Referenced Documents

Federal Standard 595

Manual on Uniform Traffic Control Devices for Streets and Highways

AASHTO M 247

AASHTO M 249

ASTM E 274

ASTM E 303

ASTM D 476

QPL 74

659.1.03 Submittals

Transfer to the Department all manufacturer warranties or guarantees for heat-applied preformed plastic marking materials. Ensure warranties or guarantees can be transferred.

659.2 Materials

Select one of the following types of preformed marking material according to the Plans and Proposal.

Type HA – Hot Applied Preformed Thermoplastic Marking

Type HA-BLM – Hot Applied Preformed Thermoplastic Marking - Bike Lane Marking

Type HA-CBL - Hot Applied Preformed Thermoplastic Marking – Colorized Bike Lane

For a list of sources, see QPL-74.

A. Marking Characteristics

Ensure markings have the following characteristics:

1. Composition

   Use pavement marking material consisting of a homogeneous mixture of high quality hydrocarbon resin, alkyd resin, or modified ester rosin solution in conjunction with aggregates, pigments, binders, and glass beads. Use thermoplastic material conforming to AASHTO M 249, except for relevant differences due to the material being supplied in a preformed state.

   a. Ensure Type HA-CBL pavement marking material contains no glass beads.

   b. Ensure Type HA and Type HA-BLM pavement marking materials contain at least 30% glass beads conforming to AASHTO M 247, Type 1. Use clear and transparent glass beads with a minimum idex of refraction of 1.50 and at least 80% being true spheres.

2. Color

   a. White

      Use white markings containing at least 8% by weight of titanium dioxide pigment meeting ASTM D 476, Type II, Rutile. Ensure color meets Federal Highway White, Color 17886, as per Federal Standard 595. Use white markings with a minimum daylight reflectance (Y value) at 45°/0° of 80%.

   b. Yellow

      Use yellow markings containing sufficient yellow pigment to ensure the color meets Federal Highway Yellow, Color 13538, as per Federal Standard 595. Use yellow markings with a minimum daylight reflectance (Y value) at 45°/0° of 45%.

   c. Colorized Bike Lane (Type HA-CBL)

      Ensure colorized bike lane material meet the color requirements of the Manual on Uniform Traffic Control Devices.

3. Shapes and Sizes

   Ensure prefabricated legends and symbols conform to the applicable shapes and sizes outlined in the "Manual on Uniform Traffic Control Devices for Streets and Highways." As an option, turn arrows and combination arrows may come without pre-applied surface glass beads to allow reversibility.

4. Thickness

   Ensure Type HA pavement marking material is at least 0.125 in (3.175 mm) thick.

   Ensure Type HA-CBL and Type HA-BLM pavement marking materials are at least 0.090 in (2.286 mm) thick.

5. Retroreflectivity

   Obtain pavement marking retroreflectivity values with a 30 meter geometry retroreflectometer.

   Use preformed markings meeting the following initial minimum reflectivity values:

   a. Non-Bike Lane Markings (Type HA)

	White	Yellow
Dry (ASTM E 1710)	350 mcd/lux/m^2	200 d/lux/m^2

   b. Colorized Bike Lanes (Type HA-CBL)

Colorized bike lanes do not contain glass beads or reflective elements. Thus, colorized bike lanes are non-reflective.

c. Markings inside the Bike Lane (Type HA-BLM)

	White	Yellow
Dry (ASTM E 1710)	275 mcd/lux/m^2	--

6. Skid Resistance

   Ensure the surface of Type HA preformed markings provides a minimum skid resistance of 45 BPN when tested according to ASTM E 303.

   Ensure the surface of Type HA-BLM preformed markings provides a minimum skid resistenace of 55 BPN when tested according to ASTM E 303.

   Ensure the surface of Type HA-CBL preformed markings maintains a minimum level of friction of 32 when tested according to ASTM E 274 after one year in place.

B. Heating Characteristics

Use preformed markings capable of being affixed to bituminous or Portland cement concrete pavements by the use of the normal heat of a torch recommended by the manufacturer and according to the manufacturer's installation guidelines. Ensure preformed markings resealing characteristics allow it to fuse with itself and with previously applied marking material of the same composition under normal conditions of use.

659.2.01 Delivery, Storage, and Handling

Manufacture and package preformed markings permiting storage at normal shelf temperatures for up to one year after purchase.

659.3 Construction Requirements

659.3.01 Personnel

General Provisions 101 through 150.

659.3.02 Equipment

General Provisions 101 through 150.

659.3.03 Preparation

General Provisions 101 through 150.

659.3.04 Fabrication

General Provisions 101 through 150.

659.3.05 Construction

A. Pre-Conditions for Applying Markings with Heat

Apply markings under the following conditions:

1. Ambient temperature is 35 °F (2 °C) or above.
2. Pavement is clean, dry, and free of debris.
3. Prior to installation, follow manufacturer's recommendations for preheating road surface.

B. Applying Drop-On Glass Beads

1. Apply drop-on glass beads to the entire surface of preformed markings not having factory pre-applied surface beads.
2. Apply the drop-on glass beads to the preformed marking material while still in a liquid state. Use beads meeting the requirements specified in Subsection 659.2.A.
3. Do not apply drop-on glass beads to colorized bike lanes.

659.3.06 Quality Acceptance

Use material evaluated by the National Transportation Product Evaluation Program (NTPEP), the Georgia Department of Transportation or other State DOT test facilities.

Hot applied preformed plastic pavement markings meeting the laboratory test and field test requirements will be placed on the Georgia Department of Transportation Qualified Products List. Provide certification from the manufacturer certifying the Hot Applied Preformed Plastic Pavement Markings supplied to construction and maintenance projects is formulated of the same material as when tested by NTPEP and will conform to the requirements of this Specification. Products meeting all the requirements in this Section but fail to perform adequately in actual use will be removed from the Qualified Products List.

659.3.07 Contractor Warranty and Maintenance

General Provisions 101 through 150.

659.4 Measurement

Heat-applied preformed plastic pavement markings, complete in-place and accepted, are measured as follows:

A. Solid Traffic Stripe

Solid traffic stripe of the color, width, and type shown on the Plans or in the Proposal will be measured by the linear foot (meter) or linear mile (kilometer) as specified. Breaks or omissions in solid lines or stripes at street or road intersections will not be measured for payment.

B. Skip Traffic Stripe

Skip traffic stripe of the color, width, and type shown on the Plans or in the Proposal will be measured by the gross linear foot (meter) or gross linear mile (kilometer) as specified. The unpainted spaces between the stripes will be included in the overall measurement if the Plan ratio remains uninterrupted. Measurement will begin and end on a stripe.

C. Payment by Square Yard (Meter)

When hot applied preformed plastic pavement markings are paid for by the square yard (meter), the actual number of square yards (meters) covered will be measured in the overall measurement, including the space between the markings. The color, width, and type shall be indicated on the Plans.

D. Heat Applied Preformed Plastic

Each heat-applied preformed plastic word or symbol, complete according to Plan dimensions, is measured by the unit. The code for each word or symbol is stated in the Plan.

659.4.01 Limits

General Provisions 101 through 150.

659.5 Payment

Payment in each case will be full compensation for all aspects of heat-applied markings, including adhesives, cleaning, application, and traffic control necessary to complete the Item.

Payment will be made under:

Item No. 659	Hot applied preformed plastic solid pavement markings_____ in (mm), (color), (type)	Per linear foot (meter)
Item No. 659	Hot applied preformed plastic solid pavement markings_____ in (mm), (color), (type)	Per linear mile (kilometer)
Item No. 659	Hot applied preformed plastic skip pavement markings_____ in (mm), (color), (type)	Per gross linear foot (meter)
Item No. 659	Hot applied preformed plastic skip pavement markings_____ in (mm), (color), (type)	Per gross linear mile (kilometer)
Item No. 659	Hot applied preformed plastic pavement markings (color), (type)	Per square yard (meter)
Item No. 659	Hot applied preformed plastic pavement markings (color), (type)	Per linear foot (meter)
Item No. 659	Hot applied preformed plastic pavement markings (color), (type)	Per gross linear foot (meter)

Item No. 659	Hot applied preformed plastic pavement markings words or symbols (color), (type)	Per each

659.5.01 Adjustments

General Provisions 101 through 150.

Office of Materials & Testing

May 23, 2013

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SUPPLEMENTAL SPECIFICATION

Add the following:

Section 661—Standard and Wet Weather Epoxy Traffic Stripe

661.1 General Description

This work includes furnishing and applying reflectorized standard and wet weather epoxy traffic stripe according to the Plans and these Specifications.

This Item also includes applying words and symbols according to Plan details, Specifications, and the current Manual on Uniform Traffic Control Devices.

661.1.01 Definitions

Painted Stripes: Solid or broken (skip) lines. The location and color are designated on the Plans.

Skip Traffic Stripes: Painted segments between unpainted gaps on a designated sequence with a ratio of 1:3 [10 ft (3 m) segment and 30 ft (9 m) gap] as specified on the Plans. The location and color are designated on the Plans.

661.1.02 Related References

A. Standard Specifications

General Provisions 101 through 150.

Section 656—Removal of Pavement Markings

B. Referenced Documents

QPL 46

QPL 71

AASHTO M 247

ACI Method 503

ASTM			
D 476	D 711	D 6628	E 303
E 1710	E 2177	G 53-77	

Federal Standard No. 595A-17778

SOP 39

US EPA Method 3052

US EPA Method 6010

661.2 Materials

A. General Requirements

- Use epoxy material that has been evaluated (2 year field evaluation) by the National Transportation Product Evaluation Panel (NTPEP) test facility or other approved test facility.

- Use epoxy material produced from an approved source listed on QPL 46.
- Use an epoxy composition that is specifically formulated for use as a durable pavement marking material.
- Ensure the liquid markings consist of a two-component (Part A and Part B), 100% solids epoxy film formulated and designed to provide a simple volumetric mixing ratio as recommended by the manufacturer.
- Use white or yellow films for the markings, and use colors for bike lanes as required on the Plans. Ensure that these films are manufactured without the use of lead chromate pigments or other similar, lead-containing chemicals.
- Ensure that the mixed white epoxy contains not less than 13% by weight ASTM D 476 rutile titanium dioxide pigment to insure adequate opacity, hiding power,and reflective properties.

B. Glass Spheres and Reflective Composite Optics

Use glass spheres and/or reflective composite optics for the reflective media system that ensures the epoxy pavement markings meet the reflectance performance requirements in Subsection 661.3.04. Do not use beads and/or optics containing greater than 200 ppm total arsenic, 200 ppm total antimony, or 200 ppm total lead when tested according to the most recent US EPA Methods 3052 and 6010, or other approved methods.

Ensure glass spheres meet the requirements of AASHTO M 247. Use glass spheres produced from an approved source listed on QPL 71. Glass spheres conforming to an alternative gradation may be used provided all other requirements of AASHTO M 247 and this specification are met.

C. Finished Product Requirements:

1. Composition

   Ensure that the retroreflective pavement markings consist of a mixture of high-quality resins, curing agent and pigments, with a reflective layer bonded to the top surface consisting of glass spheres and/or reflective composite optics.

2. Color

   Meet these color requirements:

   - White markings are pure white and free from dirt or tint.
   - Yellow markings are “Federal Yellow” in color.
   - Colors for bike lanes match the colors as shown on the Plans.
   - The material does not change its color and brightness characteristics after prolonged exposure to sunlight.

3. Skid Resistance

   Ensure the surface of the retroreflective marking provides an initial average skid resistance value of 45 BPN when tested according to ASTM E 303.

4. Color and Weathering Resistance

   Ensure that the mixed epoxy compound, both white and yellow, when applied to 3 in (75 mm) x 6in (150 mm) aluminum panels at 15 ± 1 mils (0.381 mm ± 0.025 mm) thick without glass beads and exposed in a Q.U.V. Environmental Testing Chamber, as described in ASTM G 53-77, conforms to the following minimum requirements:

   - The color of the white epoxy compound is not darker than Federal Standard No. 595A-17778, as measured by the Luminance factor Y according to ASTM D 6628.
   - The color of the yellow epoxy compound meets the requirements of the “Federal Yellow” color chart.

5. Drying Time (Laboratory)

   When tested in accordance with ASTM D 711 the epoxy marking material shall reach a no-pick-up condition in 30 minutes or less. Perform this test with AASHTO M247 Type 1 beads applied at a rate of 0.099 pounds per square foot (0.483 kg/m^2). Ensure that the drying time does not increase substantially with decreasing temperature.

6. Drying Time (Field)

   When installed at 77 ºF (25 ºC), at a thickness of 25 ± 2 mils (0.635 mm ± 0.051 mm) above the surface of the pavement on open graded asphalt concrete friction coureses and 20± 2 mils (0.508 mm ± 0.051 mm) on all other pavement types, and reflectorized with glass spheres and/or reflective composite optics, ensure that the epoxy markings reach a no-track condition in less than 30 minutes. Dry to “no-tracking” will be

considered as the condition where no visual deposition of the epoxy marking to the pavement surface is observed when viewed from a distance of 50 feet (15 m), after a traveling vehicle's tires have passed over the marking.

7. Adhesion to Concrete

   Ensure that the epoxy pavement marking materials, when tested according to ACI Method 503, have such a high degree of adhesion to the specified concrete surface that there is a 100% concrete failure in the performance of this test. Condition the prepared specimens at room temperature 75 º ± 2 ºF (24 ºC) for a minimum of 24 hours and maximum of 72 hours prior to the performance of this test.

8. Adhesion to Asphalt

   Ensure that the epoxy pavement marking materials, when tested according to ACI Method 503, have such a high degree of adhesion to the specified asphalt surface that there is a 100% asphalt failure in the performance of this test. Condition the prepared specimens at room temperature 75 º ± 2 ºF (24 ºC) for a minimum of 24 hours and maximum of 72 hours prior to the performance of this test.

661.3 Construction Requirements

661.3.01 Equipment

A. Traveling Traffic Striping Machine

To apply the traffic marking material, use a mobile, truck mounted and self contained pavement marking machine, specifically designed to apply two-component liquid materials, and glass beads, in a continuous and skip-line pattern.

Apply the two-component liquid materials through airless impingement mixing guns or static mix tubes. The guns must accommodate a plural component material system at the manufacturer's recommended volumetric mixing ratio. The guns must have the capacity to deliver materials from approximately 1.5 gal (5.7 L) to 3 gal (11.4 L) per minute to compensate for a typical range of application speeds of 3 mph (5 km/h) to 6 mph (10 km/h). Ensure that the machine travels at a uniform rate of speed both uphill and downhill.

Select the necessary accessories such as spray tip, mix chamber or static tube, and rod diameter to ensure proper mixing.

Ensure that the machine meets the following:

- The machine is capable of applying three separate stripes, either solid or skip, in any specified pattern by utilizing two adjacent spray nozzles at the same time.
- Each nozzle is equipped with satisfactory cutoff valves that will apply skip lines automatically.
- The application equipment is maneuverable to the extent that straight lines can be followed and normal curves can be made in a true arc.
- The truck-mounted unit is provided with accessories to allow for the marking of symbols and legends.

Ensure that the mobile applicator also includes the following features:

- The mobile applicator provides individual material reservoirs for the storage of Part A and Part B of the resin composition.
- The applicator is equipped with glass spheres dispensing equipment and capable of applying the glass spheres at a uniform rate.
- The application equipment is equipped with metering devices or pressure gauges on the proportioning pumps as well as stroke counters to monitor volumetric usage. Ensure that the metering devices or pressure gauges and stroke counters are visible.
- The applicator is equipped with all the necessary spray equipment, mixers, compressors, and other appurtenances to allow for the placement of reflectorized pavement markings in a simultaneous sequence of operations.

B. Hand Equipment

Use hand equipment for projects with small quantities of bike lanes, lane lines, edge lines, and center lines, or for conditions that require the equipment. Use hand equipment approved by the Engineer.

C. Cleaning Equipment

Use brushes, brooms, scrapers, grinders, high-pressure water jets, or air blasters to remove dirt, dust, grease, oil, and other foreign matter without damaging the underlying pavement.

661.3.02 Preparation

Notify the Engineer prior to the placement of the epoxy materials. Furnish the Engineer with the manufacturer's name and batch numbers of the epoxy materials and glass spheres to be used. Ensure that the approved batch numbers appear on the epoxy materials and glass spheres packages.

Before striping, thoroughly clean pavement surfaces of dust, dirt, grease, oil, and all other foreign matter.

Remove concrete curing compounds on new Portland cement concrete surfaces and existing pavement markings on both concrete and asphalt surfaces.

661.3.03 Construction

A. Atmospheric Conditions

1. Apply pavement markings only during conditions of dry weather and subsequently dry pavement surfaces. Ensure that the pavement surface temperature and the ambient temperature at the time of installation are both greater than 40 ºF (4 ºC) and that the relative humidity is not greater than 85%.

2. Moisture

   Do not apply when the surface is moist. When directed by the Engineer, perform a moisture test on the Portland cement concrete pavement surface. Perform the test as follows:

   a. Place approximately 1 yd^2 ($1m^2$) of roofing felt on the pavement surface.
   b. Pour approximately 1/2 gallon (2 L) of mixed epoxy onto the roofing felt.
   c. After 2 minutes, lift the roofing felt and inspect to see if moisture is present on the pavement surface or underside of the roofing felt.
   d. If moisture is present, do not proceed with the striping operation until the surface has dried sufficiently to be moisture free.

B. Alignment

Ensure that the traffic stripe is the specified length, width, and placement. On sections where no previously applied markings are present, ensure accurate stripe location by establishing control points at spaced intervals. The Engineer will approve control points.

C. Application

Apply the pavement markings as follows:

1. Apply the liquid marking material by spray method and according to the manufacturer's installation instructions.
2. Ensure marking configurations are in accordance with the "Manual on Uniform Traffic Control Devices."
3. Place the reflectorized pavement markings only on properly prepared surfaces and at the widths and patterns designated on the Plans. Do not begin marking operations until applicable surface preparation work is completed and approved by the Engineer.
4. Air-blast the surface first, to remove any dirt and residues from the pavement. Then apply the pavement markings as a continuous operation.
5. Ensure that mixing of the two components occurs in a static tube or impingement chamber prior to reaching the application spray nozzle.
6. Spray the mixed resin onto the pavement at a rate to obtain a minimum uniform dry thickness of 25 mils ± 2 mils (0.635 mm ± 0.051 mm) above the surface of the pavement on open graded asphalt concrete friction coureses and 20 mils ± 2 mils (0.508 mm ± 0.051 mm) above the surface of the pavement on all other pavement types .

7. Glass Spheres and Reflective Composite Optics

   a. Apply glass spheres and/or reflective composite optics to installed stripe surface above the minimum rate recommended by the epoxy material manufacturer to produce the required retroreflectivity value in accordance with Subsection 661.3.04.

   b. Apply the glass sphere and/or reflective composite optics top-coating with a pressure-type gun specifically designed for applying glass spheres and/or reflective composite optics that will embed at least one-half of the sphere's and optic's diameter into the epoxy immediately after the material has been applied to the pavement.

   c. Do not apply glass spheres or reflective composite optics to bike lanes.

Following an application of glass spheres and/or reflective composite optics, and upon curing, ensure that the resulting marking is an adherent reflectorized stripe of the specified thickness and width that is capable of resisting deformation by traffic.

D. Protective Measures

Protect newly applied striping as follows:

1. Traffic

   Control and protect traffic with warning and directional signs during application. Set up warning signs before beginning each operation and place signs well ahead of the equipment. When necessary, use a pilot car to protect both the traffic and the striping operation.

2. Fresh Striping

   Protect the freshly applied stripe using cones or other satisfactory devices. Repair stripe damage or pavement smudges caused by traffic according to Subsection 661.3.04.

E. Appearance and Tolerance of Variance

Continually deviating from stated dimensions is cause for stopping the work and removing the nonconforming stripe. (See Section 656.) Adhere to the following measurements:

1. Width

   Do not lay stripe less than the specified width. Do not lay stripe more than 1/2 in (13 mm) over the specified width.

2. Length

   Ensure that the 10 ft (3 m) skip stripe and the 30 ft (10 m) gap between skip segments vary no more than ± 1 ft (300 mm) each.

3. Alignment

   a. Ensure that the stripe does not deviate from the intended alignment by more than 1 in (25 m) on straight lines or curves of 1 degree or less.

   b. Ensure that the stripe does not deviate by more than 2 in (50 mm) on curves exceeding 1 degree.

661.3.04 Quality Acceptance

A. General

For a minimum of 30 days from the time of placement, ensure the epoxy traffic pavement marking material shows no signs of failure due to blistering, excessive cracking, chipping, bleeding, staining, discoloration, oil content of the pavement materials, smearing or spreading under heat, deterioration due to contact with grease deposits, oil, diesel fuel, or gasoline drippings, spilling, poor adhesion to the pavement material, vehicular damage, and normal wear. In the event that failures mentioned above occur, ensure corrective work is completed at no additional cost to the Department.

Ensure that stripes and segments of stripes are clean-cut and uniform. Markings that do not appear uniform or satisfactory, either during the day or night, or do not meet Specifications or become marred or damaged by traffic or from other causes, will be corrected at the Contractor's expense.

Obtain pavement marking retroreflectivity values with a 30 meter geometry retroreflectometer.

1. Correction of Alignment

   When correcting a deviation that exceeds the permissible tolerance in alignment, do the following:

   a. Remove the affected portion of stripe, plus an additional 25 ft (8 m) in each direction in accordance with Section 656.

   b. Apply a new stripe according to these Specifications.

2. Removal of Excess Marking Material

   Remove misted, dripped, or spattered markings to the Engineer's satisfaction. Do not damage the underlying pavement during removal.

   Refer to the applicable portions of Section 656.

B. Initial Retroreflectivity

1. Longitudinal Lines

   Within 30 days of installation, ensure the in-place markings meet the following minimum reflectance values:

   a. Standard Epoxy Traffic Material

	White	Yellow
Dry (ASTM E 1710)	400 mcd/lux/m^2	300 mcd/lux/m^2

   b. Wet Weather Epoxy Traffic Material

	White	Yellow
Dry (ASTM E 1710)	400 mcd/lux/m^2	300 mcd/lux/m^2
Wet recovery (ASTM E 2177)	150 mcd/lux/m^2	125 mcd/lux/m^2

   For each center line, edge line, and skip line, measure retroreflectivity 9 times for each mile; 3 times within the first 500 ft (152 m), 3 times in the middle, and 3 times within the last 500 ft (152 m). For projects less than one mile in length, measure retroreflectivity 9 times as above.

   Record all retroreflectivity measurements on the form OMR CVP 66 in SOP 39.

2. Messages, Symbols, Transverse Lines, and Bike Lanes

   Within 30 days of installation, ensure the in-place markings when tested according to ASTM E 1710 meet the following minimum reflectance value of 275 mcd/lux/m^2.

Perform at a minimum, one retroreflectivety measurement at one message, one symbol and one transverse line per intersection. Take one measurement per mile for locations other than intersections (i.e. school messages, railroad messages, etc.) Do not measure retroreflectivity of bike lanes.

C. Six Month Retroreflectivity (Longitudinal Lines)

Maintain the following minimum reflectance values for 180 days after installation:

1. Standard Epoxy Traffic Material

	White	Yellow
Dry (ASTM E 1710)	400 mcd/lux/m^2	300 mcd/lux/m^2

2. Wet Weather Epoxy Traffic Material

	White	Yellow
Dry (ASTM E 1710)	400 mcd/lux/m^2	300 mcd/lux/m^2
Wet recovery (ASTM E 2177)	150 mcd/lux/m^2	125 mcd/lux/m^2

Retest the in-place markings 180 days after installation to ensure these minimum retroreflectance values are maintained.

Note: The Contractor is responsible for retroreflectivity testing. Furnish initial test results to the Engineer within 30 days of application. Furnish 6 month test results to the Engineer within 180 days of application or prior to final acceptance, whichever comes first.

D. Thickness

Check the thicknesses on all skip lines, edge lines and center lines by placing durable tape, film, or metal plate of known and uniform thickness on an area to be striped. After the striper has passed over, remove the sample and measure the thickness with calipers or a micrometer.

For each center line, edge line, and skip line, measure thickness above the pavement 3 times for each mile; once within the first 500 ft (152 m), once in the middle, and once within the last 500 ft (152 m). For projects less than one mile in length, measure the thicknesss above the pavement 3 times.

Record thickness measurements on the form OMR CVP 66 in SOP 39.

Submit results to Engineer.

E. Corrective Work

For each mile section, if epoxy traffic stripe fails to meet Plan details or Specifications or deviates from stated dimensions, correct it at no additional cost to the Department. If removal of pavement markings is necessary, remove it according to Section 656 and replace it according to this Specification. No additional payment will be made for removal and replacement of unsatisfactory striping. Ensure corrective work is completed at no additional cost to the Department. Perform testing according to this Specification. Any retest due to failures will be performed at no additional cost to the Department. Furnish all test reports to the Department.

Retroreflectivity and Thickness Longitudinal Line Deficiency: A deficiency will ensue when two or more Location Average results as recorded on form OMR CVP 66 within a One-Mile Section do not meet the performance criteria herein. The entire line within this one mile section will be determined to be deficient. If the evaluated section is less than 1.0 mile, a single Location Average result not meeting the performance criteria herein will result in the entire line to be determined to be deficient.

Retroreflectivity Transverse Markings and Symbol Deficiency: A single Location Average result on the marking or symbol not meeting the performance criteria herein will result in the marking or symbol to be determined to be deficient.

661.3.05 Verification

See SOP 39.

661.4 Measurement

When traffic stripe is paid for by the square yard (meter), the number of square yards (meters) striped is measured and the space between stripes is included in the overall measurement.

Linear measurements are made on the striped surface by an electronic measuring device attached to a vehicle. On curves, chord measurements, not exceeding 100 linear feet (30 linear meters), are used.

Traffic stripe and markings, complete in place, are measured and accepted for payment as follows:

A. Solid Traffic Stripe

Solid traffic stripe is measured by the linear foot (meter), linear mile (kilometer), or square yard (meter). Breaks or omissions in solid lines or stripes at street or road intersections are not measured.

B. Skip Traffic Stripe

Skip traffic stripe is measured by the gross linear foot (meter) or gross linear mile (kilometer). Unstriped spaces between the skips are included in the overall measurements if the Plan ratio of 1 to 3 remains uninterrupted. Measurement begins and ends on a skip.

C. Pavement Markings

Pavement markings, words and symbols completed according to Plan dimensions are measured by the unit.

661.5 Payment

Payment will be full compensation for the work under this Section, including the following:

Cleaning and preparing surfaces
Furnishing materials, including epoxy, beads, and thinners
Applying, curing, and protecting epoxy
Protecting traffic, including providing and placing necessary warning signs
Furnishing tools, machines, and other equipment necessary to complete the Item

Payment will be made under:

Item No. 661	Standard solid epoxy traffic stripe, _____ in (mm), (color)	Per linear mile (kilometer)
Item No. 661	Standard skip epoxy traffic stripe, _____in (mm), (color)	Per gross linear mile (kilometer)
Item No. 661	Standard solid epoxy traffic stripe, _____in (mm), (color)	Per linear foot (meter)
Item No. 661	Standard skip epoxy traffic stripe, _____in (mm), (color)	Per gross linear foot (meter)
Item No. 661	Standard epoxy pavement markings, words, and symbols, (color)	Per each
Item No. 661	Standard epoxy traffic stripe, _____in (mm), (color)	Per square yard (meter)
Item No. 661	Wet weather solid epoxy traffic stripe, _____ in (mm), (color)	Per linear mile (kilometer)
Item No. 661	Wet weather skip epoxy traffic stripe, _____in (mm), (color)	Per gross linear mile (kilometer)
Item No. 661	Wet weather solid epoxy traffic stripe, _____in (mm), (color)	Per linear foot (meter)
Item No. 661	Wet weather skip epoxy traffic stripe, _____in (mm), (color)	Per gross linear foot (meter)
Item No. 661	Wet weather epoxy pavement markings, words, and symbols, (color)	Per each
Item No. 661	Wet weather epoxy traffic stripe, _____in (mm), (color)	Per square yard (meter)

Office of Materials & Testing

July 12, 2012
First Use: September 21, 2012
February 12, 2013
February 27, 2014

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SUPPLEMENTAL SPECIFICATION

Section 800—Coarse Aggregate

Delete Section 800 and substitute the following:

800.1 General Description

This section includes requirements for coarse aggregate. All aggregate shall be the specified type, class, and grade, and shall meet the requirements for the intended use.

800.1.01 Related References

A. Standard Specifications

Section 424—Bituminous Surface Treatment

B. Referenced Documents

AASHTO	ASTM
T 11 T 27 T 96 T 104 T 303	C 295 E 30 G 23

GDT 104

GDT 129

GDT 133

QPL 2

SOP 1

800.2 Materials

800.2.01 Coarse Aggregate

A. Requirements

The Contractor shall use the type, group, class, and grade of coarse aggregate specified. For coarse aggregate sources, see QPL 2.

1. Coarse Aggregate Types

Type	Characteristics

Type	Characteristics
Crushed stone	Sound, durable rock particles.
Gravel	Sound, durable rock without damaging coatings.
Air-cooled blast furnace slag	Sound, durable particles with uniform density and quality, or other slags that have a good service record. Dry slag shall weigh at least 70 lb/ft³ (1120 kg/m³) compacted and shall contain less than 30% glassy particles by weight. Do not use slag as aggregate for Portland cement concrete.
Synthetic aggregate	Sound, durable, expanded clay, shale, or other manufactured product.

2. Coarse Aggregate Groups
   a. Group I: Limestone, dolomite, marble, or any combination thereof. Ensure Group I aggregates meet the abrasion requirement for Class A stone when used in Portland cement concrete of any type or class.
   b. Group II: Slag, gravel, granitic and gneissic rocks, quartzite, synthetic aggregate, or any combination thereof.
3. Classes

   Aggregates are classified by physical properties that determine how they are used.
   a. Do not blend aggregates that meet abrasion requirements with aggregates that do not meet requirements.
   b. "Class A" and "Class B" aggregate used in Portland cement concrete, asphaltic concrete, and bituminous surface treatment shall meet these limits:

Percent Wear AASHTO T 96 ("B" Grading)		
	Class A	**Class B**
Group I Aggregates	0-40	41-55
Group II Aggregates	0-50	51-60

   c. "Class B" aggregates used in all applications other than Portland cement concrete, asphaltic concrete, or bituminous surface treatment shall meet these limits:

Percent Wear AASHTO T 96 ("B" Grading)	
	Class B
Group I Aggregates	41-55
Group II Aggregates	51-65

4. Soundness

   Test coarse aggregate used in Portland cement concrete, bituminous surfaces, bituminous bases, aggregate bases, or surface treatment with five alternations of the magnesium sulfate soundness test.
   a. Use aggregate with a weight loss of less than 15 percent.
   b. The 15 percent soundness loss for a Class "CS" concrete is waived if it has a 5-year service record.
   c. If the material meets all the requirements except for the 15 percent soundness requirement, the material may be used in Zones 3 and 4 (see Subsection 424.3.05, "Construction Requirements") under the following conditions:
      1) The aggregate in bituminous courses and in all types and classes of Portland cement concrete construction, except as stated in Group I, has a satisfactory five-year service record under similar service and exposure.
      2) The Engineer's investigation shows that it equals or exceeds the quality of approved aggregate (in cases where the material's uniformity changes at the source, or does not have a five-year service record).
5. Grades

   Use coarse aggregate that is well graded within the limits and sizes specified in Table 800.1.

6. Detrimental Substances
   a. Detrimental substances include shale, weathered or decomposed rock, friable particles, or any substance that may be detrimental for the use intended.
   b. Do not use any aggregate that can cause a deleterious reaction.
   c. Do not use aggregates that contain Chrysotile (defined as fibrous serpentinite) as a temporary or permanent unbound surfacing for roads, nor as stabilizer for soil used as subgrade, base, or surface course.
   d. Detrimental substances shall not exceed the following limits:
      1) For Portland Cement Concrete:

Substance	Max % Allowed
Mica schist—Materials defined in ASTM C 294 as phyllite or schist. Use GDT 104 to analyze these materials.	5
Materials that pass the No. 200 (75 µm) sieve.	1.5
Flat and elongated pieces (with lengths more than five times the average thickness).	10
Sulphur content computed as sulfide sulphur (for bridge-type structures)—If the sulphur content exceeds 0.01%, do not use the aggregate unless it passes a petrographic analysis and a weathering test equivalent to 6 months or more of exposure.	0.01
Other local detrimental substances. (Any Combination)	2.0
NOTE: Do not use aggregate in Portland Cement concrete that is capable of producing a deleterious reaction when combined with Portland Cement.	

      2) For Asphaltic Concrete:

Substance	Max. % Allowed
Mica schist—Materials defined in ASTM C 294 as phyllite or schist. Use GDT 104 to analyze these materials. (Use this requirement for Interstate Construction, SMA mixes, OGFC mixes and all surface mixes on roadways ≥ 25,000 ADT).	10
Flat or elongated particles (with lengths more than five times the average thickness).	10
Glassy particles (slag).	30
Other local detrimental substances. (Any combination)	2.0

      3) For Bituminous Surface Treatment:

Substance	Max. % Allowed
Mica schist—Materials defined in ASTM C 294 as phyllite or schist. Use GDT 104 to analyze these materials.	10
Material finer than No. 200 (75 µm) sieve. #5 Stone #6 Stone #7 Stone #89 Stone	 0.5 0.7 0.7 1.0
Flat and elongated particles (with lengths more than five times the average thickness).	10
Glassy particles (slag).	30
Other local detrimental substances. (Any combination)	2

7. Ensure that gravel used in Asphaltic Concrete and Bituminous Surface Treatment meets the following additional requirements:
   - Consists of siliceous particles.

- A minimum of 85%, by count, of the material retained on the No. 4 (4.75 mm) sieve has one or more fractured faces.
- The fracture is for the approximate average diameter or thickness of the particle.

8. Ensure that No. 7 stone used in Bituminous Surface Treatment meets the following gradation:

¾" (19 mm)	½" (12.5 mm)	3/8" (9.5 mm)	No. 4 (4.75 mm)	No. 8 (2.36 mm)
100	85-100	40-70	0-15	0-5

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

Test as follows:

Test	Method
Material that passes the No. 200 (75 µm) sieve	AASHTO T 11
Sulphur content	ASTM E 30, Leco method
Weathering	ASTM G 23
Petrographic analysis	ASTM C 295
Soundness (magnesium sulfate)	AASHTO T 104
Percent wear	AASHTO T 96
Aggregate gradation	AASHTO T 27
Reactivity	AASHTO T 303
Schist or phyllite	GDT 104
Flat and elongated particles	GDT 129
Friable Particles	GDT 133

D. Materials Warranty

General Provisions 101 through 150.

TABLE 800.1 - SIZES OF COARSE AGGREGATES

SIZE NO	NOMINAL SIZE SQUARE OPENINGS		AMOUNTS FINER THAN EACH LABORATORY SIEVE (SQUARE OPENINGS). %, BY WEIGHT										
	(1)	mm	2 ½"	2"	1 ½"	1"	¾"	½"	3/8"	No. 4	No. 8	No-16	No. 50
			63 mm	50 mm	37.5mm	25 mm	19 mm	12.5 mm	9.5 mm	4.75 mm	2.36mm	1.18 mm	300 µm
3	2-1	50 - 25	100	90-100	35-70	00-15	-----	00-5	----	-----	-----	-----	-----
357	2-No. 4	50 - 4.75	100	95-100	-----	35-70	-----	10-30	----	00-5	-----	-----	-----
4	1 ½ - 3/4	37.5 - 19	-----	100	90-100	20-55	00-15	-----	00-5	-----	-----	-----	-----
467	1 ½-No. 4	37.5 - 4.75	-----	100	95-100	-----	35-70	-----	10-30	00-5	-----	-----	-----
5	1-1/2	25 – 12.5	-----	-----	100	90-100	20-55	00-10	00-5	-----	-----	-----	-----
56	1-3/8	25 – 9.5	-----	-----	100	90-100	40-75	15-35	00-15	00-5	-----	-----	-----
57	1-No. 4	25 – 4.75	-----	-----	100	95-100	-----	25-60	-----	00-10	00-5	-----	-----
6	¾-3/8	19 – 9.5	-----	-----	-----	100	90-100	20-55	00-15	00-5	-----	-----	-----
67	¾-No. 4	19 – 4.75	-----	-----	-----	100	90-100	-----	20-55	00-10	00-5	-----	-----
68	¾-No. 8	19 – 2.36	-----	-----	-----	100	90-100	-----	30-65	05-25	00-10	0-5	-----
7	½-No. 4	12.5 – 4.75	-----	-----	-----	-----	100	90-100	40-70	00-15	00-5	-----	-----
78	½-No. 8	12.5 – 2.36	-----	-----	-----	-----	100	90-100	40-75	05-25	00-10	0-5	-----
8	3/8-No. 8	9.5 – 2.36	-----	-----	-----	-----	-----	100	85-100	10-40	0-10	0-5	-----
89	3/8-No. 16	9.5 – 1.18	-----	-----	-----	-----	-----	100	90-100	20-55	0-15	0-10	0-5
9	No. 4-No. 16	4.75 – 1.18	-----	-----	-----	-----	-----	-----	100	85-100	10-40	0-10	0-5

(1) In inches, except where otherwise indicated. Numbered sieves are those of the United States Standard Sieve Series.

First Use Date: November 17, 2006
Revised: January 17, 2014

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SUPPLEMENTAL SPECIFICATION

Section 801—Fine Aggregate

Delete Subsection 801.2.02.A.7 and substitute the following:

7. Grades

Grade fine aggregates for Portland cement concrete and mortar as follows:

Size No.	Description	Total Percent by Weight Passing Each Sieve					
		3/ 8 in (9.5 mm)	No. 4 (4.75 mm)	No. 16 (1.18 mm)	No. 50 (300 µm)	No. 100 (150 µm)	No. 200 (75 µm)
10 NS	Natural concrete sand	100	95-100	45-95	5-30	0-10	0-3
20 NS	Natural mortar sand	100	100	90-100	15-50	0-15	0-5
10 SM	Standard manufactured concrete sand	100	95-100	45-95	8-30	1-10	0-4
10 FM	Fine manufactured concrete sand	100	95-100	45-95	15-42	6-22	0-9

Office of Materials and Testing

August 13, 2013

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

SECTION 805 – RIPRAP AND CURBING STONE

Add Sub-Section 805.2.01.A.4

STONE PLAIN RIPRAP FOR STREAM DETAILS

Stone Plain Riprap for Stream Details shall be clean and essentially free of rock dust and fines. Stone shall be relatively flat on either side in the same dimension, preferably the long dimension. The material shall be processed such that 90 % of the particles within the size class shall have all dimensions within the ranges stated in the size classifications listed below:

TYPE A: Stone in this size class shall meet the following gradation requirements:

SIZE	PERCENT BY WEIGHT
Passing 12” Sieve	100
Passing 4” Sieve	0-25
Passing No.4 Sieve (4.75 mm)	0-10

Test: Method of Test shall be in accordance with the following:

Sieve Analysis	AASHTO: T 27

For use as fill for upstream fill portions of Cross Vanes, Rock Vanes, J-Hook Vanes, and in other structures and areas as indicated on the Plans and Details, as directed and approved by the Engineer.

TYPE B: Generally 2-4 cubic feet and weighing 0.16-0.33 tons. Maximum weight for this size class can be 0.52 ton. The dimensions of these stones shall be 2’ x 1’ x 1’ to 2’ x 2’ x 1’. Variability is allowed, however, with 1 foot being the smallest dimension and 2.5 foot being the largest dimension along any axis to be accepted within this size class. For use in Root Wad structures, Rock Vanes, Cross Vanes, J-Hook Vanes, and in other in-stream structures as indicated on the Plans and Details, as directed and approved by the Engineer.

TYPE C: Generally 4-8 cubic feet and weighing 0.33-0.66 tons. Maximum weight for this size class can be 1 ton. The dimensions of these stones shall be 2’ x 2’ x 1’ to 2’ x 2’ x 2’. Variability is allowed, however, with 1 foot being the smallest dimension and 2.5 feet being the largest dimension along any axis to be accepted within this size class. For use in Root Wad structures, Rock Vanes, Cross Vanes, J-Hook Vanes, and in other in-stream structures as indicated on the Plans and Details, as directed and approved by the Engineer.

TYPE D: Generally 12-18 cubic feet and weighing 1.0-1.5 Tons. Weight range can vary between 1 ton up to 2 tons. The dimensions of these stones shall be 3’ x 2’ x 2’ to 3’ x 3’ x 2’. Variability is allowed, however, with the smallest dimension being 2 feet and 3.5 feet being the largest dimension along any axis to be accepted within this size class. For use in in-stream structures such as Cross Vanes, J-Hook Vanes, Rock Vanes and in other structures and areas as indicated on the Plans and Details, as directed and approved by the Engineer.

TYPE E: Generally 24-72 cubic feet and weighing 2.0-6.0 tons. Weight range can vary between 2 tons up to and exceeding 6 tons with approval by the Engineer. The dimensions of this size class shall be to 6’ x 4’ x 3’. However, variability is allowed in that dimensions for this size class shall fall between the smaller 4’ x 3’ x 2’ and a maximum as determined by the Engineer. For use in large in-stream structures such as Cross Vanes, J-Hook Vanes, Rock Vanes, Step Pools, and in other structures and in areas indicated on the Plans and Details, as directed and approved by the Engineer.

Delete 805.2.01.C and Substitute the following:

C. Acceptance:

Test as follows:

Test	Method
Percent Wear	AASHTO: T96
Petrographic Analysis	ASTM: C295
Riprap Size	ASTM D5519-07
Soundness (Magnesium Sulfate)	AASHTO T 104

July 10, 2013

DEPARTMENT OF TRANSPORTATION

STATE OF GEORGIA

SPECIAL PROVISION

Section 812—Backfill Materials

Delete Section 812 and substitute the following:

812.1 General Description

This section includes the requirements for four types of material used as backfill: foundation backfill, Types I and II, imperfect trench backfill, Type III, and mechanically stabilized wall backfill.

812.1.01 Related References

A. Standard Specifications

Section 810—Roadway Materials

B. Referenced Documents

AASHTO T 11

AASHTO T 27

AASHTO T 96

AASHTO T 104

GDT 4

GDT 6

GDT 7

GDT 24a

GDT 24b

GDT 67

GDT 75

GDT 98

SOP 1

812.2 Materials

812.2.01 Foundation Backfill, Type I

A. Requirements

1. Use natural or artificial mixtures of materials consisting of hard, durable particles of sand or stone, mixed with silt, clay and/or humus material for Type I backfill.

2. Have the final blend of material meet the requirements of Class I or II soils in Subsection 810.2.01.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

Test as follows:

Test	Method
Soil gradation	GDT 4
Volume change	GDT 6
Maximum density	GDT 7 or GDT 67

D. Materials Warranty

General Provisions 101 through 150.

812.2.02 Foundation Backfill, Type II

A. Requirements

1. Type

   Use material meeting the requirements of Section 800, Class A or B aggregate, and SOP 1. Crushed concrete may be used provided it meets the requirements of Section 800 that are applicable to Group 2 Aggregates.

   Do not use backfill aggregate containing soil or decomposed rock.

2. Gradation

   Use material meeting the following gradation requirements:

Sieve Size	% Passing by Weight
1-1/2 in (37.5 mm)	100
1 in (25 mm)	80-100
No. 8 (2.36 mm)	0-5

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

Test as follows:

Test	Method
Sieve analysis	AASHTO T 27

D. Materials Warranty

General Provisions 101 through 150.

812.2.03 Imperfect Trench Backfill, Type III

A. Requirements

1. Type

Use material made from either of the following for Type III backfill:

- A natural soil with a density of less than 95 lb/ft³ (1520 kg/m³) when tested with GDT 7
- An artificial mixture of soil and organic material, such as hay, leaves, or straw

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

The laboratory will:

1. Test the soil density with GDT 7.
2. Review the mixture and the percentages of each material, and approve a mixture suitable for the Project.

D. Materials Warranty

General Provisions 101 through 150.

812.2.04 Mechanically Stabilized Embankment Backfill

A. Requirements

Use material comprised of crushed stone, natural sand, or a blend of crushed stone and natural sand free of soils, organic or any other deleterious substances meeting the following additional requirements:

1 Crushed Stone

Use a material manufactured from Class A or B stone that is free of soil overburden, has a soundness loss of not more than 15 percent, and conforms to the requirements of SOP 1.

2. Natural Sand

May be used in conjunction with an approved, non-corrodible, extensible reinforcement. Use non-plastic material consisting of strong, hard, durable particles having a durability index of at least 70.

3. Gradation

Sieve Size	% Passing by Weight
4 in (100 mm)	100
2 in (50 mm)	80 -100
No. 10 (2 mm)	20 - 90*
No 200 (75 μm)	0 - 12
* Natural Sand may be 20 - 100	

4. Chemical

Ensure the material meets the following chemical requirements:

Test Method	Requirement
pH	*5.0 – 9.5
Resistivity	>3000 ohms/cm
Chlorides	<100 ppm
Sulfates	<200 ppm
Note: These chemical requirements are not applicable to MSE walls stabilized with an approved, non-corrodible, extensible reinforcement.	

*Sources of select backfill material having a pH between 4.5 and 5.0 may be used provided the interior face of the MSE wall panels have 3 inches of concrete cover over the reinforcement and the concrete used in the panels contains the following ingredients and proportions:

Material	% by Weight	
	Minimum	Maximum
Cement	30	--
Type F Fly Ash	10	20
Slag	50	60
Type F Fly Ash and Slag	--	70

5. Maximum Dry Density

   Use backfill material with a maximum dry density equal to or greater than the design unit weight shown on the plans. If no maximum dry density of the backfill material is shown, use a weight of 125 lb/ft^3 (2000 kg/m^3).

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

Test the material as follows:

Test Method	Requirement
Percent Wear	AASHTO T96 (“A” Grading)
Sieve Analysis	AASHTO T 27
Material Passing No. 200 (75 μm) Sieve	AASHTO T 11
Durability Index	GDT 75
Maximum Dry Density	GDT 7 or GDT 24a, GDT 24b
Soundness (Magnesium Sulfate)	AASHTO T 104
pH	GDT 98
Resistivity	GDT 98
Chlorides	GDT 98
Sulfates	GDT 98

D. Materials Warranty

General Provisions 101 through 150.

Revised: April 11, 2012
Revised: April 30, 2012
Revised: November 8, 2012
Revised: November 16, 2012
Revised: June 25, 2013

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

Special Provision

Section 828—Hot Mix Asphaltic Concrete Mixtures

Delete Section 828 and substitute the following:

828.1 General Description

This specification includes the requirements for hot mix asphaltic concrete mixtures, including:

- Open-graded surface mixtures (OGFC and PEM)
- Stone Matrix Asphalt mixtures (SMA)
- Superpave mixtures
- Fine-graded (4.75 mm) mixtures

828.1.01 Definitions

The Nominal Maximum Sieve Size is one standard sieve size larger than the first sieve to retain more than ten percent of the aggregate, per AASHTO R35. Mixture types in this section are identified according to Nominal Maximum Sieve Size.

828.1.02 Related References

A. Standard Specifications

Section 400-Hot Mix Asphaltic Concrete Construction

Section 800–Coarse Aggregate

Section 802–Aggregates for Asphaltic Concrete

Section 819–Fiber Stabilizing Additives

Section 820–Asphalt Cement

Section 831–Admixtures

Section 882–Lime

Section 883–Mineral Filler

B. Referenced Documents

AASHTO R30

AASHTO R35

AASHTO T 321

AASHTO T 112

AASHTO T 209

AASHTO T 305

AASHTO T 312

AASHTO T 245

AASHTO T 340

SOP-36

SOP-2

GDT 1

GDT 56

GDT 63

GDT 66

GDT 114

GDT 115

GDT 123

QPL 1

QPL 2

QPL 7

QPL 26

QPL 41

QPL 77

QPL 81

828.2 Materials

A. Requirements

Use approved hot mix asphalt concrete mixtures that meet the following requirements:

1. Produce each asphalt mixture according to a Department approved Job Mix Formula and Asphalt Mix Design, see Subsection 400.1 for submittal and approval of Job Mix Formulas.
2. Ensure individual acceptance test results meet the Mixture Control Tolerances specified in the appropriate table below, Subsections 828.2.01 through 828.2.04.
3. Ensure the Engineer approves all materials used to prepare and place the mixtures before incorporating them into the Work. Use only the ingredients listed in the approved Asphalt Mix Design and Job Mix Formula. For virgin aggregates use sources meeting the requirements of Section 802 and are listed in QPL 1 or QPL 2; for mixes in which local sand is permitted, use the approved sand source identified in the mix design. For mixtures containing Reclaimed Asphalt Pavement (RAP), use only RAP from the approved stockpile identified in the mix design. Use asphalt cement meeting the requirements of Section 820, from a source listed in QPL 7.
4. Obtain approved SMA mix designs, Superpave mix designs and 4.75 mm mix designs from a mix design laboratory certified by the Department. Obtain approved mix designs for types PEM and OGFC mixtures from the Department's Office of Materials, which produces and furnishes these mix designs.
5. Ensure all SMA mix designs are designed in accordance with GDT-123 ("Determining the Design Proportions of Stone Matrix Asphalt Mixtures"). Ensure SMA mix designs are verified and approved by the Department prior to use. Ensure Superpave and 4.75 mm mix designs are designed in accordance with SOP-2 ("Control of Superpave Bituminous Mixture Designs") and are approved by the Department as provided therein. Ensure these mixes are designed by a laboratory and technician certified in accordance with SOP-36, ("Certification of Laboratories and Personnel for Design of SMA and Superpave Asphalt Mixtures").
6. Use only mixtures composed of the aggregate groups and blends indicated in the Proposal and Plans by their pay item designations, defined as follows:

Pay Item Designation	Allowable Aggregate Groups
Group I or II	Group I, Group II, or Blend I
Group II only	Group II only
Blend I	Either 100% Group II material or a blend of Group I and Group II. Do not use Group I material for more than 60%, by weight, of the total aggregate nor

	more than 50%, by weight, of the coarse aggregate fraction.

7. For patching or leveling use Group I, Group II, or Blend I. Mix types for patching and leveling are specified in Subsection 400.3.03.B.
8. Include lime (hydrated lime) from an approved source and meeting the requirements of Section 882 in all paving courses except as otherwise provided in the Contract. For a list of approved sources of lime, see QPL 41.
   a. Add lime to each mixture at the rate prescribed in the approved mix design.
   b. Ensure mix designs using only virgin aggregate include lime at a minimum rate of 1.00 % of the total dry aggregate weight. Ensure mix designs using RAP include lime at a minimum rate equal to 1.00 % of the virgin aggregate fraction plus 0.50 % of the aggregate in the RAP fraction.
   c. Add more lime or add lime plus an approved Heat-Stable Anti-Stripping Additive meeting the requirements of Section 831, if necessary to meet requirements for mixture properties, and pursuant to an approved mix design. However, the Department will not make additional payment for these materials. For a list of sources of Heat-Stable Anti-Stripping Additives, see QPL 26.
   d. Where specifically allowed in the contract on LARP, airport, and parking lot projects, an approved Heat-Stable Anti-Stripping Additive meeting the requirements of Section 831 may be substituted for hydrated lime. Ensure the mix gradation is adjusted to replace the lime with an equivalent volume of fines passing the 0.075 mm sieve. Add Heat-Stable Anti-stripping Additive at a minimum rate of 0.5 percent of the asphalt cement portion.
9. Use performance grade PG 64-22 or PG 67-22 asphalt cement in all mix designs and mixtures except as follows:
   a. The State Materials Engineer will determine the performance grade to be used, based on Table 2 – Binders Selection Guideline for Reclaimed Asphalt Pavement (RAP) Mixtures, AASHTO M323 and laboratory testing results as required in Section 828.2.B for mixtures containing ≥ 25% equivalent binder replacement for RAP/RAS mixtures.
   b. Use only grade PG 76-22, excluding shoulder construction in the following mixes: all SMA, 12.5 mm PEM, 9.5 mm and 12.5 mm OGFC, 12.5 mm Superpave, on projects with ADT greater than 25,000; and in all mixtures for which polymer-modified asphalt is specified in the pay item.
10. Use of local sand is restricted as follows:
   a. Do not place mixtures containing local sand on the traveled way of the mainline or ramps of the Interstate System. Mixtures with local sand may be used for shoulder construction on these facilities.
   b. Ensure local sand will not constitute more than 20 % of the total aggregate weight of any mix design or production mix.
   c. Subject to the above limits, 19 mm, 12.5 mm, and 9.5 mm Superpave mix designs and 4.75 mm mix designs containing local sand may be used on projects with a current ADT not exceeding 2,000.
   d. 25 mm Superpave mix designs containing not more than 20 % local sand may be used on all facilities except the main line and ramps of the Interstate System.
   e. Obtain local sand for use in asphalt mixtures from a source approved by the Department.
   f. Approval of local sand sources: The Department will sample, test, and approve sources of local sand. Ensure local sand contains no more than 7.0 % clay by weight and is free of foreign substances, roots, twigs, and other organic matter. Ensure sand is free of clay lumps, as determined by AASHTO T 112, and has a sand equivalent value exceeding 25%, as determined by GDT 63.

B. Fabrication

1. Design procedures: For all Superpave and 4.75 mm mixes, ensure conformance with the Superpave System for Volumetric Design (AASHTO T 312 and AASHTO R30), as adapted in SOP-2. Ensure Superpave mixes are designed at a design gyration number (N_{des}) of 65 gyrations and initial gyration number (N_{ini}) of 6 gyrations. Ensure 4.75 mm mixes, (N_{des}) are designed at 50 gyrations, and (N_{ini}) at 6 gyrations. Open-graded mix designs will be designed by the Department in accordance with GDT 114. In all cases, the procedure for measuring Maximum Specific Gravity (G_{mm}) is AASHTO T 209. In addition to gradation and volumetric analysis, ensure mix designs include the following performance tests, as applicable.
2. Performance Test:
   a. Permeability test: Ensure Superpave and Stone Matrix mix designs include testing according to GDT -1 Measurement of Water Permeability of Compacted Asphalt Paving Mixtures. Ensure specimen air voids for this test are 6.0 ±1.0 %. The average permeability of three specimens may not exceed 3.60 ft per day (125 $\times 10^{-5}$cm per sec).

b. Moisture susceptibility test: Ensure mix designs of all types except open-graded surface mixes include testing for moisture susceptibility according to GDT 66. Ensure specimen air voids for this test are 7.0 ±1.0% for all mixes excluding Stone Matrix mixes. Ensure specimen air voids for this test are 6.0 ± 1.0% for Stone Matrix mixes. The minimum tensile splitting ratio is 0.80, except a tensile splitting ratio of no less than 0.70 may be acceptable if all individual strength values exceed 100 psi (690 kPa). Ensure average splitting strength of the three conditioned and three controlled samples are not less than 60 psi (415 kPa) for either group. Ensure retention of coating as determined by GDT 56 is not less than 95%.

c. Rutting susceptibility test: Ensure mix designs of all types except Open-graded Surface Mixes (OGFC and PEM), and mixtures designed exclusively for trench widening include testing according to GDT 115 or AASHTO T 340. Design limits for this test are as follows: Ensure specimen air voids for this test are 5.0 ± 1.0% for all mix types incorporating ≥ 15 percent RAP, excluding SMA mixtures. Ensure specimen air voids for this test are 6.0 ± 1.0% for all mix types incorporating < 15 percent RAP, excluding SMA mixtures. Ensure specimen air voids for this test are 6.0 ± 1% for all SMA mixtures. Ensure testing temperature is 64°C (147°F) for all mix types except 19 mm and 25 mm Superpave mixes, which are to be tested at 49°C (120°F). Ensure maximum deformation is 5.0 mm for all mixes except 4.75 mm mix, 9.5 mm Types I and II Superpave mixes. Ensure maximum deformation for the 9.5 mm Type II Superpave mix is 6.0 mm at 64°C (147°F) and 8.0 mm at 64°C (147°F) for the 4.75 mm and 9.5 mm Type I Superpave mix.

d. Fatigue testing: The Department may verify dense-graded mix designs by fatigue testing according to AASHTO T 321 or other procedure approved by the Department.

e. Hamburg Wheel-Tracking Test: The Department may verify Warm Mix Asphalt dense-graded mix designs or mix designs incorporating Polyphosphoric Acid (PPA) modified binders by Hamburg Wheel-tracking testing according to AASHTO T 324.

C. Acceptance

See Subsection 106.03 and Section 400. Ensure individual test results meet the Mixture Control Tolerances listed in Subsections 828.2, 828.2.01 ,828.2.02, 828.2.03, or 828.2.04, whichever applies with the following exception. Ensure field verification results for rutting susceptibility tests performed on laboratory fabricated and/or roadway cores obtained from asphalt plant produced mixtures meet specified requirements with a tolerance of +2.0 mm.

D. Materials Warranty

See General Provisions 101 through 150.

828.2.01 Open-Graded Surface Mixtures

A. Requirements

Produce the mixture according to an approved mix design and Job Mix Formula. Ensure Open-Graded Surface Mixtures meet the following mixture control tolerances and mix design criteria:

Sieve Size	Mixture Control Tolerance, %	Design Gradation Limits, % Passing		
		9.5 mm OGFC	12.5 mm OGFC	12.5 mm PEM
3/4 in (19 mm) sieve	±0.0		100*	100*
1/2 in (12.5 mm) sieve	±6.1	100*	85-100	80-100
3/8 in (9.5 mm) sieve	±5.6	85-100	55-75	35-60
No. 4 (4.75 mm) sieve	±5.7	20-40	15-25	10-25
No. 8 (2.36 mm) sieve	±4.6	5-10	5-10	5-10
No. 200 (75 µm) sieve	±2.0	2-4	2-4	1-4
Range for % AC	±0.4	6.0-7.25	5.75-7.25	5.5-7.0
Class of stone (Section 800)		"A" only	"A" only	"A" only
Drain-down (AASHTO T305), %		<0.3	<0.3	<0.3

* Mixture control tolerance is not applicable to this sieve for this mix.

1. In 12.5 mm and 9.5 mm OGFC and 12.5 mm PEM mixes, use only PG 76-22 asphalt cement (specified in Section 820).

2. Ensure all OGFC and PEM mixes include a stabilizing fiber of the type (cellulose or mineral) specified in the mix design and meeting the requirements of Section 819. Ensure the dosage rate is as specified in the mix design and sufficient to prevent drain-down exceeding the above tolerance.

B. Fabrication

See Section 400.

828.2.02 Stone Matrix Asphalt Mixtures

A. Requirements

Produce the mixture according to an approved mix design and Job Mix Formula. Ensure Stone Matrix Asphalt mixtures meet the following mixture control tolerances and mix design criteria:

Sieve Size	Mixture Control Tolerance	Design Gradation Limits, Percent Passing		
		9.5 mm SMA	12.5 mm SMA	19 mm SMA
1- in (25 mm) sieve	±0.0			100*
3/4 in (19 mm) sieve	±7.0	100*	100*	90-100
1/2 in (12.5 mm) sieve	±6.1	98-100**	85-100	44-70
3/8 in (9.5 mm) sieve	±5.6	70-100	50-75	25-60
No. 4 (4.75 mm) sieve	±5.7	28-50	20-28	20-28
No. 8 (2.36) mm sieve	±4.6	15-30	16-24	15-22
No. 50 (300 µm) sieve	±3.8	10-17	10-20	10-20
No. 200 (75 µm) sieve	±2.0	8-13	8-12	8-12
Range for % AC (Note 1)	±0.4 (Note 2)	6.0-7.5	5.8-7.5	5.5-7.5
Design optimum air voids (%)		3.5 ±0.5	3.5 ±0.5	3.5 ±0.5
% aggregate voids filled with AC (VFA)		70-90	70-90	70-90
Tensile splitting ratio after freeze-thaw cycle GDT-66		80%	80%	80%
Drain-down (AASHTO T305), %		<0.3	<0.3	<0.3

*Mixture control tolerance is not applicable to this sieve for this mix.

**Mixture control tolerance is ± 2.0% for this sieve for 9.5 mm SMA mixes placed at spread rates greater than 135 lb/yd^2. For 9.5 mm SMA mixes placed at spread rates of 135 lb/yd^2 or less, 100 % passing is required on this sieve.

Note 1: Range for % AC is Original Optimum AC (OOAC) at 35 gyrations (Gyratory compactor) or 50 blows (Marshall compactor) prior to Corrected Optimum AC (COAC) calculation detailed in GDT 123 (Appendix A)

Note 2: Quality Acceptance Test Results for AC content that deviate > ± 0.3% from the approved Job Mix Formula (JMF) consistently over three lots may subject the mix to a revised AC content on project JMF at the discretion of the State Materials Engineer based on statistical trend.

1. Ensure SMA mixtures are compacted at 35 gyrations with the Superpave Gyratory compactor or 50 blows with the Marshall compactor.
2. Ensure SMA mixtures contain mineral filler and fiber stabilizing additives and meet the following requirements:
   a. Asphalt cement grade PG-76-22 (specified in Section 820) is required in all SMA mixtures.
   b. Aggregates for SMA meet the requirements of Subsection 802.2.02.A.3.
   c. Use the approved mineral filler specified in the mix design and meeting the requirements of Section 883 Approved sources of mineral filler are listed in QPL 81.

Use the approved Fiber Stabilizing Additive of the type (cellulose or mineral) specified in the mix design and meeting the requirements of Section 819. Approved sources of Fiber Stabilizing Additive are listed in QPL 77. The dosage rate will be as specified in the mix design and sufficient to prevent drain-down exceeding the above tolerance.

B. Fabrication

See Section 400.

828.2.03 Superpave Asphalt Concrete Mixtures

A. Requirements for Superpave Mixtures (except Parking Lot Mixtures)

Produce the mixture according to an approved mix design and Job Mix Formula. Ensure Superpave Asphalt Concrete mixtures meet the following mixture control tolerances and mix design limits:

1. Gradation limits for Superpave mixtures are as follows:

Sieve Size	Mixture Control Tolerance	Design Gradation Limits, Percent Passing				
		9.5 mm Superpave Type I	9.5 mm Superpave Type II	12.5 mm Superpave (Note 1)	19 mm Superpave	25 mm Superpave
1½ in (37.5 mm)						100*
1- in (25.0 mm)	± 8.0			100*	100*	90-100
3/4 in (19.0 mm)	±8.0**	100*	100*	98-100****	90-100	55-89**
1/2 in (12.5 mm)	±6.0***	98-100****	98-100****	90-100	60-89***	50-70
3/8 in (9.5 mm)	±5.6	90-100	90-100	70-89	55-75	
No. 4 (4.75 mm) s	±5.6	65-85	55-75			
No. 8 (2.36 mm)	±4.6	48-55	42-47	38-46	32-36	30-36
No. 200 (75 µm)	±2.0	5.0-7.0	5.0-7.0	4.5-7.0	4.0-6.0	3.5-6.0
Range for % AC (Note 3)	± 0.4 (Note 2)	5.50-7.25	5.25-7.00	5.00-6.25	4.25-5.50	4.00-5.25

* Mixture control tolerance is not applicable to this sieve for this mix.

** Ensure mixture control tolerance is within ± 10.0% for this sieve for 25 mm Superpave.

***Ensure mixture control tolerance is within ± 8.0% for this sieve for 19 mm Superpave.

***Ensure mixture control tolerance is within ± 2.0% for this sieve for 12.5 mm and 9.5 mm mixes.

Note 1: Use PG 76-22 in 12.5 mm Superpave, excluding shoulder construction, on all projects with ADT greater than 25,000 as detailed in the Contract Pay Item.

Note 2: Quality Acceptance Test Results for AC content deviating > ± 0.3 % from the approved Job Mix Formula (JMF) consistently over three Lots may subject the mix to a revised AC content on the project JMF at the discretion of the State Materials Engineer based on statistical trend.

Note 3: Range for % AC is Original Optimum AC (OOAC) at 65 gyrations prior to the Corrected Optimum AC (COAC) calculation detailed in SOP 2 (Appendix D).

2. Volumetric limits are as follows:

Design Parameter	Mix Type	Limits
% of Max. Specific Gravity (Gmm) at design gyrations, (Ndes)	All	96%
% Gmm at the initial number of gyrations, Ni	All	91.5% maximum
% voids filled with asphalt (VFA) at Ndes	9.5 mm Type I	Min. 72; Max. 80
	9.5 Type II and 12.5 mm	Min. 72; Max. 76
	19 mm	Min. 71; Max 76
	25 mm	Min. 69; Max 76
Fines to effective asphalt binder ratio (F/Pbe)	9.5 mm Type I	0.6 to 1.4
	All other types	0.8 to 1.6
Minimum Film Thickness (microns)*	All	> 7.00
Minimum % Voids in Mineral Aggregate (VMA) Note: VMA shall be calculated using the effective specific gravity of the aggregate (Gse). See SOP-2SP.	25 mm	13.0
	19 mm	14.0
	12.5 mm	15.0
	9.5 Type I	16.0
	9.5 Type II	16.0

*Superpave Mixtures approved prior to January 31, 2012, may be adjusted to meet Minimum Film Thickness requirements by the State Materials Engineer.

B. Requirements for Superpave Parking Lot Mixes (NOT FOR STANDARD HIGHWAY/STREET PAVING)

1. Surface Layers for parking facilities:

Sieve Size	Mixture Control Tolerance	Design Gradation Limits, Percent Passing		
		4.75 mm Mix	9.5 mm Superpave Type I	9.5 mm Superpave Type II
1- in (25.0 mm) sieve	± 8.0			
3/4 in (19.0 mm) sieve	±8.0**		100*	100*
1/2 in (12.5 mm) sieve	±6.0	100*	98-100****	98-100****
3/8 in (9.5 mm) sieve	±5.6	90-100	90-100	90-100
No. 4 (4.75 mm) sieve	±5.6	75-95	65-85	55-75
No. 8 (2.36 mm) sieve	±4.6	60-65	48-55	42-47
No. 50 (300 µm) sieve	+3.8	20-50		
No. 200 (75 µm) sieve	±2.0	4-12	5.0-7.0	5.0-7.0
Range for Total AC	+ 0.4	6.00 - 7.50	5.50 - 7.25	5.25 - 7.00

* Mixture control tolerance is not applicable to this sieve for this mix.

****Ensure mixture control tolerance is within ± 2.0% for this sieve for 12.5 mm and 9.5 mm mixes.

2. Subsurface Layers for parking facilities:

Sieve Size	Mixture Control	Design Gradation Limits, Percent Passing	

	Tolerance	12.5 mm Superpave	19 mm Superpave	25 mm Superpave
				100*
1- in (25.0 mm) sieve	± 8.0	100*	100*	90-100
3/4 in (19.0 mm) sieve	±8.0**	98-100****	90-100	55-89**
1/2 in (12.5 mm) sieve	±6.0***	90-100	60-89***	50-70
3/8 in (9.5 mm) sieve	±5.6	70-89	55-75	
No. 8 (2.36 mm) sieve	±4.6	38-46	32-36	30-36
No. 200 (75 µm) sieve	±2.0	4.5-7.0	4.0-6.0	3.5-6.0
Range for Total AC	+ 0.4	5.00 - 6.25	4.25 - 5.50	4.00 - 5.25

*Mixture control tolerance is not applicable to this sieve for this mix.

**Ensure mixture control tolerance is within ±10.0% for this sieve for 25 mm Superpave mixes.

*** Ensure mixture control tolerance is within ±8.0% for this sieve for 19 mm Superpave mixes.

****Ensure mixture control tolerance is within ±2.0% for this sieve for 12.5 mm and 9.5 mm Superpave mixes.

3. Volumetric limits for parking facilities are as follows:

Design Parameter	Mix Type	Limits
% of Max. Specific Gravity (Gmm) at design gyrations, Ndes)	All	96%
% Gmm at the initial number of gyrations, Ni	All	91.5 % maximum
% voids filled with asphalt (VFA) at Ndes	9.5 mm Type I	Min. 72; Max. 80
	9.5 Type II and 12.5 mm	Min. 72; Max. 78
	19 and 25 mm	Min. 71; Max 76
Fines to effective asphalt binder ration (F/Pbe)	9.5 mm Type I	0.6 to 1.4
	All other types	0.8 to 1.6
Minimum Film Thickness (microns)*	4.75 mm	> 6.00
	All other types	> 7.00
Minimum % Voids in Mineral Aggregate (VMA) Note: VMA shall be calculated using the effective specific gravity of the aggregate (Gse). See SOP-2	25 mm	13.0
	19 mm	14.0
	12.5 mm	15.0
	9.5 mm Types I, II	16.0

* Mixtures approved prior to January 31, 2012, may be adjusted to meet Minimum Film Thickness requirements by the State Materials Engineer.

C. Fabrication

See Section 400.

828.2.04 Fine-Graded Mixtures

A. Requirements

Produce the mixture according to an approved mix design and Job Mix Formula. Ensure ~~that~~ fine-graded mixtures meet the following mixture control tolerances and design limits:

ASPHALTIC CONCRETE - 4.75 mm Mix

Sieve Size	Mixture Control Tolerance	Design Gradation Limits, % passing
1/2 in (12.5 mm) sieve*	±0.0	100*
3/8 in (9.5 mm) sieve	±5.6	90-100
No. 4 (4.75 mm) sieve	±5.7	75-95
No. 8 (2.36 mm) sieve	±4.6	60-65
No. 50 (300 μm) sieve	±3.8	20-50
No. 200 (75 μm) sieve	±2.0	4-12
Range for % AC	±0.4	6.00 – 7.50
Design optimum air voids (%)		4.0 – 7.0
% Aggregate voids filled with AC		60 - 80
Minimum Film Thickness (microns)**		> 6.00

* Mixture control tolerance is not applicable to this sieve for this mix.

** 4.75 mm Mixtures approved prior to January 31, 2012, may be adjusted to meet Minimum Film Thickness requirements by the State Materials Engineer.

B. Fabrication

See Section 400.

C. Acceptance

See Subsection 106.3 and Section 400. Ensure individual test results meet the Mixture Control Tolerances listed in Subsections 828.2, 828.2.01, 828.2.02, 828.2.03, 828.2.04, whichever applies.

D. Materials Warranty

See General Provisions 101 through 150.

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SUPPLEMENTAL SPECIFICATION

Section 925—Traffic Signal Equipment

Delete Section 925 and substitute the following:

925.1 General Description

This section provides Specifications for a variety of traffic signal equipment. Ramp Meters are defined as a form of traffic signalization and all general provisions for traffic signalization are applicable unless otherwise noted in the Plans and Specifications.

925.1.01 Related References

A. Standard Specifications

Section 500—Concrete Structures

Section 639—Strain Poles for Overhead Sign and Signal Assemblies

Section 647—Traffic Signal Installation

Section 682—Electrical Wire, Cable and Conduit

Section 833—Joint Fillers and Sealers

Section 861—Piling and Round Timber

Section 870—Paints (Field Painting)

Section 915—Mast Arm Assemblies

Section 922—Electrical Wire and Cable

Section 923—Electrical Conduit

Section 926—Wireless Communication Equipment

Section 935—Fiber Optic System

Section 937 – Video Detection System

Section 939—Communications and Electronic Equipment

B. Referenced Documents

- National Electrical Manufacturers Association (NEMA) Standards Publication TS 1 Section 15
- NEMA Standard Publication TS 2- 1998
- Institute of Transportation Engineers (ITE)Vehicle Traffic Control Signal Heads Specification
- ITE Vehicle Traffic Control Signal Heads: Light Emitting Diode (LED)Circular Signal Supplement June 27, 2005 Specification
- ITE Vehicle Traffic Control Signal Heads – Part 3: Light Emitting Diode (LED) Vehicle Arrow Traffic Signal Modules Specification
- ITE Pedestrian Traffic Control Signal indications – Part 2: Light Emitting Diode (LED) Pedestrian Traffic Signal Modules Specification

- International Municipal Signal Association (IMSA) #20-1 Specification
- IMSA #20-4Specification
- IMSA #20-6Specification
- IMSA #50-2Specification
- IMSA #51-1Specification
- Underwriters Laboratory Inc. (UL) 94 Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
- UL 493 Standard for Safety for Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables
- Traffic Signal Control Equipment Specifications, January 1989 edition and applicable addenda, State of California Business, Transportation & Housing Agency
- State of California Department of Transportation (CALTRANS) Qualified Products List (QPL) Controller Assemblies for the Model 170/2070 Traffic Controller,
- CALTRANS Transportation Electrical Equipment Specifications (TEES) August 16, 2002 and applicable addenda
- Georgia Department of Transportation Qualified Products List 75"Polyurethane Sealant for Inductive Loops"(American Society of Testing and Materials(ASTM) A36 Standard Specification for Carbon Structural Steel
- ASTM A53 Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc-Coated, Welded and Seamless
- ASTM A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coating on Iron and Steel Products
- ASTM A153 Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware
- ASTM A325 Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
- ASTM A475 Standard Specification for Zinc-Coated Steel Wire Strand
- ASTM A572 Standard Specification for High- Strength Low-Alloy Columbium-Vanadium Structural Steel
- ASTM C1028 Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method
- ASTM D256 Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics
- ASTM D638 Standard Test Methods for Tensile Properties of Plastics
- ASTM D785 Standard Test Method for Rockwell Hardness of Plastics: Electrical Insulating Materials
- ASTM D790 Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
- ASTM D2444 Standard Test Methods for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup
- ASTM D543 Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagants
- Electronic Industries Standards (EIA)

925.2 Materials

925.2.01 General

A. Requirements

Ensure that the traffic signal equipment and materials meet the Plans and Specifications.

All equipment furnished shall be new and meet the requirements of the following:

- Underwriter's Laboratory Incorporated (UL)
- Electronic Industries Association (EIA)
- National Electric Code (NEC)
- American Society of Testing and Materials (ASTM)
- American National Standards Institute (ANSI)
- International Municipal Signal Association (IMSA)

- National Electrical Manufacturers Association (NEMA)
- Applicable Standards, Specifications, and Regulations of the:

  Georgia Department of Transportation
  Traffic Signal Electrical Facility & NaviGAtor Support (TSEF)
  935 E. Confederate Avenue, Building 5
  Atlanta, GA 30316

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

- Provide to the District Signal Engineer or maintaining agency all manufacturers' warranties and guarantees for all signal equipment items listed in this document as well as any signal equipment listed in the Plans, except for state supplied equipment.
- Ensure that warranties and guarantees are consistent with those provided as customary trade practices; or as otherwise specified in the Plans, Standard Specifications, Supplemental Specifications or Special Provisions.
- Ensure, and state, that manufacturer's and supplier's warranties and guarantees are transferable to the agency or user that is responsible for traffic signal maintenance. And said warranties and guarantees are continuous throughout their duration.
- Ensure equipment provided under this specification shall be warranted by the manufacturer to be free from defects in materials and workmanship for a minimum period of two years from date of receipt or one year from date of acceptance of installation. The exception is the other materials stated in this specification which have longer warranty durations.
- Ensure the manufacturer will repair any faulty equipment during this period at no charge to the Department for parts, labor or shipping to and from the factory.

925.2.02 Type 2070 Controller Assemblies

A. Requirements

For 2070 controller cabinet assemblies, use 2070 controller units that meet the requirements of the following or are previously approved by TSEF:

- *Traffic Electrical Equipment Specifications (TEES)* published by the State of California Business, Transportation, and Housing Agency; Department of Transportation, current edition and current addenda
- *CALTRANS* Qualified Products List (QPL)
- Ensure the unit supplied is compatible with current GDOT licensed firmware.

The following Specifications augment the CALTRANS Specifications and take precedence over conflicting CALTRANS Specifications.

1. Input/output (I/O) and Configuration:

   The 2070 Controller shall be supplied in one of the following configurations, as specified in the Plans (all modules are specified in TEES, but these configurations supersede the defined configurations in TEES):

   - 2070L: Provide Chassis, 2070-1B Single-Board CPU, 2070-2A Field I/O Module, 2070-3B Front Panel (8x40 display), 2070-4B 3.5-amp Power Supply, and a 2070-7A Module. This unit is intended for interfacing in Type 170E or ITS cabinets and shall provide the default input and output configuration as shown in Tables 925-13, 925-15 and 925-16 for ITS cabinets using a traffic signal application.

- 2070E: Provide Chassis, 2070-1E Single-Board CPU, 2070-2A Field I/O Module, 2070-3B Front Panel (8x40 display), 2070-4B 3.5-amp Power Supply, and a 2070-7A Module. This unit is intended for interfacing in Type 170E or ITS cabinets and shall provide the default input and output configuration as shown in Tables 925-13, 925-15 and 925-16 for ITS cabinets using a traffic signal application.
- 2070LC: Provide Chassis, 2070-1B Single-Board CPU, 2070-2B Field I/O Module, 2070-3B Front Panel (8x40 display), 2070-4B 3.5-amp Power Supply, and a 2070-7A Module. This unit is intended for interfacing in ITS cabinets only and shall provide the default input and output configuration as shown in Tables 925 -13, 925-15 and 925-16 for ITS cabinets using a traffic signal application.
- 2070 LB: Provide Chassis, 2070-1B Single –Board CPU, 2070-2A Field I/O Module, 2070-3C Front Panel, 2070-4B 3.5-amp Power Supply, This unit is intended for interfacing in Type 170E or ITS cabinets where a user interface is not required and shall provide the default input and output configuration as shown in Tables 925 -13, 925-15 and 925-16 for ITS cabinets using a traffic signal application.
- 2070 LN1: Provide Chassis, 2070-1B Single-Board CPU, 2070-2B Field I/O Module, 2070-3B Front Panel (8x40 display), 2070-4NB 3.5-amp Power Supply, 2070-8 NEMA Interface Module, and a 2070-7A Module. This unit is intended for interfacing in NEMA TS 1 or NEMA TS 2 Type 2 cabinets.
- 2070 LN2: Provide Chassis, 2070-1B Single-Board CPU, 2070-2N Field I/O Module, 2070-3B Front Panel (8x40 display), 2070-4NB 3.5-amp Power Supply, and a 2070-7A Module. This unit is intended for interfacing in a NEMA TS 2 Type 1 cabinet.

2. Power Supply Modules:

   Either the 2070-4A, 2070-4B, 2070-4NA or 2070-4NB module shall be provided as required in the configuration requirements in the preceding Item. In addition to all requirements of the TEES, the power supplies shall be clearly marked as a “2070-4A”, “2070-4B”,”2070-4NA”, or “2070-4NB”. The Vendor may supply a 2070-4A or 4NA power supply module in lieu of a 2070-4B or 4NB, as long as it is so marked and adds no additional cost to GDOT.

3. Documentation:

   Include with each controller, manuals that document the programming, operation, and maintenance of the unit. Include schematic drawings and pin assignment charts in the manuals for maintenance. Documentation shall include all components, including communications modules. Specific reference is made to section 1.2.4 Documentation in the CALTRANS TEES concerning required documentation to be provided.

4. Testing:

   Provide for complete testing of unit before it is shipped. If unit is shipped with applications firmware installed, it must be tested with the application (e.g. Traffic Signal Control). If a random sample of greater than 10 percent of the units tested is rejected then the total shipment shall be rejected and vendor will be responsible for all costs to test and repair all units provided.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

See Subsection 925.2.02 for compliance with CALTRANS QPL. Also see item 4 Testing in Section A above.

D. Materials Warranty:

(See Subsection 925.2.01 D for Materials Warranties).

925.2.03 Type 2070 Controller Subassemblies

A. Requirements

For 2070 controller subassemblies, use 2070 controller subassembly units that meet the requirements of the following or are previously approved by TSEF:

- *Traffic Electrical Equipment Specifications (TEES)* published by the State of California Business, Transportation, and Housing Agency; Department of Transportation, current edition and current addenda
- *CALTRANS* Qualified Products List (QPL)

The following Specifications augment the CALTRANS Specifications and take precedence over conflicting CALTRANS Specifications.

1. 2070 1B Module:

   The 2070 1B module may be supplied as a separate item to be used in all versions of the 2070 controller. The 2070 1B module shall be supplied complete with the operating software. Ensure it contains the required files to be compatible with the current GDOT applications software.

2. 2070 1E Module:

   The 2070 1E module may be supplied as a separate item to be used in all versions of the 2070 controller. The 2070 1E module shall be supplied complete with operating software. Ensure it contains the required files to be compatible with the current GDOT applications software.

3. 2070 1C Module:

   The 2070 1C module may be supplied as a separate item to be used in all versions of the 2070 controller. The 2070 1C module shall be supplied complete with operating software. Ensure it contains the required files to be compatible with the current GDOT applications software.

4. 2070 2A Field I/O Module

   The 2070 2A Field I/O module may be supplied as a separate item. The 2070 2A Field I/O module shall consist of the Field Controller Unit; Parallel Input/Output Ports; other Module Circuit Functions (includes muzzle jumper); Serial Communication Circuitry; Module Connectors C1S, C11S and C12S mounted on the module front plate; VDC Power Supply (+12VDC to + 5VDC) and required software. Ensure it contains any configuration jumpers to be compatible with current GDOT Applications software. Ensure the 2070 2A field I/O Module functions with a Model 2070L or 2070LB Controller Assembly and is compatible with current GDOT applications software.

5. 2070 2B Field I/O Module:

   The 2070 2B Field I/O module may be supplied as a separate item and consist of the Serial Communication Circuitry, DC power Supply, and Module Connector 12S mounted on the module front plate only. Ensure it contains any configuration jumpers to be compatible with current GDOT Applications software. Ensure the 2070 2B field I/O Module functions with a Model 2070 LC or 2070LN1 Controller Assembly and is compatible with current GDOT applications software.

6. 2070 2N Field I/O Module:

   The 2070 2N Field I/O module may be supplied as a separate item and provides a NEMA TS2-1compatible SDLC interface via Serial Port 3. AC power to the 2070 Unit and Fault Monitor Logic Output via 2070 Serial Port 5 and Output Frame Byte 9 Bit 6 to the NEMA TS2 Cabinet Monitor Unit (CMU). Ensure it contains any configuration jumpers to be compatible with current GDOT Applications software. Ensure the 2070 2N field I/O Module functions with a Model 2070 LN2 Controller Assembly and is compatible with current GDOT applications software.

7. 2070 3B Front Panel Display Module:

   The 2070 3B Display Module may be supplied as a separate item and provides a Front Panel Assembly controller, two keyboards, AUX switch alarm bell and an 8 line by 40 character display. This assembly shall also include a panel with latch assembly and two TSD #1 hinge attaching devices, assembly PCB, external serial port connectors, CPU active LED indicator, contrast adjustment knob, and Front Panel Harness. Ensure it contains any configuration jumpers to be compatible with current GDOT Applications software. Ensure the 2070 3B Front Panel Assembly Module functions with Models 2070L, 2070LC, 2070LN1 and 2070 LN2 Controller Assemblies and is compatible with current GDOT applications software. Ensure the hardware hinge attaching devices mate with existing 2070 assemblies. Ensure the Front Panel Harness is connected to the front panel via a removable connector. Ensure the front panel connector supports the aux switch.

8. 2070 3C Front Panel Display Module:

   The 2070 3C Display Module may be supplied as a separate item and provides a System Serial Port 6Lines, Isolated and vectored to Connector C60S. This assembly shall also include a panel with latch assembly and two TSD #1 hinge attaching devices, assembly PCB, external serial port connectors, CPU active LED indicator, and Front Panel Harness. Ensure it contains any configuration jumpers to be compatible with current GDOT Applications software. Ensure the 2070 3B Front Panel Assembly Module functions with Model 2070LB Controller Assembly and is compatible with current GDOT applications software. Ensure the hardware hinge attaching devices mate with existing 2070 assemblies. Ensure the Front Panel Harness is connected to the front panel via a removable connector. Ensure the front panel connector supports the aux switch.

9. 2070 4B Power Supply Module:

   The 2070 4B Power Supply Module may be supplied as a separate item and is an independent, self contained module. Ensure that it is vented and cooled by convection only. Provide module that slides into power supply compartment from the back of the chassis and is attached to the Backplane mounting surface by its four TSD #3 Devices. Ensure the module supplies at least 3.5 amperes of +5VDC. Ensure the 2070 4B Power Supply Module is compatible with Models 2070L, 2070LB, and 2070LC Controller Assemblies and is compatible with current GDOT applications software. Ensure the connection harness PS 2 on existing units can be mated with the 4B module supplied. A 2070 4A Power Supply Module may be provided in place of a 4B module as long as it is labeled as such and there is no additional cost to GDOT. Ensure the module supplied is appropriately marked as a 4B or 4A module.

10. 2070 4NB Power Supply Module:

    The 2070 4NB Power Supply Module may be supplied as a separate item and is an independent self contained module. Ensure that it is vented and cooled by convection only. Provide module that slides into power supply compartment from the back of the chassis and is attached to the Backplane mounting surface by its four TSD #3 Devices. Ensure the module supplies at least 3.5 amperes of +5VDC. Ensure the 2070 4B Power Supply Module is compatible with Models 2070 LN1 and 2070 LN2 Controller Assemblies and is compatible with current GDOT applications software. Ensure the connection harness PS 2 on existing units can be mated with the 4B module supplied. Ensure the 4NB power supply module supports the NEMA TS1 and TS2 Standards. A 2070 4A Power Supply Module may be provided in place of a 4B module as long as it is labeled as such and there is no additional cost to GDOT. Ensure the module supplied is appropriately marked as a 4NA or 4NB module.

11. 2070 6B Communications Module:

    The 2070 6B Communications Module is supplied as a separate item. The 6B communications module is a dual async/modem serial module. Ensure the module supports both Serial and modem FSK communications on both of two separate ports. Ensure the Modem data baud rate supports 0 to 9600. Ensure the module is configured to support FSK communications on the C2S connection. Ensure it contains any configuration jumpers to be compatible with current GDOT Applications software.

12. 2070 7A Communications Module:

    The 2070 7A Communications Module may be supplied as a separate item. The 7A communications module is a dual async serial communications module. Ensure the module supports serial communications on both ports. Ensure it contains any configuration jumpers to be compatible with current GDOT Applications software.

13. 2070 8 Field I/O Module:

    The 2070 8 Field I/O Module may be supplied as a separate item. The 8 Field I/O Module consists of the module chassis, module power supply, Field Control Unit Controller, parallel input/output ports, serial communications circuits and module connectors. Ensure the EX1 connector is provided with appropriate mating connections to interface with either 6B or 7A communications modules. Ensure the 2070 8 Field I/O module is provided with the appropriate mating connector to mate with the C12S connector on the 2070 2B Field I/O module. Ensure the 2070 8 Field I/O module functions as part of a Model 2070 LN1 controller.

14. 2070 D Panel:

    The 2070 D panel is supplied as a separate item. The 2070 D panel supports the inputs and outputs of the “D” connector provided on a 2070-8 module which is also part of a Model 2070 LN1. Ensure the “D” Connector panel supports all 61 pins with a connecting MS “D” connector and terminal blocks. Ensure the 2070 D Panel provides adequate cable length to allow attachment in an existing NEMA Cabinet. Ensure that the terminal blocks allow for two connections.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

(See Subsection 925.2.02 for compliance with CALTRANS QPL).

D. Materials Warranty:

(See Subsection 925.2.01.D for Materials Warranties).

925.2.04 Cabinet Assemblies

A. Requirements

In addition to the CALTRANS Specifications, ensure that the cabinet assembly conforms to the requirements listed below, which take precedence over conflicting CALTRANS Specifications.

1. Cabinet configuration:

Supply cabinets in accordance with these Specifications. Equip the cabinets with auxiliary equipment as follows:

a. Model 332A Cabinet:

Lower input field termination panel

1 – Model 242 DC Isolator in Slot 14 of Upper Input File

4 – Flash Transfer Relays

2 – Model 204 Flashers

1- 4 Position Power Strip

1- Manual push button assembly

1- Auxiliary Output File

b. Model 336S Cabinet:

1-Model 242 DC Isolator in Slot 14 of Input File

4- Flash Transfer Relays

2-Model 204 Flashers

1- 4 Position Power Strip

1- Manual push button assembly

1-"M" Base Adapter installed (Base Mount Cabinets Only)

1-Aluminum Cover Plate for Cabinet Bottom (Pole Mount Cabinets Only)

c. Model 337 Cabinet

3-Flash Transfer Relays

1-Model 204 Flasher

1- Manual push button assembly

d. Model 334 Cabinet with Auxiliary Output File for Ramp Metering Operations

1- Output/PDA Type 3 with Model 206 24 Volt DC Power Supply with flash transfer relay

1- Model 208 Monitor Unit

1-Load Switch Model 200

1- 4 Position Power Strip

1- Lower Input Field Termination Panel

1- Detector Test Switch Panel

NOTE: Include above components in cabinet at time of delivery.

Other auxiliary cabinet components such as controllers, monitors, load switches, etc. will be ordered as separate items.

2. Finish

Use cabinets that have a bare aluminum finish (see Subsection 925.2.04.B.1 for controller-cabinet minimum fabrication Specifications).

3. Locks

Equip the main cabinet door with locks that accept No. 2 Corbin keys. Provide two sets of keys with each cabinet. One set of keys is defined as one – No. 2 key and one - police panel key.

4. Power

Equip the cabinet assemblies with a power distribution assembly to generate AC and DC power for the electronic components, except the DC power for the controller units. Provide the Model 332 and 336S cabinets with a DC isolator for stop time/flash sense, located in slot 14 of the input file.

5. Mounting

   Equip the cabinets for pole or base mounting, as specified in the Plans.

   a. Base Mount

      Supply Model 336S cabinets, when specified as base mount, with an “M” base-mounting adapter installed.

   b. Pole Mount

      Supply Model 336S or 337 cabinets, when specified as pole mount, with two exterior pole mounting brackets that allow for mounting on steel, concrete, and timber poles.

      Ensure that the bracket mounting holes are properly reinforced with metal plates of adequate size and strength, welded longitudinally across the inside depth of the cabinet.

      Ensure that the exterior-mounting bracket is shipped installed on the cabinet housing. Additionally, provide an aluminum plate, which covers the bottom cabinet opening.

6. Unused Phase Monitoring

   Provide odd-phase reds with ballast resistor (2K, 10 watt) dummy loads. Do not wire the cabinet to monitor pedestrian yellow indications. When auxiliary output file is used provide resistors for overlaps.

   Neatly lace, label and bundle the wiring from the signal monitor for pedestrian yellow monitoring on the back panel.

7. Red Monitoring

   Provide a connector and terminal assembly designated as P20 for monitoring the absence of red as an integral part of the output file. Terminate the connector and ensure compatible with the cable and C connector of a Type 2010 conflict monitor unit capable of monitoring the absence of red.

   Provide the pin assignments of the P20 connector and terminal assemble with the cabinet Plans.

   Ensure that the P20 connector is physically alike to the cable and connector of a Type 2010 conflict monitor unit to prevent the absence of red cable connector from being inserted into the P20 connector 180 degrees out of alignment.

   Submit details for programming of the unused red channels for approval.

8. Cabinet Light

   Include in each cabinet one fluorescent strip lighting fixture mounted inside the top front portion of the cabinet. Do not use screw in type fluorescent lamp.

   The fixture includes a cool white lamp, covered, and operated by a normal power factor, UL listed ballast.

   Install a door-actuated switch to turn on the cabinet light when either door is opened.

   Cabinet fan and light shall be fed from 15 amp equipment breaker.

9. Cabinet Interlock

   Do not install the interlock circuit, as detailed in the CALTRANS Specifications.

10. Laptop Shelf

    Equip each Model 334, 332A, and 336S cabinet with a hinged aluminum shelf and integrated storage compartment mounted on the front door, inside the cabinet assembly. To allow proper ventilation throughout the cabinet, a sliding shelf/drawer shall not be mounted in the rack assembly. The shelf shall have a smooth, non-slip surface, sufficient for use as a writing platform and of sufficient size and stability to support a typical laptop computer when extended. The shelf shall have rounded or insulated edges that do not have the potential to harm the user. The shelf shall lock into place when folded for storage. Locking the shelf for storage and/or extending it for use shall not require the use of any tool.

11. Red Enable Board Cover

    The Output File Assembly shall implement a hinged, clear, polycarbonate cover to protect the Red Enable Board during normal operation. This cover shall be hinged on the left or right side. When closed, the side opposite the hinged shall be secured to the Output File Assembly without the use of any hardware or tool. When fully opened, the cover shall not inhibit the removal, replacement or configuration of the Red Enable Board. Removal and replacement o the Red Enable Board shall not require the removal of the protective cover.

12. Power Strip

    Equip each cabinet with a metal power strip (minimum of 4 outlets) to support AC power for external communications devices in cabinet. Provide metal strip that is mounted vertically on the rear rail. Ensure that the power strip may be used by block power supplies such that the block power supply does not block other outlets.

Attach power strip to a permanent location that is easily accessible to devices in the rear of the cabinet. Provide hard wire connection to the Cabinet AC power, controlled by a 15 amp breaker. Do not use plug in power strips.

13. Surge Protection

Equip each cabinet with devices to protect the control equipment from surges and over voltages.

Design the surge protector panels to allow for adequate space for a wire connection and surge protector replacement without the removal of terminal blocks or panels. Provide surge protectors for the input sections as detailed below and as shown in the Input Terminal and Surge Arrestor Detail.

Supply surge protectors that meet the following Specifications.

a. AC Service Input

- Include a surge protection unit for each cabinet on the AC service input that meets or exceeds the following requirements: Provide a hybrid type power line surge protection device on the cabinet service panel.
- Install the protector between the applied line voltage and earth ground.
- Use a surge protector capable of reducing the effect of lightning transient voltages applied to the AC line that conforms to the following:

Peak surge current for an 8 x 20 µs waveform:	20,000A for 20 occurrences
Clamp voltage @ 20,000A:	280V max
Maximum continuous operating current:	@ 120V / 60 Hz 10A
Series Inductance:	AC Line/AC Neutral - 200 micro henries
Response time:	Voltage never exceeds 280V during surge
Spike suppression for +/- 700 V spike:	+/- 40 V deviation from sine wave at all phases Angles between 0 and 180 degrees.

- Provide a protector that is modular and uses a 12 pin Beau connector with the following terminals:

  Main Line (AC line first stage terminal)

  Main Neutral (AC neutral input terminal)

  Equipment Line In (AC line second stage input terminal, 10A)

  Equipment Line Out (AC line second stage output terminal, 10A)

  Equipment neutral out (neutral terminal to protected equipment)

  GND (Earth connection)
- Supply a protector that is epoxy encapsulated in a flame-retardant material.
- Configure the Equipment Line Out to provide power to the Type 2070 and to the 24 V power supply.

b. AC+ Interconnect Cable Inputs

Use a surge protection device to protect each AC interconnect line as it enters the cabinet with a surge protection device that meets or exceeds the following requirements:

- 3-electrode gas tube type of surge arrestor
- Striking voltage of 300-500 V DC with a minimum holder over voltage of 155V DC
- A three terminal device, one of which is connected to ground, the other two are connected across each input respectively

- The units must meet the following minimum requirements:

Impulse breakdown:	Less than 100V in less than 1.1 µs at 10 kV/µs
Impulse breakdown balance:	0.01 microsecond (or less) difference at 10 kV/µs impulse
Energy application:	Withstands 20A AC for one (1) second applied ten (10) times at three (3) minute intervals on either section
Current rating:	10,000A (8 x 20 µs impulse)
Capacitance:	6 pF, line to ground

c. Inductive Loop Detector Inputs

Provide surge arrestors in the cabinet as shown in Table 925-5, Table 925-7 or Table 925-9 for the applicable cabinet. Protect each inductive loop detector channel input by an external surge protection device that meets or exceeds the following requirements:

- A three-terminal device, two (2) of which are connected across the signal inputs of the detector with the third connected to the chassis ground to protect against common mode damage.
- Instantly clamps differential mode surges (induced voltage across the loop detector input terminals) via a semiconductor array. The array appears as a low capacitance to the detector.
- Clamps common mode surges (induced voltage between the loop leads and ground) via solid state clamping devices.
- Withstand 25-100A surge current occurrences of a 10 x 700 µs waveform.
- Have the following clamp characteristics:

Maximum break over voltage:	170 V
Maximum on-stage clamping voltage:	3V
Response Time:	<5 ns
Off-stage leakage current:	<10 µA
Capacitance:	less than 220 pf

- Ensure that the unit also meets the following minimum requirements:

Peak surge current:	6 times
Differential mode:	400 A (8 x 20 ms)
Common mode:	1,000 A (8 x 20 ms)
Estimated occurrences:	500 @ 200 A
Response time:	40 ns
Input capacitance:	35 pF typical
Temperature:	-40° F to +185° F (-40º C to 85º C)
Mounting:	No. 10-32 x 3/8-inch (No. 5 x 10 mm) bolt
Clamp voltage @400 A diff.	Mode: 30 V max.
Clamp voltage @1,000 A comm.	Mode: 30 V max.

d. Signal Load Switches (Switchpacks)

Provide the output of all switchpacks in all output files and output/PDAs with metal oxide varistors (MOV) tied from the AC positive field terminal to the chassis ground to protect switchpacks from surges on the AC output lines

Ensure that these MOVs meet or exceed these requirements:

- Steady state sinusoidal voltage (RMS) rating at 50 to 60 Hz of at least 150 V at 77 ºF (25 °C)
- Steady state applied DC voltage rating of at least 200 V at 77 ºF (25 °C)
- Transient energy rating is of at least 80 J for a single impulse of 10/1,000 µs current waveform at 77 ºF (25 °C)
- Peak current rating of 6,500 A for a single impulse of 8/20 µs waveform with the rated continuous voltage applied
- Varistor voltage of at least 212 V at 1.0mA of DC current applied for the duration of 20 µs to 5s

- Clamping voltage of at least 395 V with an applied 8/20 µs impulse of 100 A
- Typical capacitance at a frequency of 0.1 to 1.0 MHz of 1600 pF
- Two-terminal device, one of which is connected to the AC output of the signal load switch on the output file terminals (backside of the field terminals) with the other connected to AC neutral

e. Communication Inputs

Protect low voltage communications input as it enters the cabinet with a solid-state surge protection unit that meets or exceeds these requirements:

- Dual pair (4-wire) module with a printed circuit board connector, double sided and gold plated for reliability
- Ability to mate with and be installed in a 10-circuit Buchanan connector Part Number PCB1B10S or Tyco Part Number 2-1437410-3 or equivalent
- Usable as two independent signal pairs
- The data circuits pass through the protection in a serial fashion
- C2 connector of the 2070 controller that terminates on the line side of the unit
- Communication field wires for this local side that terminate on the line side of the unit
- Ground terminals connected to power ground
- Ensure that the unit meets the following minimum requirements:

Peak surge current:	10 kA (8 x 20 µs wave shape)
	500A (10 x 700 µs wave shape)
Occurrences @ peak:	50 typical
Response time:	<1ns
Voltage Clamp:	8V line to line
Series Resistance:	24 Ω total
Temperature:	-40 °F (-40 °C) to +185 °F (85 °F)
Primary protector:	3 element gas tube 5kA, (8 x 20µs wave shape), per side
Secondary protector:	Silicon avalance, 1.5 kW minimum

f. Low Voltage DC Inputs

Provide an external surge protection device for each low voltage DC input channel which meets the same requirements as the communication inputs with the following exception of the Voltage clamp, which shall be 30 V line-to-line.

14. Type 2010 Signal Monitors:

a. Introduction

This Specification sets forth the minimum requirements for a rack-mountable, sixteen channel, solid-state 2010 Signal Monitor for Traffic Cabinet Assembly. Ensure that as a minimum, the Signal Monitor complies with all Specifications outlined in Chapter 3 Section 6 of the *California TEES*, August 2002. Where differences occur, this Specification governs. Ensure that the manufacturer of the unit is listed on the current California Department of Transportation (CALTRANS) Qualified Products List (QPL) for signal monitors.

Provide a Signal Monitor that is capable of monitoring sixteen channels consisting of a Green input, a Yellow input, and a Red input for each channel. Ensure that the unit also includes the enhanced monitoring functions described in Subsection 925.2.04.A.15.

b. Monitor Functions

Except for Conflict faults, compute all fault timing for each channel individually.

1.) Conflict Monitoring

Ensure that the Signal Monitor is able to detect the presence of conflicting green or yellow signal voltages on the AC field terminals between two or more non-compatible channels. A Conflict fault (CONFLICT) shall be a latching fault.

2.) Conflict Recognition Time

Ensure the Signal Monitor shall trigger when voltages on any conflicting channels are present for more than 500 ms. Ensure that the Signal Monitor does not trigger when voltages on any conflicting channels are present for less than 200 ms. Conflicting signals sensed for more than 200 ms and less than 500 ms may or may not trigger the unit.

3.) 24VDC Monitoring VDC

Ensure that the Signal Monitor is able to detect that the cabinet +24 Vdc supply has fallen below 18 Vdc. A 24VDC failure (VDC FAIL) shall be a latching fault.

4.) 24VDC Recognition Time

Ensure that the Signal Monitor shall trigger when the voltage on the +24V input is below 18 Vdc for more than 500 ms. Ensure that the Signal Monitor does not trigger when the voltage on the +24V input is below 18 Vdc for less than 200 ms. A voltage level of +22 Vdc will be required to prevent the unit from triggering.

5.) Controller Watchdog Monitoring

Ensure that the Signal Monitor triggers when the Watchdog input does not toggle within the programmed time period (WDT ERROR). Ensure that the unit remains latched in the fault state until reset by the Reset button, an External Reset input command, or AC Line voltage restoring from an AC Line Brownout event. Ensure that a reset resulting from an AC Line Brownout event does not clear the WDT ERROR LED.

a. Controller Watchdog Latch Option

Ensure a programming option sets the Watchdog monitoring function to a latching mode and that only a reset from the Reset button or External Reset input can clear a Watchdog fault. An AC Line brownout condition will not reset the fault.

b. Controller Watchdog Recognition Time

Ensure a programming option sets the maximum Watchdog recognition time to: 1000 + or - 100 ms; or 1500 + or - 100 ms.

c. Controller Watchdog Enable Switch

Provide an internal switch to disable the Watchdog monitoring function. Mount the switch on the PCB and be clearly label "WD ENABLE - ON...OFF". Ensure that placement of the switch in the OFF position causes monitoring of the Watchdog to be inhibited.

d. WDT ERROR LED Control

Ensure that the WDT ERROR LED illuminates when the unit has been triggered by a Watchdog fault. Ensure that it can only be cleared by a reset command from the front panel Reset switch or External Reset input. If the Watchdog monitoring function is inhibited due to the Watchdog Enable switch, the WDT ERROR LED shall flash at a 0.5 Hz rate.

6.) AC Line Monitoring

a. AC Line Brownout Recognition

Ensure that the Signal Monitor is able to detect that the AC Line has fallen below 98 + or - 2 Vac for greater than 400 + or - 50 ms. This shall force the output Relay to the de-energized "fault" state, enable the Stop-Time output, and cause the AC POWER LED to flash at a 2 Hz rate. Ensure that the unit maintains this state until the AC Line voltage rises above 103 + or - 2 Vac for greater than 400 + or - 50 ms. Provide a jumper option which will change the AC Brownout dropout level to 92 + or - 2 Vac and the restore level to 98 + or - 2 Vac.

b. AC Line Power-up and Brownout Delay Time

When the AC Line is greater than 103 + or - 2 volts after power-up or Brownout restore, ensure that the Signal Monitor holds the Output Relay in the de-energized "fault" state and enable the Stop-Time output, for a period of not less than 6.0 + or - 0.5 seconds and not greater than 10.0 + or - 0.5 seconds. Ensure that this flash interval is terminated after at least 6.0 + or - 0.5 seconds if the Signal Monitor has detected at least five transitions of the Watchdog input. If the Signal Monitor does not detect five transitions of the Watchdog input before 10.0 + or - 0.5 seconds, ensure that the Signal Monitor goes to the fault state. During this interval, ensure that the AC POWER LED flashes at a 4 Hz rate.

7.) Red Fail Monitoring

Ensure that the Signal Monitor is able to detect the absence of an active voltage on the green and yellow and red field signal inputs of a channel. Red Fail fault (RED FAIL) shall be a latching fault. Ensure that the

Red Fail monitoring function is enabled for all channels except when the Red Enable input is not active, or pin #EE is active, or Special Function #1 input is active, or Special Function #2 input is active.

a. Red Fail Recognition Time

Ensure the Signal Monitor triggers when an active voltage on one of the three inputs of a channel are absent for more than 1500 ms. Ensure that the Signal Monitor does not trigger when an active voltage on one of the three inputs of a channel are absent for less than 1200 ms. Channels without proper voltages sensed for more than 1200 ms and less than 1500 ms may or may not trigger the unit. Provide an option switch (RF 2010) which will change the fault recognition time to between 700 ms and 1000 ms.

b. Red Interface Cable Fault

Ensure a programming option is provided such that operating without the Red Interface cable installed shall cause the Signal Monitor to enter the fault mode causing the Output relay contacts to close and enabling the Stop-Time output to the controller. To indicate this fault mode, ensure that the Red Fail indicator is illuminated with all fault channel indicators Off.

Ensure that any Red Fail preemption control to the monitor uses the Special Function inputs #1 or #2.

8.) Dual Indication Monitoring

Ensure that the Signal Monitor is able to detect the presence of active voltage on the green and yellow, green and red, or yellow and red field signal inputs of a channel. GYR Dual Indication fault (DUAL IND) shall be a latching fault. Ensure this function is enabled on a per channel basis using dip switches mounted on the PCB labeled "CH1" through "CH16". Ensure that the GYR Dual Indication monitoring function is enabled for all selected channels except when the Red Enable input is not active or pin #EE is active.

a. GY Dual Indication Monitoring

Ensure that the Signal Monitor is able to detect the presence of active voltage on the green and yellow field signal inputs of a channel. GY Dual Indication fault (DUAL IND) shall be a latching fault. Enable this function with a dip switch on the PCB labeled "GY ENABLE". When the switch is in the ON position, monitor all channels for simultaneous active green and yellow inputs on a channel. When selected by the GY ENABLE switch, ensure that the GY Dual Indication monitoring function is disabled when pin #EE is active.

b. Dual Indication Recognition Time

Ensure that the Signal Monitor triggers when multiple inputs are active on a channel for more than 500 ms. Ensure that the Signal Monitor does not trigger when multiple inputs are active on a channel for less than 250 ms. Channels with multiple voltages active for more than 250 ms and less than 500 ms may or may not trigger the unit.

9.) Clearance (Short or Absent Yellow) Monitoring

Ensure that the Signal Monitor is able to detect that a channel has not provided an adequate Yellow Clearance interval during a green to yellow to red sequence. A Sequence failure (SEQUENCE) shall be a latching fault. Ensure that this function is enabled on a per channel basis using dip switches mounted on the PCB labeled "CH1" through "CH16". Ensure that the Sequence monitoring function is enabled for all selected channels except when the Red Enable input is not active or pin #EE is active.

10.) Clearance Recognition Time

Ensure that the Yellow Clearance interval is 2.7 seconds

11.) Flickering Indication Detection

Ensure that the Signal Monitor provides a method of detecting Conflict, Red Fail, and Dual Indication faults that result from intermittent or flickering field signal inputs that may not meet the duration requirements but continue to flicker for an extended period of time. These flickering indications shall result in a latching fault with an indication illuminated along with the resulting Conflict, Red Fail, or Dual Indication indicator. Provide an option switch to disable this option.

12.) Configuration Change Monitoring

On power-up, reset, and periodically during operation, ensure that the Signal Monitor compares the current configuration settings with the previously stored value and if the settings have changed, the Signal Monitor automatically logs the new setting. Ensure that these settings include the permissive diode matrix, all switches, all jumpers, and the Watchdog Enable switch.

Provide a programming option such that any change in the configuration parameters will cause the Signal Monitor to enter the fault mode causing the Output relay contacts to close and enabling the Stop-Time output to the controller. To indicate this fault mode ensure that the PCA indicator will flash at a 4 Hz rate. Depressing the Reset button for 5 full seconds is required to clear this fault and log the new configuration parameters.

If the programming option is not selected, ensure that the unit does not set the fault mode but will still log the configuration change.

13.) Program Card Ajar

Ensure that when the Programming Card is removed or not seated properly, the Signal Monitor forces the Output Relay to the de-energized "fault" state, enable the Stop-Time output, and illuminate the PCA LED. A reset command from the front panel Reset switch or External Reset input is required once the Program Card is in place.

14.) Exit Flash

When the Signal Monitor exits the flash state (Output relay de-energized) as a result of a Reset command or AC Line brownout restore, ensure that the Stop Time output goes to the inactive state 250 + OR - 50 ms before the Output relay transfers to the energized state. This transition will provide an early indication to the Controller Unit that the cabinet will transfer from flash to signal operation.

c. Display Functions

Ensure that it is possible to view the active channels for each individual color (GYR) during operation and when latched in a fault state. When the Signal Monitor is latched in a fault state ensure that it is also be possible to view the active channels for each individual color and fault status for each channel for the current fault and the two previous faults.

1) Previous Fault GYR Display

When the Signal Monitor has been triggered by a fault the channel status display will alternate between the channels which were involved in the fault (fault status) for 2 seconds, and the field signals active at the time of the fault for 6 seconds. The channels involved in the fault will flash their respective Green, Yellow, and Red indicators simultaneously at a 4 Hz rate for the 2 second interval.

The two previous faults may also be displayed individually. This status is not reset by an AC Line power interruption. To enter this display mode remove the Program Card. The sequence is as follows:

Reset	Event	PCA LED	Fault Status LEDs	Channel Status LEDs
---	#1	Single flash	Current Fault Status (newest)	Current Field status
#1	#2	Double flash	Event #2 Fault Status	Event #2 Field status
#2	#3	Triple flash	Event #3 Fault Status (oldest)	Event #3 Field status
(repeats back to top)				

d. Event Logging Functions

Ensure that the Signal Monitor is capable of storing in non-volatile memory a minimum of 100 events. Mark each event with the time and date of the event. These events consist of fault events, AC Line events, reset events, and configuration change events. Provide a graphical means of displaying the signal states of all field inputs for 30 seconds prior to a fault trigger event. Provide the capability to assign a four-digit identification number to the unit shall be provided. Upload the event logs to a PC using the serial port of the Signal Monitor and software provided by the manufacturer.

Ensure each event log report contains the following information:

- Monitor ID#: a four digit (0000-9999) ID number assigned to the monitor.
- Time and Date: time and date of occurrence.
- Event Number: identifies the record number in the log. Event #1 is the most recent event.

1) Monitor Status Report (CS)

Ensure the Current Status report contains the following information:

- Fault Type: the fault type description.
- Field Status: the current GYR field status and field RMS voltages if the monitor is not in the fault state, or the latched field status and field RMS voltages and fault channel status at the time of the fault.

- Cabinet Temperature: the current temperature if the monitor is not in the fault state, or the latched temperature at the time of the fault.
- AC Line Voltage: the current AC Line voltage if the monitor is not in the fault state, or the AC Line voltage at the time of the fault.
- Control Input Status: the current state and RMS voltages of the Red Enable input, EE input, and Special Function #1 and #2 inputs if the monitor is not in the fault state, or the status latched at the time of the fault.

2) Previous Fault Log (PF)

Ensure the Previous Fault log contains the following information:

- Fault Type: the fault type description.
- Field Status: the latched field status with RMS voltages, and fault channel status at the time of the fault.
- Cabinet Temperature: the latched temperature at the time of the fault.
- AC Line Voltage: the AC Line voltage at the time of the fault.
- Control Input Status: the latched state of the Red Enable input, EE input, and Special Function #1 and #2 inputs at the time of the fault.

3) AC Line Event Log (AC)

The AC Line log shall contain the following information:

- Event Type: describes the type of AC Line event that occurred.
  - Power-up—AC on, monitor performed a cold start
  - Interrupt—AC Line < Brownout level
  - Restore—AC restored from brown-out or interruption (AC Off), no cold start
- AC Line Voltage: the AC Line voltage at the time of the event.

4) Monitor Reset Log (MR)

Ensure the Monitor Reset log contains the following information:

The monitor was reset from a fault by the front panel Reset button or External Reset input.

5) Configuration Change Log (CF)

Ensure the Configuration Change log contains the following information:

a. Program Card Matrix: the permissive programming for each channel.
b. Yellow Disable Jumpers: the Yellow Disable programming for each channel.
c. Dual/Sequence Switches: the switch programming for each channel.
d. Option Switches: RF 2010, RP Disable, GY Enable, SF1 Polarity, Sequence Timing, Minimum Flash Enable, Configuration Fault Enable, Red Cable Fault enable, AC Brownout timing.
e. Watchdog Programming: Watchdog Enable, Watchdog Latch, and Watchdog timing.
f. Configuration CRC: A unique CRC value which is based on the configuration of items #a though #e above.

Indicate on the log, which items have been changed since the last log entry.

6) Signal Sequence Log

Provide a log that graphically displays all field signal states for up to 30 seconds prior to the current fault trigger event. Ensure that the resolution of the display is at least 50 milliseconds.

e. Communications Functions

1) Controller Unit Communications

Type A: Ensure that the Signal Monitor is compatible with the protocol of the current GDOT licensed firmware for 2070 controllers and Central System Control. Ensure the 2010 Conflict Monitor supplied is able to communicate via a serial link. to the 2010 Controller and then to a Central System using the current licensed GDOT Central System Software for reporting, configuring and logging.

Type B: Ensure that the Signal Monitor is compatible with the protocol of the current GDOT licensed firmware for 2070 controllers and Central System Control. Ensure the 2010 Conflict Monitor supplied is able to communicate via a RJ-45 connector (Ethernet).

2) Personal Computer Communications

Have the manufacturer provide software to access the Signal Monitor status and event logs described in Subsection 925.2.04.A.14.d. Ensure this software operates with current version of Microsoft Windows or Windows XP™

f. Hardware

1) Red Monitoring

a. Red Field Inputs

Ensure that the Signal Monitor is capable of monitoring sixteen Red field signals. Ensure that a Red input is sensed active when the input voltage exceeds 70 Vrms. Ensure that a Red input is sensed not active when the input voltage is less than 50 Vrms. A Red input may or may not be sensed active when the input voltage is between 50 Vrms and 70 Vrms.

b. Red Enable Input

Ensure that the Red Enable input provides an AC input to the unit which enables Red Monitoring, Dual Indication Monitoring, and Sequence monitoring when the input is sensed active.

Ensure that the Red Enable input is sensed active when the input voltage exceeds 70 Vrms. Ensure that the Red Enable input is sensed not active when the input voltage is less than 50 Vrms. The Red Enable input may or may not be sensed active when the input voltage is between 50 Vrms and 70 Vrms.

c. Special Function Preemption Inputs

Ensure that the Special Function Preemption inputs #1 and #2 provide an AC input to the unit which disables only Red Fail Monitoring (Lack of Output) when either input is sensed active.

Ensure that a Special Function input is sensed active when the input voltage exceeds 70 Vrms. Ensure that a Special Function input is sensed not active when the input voltage is less than 50 Vrms. A Special Function input may or may not be sensed active when the input voltage is between 50 Vrms and 70 Vrms.

Use a PCB mounted switch to provide the option to invert the active status of the Special Function #1 input. When the switch is in the ON position, ensure that the Special Function #1 input is sensed not active when the input voltage exceeds 70 Vrms. Ensure that the Special Function #1 input is sensed active when the input voltage is less than 50 Vrms. The Special Function #1 input may or may not be sensed active when the input voltage is between 50 Vrms and 70 Vrms.

d. Red Interface Connector

This connector provides the required inputs for the unit to monitor the Red field signal outputs. Ensure the connector is a 20 pin connector that mates with the P20 Cable from the output file. Provide a high quality connector that is polarized to insure proper mating with the cable. Ensure Ejector latches are included to facilitate removal and prevent the cable from inadvertently disconnecting. Ensure the unit shall function as a standard 210 Signal Monitor when the cable is disconnected. Use the pin assignments shown in Table 925-1.

Table 925 -1 Red Interface Connector			
Pin	**Function**	**Pin**	**Function**
1	Channel 15 Red	11	Channel 9 Red
2	Channel 16 Red	12	Channel 8 Red
3	Channel14 Red	13	Channel 7 Red
4	Chassis Ground*	14	Channel 6 Red
5	Channel 13 Red	15	Channel 5 Red
6	Special Function #2	16	Channel 4 Red
7	Channel 12 Red	17	Channel 3 Red
8	Special Function #1	18	Channel 2 Red
9	Channel 10 Red	19	Channel 1 Red
10	Channel 11 Red	20	Red Enable
*A jumper option shall be provided to allow the connection of Pin #4 to be made with Chassis Ground.			

2) Front Panel

Ensure the front panel is constructed of sheet aluminum with a minimum thickness of 0.090 in. (2.286 mm), and finished with an anodized coating. Ensure the model information shall be permanently displayed on the front surface.

a. Indicators

Ensure that all display indicators are mounted on the front panel of the Signal Monitor and are water clear, T-1 package, Super Bright type LEDs. Ensure that all fault LEDs are red except the AC POWER indicator which is green. Provide a separate Red, Yellow, and Green indicator for each channel. Label the indicators and provide the information as follows:

- AC POWER

  Ensure the AC Power indicator flashes at a rate of 2 Hz when the unit has detected a low voltage condition as described in Subsection 925.2.04.A.15. Ensure the AC POWER indicator flashes at a rate of 4 Hz during the minimum flash interval as described in Subsection 925.2.04.A.15. Ensure that the indicator illuminates when the AC Line voltage level is restored above the brownout level. Ensure the indicator extinguishes when the AC Line voltage is less than 80 Vac.

- VDC FAILED

  Ensure the VDC FAILED indicator illuminates when a 24VDC fault condition is detected. This indicator remains extinguished if the monitor has not been triggered by a 24VDC fault.

- WDT ERROR

  Ensure the WDT ERROR indicator illuminates when a controller Watchdog fault is detected. Ensure the WDT Error indicator flashes ON once every 2 seconds if the WD Enable switch on the monitor is placed in the OFF position to disable Watchdog monitoring, or the AC Line voltage is below the Watchdog disable level.

- CONFLICT

  Ensure that the CONFLICT indicator illuminates when a conflicting signal fault is detected.

- DIAGNOSTIC

  Ensure the DIAGNOSTIC indicator illuminates when one of the following faults is detected: Internal Watchdog fault, Memory Test fault, or Internal power supply fault. This indicator is intended to inform the service technician of a monitor hardware or firmware failure.

- RED FAIL

  Ensure the RED FAIL indicator illuminates when an absence of signal is detected on a channel(s). Ensure the RED FAIL indicator flashes ON once every two seconds if the RED ENABLE input is not active, or a Special Function input is active, or the EE input is active

- DUAL IND.

  Ensure the Dual IND. indicator illuminates when a GY-Dual or GYR-Dual Indication fault is detected on a channel(s).
- CLEARANCE

  Ensure the Sequence indicator illuminates when the minimum Yellow Clearance time has not been met on a channel(s).
- PCA

  Ensure the PCA indicator illuminates if the Program Card is absent or not properly seated.

  If the unit is in the Diagnostic Display mode, ensure the PCA indicator flashes ON (once, twice, or three times) to indicate the fault event number being displayed. See Subsection 925.2.04.A.15.
- RP DETECT

  Ensure the RP DETECT indicator illuminates when the unit has detected a Conflict, Red Fail, or Dual Indication fault as a result of recurring pulse field inputs.
- CHANNEL STATUS

  Ensure that during normal operation the 48 Channel Status indicators display all active signals (Red, Green, and Yellow).

  In the fault mode, ensure that the Channel Status indicators display all signals active at the time of the fault for six seconds and then indicate the channels involved in the fault for 2 seconds.

b. Front Panel Control-Reset Button

- Provide a momentary SPST Control switch labeled RESET on the unit front panel to reset the monitor circuitry to a non-failed state. Position the switch on the front panel such that the switch can be operated while gripping the front panel handle. Ensure that a reset command issued from either the front panel button or External Reset input is a one-time reset input to prevent the unit from constant reset due to a switch failure or constant external input, and causes all LED indicators to illuminate for 300 ms.
- The Reset button also provides control of the Diagnostic Display mode. For a complete description of Diagnostic Display operation, see Subsection 925.2.04.A.15.

c. Serial Communications Connector

Use this connector to provide EIA-232 serial communications. Ensure that it is a high quality 9 pin metal shell D subminiature type with female contacts. Refer to Table 925-2 for Pin assignments.

Table 925-2 Serial Communications Connector

Pin	Function
1	DCD*
2	TX DATA
3	RX DATA
4	DTR (Data Terminal Ready)
5	SIGNAL GROUND
6	DSR
7	DSR*
8	CTS*
9	NC

* Provide Jumper options to allow the connection of Pin #4 to be made with Pin #7, and the connection of Pin #8 to be made with Pin #1.

3) Electronics

a. RMS Voltage Sampling

Use high speed sampling techniques to determine the true RMS value of the AC field inputs. Sample each AC input at least 32 times per cycle. Ensure that the RMS voltage measurement is insensitive to phase, frequency, and waveform distortion.

b. Internal MPU Watchdog

Use a microprocessor for all timing and control functions. Verify continuing operation of the microprocessor by an independent monitor circuit, that forces the Output Relay to the de-energized "fault" state, enable the Stop-Time output, and illuminate the DIAGNOSTIC indicator if a pulse is not received from the microprocessor within 300 ms.

If the microprocessor should resume operation, ensure the Signal Monitor continues to operate. Ensure that this monitoring circuit is also configurable to latch in the fault state. Ensure the unit requires a power-up cycle to reset the circuit once it is triggered.

c. Sockets

In the interest of reliability, ensure that only the PROM memory device for the microprocessor firmware is socket mounted. Ensure that the PROM memory socket is a precision screw machine type socket with a gold contact finish providing a reliable gas tight seal. Low insertion force sockets or sockets with "wiper" type contacts are not acceptable.

d. Internal Power Supply

Use a built-in, high-efficiency switching power supply to generate all required internal voltages. Ensure that all supply voltages regulated. Failure of the internal power supply to provide proper operating voltages shall force the output Relay to the de-energized "fault" state, enable the Stop-Time output, and illuminate the DIAGNOSTIC indicator. Provide a user replaceable slow blow fuse for the AC Line input. Ensure the unit is operational over the AC Line voltage range of 75 Vac to 135 Vac.

e. EIA-232 Interface

Ensure the EIA-232 port interface electronics is electrically isolated from all monitor electronics except chassis ground.

f. Configuration Parameters

Select user-programmed configuration settings using PCB mounted switches or jumpers. Designs requiring a Personal Computer (PC) to program or verify the configuration parameters are not acceptable. Ensure that user-programmed configuration settings that are transferred to memory are stored in a programmable read-only memory (PROM or EEPROM). Designs using a battery to maintain configuration data are not acceptable.

g. Field Terminal Inputs

Ensure that all 120 Vac field terminal inputs provide an input impedance of 150K 50K ohms and be terminated with a discrete resistor having a power dissipation rating of 0.5 Watts or greater and a voltage rating exceeding 350 volts.

h. Component Specifications

Ensure that all electrical components used in the Signal Monitor are rated by the component manufacturer to operate beyond the full unit operating temperature range of –29 °F to 165 °F(-34 °C to +74 °C).

i. Printed Circuit Boards

Ensure that all printed circuit boards meet the requirements of the *California Traffic Signal Control Equipment Specifications*, January 1989, plus the following requirements to enhance reliability:

- All plated-through holes and exposed circuit traces are plated with solder.
- Both sides of the printed circuit board are covered with a solder mask material.
- The circuit reference designation for all components and the polarity of all capacitors and diodes are clearly marked adjacent to the component. Ensure that Pin #1 for all integrated circuit packages is designated on both sides of all printed circuit boards.
- All electrical mating surfaces are gold plated.
- All printed circuit board assemblies are coated on both sides with a clear moisture-proof and fungus-proof sealant.
- All components and wire harnesses are mounted to the PCB using plated holes. "Piggy back" connections or jumper wires are not acceptable.

15. Type 2018 Signal Monitors:

a. Introduction

This Specification sets forth the minimum requirements for a rack-mountable, eighteen channel, solid-state 2018 Signal Monitor for Traffic Cabinet Assembly. Ensure that as a minimum, the Signal Monitor complies with all applicable Specifications outlined in Chapter 4 of the *California TEES*, January 1989. Where differences occur, this specification governs. Ensure that the manufacturer of the unit shall is listed on the current Caltrans QPL for signal monitors.

Provide a signal monitor that is capable of monitoring eighteen channels consisting of a Green input, a Yellow input, and a Red input for each channel. Ensure that the unit also includes the enhanced monitoring functions described in 925.2.04.A.15.

b. Monitor Functions

1.) Conflict Monitoring

Ensure that the Signal Monitor is able to detect the presence of conflicting green or yellow signal voltages on the AC field terminals between two or more non-compatible channels. A Conflict fault (CONFLICT) shall be a latching fault. Ensure that programming of the permissive matrix is contained in the Datakey.

2.) Conflict Recognition Time

Ensure the Signal Monitor triggers when voltages on any conflicting channels are present for more than 500 ms. Ensure that the Signal Monitor does not trigger when voltages on any conflicting channels are present for less than 200 ms. Conflicting signals sensed for more than 200 ms and less than 500 ms may or may not trigger the unit.

3.) 24VDC Monitoring

Ensure that the Signal Monitor is able to detect that the cabinet +24 Vdc supply has fallen below 18 Vdc. A 24VDC failure (VDC FAIL) shall be a latching fault.

4.) 24VDC Recognition Time

Ensure that the Signal Monitor shall trigger when the voltage on the +24V input is below 18 Vdc for more than 500 ms. Ensure that the Signal Monitor does not trigger when the voltage on the +24V input is below 18 Vdc for less than 200 ms. A voltage level of +22 Vdc will be required to prevent the unit from triggering.

5.) Controller Watchdog Monitoring

Ensure that the Signal Monitor triggers when the Watchdog input does not toggle within the programmed time period (WDT ERROR). Ensure that the unit remains latched in the fault state until reset by the Reset button, an External Reset input command, or AC Line voltage restoring from an AC Line Brownout event. Ensure that a reset resulting from an AC Line Brownout event does not clear the WDT ERROR LED.

a. Controller Watchdog Latch Option

Ensure a Datakey programming option sets the Watchdog monitoring function to a latching mode and that only a reset from the Reset button or External Reset input can clear a Watchdog fault. Ensure that an AC Line brownout condition does not reset the fault.

b. Controller Watchdog Recognition Time

Ensure a Datakey programming option sets the maximum Watchdog recognition time to 1000 + or - 100 ms; or 1500 + or - 100 ms.

c. Controller Watchdog Enable Switch

Provide an internal switch to disable the Watchdog monitoring function. Mount the switch on the PCB and be clearly label "WD ENABLE - ON...OFF". Ensure that placement of the switch in the OFF position causes monitoring of the Watchdog to be inhibited.

d. WDT ERROR LED Control

Ensure that the WDT ERROR LED illuminates when the unit has been triggered by a Watchdog fault. Ensure that it can only be cleared by a reset command from the front panel Reset switch or External Reset input. If the Watchdog monitoring function is inhibited due to the Watchdog Enable switch, the WDT ERROR LED shall flash at a 0.5 Hz rate.

6.) AC Line Monitoring

a. AC Line Brownout Recognition

Ensure that the Signal Monitor is able to detect that the AC Line has fallen below 98 + or - 2 Vac for greater than 400 + or - 50 ms. This shall force the output Relay to the de-energized "fault" state, enable

the Stop-Time output, and cause the AC POWER LED to flash at a 2 Hz rate. Ensure that the unit maintains this state until the AC Line voltage rises above 103 + or - 2 Vac for greater than 400 + or - 50 ms. Provide a jumper option which will change the AC Brownout dropout level to 92 + or - 2 Vac and the restore level to 98 + or - 2 Vac.

b. AC Line Power-up and Brownout Delay Time

When the AC Line is greater than 103 + or - 2 volts after power-up or Brownout restore, ensure that the Signal Monitor holds the Output Relay in the de-energized "fault" state and enable the Stop-Time output, for a period of not less than 6.0 + or - 0.5 seconds and not greater than 10.0 + or - 0.5 seconds. Ensure that this flash interval is terminated after at least 6.0 + or - 0.5 seconds if the Signal Monitor has detected at least five transitions of the Watchdog input. If the Signal Monitor does not detect five transitions of the Watchdog input before 10.0 + or - 0.5 seconds, ensure that the Signal Monitor goes to the fault state. During this interval, ensure that the AC POWER LED flashes at a 4 Hz rate.

Ensure that the Datakey Minimum Flash Time parameter has a range of zero and from six to sixteen seconds.

7.) Red Fail Monitoring

Ensure that the Signal Monitor is able to detect the absence of an active voltage on the green and yellow and red field signal inputs of a channel. Red Fail fault (RED FAIL) shall be a latching fault. Ensure that the Red Fail monitoring function is enabled in the Datakey on a per channel basis except when the Red Enable input is not active, or pin #EE is active, or Special Function #1 input is active, or Special Function #2 input is active.

a. Red Fail Recognition Time

Ensure the Signal Monitor triggers when an active voltage on one of the three inputs of a channel are absent for more than 1500 ms. Ensure that the Signal Monitor does not trigger when an active voltage on one of the three inputs of a channel are absent for less than 1200 ms. Channels without proper voltages sensed for more than 1200 ms and less than 1500 ms may or may not trigger the unit. Ensure that a Datakey Red Fail Timing option is provided which will change the fault recognition time between 700ms and 1000 ms.

b. Red Interface Cable Fault

Ensure a Datakey programming option is provided such that operating without the Red Interface cable installed shall cause the Signal Monitor to enter the fault mode causing the Output relay contacts to close and enabling the Stop-Time output to the controller. To indicate this fault mode, ensure that the Red Fail indicator is illuminated with all fault channel indicators Off.

Ensure that any Red Fail preemption control to the monitor uses the Special Function inputs #1 or #2.

8.) Dual Indication Monitoring

Ensure that the Signal Monitor is able to detect the presence of active voltage on the green and yellow, green and red, or yellow and red field signal inputs of a channel. GYR Dual Indication fault (DUAL IND) shall be a latching fault. Ensure this function is enabled in the Datakey on a per channel basis for Green and Yellow combinations, Green and Red combinations, and Yellow and Red combinations. Ensure that the GYR Dual Indication monitoring function is enabled for all selected channels except when the Red Enable input is not active or pin #EE is active.

a. GY Dual Indication Monitoring

Ensure that the Signal Monitor is able to detect the presence of active voltage on the green and yellow field signal inputs of a channel. GY Dual Indication fault (DUAL IND) shall be a latching fault. Enable this function with a dip switch on the PCB labeled "GY ENABLE". When the switch is in the ON position, monitor all channels for simultaneous active green and yellow inputs on a channel. When selected by the GY ENABLE switch, ensure that the GY Dual Indication monitoring function is disabled when pin #EE is active.

b. Dual Indication Recognition Time

Ensure that the Signal Monitor triggers when multiple inputs are active on a channel for more than 500 ms. Ensure that the Signal Monitor does not trigger when multiple inputs are active on a channel for less than 250 ms. Channels with multiple voltages active for more than 250 ms and less than 500 ms may or may not trigger the unit.

9.) Clearance (Short or Absent Yellow) Monitoring

Ensure that the Signal Monitor is able to detect that a channel has not provided an adequate Yellow Clearance interval during a green to yellow to red sequence. A Sequence failure (SEQUENCE) shall be a latching fault. Ensure that this function is enabled in the Datakey on a per channel basis. Ensure that the Sequence monitoring function is enabled for all selected channels except when the Red Enable input is not active or pin #EE is active.

10.) Clearance Recognition Time

Ensure that the Yellow Clearance interval is 2.7 seconds

11.) Flickering Indication Detection

Ensure that the Signal Monitor provides a method of detecting Conflict, Red Fail, and Dual Indication faults that result from intermittent or flickering field signal inputs that may not meet the duration requirements but continue to flicker for an extended period of time. These flickering indications shall result in a latching fault with an indication illuminated along with the resulting Conflict, Red Fail, or Dual Indication indicator. Insure a programming option is provided in the Datakey to disable the RP Detect function.

12.) Configuration Change Monitoring

On power-up, reset, and periodically during operation, ensure that the Signal Monitor compares the current configuration settings with the previously stored value and if the settings have changed, the Signal Monitor automatically logs the new setting. Ensure that these settings include the permissive diode matrix, all switches, all jumpers, and the Watchdog Enable switch.

Provide a programming option such that any change in the configuration parameters will cause the Signal Monitor to enter the fault mode causing the Output relay contacts to close and enabling the Stop-Time output to the controller. To indicate this fault mode ensure that the PCA indicator will flash at a 4 Hz rate. Depressing the Reset button for 5 full seconds is required to clear this fault and log the new configuration parameters.

If the programming option is not selected, ensure that the unit does not set the fault mode but will still log the configuration change.

13.) Program Card Ajar

Ensure that when the Programming Card is removed or not seated properly, the Signal Monitor forces the Output Relay to the de-energized "fault" state, enable the Stop-Time output, and illuminate the PCA LED. A reset command from the front panel Reset switch or External Reset input is required once the Program Card is in place.

14.) Datakey Error

Ensure that when the Datakey is removed or when a nonvalid Datakey is inserted, the Signal Monitor forces the Output Relay to the de-energized fault state, enables the Stop-Time output, and illuminates the KEY indicator. Ensure that a reset command from the front panel Reset switch or External Reset input is required once a valid Datakey is in place. Ensure that failure to read the Datakey correctly results in a Datakey Error illuminating the KEY indicator.

15.) Exit Flash

When the Signal Monitor exits the flash state (Output relay de-energized) as a result of a Reset command or AC Line brownout restore, ensure that the Stop Time output goes to the inactive state 250 + OR - 50 ms before the Output relay transfers to the energized state. This transition will provide an early indication to the Controller Unit that the cabinet will transfer from flash to signal operation.

c. Display Functions

1) Ensure that it is possible to view the active channels for each individual color (GYR) during operation and when latched in a fault state. When the Signal Monitor is latched in a fault state ensure that it is also be possible to view the active channels for each individual color and fault status for each channel for the current fault and the two previous faults.

2) Previous Fault GYR Display

When the Signal Monitor has been triggered by a fault, the channel status display will alternate between the channels which were involved in the fault (fault status) for 2 seconds, and the field signals active at the time of the fault for 6 seconds. The channels involved in the fault will flash their respective Green, Yellow, and Red indicators simultaneously at a 4 Hz rate for the 2 second interval.

The two previous faults may also be displayed individually. This status is not reset by an AC Line power interruption. To enter this display mode remove the Datakey. The sequence is as follows:

Reset	Event	PCA LED	Fault Status LEDs	Channel Status LEDs
---	#1	Single flash	Current Fault Status (newest)	Current Field status
#1	#2	Double flash	Event #2 Fault Status	Event #2 Field status
#2	#3	Triple flash	Event #3 Fault Status (oldest)	Event #3 Field status
(repeats back to top)				

To exit this display mode, replace the Datakey.

d. Event Logging Functions

Ensure that the Signal Monitor is capable of storing in non-volatile memory a minimum of 100 events. Mark each event with the time and date of the event. These events consist of fault events, AC Line events, reset events, and configuration change events. Provide a graphical means of displaying the signal states of all field inputs for 30 seconds prior to a fault trigger event. Provide the capability to assign an eight-digit identification number to the unit shall be provided. Upload the event logs to a PC using the serial port of the Signal Monitor and software provided by the manufacturer.

Ensure each event log report contains the following information:

- Monitor ID#: an eight digit (0-99999999) ID number assigned to the monitor.
- Time and Date: time and date of occurrence.
- Event Number: identifies the record number in the log. Event #1 is the most recent event.

1) Monitor Status Report (CS)

Ensure the Current Status report contains the following information:

- Fault Type: the fault type description.
- Field Status: the current GYR field status and field RMS voltages if the monitor is not in the fault state, or the latched field status and field RMS voltages and fault channel status at the time of the fault.
- Cabinet Temperature: the current temperature if the monitor is not in the fault state, or the latched temperature at the time of the fault.
- AC Line Voltage: the current AC Line voltage if the monitor is not in the fault state, or the AC Line voltage at the time of the fault.
- Control Input Status: the current state and RMS voltages of the Red Enable input, EE input, and Special Function #1 and #2 inputs if the monitor is not in the fault state, or the status latched at the time of the fault.

2) Previous Fault Log (PF)

Ensure the Previous Fault log contains the following information:

- Fault Type: the fault type description.
- Field Status: the latched field status with RMS voltages, and fault channel status at the time of the fault.
- Cabinet Temperature: the latched temperature at the time of the fault.
- AC Line Voltage: the AC Line voltage at the time of the fault.
- Control Input Status: the latched state of the Red Enable input, EE input, and Special Function #1 and #2 inputs at the time of the fault.

3) AC Line Event Log (AC)

The AC Line log shall contain the following information:

- Event Type: describes the type of AC Line event that occurred.
  - Power-up—AC on, monitor performed a cold start
  - Interrupt—AC Line < Brownout level
  - Restore—AC restored from brown-out or interruption (AC Off), no cold start
- AC Line Voltage: the AC Line voltage at the time of the event.

4) Monitor Reset Log (MR)

Ensure the Monitor Reset log contains the following information:

a. Event Type: The monitor was reset from a fault by the front panel Reset button or External Reset input.
b. Time and Date: the time and date of the event.

5) Configuration Change Log (CF)

Ensure the Configuration Change log contains the following information:

a. Datakey Contents and any additional programming parameters resulting from hardware configuration settings.
b. The log shall indicate which items have been changed since the last log entry.
c. Time and Date: the time and date of the event.

6) Signal Sequence Log

Provide a log that graphically displays all field signal states for up to 30 seconds prior to the current fault trigger event. Ensure that the resolution of the display is at least 50 milliseconds.

e. Communications Functions

1) Controller Unit Communications

Type A: Ensure that the Signal Monitor is compatible with the protocol of the current GDOT licensed firmware for 2070 controllers and Central System Control. Ensure the 2018 Conflict Monitor supplied is able to communicate via a serial link to the 2010 Controller and then to a Central System using the current licensed GDOT Central System Software for reporting, configuring and logging.

Type B: Ensure that the Signal Monitor is compatible with the protocol of the current GDOT licensed firmware for 2070 controllers and Central System Control. Ensure the 2018 Conflict Monitor supplied is able to communicate via a RJ-45 connector (Ethernet).

2) Personal Computer Communications

Have the manufacturer provide software to access the Signal Monitor status and event logs described in Subsection 925.2.04.A.14.d. Ensure this software operates with current version of Microsoft Windows or Windows XP™

f. Hardware

1) Monitor Configuration Programming

Ensure a monitor parameter programming is provided in a removeable and interchangeable Datakey nonvolatile memory device mounted on the front panel.

a. Monitor Unit Serial Memory Key

Ensure that the monitor has a Datakey™ model KC4210 Keycepticle™ socket or equal mounted on the front panel containing a Datakey™ model LCK4000-RED serial memory key or equal. Ensure that the serial memory key is rated for –40 to +80 °C operation. (Note: Datakey™ and Keycepticle™ are registered trademarks of Datakey Electronics, Inc.)

b. Monitor Unit Serial Memory Key Interface

Ensure that the Signal Monitor does not provide the capability to program the serial memory key. It shall be used only as a read only device. Ensure that the 16 bit Frame Check Sequence (FCS) procedure defined in clause 4.6.2 of ISO/IEC 3309 is used to verify the integrity of the read data. Ensure that failure to read the serial memory key correctly results in a latched Diagnostic fault. Ensure that interface circuitry to the Datakey utilizes the LOFO switch on the serial memory key socket to ensure the device is removed and inserted with no power applied to the interface pins (i.e. dead socket).

c. Datakey Programming Tool

Ensure the programming tool provides all the electronics necessary to read data from and write data to the Datakey device. Ensure the programmer is configured to Read and Write to the Datakey model LCK4000 which provides 512 bytes of storage. Ensure power for the programming tool is obtained from the personal computer communications port so that no external power supply source is required.

d. Datakey Programming Software

Ensure that the manufacturer provides software to operate the Datakey Programming Tool.

Ensure that the Datakey programming parameters are stored in a Windows file format according to currently used Signal Monitor identification number and name.

e. Parameter Forms

Ensure that a parameter form is provided for each programmable Signal Monitor function. Ensure that Signal Monitor configuration data is entered on a parameter form and then saved to the main data buffer image. When all parameter forms are completed ensure that a Write function transfers the contents of the data buffer to the nonvolatile memory of the Datakey device. Ensure that reading the contents of a Datakey device sets the parameters of each form for review or modification.

f. Datakey Parameter Verify

Ensure that a Datakey Parameter Verify function is provided that compares the contents of a Datakey device with parameters in the data buffer. The data buffer parameters may be set by changing parameters on the forms, reading the contents of a Datakey device, or loading a set of parameters from a file.

g. Initial Parameter Setup Wizard

Ensure that an Initial Parameter Setup wizard is provided that defines and sets a basic set of parameters for a new Datakey setup. Ensure that the wizard asks a series of questions describing basic intersection setup and develop a template for the following set of parameters:

1. Red Fail Monitoring
2. Dual Indication Monitoring
3. Clearance Monitoring
4. Yellow Disable

h. Parameter Check Wizard

Ensure that a Parameter Check wizard is provided that will apply a set of basic configuration rules to the data buffer and provide a warning that configuration conflicts or inconsistencies may exist.

i. Parameter Reports

Ensure that the contents of the data buffer are displayed in a hex format for numerical analysis. A text report shall also be printed that specifies all parameter settings.

2) Red Monitoring

a. Red Field Inputs

Ensure that the Signal Monitor is capable of monitoring sixteen Red field signals. Ensure that a Red input is sensed active when the input voltage exceeds 70 Vrms. Ensure that a Red input is sensed not active when the input voltage is less than 50 Vrms. A Red input may or may not be sensed active when the input voltage is between 50 Vrms and 70 Vrms.

b. Red Enable Input

Ensure that the Red Enable input provides an AC input to the unit which enables Red Monitoring, Dual Indication Monitoring, and Sequence monitoring when the input is sensed active.

Ensure that the Red Enable input is sensed active when the input voltage exceeds 70 Vrms. Ensure that the Red Enable input is sensed not active when the input voltage is less than 50 Vrms. The Red Enable input may or may not be sensed active when the input voltage is between 50 Vrms and 70 Vrms.

c. Special Function Preemption Inputs

Ensure that the Special Function Preemption inputs #1 and #2 provide an AC input to the unit which disables only Red Fail Monitoring (Lack of Output) when either input is sensed active.

Ensure that a Special Function input is sensed active when the input voltage exceeds 70 Vrms. Ensure that a Special Function input is sensed not active when the input voltage is less than 50 Vrms. A Special Function input may or may not be sensed active when the input voltage is between 50 Vrms and 70 Vrms.

Ensure that a programming option is provided in the Datakey to invert the active status of the Special function #1 input. When the the option is enabled, ensure that the Special Function #1 input is sensed not active when the input voltage exceeds 70 Vrms. Ensure that the Special Function #1 input is sensed active when the input voltage is less than 50 Vrms. The Special Function #1 input may or may not be sensed active when the input voltage is between 50 Vrms and 70 Vrms.

d. Red Interface Connector

This connector provides the required inputs for the unit to monitor the Red field signal outputs. Ensure the connector is a 20 pin connector that mates with the P20 Cable from the output file. Provide a high quality connector that is polarized to insure proper mating with the cable. Ensure Ejector latches are included to facilitate removal and prevent the cable from inadvertently disconnecting. Ensure the unit shall function as a standard 210 Signal Monitor when the cable is disconnected. Use the pin assignments shown in Table 925-1.

Table 925 -1 Red Interface Connector

Pin	Function	Pin	Function
1	Channel 15 Red	11	Channel 9 Red
2	Channel 16 Red	12	Channel 8 Red
3	Channel14 Red	13	Channel 7 Red
4	Chassis Ground*	14	Channel 6 Red
5	Channel 13 Red	15	Channel 5 Red
6	Special Function #2	16	Channel 4 Red
7	Channel 12 Red	17	Channel 3 Red
8	Special Function #1	18	Channel 2 Red
9	Channel 10 Red	19	Channel 1 Red
10	Channel 11 Red	20	Red Enable

*A jumper option shall be provided to allow the connection of Pin #4 to be made with Chassis Ground.

3) Front Panel

Ensure the front panel is constructed of sheet aluminum with a minimum thickness of 0.090 in. (2.286 mm), and finished with an anodized coating. Ensure the model information shall be permanently displayed on the front surface.

a. Indicators

Ensure that all display indicators are mounted on the front panel of the Signal Monitor and are water clear, T-1 package, Super Bright type LEDs. Ensure that all fault LEDs are red except the AC POWER indicator which is green. Provide a separate Red, Yellow, and Green indicator for each channel. Label the indicators and provide the information as follows:

- AC POWER

  Ensure the AC Power indicator flashes at a rate of 2 Hz when the unit has detected a low voltage condition as described in Subsection 925.2.04.A.15. Ensure the AC POWER indicator flashes at a rate of 4 Hz during the minimum flash interval as described in Subsection 925.2.04.A.15. Ensure that the indicator illuminates when the AC Line voltage level is restored above the brownout level. Ensure the indicator extinguishes when the AC Line voltage is less than 80 Vac.

- VDC FAILED

  Ensure the VDC FAILED indicator illuminates when a 24VDC fault condition is detected. This indicator remains extinguished if the monitor has not been triggered by a 24VDC fault.

- WDT ERROR

  Ensure the WDT ERROR indicator illuminates when a controller Watchdog fault is detected. Ensure the WDT Error indicator flashes ON once every 2 seconds if the WD Enable switch on the monitor is placed in the OFF position to disable Watchdog monitoring, or the AC Line voltage is below the Watchdog disable level.

- CONFLICT

  Ensure that the CONFLICT indicator illuminates when a conflicting signal fault is detected.

- DIAGNOSTIC

  Ensure the DIAGNOSTIC indicator illuminates when one of the following faults is detected: Internal Watchdog fault, Memory Test fault, or Internal power supply fault. This indicator is intended to inform the service technician of a monitor hardware or firmware failure.

- RED FAIL

  Ensure the RED FAIL indicator illuminates when an absence of signal is detected on a channel(s). Ensure the RED FAIL indicator flashes ON once every two seconds if the RED ENABLE input is not active, or a Special Function input is active, or the EE input is active
- DUAL IND.

  Ensure the Dual IND. indicator illuminates when a GY-Dual or GYR-Dual Indication fault is detected on a channel(s).
- SEQUENCE

  Ensure the Sequence indicator illuminates when the minimum Yellow Clearance time has not been met on a channel(s).
- PCA

  Ensure the PCA indicator illuminates if the Program Card is absent or not properly seated.

  If the unit is in the Diagnostic Display mode, ensure the PCA indicator flashes ON (once, twice, or three times) to indicate the fault event number being displayed. See Subsection 925.2.04.A.15.
- RP DETECT

  Ensure the RP DETECT indicator illuminates when the unit has detected a Conflict, Red Fail, or Dual Indication fault as a result of recurring pulse field inputs.
- CHANNEL STATUS

  Ensure that during normal operation the 48 Channel Status indicators display all active signals (Red, Green, and Yellow).

  In the fault mode, ensure that the Channel Status indicators display all signals active at the time of the fault for six seconds and then indicate the channels involved in the fault for 2 seconds.

b. Front Panel Control-Reset Button

- Provide a momentary SPST Control switch labeled RESET on the unit front panel to reset the monitor circuitry to a non-failed state. Position the switch on the front panel such that the switch can be operated while gripping the front panel handle. Ensure that a reset command issued from either the front panel button or External Reset input is a one-time reset input to prevent the unit from constant reset due to a switch failure or constant external input, and causes all LED indicators to illuminate for 300 ms.
- The Reset button also provides control of the Diagnostic Display mode. For a complete description of Diagnostic Display operation, see Subsection 925.2.04.A.15.

c. Serial Communications Connector

Use this connector to provide EIA-232 serial communications. Ensure that it is a high quality 9 pin metal shell D subminiature type with female contacts. Refer to Table 925-2 for Pin assignments.

Table 925-2 Serial Communications Connector

Pin	Function
1	DCD*
2	TX DATA
3	RX DATA
4	DTR (Data Terminal Ready)
5	SIGNAL GROUND
6	DSR
7	DSR*
8	CTS*
9	NC

* Provide Jumper options to allow the connection of Pin #4 to be made with Pin #7, and the connection of Pin #8 to be made with Pin #1.

4) Electronics

a. RMS Voltage Sampling

Use high speed sampling techniques to determine the true RMS value of the AC field inputs. Sample each AC input at least 32 times per cycle. Ensure that the RMS voltage measurement is insensitive to phase, frequency, and waveform distortion.

b. Internal MPU Watchdog

Use a microprocessor for all timing and control functions. Verify continuing operation of the microprocessor by an independent monitor circuit, that forces the Output Relay to the de-energized "fault" state, enable the Stop-Time output, and illuminate the DIAGNOSTIC indicator if a pulse is not received from the microprocessor within 300 ms.

If the microprocessor should resume operation, ensure the Signal Monitor continues to operate. Ensure that this monitoring circuit is also configurable to latch in the fault state. Ensure the unit requires a power-up cycle to reset the circuit once it is triggered.

c. Sockets

In the interest of reliability, ensure that only the PROM memory device for the microprocessor firmware is socket mounted. Ensure that the PROM memory socket is a precision screw machine type socket with a gold contact finish providing a reliable gas tight seal. Low insertion force sockets or sockets with "wiper" type contacts are not acceptable.

d. Internal Power Supply

Use a built-in, high-efficiency switching power supply to generate all required internal voltages. Ensure that all supply voltages regulated. Failure of the internal power supply to provide proper operating voltages shall force the output Relay to the de-energized "fault" state, enable the Stop-Time output, and illuminate the DIAGNOSTIC indicator. Provide a user replaceable slow blow fuse for the AC Line input. Ensure the unit is operational over the AC Line voltage range of 75 Vac to 135 Vac.

e. Output Relay

Ensure the Signal Monitor Output Relay provides both normally open and normally closed contacts. Ensure a programming option is provided to select the polarity of the EE input to accommodate the flash drive voltage state drive on pin EE.

f. EIA-232 Interface

Ensure the EIA-232 port interface electronics is electrically isolated from all monitor electronics except chassis ground.

g. Configuration Parameters

Select user-programmed configuration settings using PCB mounted switches or jumpers. Designs requiring a Personal Computer (PC) to program or verify the configuration parameters are not acceptable. Ensure that user-programmed configuration settings that are transferred to memory are stored in a programmable read-only memory (PROM or EEPROM). Designs using a battery to maintain configuration data are not acceptable.

h. Field Terminal Inputs

Ensure that all 120 Vac field terminal inputs provide an input impedance of 150K 50K ohms and be terminated with a discrete resistor having a power dissipation rating of 0.5 Watts or greater and a voltage rating exceeding 350 volts.

i. Component Specifications

Ensure that all electrical components used in the Signal Monitor are rated by the component manufacturer to operate beyond the full unit operating temperature range of –29 °F to 165 °F(-34 °C to +74 °C).

j. Printed Circuit Boards

Ensure that all printed circuit boards meet the requirements of the *California Traffic Signal Control Equipment Specifications*, January 1989, plus the following requirements to enhance reliability:

- All plated-through holes and exposed circuit traces are plated with solder.
- Both sides of the printed circuit board are covered with a solder mask material.

- The circuit reference designation for all components and the polarity of all capacitors and diodes are clearly marked adjacent to the component. Ensure that Pin #1 for all integrated circuit packages is designated on both sides of all printed circuit boards.
- All electrical mating surfaces are gold plated.
- All printed circuit board assemblies are coated on both sides with a clear moisture-proof and fungus-proof sealant.

c. All components and wire harnesses are mounted to the PCB using plated holes. "Piggy back" connections or jumper wires are not acceptable.

16. Model 208 Monitor Unit

Provide Model 208 Monitor Unit in accordance with CALTRANS TEES and the following. Provide monitor that is on the CALTRANS QPL and provides the pin assignment as shown in Table 925-3.

The Model 208 Monitor Unit shall reliably sense and cause a relay output contact (FAILED STATE) when monitoring the following:

- A Watchdog Timer (WDT) Timeout Condition
- Cabinet +24 VDC Power Supply below specified threshold

a. WDT Circuitry shall be provided to monitor a controller unit output line state routed to the monitor unit at its assigned pin. The WDT Circuitry shall sense any line state change and the time between the last change. No state change for 1.5 ± 0.1 seconds shall cause a FAILED state. The timer shall reset at each state change in a NON FAILED state.

1) Only the Unit Reset or a WDT inactive due to the voltage sense shall reset the WDT from a FAILED state.
2) A FAILED state caused by the WDT shall illuminate a front panel indicator light label “WDT ERROR”. The indicator shall remain ON until Unit Reset Issuance.
3) The WDT Circuitry shall sense the incoming VAC Line and when the voltage falls below 98 ± 2VAC for 50 ± 17 ms shall inhibit the WDT Function. When the WDT Circuitry sensed the incoming VAC Line rise above 103 ± 2VAC for 50 ± 2ms the WDT shall become active. A hysteresis between the Voltage Inhibit and the Voltage Active Setting shall be a minimum of 3 Volts.

b. Power Supply Monitor Requirements

1) The monitor unit shall sense the Cabinet +24 VDC Power Supply Output Voltage.
2) Voltages sensed at +18 VDC or below for a duration of 500 ms or longer shall cause a FAILDED state.
3) Voltages sensed at+22 VDC or above shall NOT cause a FAILED state.
4) Voltages sensed below +22 VDC for a duration of 200 ms or less shall NOT cause a FAILED state.
5) All timing and voltages conditions other than those specified above may or may not cause a FAILED state.
6) A FAILED state caused by sensing the power supply shall illuminate a front panel indicator light labeled “VDC FAILED”. The indicator shall remain ON until Unit Reset.
7) Only Unit Reset shall reset the power supply sense circuitry from a FAILED state.

c. FAILED State Output Circuits

1) An electro-mechanical relay shall be provided to switch an output circuit during a FAILED state. The relay coil shall be energized in a NON FAILED State.
2) The relay contacts shall be rated for a minimum of 3 amperes at 120 VAC and 100,000 operations. Contact opening /closing time shall be 30 ms or less.

d. Monitor Unit Reset

1) A momentary SPST CONTROL switch labeled “RESET” shall be provided on the unit front panel to reset the monitor unit circuitry to a NON FAILED state. The switch shall be so positioned on the front panel that the switch can be operated while gripping the front panel handle.
~~2)~~ The unit shall be provided with provision to drive an external NE2H light through a 56K Ohm, ½ Watt Series resistor (resident on unit)
3) The PDA Type 3 WDT Reset Input shall not be sensed by the unit
4) The output relay CONTACT FOR FAILED STATE shall be OPEN.

Table 925-3 Pin Assignments For Model 208 Monitor Unit	
PIN	**FUNCTION**
1/44	DC Ground
2/43	WDT Ext. Reset
5/40	WDT IN
10/35	+24 VDC
15/30	AC-
17/28	Normally Open, Circ. #2
19/26	AC+
20/25	Normally Closed, Circ. #1
21/24	Circ. Common #1 & #2
22/23	WDT Lamp (External)
NOTE: Card connector keyed between pins 2 & 3, and pins 11 & 12.	

17. Model 242 DC Isolator

    Provide Model 242 DC Isolators that are in accordance with the latest version of CALTRANS Specifications as referenced earlier in this section. Provide isolators that:

    - Allow the 242 isolator input signal polarity to easily be inverted without the use of tools. Acceptable methods are removable jumpers or dip switches. Unacceptable methods are soldering or desoldering a diode or resistor.
    - Output is OFF for input voltages greater than 12 volts;
    - Output is ON for voltages of less than 8 volts that have a duration of at least 5 to 25 ms (optional 2-7 ms);
    - Minimum output pulse width is 100 ms with a valid input (can be disabled);
    - Output is optically isolated open collector NPN transistor;
    - Capable of sinking 50 ma when on;
    - Can register a new input within 25 ms of the old signal going away; and
    - Output clamped on power up and down
    - Compatible with 2070 controllers and latest version of CALTRANS TEES including errata

18. Model 200 Switchpack

    Provide Model 200 Switchpacks that are in accordance with the latest version of CALTRANS Specifications as referenced earlier in this section.

19. Model 204 Flasher Unit

    Provide Model 204 Flasher Units that are in accordance with the latest version of CALTRANS Specifications as referenced earlier in this section.

20. Flash Transfer Relay

    Provide Flash Transfer Relays that are in accordance with the latest version of CALTRANS Specifications as referenced earlier in this section.

21. Cabinet Model 332A

    Ensure surge protection conforms to Table 925-5 Required Surge Arrestors for Model 332A Cabinet.

    Supply Model 332A (lower input panel) cabinets, with housing Type 1B, and all components as described in these Specifications.

    Supply cabinets having two input files which conform to the CALTRANS Specifications and configured to accept two 2070 controllers in the top portion of the cabinet. Ensure the cabinet has two shelves provided for controller(s).

Configure the cabinet for dial up communications. Mount a two (2) circuit Buchanan connector on the right side panel (from rear door).

Mount a phone jack with a RJ11 connector above or to the right of the Buchanan terminal block.

Wire the phone jack to the Buchanan and to the Terminal Block (TB0) in accordance with Figure 925-2.

A manual jack shall be installed inside the cabinet. The jack shall intermate with a three circuit 1/4 inch (6.35 mm) diameter phone plug. The tip and ring (middle) circuits of the jack shall-be connected to the logic ground and the interval advance inputs of controller unit. When the manual hand cord is plugged into the jack and the pushbutton is pressed, logic ground shall be connected to the interval advance input of the controller unit.

A Manual ON- OFF Switch shall be provided on the police panel which grounds the Manual Control Enable (C1 Pin 53) input to the controller whenever the switch is in the ON position and advance input (C1 Pin 80).

A manual pushbutton with cord shall be provided. The cord shall have a minimum length of 6 feet (1.8 m). It shall have a 1/4 inch (6.35 mm) diameter, three circuit plug connected to one end and a manual pushbutton enclosed in a hand held enclosure at the other end. A complete cycle (push-release) of the manual pushbutton shall terminate the controller unit interval which is active except the vehicular yellow and all red clearance intervals. Cycling the push-button during the vehicular yellow or all red clearance intervals shall not terminate the timing of those intervals.

Ensure that the cabinet is configured with an Auxiliary Output File. Additionally, the field wiring terminals may be mounted on the rear of the input file.

22. Cabinet Model 336S (Base Mount)

This unit meets the CALTRANS Specification with the addition of approximately 6 additional inches (150 mm) of cabinet height exclusive of the "M" base adapter. Configure the internal component layout so that the additional space is available in the bottom area of the cabinet cage. Ensure that the field wiring input panels and surge protection conform to Table 925-6 Model 336S Default Input File Assignment Detail and Table 925-7 Required Surge Arrestors for Model 336S Cabinet.

Ensure that the C1 connector harness is provided with pins for all 104 inputs and outputs from the controller.

A manual jack shall be installed on the police panel. The jack shall intermate with a three circuit 1/4 inch (6.35 mm) diameter phone plug. The tip and ring (middle) circuits of the jack shall-be connected to the logic ground and the interval advance inputs of controller unit. When the manual hand cord is plugged into the jack and the pushbutton is pressed, logic ground shall be connected to the interval advance input of the controller unit.

A Manual ON- Off Switch shall be provided on the police panel which grounds the Manual Control Enable (C1 Pin 53) input to the controller whenever the switch is in the ON position

A manual pushbutton with cord shall be provided. The cord shall have a minimum length of 3 feet (0.9 m). It shall have a 1/4 inch (6.35 mm) diameter, three circuit plug connected to one end and a manual pushbutton enclosed in a hand held enclosure at the other end. A complete cycle (push-release) of the manual pushbutton shall terminate the controller unit interval which is active except the vehicular yellow and all red clearance intervals. Cycling the push-button during the vehicular yellow or all red clearance intervals shall not terminate the timing of those intervals.

23. Cabinet Model 336S (Pole Mount)

Ensure that this unit meets the requirements of Subsection 925.2.04.A.22 above, except that the cabinet is configured for pole mounting as specified in the General Requirements for Type 170 Cabinet Assemblies.

24. Cabinet Model 336S (Base Mount with Auxiliary Output File)

Ensure that this unit meets the requirements of Subsection 925.2.04.A.22 above, except that the cabinet is configured with an Auxiliary Output File. Additionally, the field wiring terminals may be mounted on the rear of the input file.

25. Cabinet Model 337

The Model 337 cabinet is a compact cabinet with an output capacity of four vehicle phases plus two pedestrian phases; the dimensions not to exceed 17 inches (425 mm) deep x 20 inches (500 mm) wide x 35 inches (875 mm) high and its shipping weight not to exceed 175 pounds (80 kg).

Supply the cabinet assembly with capacity for 11, two-channel slots in the input file.

Ensure that the pin assignments of the C1 connector are compatible with the 2070 controller as applicable according to the required number of input/outputs.

Ensure that the 337 cabinet uses standard Type 170 input and output file units.

Equip the cabinet with a C2 connector harness with field terminals protected with surge protectors for communication inputs as specified under communications inputs.

Ensure that the cabinet has two full-size doors to allow complete access from the front or back of the cabinet. Design the rack assembly to mount in CALTRANS standard rails to allow for a Model 204 flasher.

Provide a receptacle to accept the plug in power distribution assembly card guides and edge connectors for the input file card guides to support the conflict monitor, and load switches and flash transfer relays.

Due to the compact design of this cabinet assembly, the Department of Transportation may accept a non-standard type of power distribution assembly (PDA).

26. Cabinet Model 334 with Auxiliary Output File for Ramp Metering Operations

The Controller Cabinet shall comply with the CALTRANS Traffic Signal Equipment Specifications (1989), Model 334 Cabinet Specifications (Chapter 6). **DO NOT** use the February 1993 Amendments for Specifications for the Model 334C Cabinet. Do use the Specification Clarifications dated December 20, 1993.

Provide Cabinet configured as shown in Figure 925-1.

Provide Detector Test Switch Panel. Before providing cabinet submit Detector Switch Test panel design and mounting location for approval. Panel shall include one switch for each of the 13 detector inputs.

a. The Detector Test Switch Panel shall be mounted in the cabinet on the rails. The panel shall be fabricated from brushed aluminum.

b. Each switch will be labelled as to function. The label shall be silkcreened on the test panel and be at least ¼ inch in height.

c. A three position switch shall be provided for each detector input. The switch shall function as follows:

- Down (Momentary) – Call is placed into the controller on the appropriate input in parallel with field input
- Up (Lock) – Call is placed into the controller on the appropriate input in parallel with field input.
- Center (Lock) – Normal Operation field output of detector is connected to the controller unit.

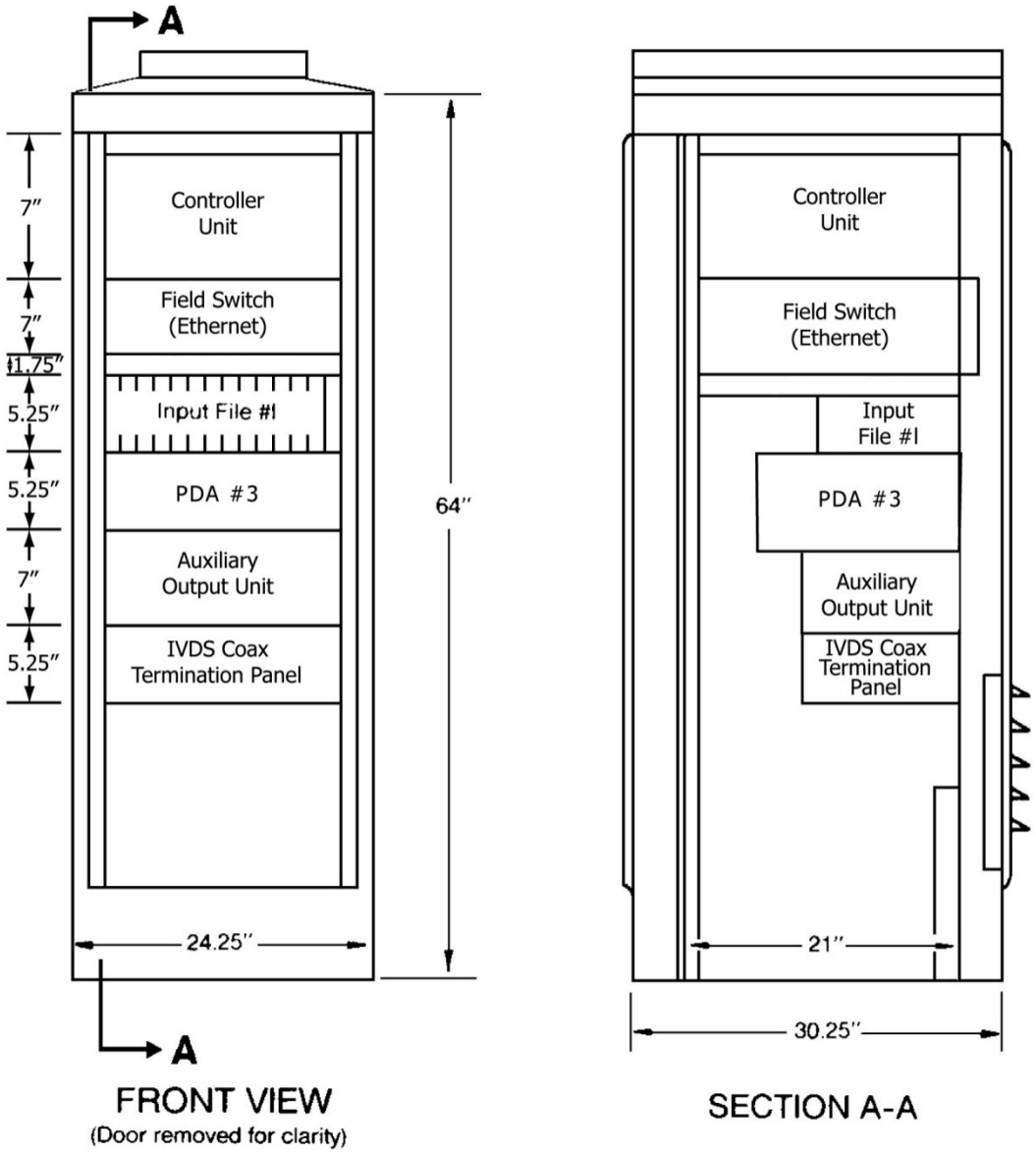


Figure 925-1 Typical 334 Cabinet Configuration

B. Fabrication

1. Cabinet

The signal cabinet shall be manufactured of aluminum with a minimum thickness of 0.125 inches (3 mm).

Ensure that the cabinet exterior has a smooth, uniform “bare” aluminum finish with all joints between adjoining cabinet components (sides and bottom) continuously welded on the outside to prevent the intrusion of moisture and dust.

Ensure that all welds are free of cracks, blow holes and other irregularities.

Ensure that shelves inside the cabinet are vented in order to allow circulation of air throughout the cabinet. Required shelves include but are not limited to those used for the input file, output file, and PDA.

Use a cabinet door that is double flanged on all four sides to prevent the entry of dirt and liquids when the door is open.

Install a one-piece gasket formed around the door opening to insure a weather tight seal when the door is secured.

Attach the door to the cabinet housing by a continuous tamper proof hinge.

Equip each cabinet with a Corbin #2 lock and one key. Police panel type locks are not acceptable.

Install an aluminum back panel in the cabinet, mounted on standoffs, to facilitate mounting of internal components.

Install exterior aluminum mounting brackets, which extend a minimum of 1.75 inches (44 mm) and a maximum of 2.5 inches (63 mm) from the top and bottom of the cabinet.

Use brackets that extend across the full width of the cabinet back on the top and bottom.

Provide these brackets with holes for mounting to a flat surface with screws and vertical slots for banding to steel, concrete or wooden signal poles.

C. Acceptance

Refer to Subsection 925.2.02 for compliance with CALTRANS QPL.

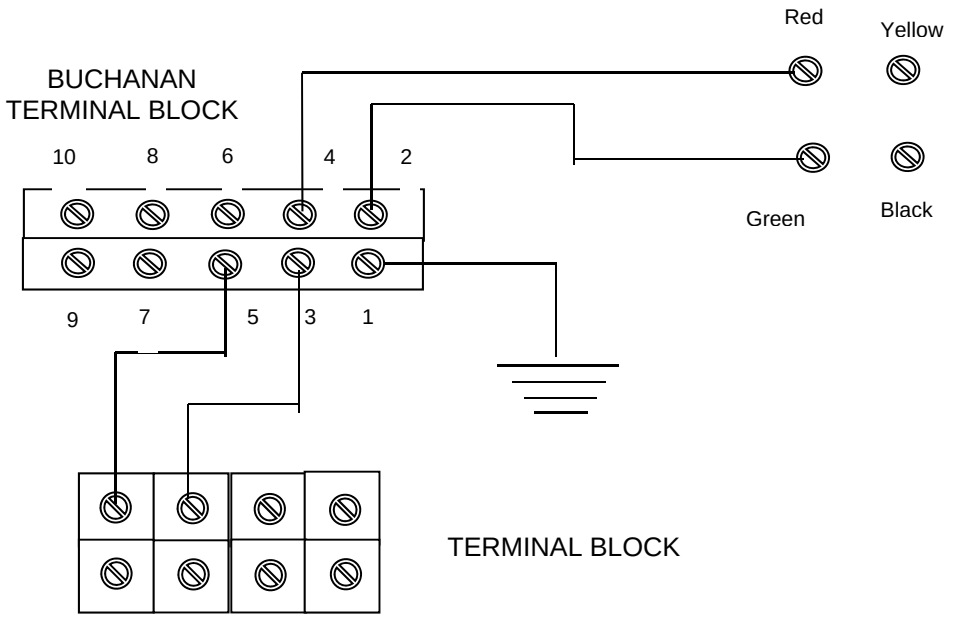
D. Materials Warranty

Refer Subsection 925.2.01.D for Materials Warranties.

Table 925 – 4 Model 332 Default Input Files Assignment Detail

Upper Input File (I)	**Slot**		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
	Type		**Det**	**Det**	**Det**	**Det**	**Det**	**Det**	**Det**	**Det**	**Det**			**DC**	**DC**	**DC**
	Channel 1	**C1 Pin**	56	39	63	47	58	41	65	49	60		80	67	68	81
		Function	Ph1	Ph2	Ph2	Ph2 CALL	Ph3	Ph4	Ph4	Ph4 CALL	Ph1		INT ADV	Ph2 PED	Ph6 PED	FLASH
		Field Term	TB-2 1,2	TB-2 5,6	TB-2 9,10	TB-4 1,2	TB-4 5,6	TB-4 9,10	TB-6 1,2	TB-6 5,6	TB- 6 9,10		NC	TB- 8 4,6	TB- 8 7,9	NC
	Channel 2	**C1 Pin**	56	43	76	47	58	45	78	49	62		53	69	70	82
		Function	Ph1	Ph2	Ph2	Ph2 CALL	Ph3	Ph4	Ph4	Ph4 CALL	Ph3		MCE	Ph4 PED	Ph8 PED	STOP TIME
		Field Term	TB-2 3,4	TB-2 7,8	TB-2 11,12	TB-4 3,4	TB-4 7,8	TB-4 11,12	TB-6 3,4	TB-6 7,8	TB-6 11,12		NC	TB-8 5,6	TB-8 8,9	NC
Lower Input File (J)	**Slot**		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
	Type		**Det**	**Det**	**Det**	**Det**	**Det**	**Det**	**Det**	**Det**	**Det**			**TBA**	**TBA**	**DC**
	Channel 1	**C1 Pin**	55	40	64	48	57	42	66	50	59		54	71	72	51
		Function	Ph5	Ph6	Ph6	Ph6 CALL	Ph7	Ph8	Ph8	Ph8 CALL	Ph5			EVA	EVB	R/R
		Field Term	TB-3 1,2	TB-3 5,6	TB-3 9,10	TB-5 1,2	TB-5 5,6	TB-5 9,10	TB-7 1,2	TB-7 5,6	TB- 7 9,10			TB- 9 4,6	TB- 9 7,9	TB- 9 10,12
	Channel 2	**C1 Pin**	55	44	77	48	57	46	79	50	61		75	73	74	52
		Function	Ph5	Ph6	Ph6	Ph6 CALL	Ph7	Ph8	Ph8	Ph8 CALL	Ph7			EVC	EVD	
		Field Term	TB-3 3,4	TB-3 7,8	TB-3 11,12	TB-5 3,4	TB-5 7,8	TB-5 11,12	TB-7 3,4	TB-7 7,8	TB-7 11,12			TB-9 5,6	TB-9 8,9	TB- 9 11,12

Table 925-5 Required Surge Arrestors for Model 332 Cabinet		
Field Terminal Block	**Terminals**	**Required Arrestor**
TB-8	1-12	Section 925.2.04.A.13.f
TB-9	10-12	Section 925.2.04.A.13.f
TB-9	4-9	Terminal Block only Section 925.2.04.A.13.f
TB-2, TB-3, TB-4, TB-5, TB-6, TB-7	1-12	Section 925.2.04.A.13.c



Note: For a typical signal installation, the Model 332 cabinet is the design standard.

Figure 925-2—Wiring Diagram for Dial-up Communications

Table 925-6 Model 336S Default Input File Assignment Detail

Slot		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Type		**Det**	**Det**	**Det**	**Det**	**Det**	**Det**	**Det**	**Det**	**DC**	**TBA**	**TBA**	**DC**	**DC**	**DC**
Channel 1	**C1 Pin**	56	39	58	41	55	40	57	42	51	71	72	67	68	81
	Function	Ph1	Ph2	Ph3	Ph4	Ph5	Ph6	Ph7	Ph8	SE1	EVA	EVB	Ph2 PED	Ph6 PED	FLASH
	Field Term	TB-7 1,2	TB-7 5,6	TB-7 9,10	TB-8 1,2	TB-8 5,6	TB-8 9,10	TB-9 1,2	TB-9 5,6	TB- 5 1,2	TB- 5 5,6	TB- 5 9,10	TB- 4 1,2	TB- 4 5,6	NC
Channel 2	**C1 Pin**	47	43	49	45	48	44	50	46	52	73	74	69	70	82
	Function	Ph2 CALL	Ph2	Ph4 CALL	Ph4	Ph6 CALL	Ph6	Ph8 CALL	Ph8	R/R	EVC	EVD	Ph4 PED	Ph8 PED	STOP TIME
	Field Term	TB-7 3,4	TB-7 7,8	TB-7 11,12	TB-8 3,4	TB-8 7,8	TB-8 11,12	TB-9 3,4	TB-9 7,8	TB-5 3,4	TB-5 7,8	TB-5 11,12	TB-4 3,4	TB-4 7,8	NC

Table 925-7 Required Surge Arrestors for Model 336S Cabinet

Field Terminal Block	Terminals	Required Arrestor
TB-4	1-12	Section 925.2.04.A.13.f
TB-5	1-4	Section 925.2.04.A.13.f
TB-5	5-12	Terminal Block only Section 925.2.04.A.13.f
TB-7, TB-8, TB-9	1-12	Section 925.2.04.A.13.c

Table 925-8 Model 334 Default Input File Assignment Detail

Slot		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Type		**Det**	**Det**	**Det**	**Det**	**Det**	**Det**	**Det**	**Det**	**Det**	**Det**	**Det**	**TBA**	**TBA**	**TBA**
Channel 1	**C1 Pin**	46	50	49	55	51	57	59	61	81	79	53	41	43	45
	Function	L1 D1	L2 D2	L1 Q1	L3 Q3	L1 MLA	L2 MLA	L3 MLA	L4 MLA		L3 D3				
	Field Term	TB-2 1,2	TB-2 5,6	TB-2 9,10	TB-3 1,2	TB-3 5,6	TB-3 9,10	TB-4 1,2	TB-4 5,6	TB-4 9,10	TB-5 1,2	TB-5 5,6	TB-5 9,10	TB-6 1,2	TB-6 5,6
Channel 2	**C1 Pin**	39	47	48	56	52	58	60	62	80	82	54	40	42	44
	Function	L1 P1	L2 P2	L2 Q2		L1 MLB	L2 MLB	L3 MLB	L4 MLB		L3 P3				
	Field Term	TB-2 3,4	TB-2 7,8	TB-2 11,12	TB-3 3,4	TB-3 7,8	TB-3 11,12	TB-4 3,4	TB-4 7,8	TB-4 11,12	TB-5 3,4	TB-5 7,8	TB-5 11,12	TB-6 3,4	TB-6 7,8

Table 925-9 Required Surge Arrestors for Model 334 Cabinet

Field Terminal Block	Terminals	Required Arrestor
TB-2, TB-3, TB-4	1-12	Section 925.2.04.A.13.c
TB-5	1-4	Section 925.2.04.A.13.c

Table 925 - 10 Model 334 PDA Type 3 Output File

	SP 1					SP 2					SP 3				
	C1 Pin	**Out #**	**Conn**	**Func**	**Field Term**	**C1 Pin**	**Out #**	**Conn**	**Func**	**Field Term**	**C1 Pin**	**Out #**	**Conn**	**Func**	**Field Term**
SP R	2	0	C6-1	Warn 1	T4-7	4	2	C6-3	Lane 1 R	T4-4	7	5	C6-6	Lane 2 R	T4-1
SP Y	37	34	C6-9		T4-8	5	3	C6-4	Lane 1 Y	T4-5	8	6	C6-7	Lane 2 Y	T4-2
SP G	3	1	C6-2	Warn 2	T4-9	6	4	C6-5	Lane 1 G	T4-6	9	7	C6-8	Lane 2 G	T4-3

Table 925 - 11 Model 334 Auxiliary Output File

	SP 9					SP 10					SP 11				
	C1 Pin	**Out #**	**Conn**	**Func**	**Field Term**	**C1 Pin**	**Out #**	**Conn**	**Func**	**Field Term**	**C1 Pin**	**Out #**	**Conn**	**Func**	**Field Term**
SP R	97	53	C5-14	Lane 3 R	A124	94	50	C5-11	Not used	A121	91	48	C5-9	Not used	A114
SP Y	98	54	C5-15	Lane 3 Y	A125	95	51	C5-12	Not used	A122	101	37	C5-18	Not used	A115
SP G	99	55	C5-16	Lane 3 G	A126	96	52	C5-13	Not used	A123	93	49	C5-10	Not used	A116
	SP 12					**SP 13**					**SP 14**				
	C1 Pin	**Out #**	**Conn**	**Func**	**Field Term**	**C1 Pin**	**Out #**	**Conn**	**Func**	**Field Term**	**C1 Pin**	**Out #**	**Conn**	**Func**	**Field Term**
SP R	88	45	C5-6	Not used	A111	85	42	C5-3	Not used	A104	83	40	C5-1	Not used	A101
SP Y	89	46	C5-7	Not used	A112	86	43	C5-4	Not used	A105	100	36	C5-17	Not used	A102
SP G	90	47	C5-8	Not used	A113	87	44	C5-5	Not used	A106	84	41	C5-2	Not used	A103

925.2.05 Type ITS Cabinet Assemblies

A. Requirements

Ensure that the cabinet assembly meets the requirements of the CALTRANS Specifications as described in this document. In addition to the CALTRANS Specifications, ensure that the cabinet assembly conforms to the requirements listed below, which take precedence over conflicting CALTRANS Specifications.

1. Cabinet configuration:

Supply cabinets in accordance with the following information and table 925-12.

a. Cabinet Traffic Signal Application - Series 340
   - 340 - 4 Door Cabinet with “P” Base Ground Mount
   - 342 - 2 Door Cabinet with “170” Base (332) Ground Mount
   - 346 - 2 Door Cabinet with ”170” Base (336S), Adaptor Mount

b. Cabinet Traffic Management Application - Series 350
   - 354 - 2 Door Cabinet with “170” Base (332) Ground Mount
   - 356 - 2 Door Cabinet with “170” Base (336S) Adaptor Mount

Table 925-12 ITS Cabinet Configurations

Items	ITS Cabinet Versions				
	340	342	346	354	356
	Qty	Qty	Qty	Qty	Qty
Housing # 1/ Cage #1		1		1	
Housing # 2/Cage #2			1		1
Housing #3/Two Cage #1	1				
“J” Panel Cage #1	4	2		2	
“J” Panel Cage #2			2		2
Service Panel Assembly with AC -/EG Bus	1	1	1	1	1
Raw/Clean AC power Assembly	1	1	1	1	1
Raw Clean AC power Extension	1				
AC Clean Module Assembly	1				
DC Power/Comm Assembly	2	1	1	1	1
DC Power/Comm Extension	2	1		1	1
Laptop Shelf Assembly	2	1	1	1	1
Input Assembly	3	2	1	1	1
Six Pack Output Assembly	1			1	1
Fourteen Pack output Assembly	1	1	1		
PDA ITS Assembly	1	1	1	1	1
Control/Serial Bus harness	8	6	4	4	4
Serial Bus 3 Harness	3	1	1	1	1

NOTE: Input Assembly shall include a Model 218 SIU. Output Assembly shall include a Model 218 SIU, Model 214 AMU and Model 205 Transfer Relays. The PDA ITS (Traffic Signal Application) shall include two Model 204 Flasher Units, Model 212 CMU and two Model 216 Power Supply Units and attached harnesses. The PDA ITS (Traffic Management System Application) shall include Model 212 CMU and two Model 216 Power Supply Units and attached harnesses.

c. Model 340 Cabinet:
   - Field termination panels
   - 9 – Flash Transfer Relays
   - 2 – Model 204 Flashers

- Specific Equipment Layout and other cabinet devices determined on a project specific basis

d. Model 342 Cabinet:
   - 1-Model 242 DC Isolator
   - 6- Flash Transfer Relays
   - 2-Model 204 Flashers

e. Model 346 Cabinet
   - 1-Model 242 DC Isolator
   - 6-Flash Transfer Relays
   - 2-Model 204 Flasher
   - 1-"M" Base Adapter installed (Base Mount Cabinets Only)
   - 1-Aluminum Cover Plate for Cabinet Bottom (Pole Mount Cabinets Only)
   - Model 354 Cabinet:
   - Specific Equipment Layout and additional cabinet equipment determined on a project specific basis.
   - Model 356 Cabinet
   - Specific Equipment Layout and additional cabinet equipment determined on a project specific basis.
   - 1-"M" Base Adapter installed (Base Mount Cabinets Only)
   - 1-Aluminum Cover Plate for Cabinet Bottom (Pole Mount Cabinets Only)

Note: Include above components in cabinet at time of delivery.

Other auxiliary cabinet components such as controllers, load switches, etc. will be ordered as separate items.

2. Finish

   Use cabinets that have a bare aluminum finish (see Subsection 925.2.04.B.1 for controller-cabinet minimum fabrication specifications).

3. Locks

   Equip the main cabinet door with locks that accept No. 2 Corbin keys. Provide two sets of keys with each cabinet. One set of keys is defined as one – No. 2 key and one - police panel key.

4. Power

   Equip the cabinet assemblies with an ITS power distribution assembly to generate AC and DC power for the electronic components, except the DC power for the controller units.

5. Mounting

   Equip the cabinets for pole or base mounting, as specified in the Plans.

   a. Base Mount

      Supply Model 346 and 356 cabinets, when specified as base mount, with a “M” base-mounting adapter installed.

   b. Pole Mount

      Supply Model 346 and 356 cabinets, when specified as pole mount, with two exterior pole mounting brackets that allow for mounting on steel, concrete, and timber poles.

      Ensure that the bracket mounting holes are properly reinforced with metal plates of adequate size and strength, welded longitudinally across the inside depth of the cabinet.

      Ensure that the exterior-mounting bracket is shipped installed on the cabinet housing. Additionally, provide an aluminum plate, which covers the bottom cabinet opening.

6. Cabinet Light

   Include in each cabinet one fluorescent strip lighting fixture mounted inside the top front portion of the cabinet. Do not use a screw in type fluorescent lamp.

   The fixture includes a cool white lamp, covered, and operated by a normal power factor, UL listed ballast.

   Install a door-actuated switch to turn on the cabinet light when either door is opened.

7. Cabinet Interlock

   Do not install the interlock circuit, as detailed in the CALTRANS Specifications.

8. Laptop Shelf

   Equip each Model 334, 332A, and 336S cabinet with a hinged aluminum shelf and integrated storage compartment mounted on the front door, inside the cabinet assembly. To allow proper ventilation throughout the cabinet, a sliding shelf/drawer shall not be mounted in the rack assembly. The shelf shall have a smooth, non-slip surface, sufficient for use as a writing platform and of sufficient size and stability to support a typical laptop computer when extended. The shelf shall have rounded or insulated edges that do not have the potential to harm the user. The shelf shall lock into place when folded for storage. Locking the shelf for storage and/or extending it for use shall not require the use of any tool.

9. Red Enable Board Cover

   The Output File Assembly shall implement a hinged, clear, polycarbonate cover to protect the Red Enable Board during normal operation. This cover shall be hinged on the left or right side. When closed, the side opposite the hinged shall be secured to the Output File Assembly without the use of any hardware or tool. When fully opened, the cover shall not inhibit the removal, replacement or configuration of the Red Enable Board. Removal and replacement of the Red Enable Board shall not require the removal of the protective cover.

10. Test Program

    Supply each cabinet with a diagnostic test program, which verifies the operation of the cabinet. Ensure that the program can test cabinet wiring related to the output file, input file, and police panel and flash switches. In addition, ensure that the program can check the operation of the SIU, AMU and CMU by generating all possible conflicts, in sequence.

11. Surge Protection

    Equip each cabinet with devices to protect the control equipment from surges and over voltages.

    Design the surge protector panels to allow for adequate space for a wire connection and surge protector replacement without the removal of terminal blocks or panels. Provide surge protectors for the input sections as detailed below and as shown in the Input Terminal and Surge Arrestor Detail.

    Supply surge protectors that meet the following Specifications.

    a. AC Service Input

       - Include a surge protection unit for each cabinet on the AC service input that meets or exceeds the following requirements:
         - Provide a hybrid type power line surge protection device on a service panel which plugs into a 12 pin Beau Connector which mounts on a service panel.
       - Install the protector between the applied line voltage and earth ground. Use a surge protector capable of reducing the effect of lightning transient voltages applied to the AC line that conforms to the following:
         - Peak surge current for an 8 x 20 μs waveform:
         - 20,000A for 20 occurrences
         - Clamp voltage @ 20,000A
         - 280V max
         - Maximum continuous operating current:
         - @ 120V / 60 Hz 10A
         - Series Inductance:
         - AC Line/AC Neutral - 200 microhenries
         - Response time:
         - Voltage never exceeds 280V during surge
         - Spike suppression for +/- 700 V spike:
         - +/- 40 V deviation from sine wave at all phases angles between 0 and 180 degrees.
       - Provide a protector with the following terminals:
         - Main Line (AC line first stage terminal)
         - Main Neutral (AC neutral input terminal)

- Equipment Line In (AC line second stage input terminal, 10A)
- Equipment Line Out (AC line second stage output terminal, 10A)
- Equipment neutral out (neutral terminal to protected equipment)
- GND (Earth connection)

- Supply a protector that is epoxy encapsulated in a flame-retardant material.
- Configure the Equipment Line Out to provide power to the Type 2070 and to the 24 V power supply.

b. Inductive Loop Detector Inputs

Protect each inductive loop detector channel input by an external surge protection device that meets or exceeds the following requirements:

- A three-terminal device, two (2) of which are connected across the signal inputs of the detector with the third connected to the chassis ground to protect against common mode damage.
- Instantly clamps differential mode surges (induced voltage across the loop detector input terminals) via a semiconductor array. The array appears as a low capacitance to the detector.
- Clamps common mode surges (induced voltage between the loop leads and ground) via solid state clamping devices.
- Withstand 25-100A surge current occurrences of a 10 x 700 µs waveform.
- Have the following clamp characteristics:

Maximum break over voltage:	170 V
Maximum on-stage clamping voltage:	3V
Response Time:	<5 ns
Off-stage leakage current:	<10 µA
Capacitance:	less than 220 pf

- Ensure that the unit also meets the following minimum requirements:

Peak surge current:	6 times
Differential mode:	400 A (8 x 20 ms)
Common mode:	1,000 A (8 x 20 ms)
Estimated occurrences:	500 @ 200 A
Response time:	40 ns
Input capacitance:	35 pF typical
Temperature:	-40° F to +185° F (-40º C to 85º C)
Mounting:	No. 10-32 x 3/8-inch (No. 5 x 10 mm) bolt
Clamp voltage @ 400 A diff. Mode:	30 V max.
Clamp voltage @ 1,000 A comm.. Mode:	30 V max.

c. Signal Load Switches (Switchpacks)

Provide the output of the switchpack in the output file with transient protection via the nine position transient protection device in the output file. Protect switchpacks from surges on the AC output lines.

Ensure that the transient protectors meet or exceed these requirements:

- Steady state sinusoidal voltage (RMS) rating at 50 to 60 Hz of at least 150 V at 77 ºF (25 °C)
- Steady state applied DC voltage rating of at least 200 V at 77 ºF (25 °C)
- Transient energy rating is of at least 80 J for a single impulse of 10/1,000 µs current waveform at 77 ºF (25 °C)
- Peak current rating of 6,500 A for a single impulse of 8/20 µs waveform with the rated continuous voltage applied
- Varistor voltage of at least 212 V at 1.0mA of DC current applied for the duration of 20 µs to 5s
- Clamping voltage of at least 395 V with an applied 8/20 µs impulse of 100 A
- Typical capacitance at a frequency of 0.1 to 1.0 MHz of 1600 pF

- Two-terminal device, one of which is connected to the AC output of the signal load switch on the output file terminals (backside of the field terminals) with the other connected to AC neutral

d. Communication Inputs

Protect low voltage communications input as it enters the cabinet with a solid-state surge protection unit that meets or exceeds these requirements:

- Dual pair (4-wire) module with a printed circuit board connector, double sided and gold plated for reliability
- Ability to mate with and be installed in a 10-circuit Buchanan connector Part Number PCBIB10S or Tyco Part Number 2-1437410-3 or equivalent
- Usable as two independent signal pairs
- The data circuits pass through the protection in a serial fashion
- C2 connector of the 2070 controller that terminates on the line side of the unit
- Communication field wires for this local side that terminate on the line side of the unit
- Ground terminals connected to power ground
- Ensure that the unit meets the following minimum requirements:

Peak surge current:	10 kA (8 x 20 µs wave shape)
	500A (10 x 700 µs wave shape)
Occurrences @ peak:	50 typical
Response time:	<1ns
Voltage Clamp:	8V line to line
Series Resistance:	24 Ω total
Temperature	-40 ^{o}F (-40 ^{o}C) to +185 ^{o}F (85 ^{o}F)
Primary protector:	3 element gas tube 5kA, (8 x 20µs wave shape), per side
Secondary protector:	Silicon avalance, 1.5 kW minimum

e. Low Voltage DC Inputs

Provide an external surge protection device for each low voltage DC input channel which meets the same requirements as the communication inputs with the following exception of the Voltage clamp, which shall be 30 V line-to-line.

12. Type 212 ITS Cabinet Monitor Unit

a. Introduction

Supply each cabinet with Type 212 ITS Cabinet Monitor Unit (CMU). Ensure the Type 212 CMU meets the CALTRANS TEES Specifications and functions as a unit with the a Type 214 Auxiliary Monitor Unit to provide the following monitoring functions: Cabinet Power Supplies,; Conflicting Channel Monitor, Serial Bus1 and 3 Error; Message 62; Diagnostic Error; Multiple Channel Inputs; Lack of Signal Inputs; Yellow Clearance; Yellow plus Red Clearance; Police and Power Distribution Switch Monitor; door Switches and Main Contactor Status; Circuit Breakers; Flash Unit Output Status; and AC Line Level Sense. Ensure the Unit supplied is listed on the most recent California Department of Transportation Qualified Products List (QPL).

b. Configuration

Supply Type 212 CMU capable of monitoring up to 28 physical load switch channels (RYG) plus 4 virtual channels for a total of 32 channels.

c. Programming

Ensure complete programming of the Type 212 CMU is by an interchangeable Datakey nonvolatile memory device. The Datakey shall store all of the configuration parameters. Ensure the programming of the datakey can easily be accomplished by a PC and provide datakey and programming device with the delivery of the first unit ordered. Orders of multiple ITS cabinets require delivery or 1 programming device with PC software for every 10 cabinets.

d. Logging

Ensure the Type 212 CMU maintains a non-volatile event log recording. The complete intersection status as well as previous fault events, AC Line events, configuration changes, monitor resets, cabinet temperature and true RMS voltages for all field inputs. A real time clock time shall stamp each log event with the time and date.

Ensure a Signal Sequence History Log is stored in nonvolatile memory. The information stored in the signal sequence log shall provide graphic displays of up to 30 seconds of signal status prior to the fault trigger event with 50 ms resolution.

The Type 212 CMU shall be provided with PC Software that allows a review of status, event log review and archival.

13. Type 214 ITS Auxiliary Monitor Unit

a. Introduction

Supply each ITS cabinet output assembly with a Type 214 ITS Auxiliary Monitor Unit (AMU). Ensure the Type 214 CMU meets the CALTRANS TEES Specifications and functions with the a Type 212 Cabinet Monitor Unit to provide cabinet monitoring functions to perform the following monitoring functions: Cabinet Power Supplies, Conflicting Channel Monitor, Serial Bus 1 and 3 Error; Message 62; Diagnostic Error; Multiple Channel Inputs; Lack of Signal Inputs; Yellow Clearance; Yellow plus Red Clearance; Police and Power Distribution Switch Monitor; door Switches and Main Contactor Status; Circuit Breakers; Flash Unit Output Status; and AC Line Level Sense. Ensure the Unit supplied is listed on the most recent California Department of Transportation Qualified Products List (QPL). The Type 214 AMU shall provide the field signal sensing.

b. Current Monitoring

Supply Type 214 AMU capable of operating in a 14 channel mode or a 6 channel mode. Ensure the address select is correct for the output assembly in which the Model 214 AMU is installed.

c. Diagnostics

Ensure the Type 214 AMU has self diagnostic tests that execute continuously to provide for correct operation to properly monitor the current for use with LED signal heads.

14. Type 218 ITS Serial Interface Unit

a. Introduction

Supply each input and output assembly with a Type 218 ITS Serial Interface Unit (SIU). Ensure the Type 218 ITS SIU supplied meets the CALTRANS TEES Specifications. Ensure the Unit supplied is listed on the most recent California Department of Transportation Qualified Products List (QPL). The Type 218 ITS SIU shall provide the interface between the 2070 controller and the input and output files.

b. Configuration

Supply Type 218 SIU capable of operating in all input and output modes. Provide a Model 218 SIU that is configured correctly for the input or output file for which it is supplied.

c. Programming

Ensure programming of the Type 218 SIU is programmed by assembly mounted address jumpers and that no other setup is required.

d. Diagnostics

Ensure the Type 218 SIU supplied has a complete set of internal diagnostics self-tests run continuously to monitor critical components of the unit. Provide unit with a front panel LED indicator that can be used to report the current Input/Output assembly address assignment of the unit for cabinet configuration verification. Ensure unite has a diagnostic EIA-232 port on the front panel to interface with the SIU 218 functions.

15. Model 242 DC Isolator

Provide Model 242 DC Isolators that are in accordance with the latest version of CALTRANS Specifications as referenced earlier in this section. Provide isolators that:

- Allow 242 isolator input signal polarity to easily be inverted without the use of tools. Acceptable methods are removable jumpers or dip switches. Unacceptable methods are soldering or desoldering a diode or resistor.
- Output is OFF for input voltages greater than 12 volts;
- Output is ON for voltages of less than 8 volts that have a duration of at least 5 to 25 ms (optional 2-7 ms);

- Minimum output pulse width is 100 ms with a valid input (can be disabled);
- Output is optically isolated open collector NPN transistor;
- Capable of sinking 50 ma when on;
- Can register a new input within 25 ms of the old signal going away; and
- Output clamped on power up and down

16. Model 200 Switchpack

    Provide Model 200 Switchpacks that are in accordance with the latest version of CALTRANS Specifications as referenced earlier in this section.

17. Model 204 Flasher Unit

    Provide Model 204 Flasher Units that are in accordance with the latest version of CALTRANS Specifications as referenced earlier in this section.

18. Flash Transfer Relay

    Provide Flash Transfer Relays that are in accordance with the latest version of CALTRANS Specifications as referenced earlier in this section.

19. Cabinet Model 342

    Provide Cabinet Model 342 that meets the CALTRANS Specification with the addition of surge protection as detailed in Table 925-13 Model 342 ITS Cabinet Default Input Files Assignment Detail, Table 925-14 Required Surge Arrestors for Model 342 ITS Cabinet, and Table 925-15 Model 342 & 346 ITS Cabinet Default Output File Assignment Detail.

    Supply Model 342 with lower input panel cabinets, with housing Type 1, and all components as described in these Specifications.

    Supply cabinets having two input files which conform to the CALTRANS Specifications and configured to accept two 2070 controllers in the top portion of the cabinet.

    Configure the cabinet for dial up communications. Mount a two (2) circuit Buchanan connector on the right side panel (from rear door).

    Mount a phone jack with a RJ11 connector above or to the right of the Buchanan terminal block.

    Wire the phone jack to the Buchanan and to the Terminal Block (TB0) in accordance with Figure 925-3.

20. Cabinet Model 346 (Base Mount)

    This unit meets the CALTRANS Specification with the addition of approximately 6 additional inches (150 mm) of cabinet height exclusive of the "M" base adapter. Configure the internal component layout so that the additional space is available in the bottom area of the cabinet cage. Ensure that the field wiring input panels and surge protection conform to Table 925-16 Model 346 ITS Cabinet Default Input File Assignment Detail, Table 925-17 Required Surge Arrestors for Model 346 Cabinet, and Table 925-15 Model 342 & 346 Default ITS Cabinet Default Output File Assignment.

21. Cabinet Model 346 (Pole Mount)

    Ensure that this unit meets the requirements of Subsection 925.2.04.A.19 above, except that the cabinet is configured for pole mounting as specified in the General Requirements for Type ITS Cabinet Assemblies.

22. Cabinet Model 340

    The Model 340 cabinet configuration will be determined by the special provisions of the project.

    Ensure that the input and output port assignments are compatible with the 2070 controller as applicable according to the required number of input/outputs. Ensure that the 340 cabinet uses standard ITS cabinet input and output file units.

    Equip the cabinet with a C2 connector harness with field terminals protected with surge protectors for communication inputs as specified under communications inputs.

    Ensure that the cabinet has four full-size doors to allow complete access from the front or back of the cabinet. Design the rack assembly to mount in CALTRANS standard rails to allow for a Model 204 flasher.

    Provide a receptacle to accept the plug in power distribution assembly card guides and edge connectors for the input file card guides to support the conflict monitor, and load switches and flash transfer relays.

B. Fabrication

Refer to Subsection 925.2.04.B.1 for controller cabinet minimum fabrication Specifications.

C. Acceptance

Refer to Subsection 925.2.02 for compliance with CALTRANS QPL.

D. Materials Warranty

Refer Subsection 925.2.01.D for Materials Warranties.

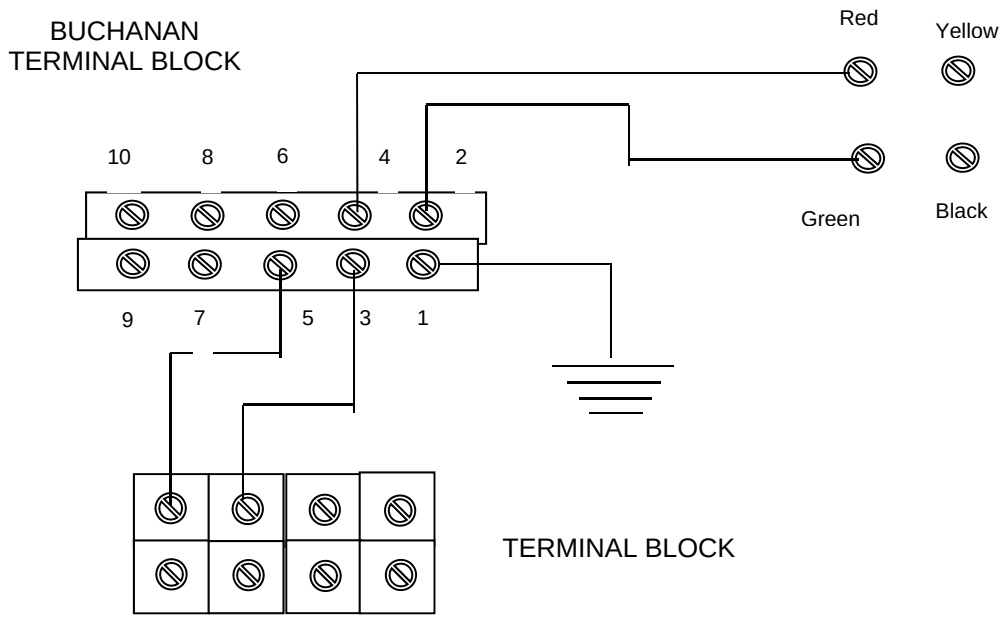
Table 925 – 13 Model 342 ITS Cabinet Default Input Files Assignment Detail

Input File	Chan	Item	File Slot 1	2	3	4	5	6	7	8	9	10	11	12
1	Upper	SIU Pin	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16
		SIU Byte,Bit	2,6	3,0	3.2	3,4	3,6	4,0	4,2	4,4	4,6	5,0	5,2	5,4
		SIU Input #	7	9	11	13	15	17	19	21	23	25	27	29
		2070 Input #	17	0	28	8	22	6	43	25	51	32	12	38
		2070 Port	3.2	1.1	4.5	2.1	3.7	1.7	6.4	4.2	7.4	5.1	2.5	5.7
		Function	Ph 1 Det	Ph 2 Det	Ph 2 Det	Ph 2 Det	Ph 3 Det	Ph 4 Det	Ph 4 Det	Sp Det 1	Sp Det 5	Pd 2 Det	Pre 1	Pre 5
		Field Term	TB-2 1,2	TB-2 5,6	TB-2 9,10	TB-4 1,2	TB-4 5,6	TB-4 9,10	TB-6 1,2	TB-6 5,6	TB-6 9,10	TB-8 4,6	TB-9 10,12	TB-9 5,6
	Lower	SIU Pin	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16
		SIU Byte,Bit	2,7	3,1	3,3	3,5	3,7	4.1	4,3	4,5	4,7	5,1	5,3	5,5
		SIU Input #	8	10	12	14	16	18	20	22	24	26	28	30
		2070 Input #	21	4	41	19	2	30	10	53	52	34	13	39
		2070 Port	3.6	1.5	6.2	3.4	1.3	4.7	2.3	7.6	7.5	5.3	2.6	5.8
		Function	Ph 1 Det	Ph 2 Det	Ph 2 Det	Ph 3 Det	Ph 4 Det	Ph 4 Det	Ph 4 Det	Sp Det 2	Sp Det 6	Pd 4 Det	Pre 2	Pre 6
		Field Term	TB-2 3,4	TB-2 7,8	TB-2 11,12	TB-4 3,4	TB-4 7,8	TB-4 11,12	TB-6 3,4	TB-6 3,4	TB-6 11,12	TB-8 5,6	TB-9 11,12	TB-9 8,9
	Opto Inputs	SIU Pin	B25	A26	B26	A27								
		SIU Byte,Bit	8,7	9,0	9,1	9,2								
		SIU Input #	Opto In 1	Opto In 2	Opto In 3	Opto In 4								
		2070 Input #	46	14	47	45								
		2070 Port	6.7	2.7	6.6	6.8								
		Function	Flsh Sen	MCE	Int Adv	S T								
2	Upper	SIU Pin	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16
		SIU Byte,Bit	2,6	3,0	3.2	3,4	3,6	4,0	4,2	4,4	4,6	5,0	5,2	5,4
		SIU Input #	7	9	11	13	15	17	19	21	23	25	27	29
		2070 Input #	16	1	29	9	18	7	44	54	49	33	36	15
		2070 Port	3.1	1.2	4.6	2.2	3.3	1.8	6.5	7.7	7.2	5.2	5.5	2.8
		Function	Ph 5 Det	Ph 6 Det	Ph 6 Det	Ph 6 Det	Ph 7 Det	Ph 8 Det	Ph 8 Det	Sp Det 3	Sp Det 7	Pd 6 Det	Pre 3	Spare 1
		Field Term	TB-3 1,2	TB-3 5,6	TB-3 9,10	TB-5 1,2	TB-5 5,6	TB-5 9,10	TB-7 1,2	TB-7 5,6	TB-7 9,10	TB-8 7,9	TB-9 4,6	TB-8 1,3
	Lower	SIU Pin	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16
		SIU Byte,Bit	2,7	3,1	3,3	3,5	3,7	4.1	4,3	4,5	4,7	5,1	5,3	5,5
		SIU Input #	8	10	12	14	16	18	20	22	24	26	28	30
		2070 Input #	20	5	42	18	3	31	11	55	50	35	37	40
		2070 Port	3.5	1.6	6.3	3.3	1.4	4.8	2.4	7.8	7.3	5.4	5.6	6.1
		Function	Ph 5 Det	Ph 6 Det	Ph 6 Det	Ph 7 Det	Ph 8 Det	Ph 8 Det	Ph 8 Det	Sp Det 4	Sp Det 8	Pd 8 Det	Pre 4	Spare 2
		Field Term	TB-3 3,4	TB-3 7,8	TB-3 11,12	TB-5 3,4	TB-5 7,8	TB-5 11,12	TB-7 3,4	TB-7 7,8	TB-7 11,12	TB-8-8,9	TB-9 7,9	TB-8 2,3
	Opto Inputs	SIU Pin	B25	A26	B26	A27								
		SIU Byte,Bit	8,7	9,0	9,1	9,2								
		SIU Input #	Opto In 1	Opto In 2	Opto In 3	Opto In 4								
		2070 Input #	NA	NA	NA	NA								
		2070 Port												
		Function												

Table 925 – 14 Required Surge Arrestors for Model 342 ITS Cabinet		
Field Terminal Block	**Terminals**	**Required Arrestors for Model 342 Cabinet**
TB - 8	1-12	Section 925.2.05.A.10.f
TB - 9	10-12	Section 925.2.05.A.10.f
TB - 9	4-9	Section 925.2.05.A.10.f
TB - 2, TB - 3, TB - 4, TB - 5, TB - 6, TB - 7	1-12	Section 925.2.05.A.10.c

Table 925 - 15 Model 342 & 346 ITS Cabinet Default Output File Assignment Detail

	Switch Pack													
Item	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
SIU Pin	A2	B3	A5	B6	A8	B9	A11	B12	A14	B15	A17	B18	A20	B21
SIU Byte, Bit	2,0	2,3	2,6	3,1	3,4	3,7	4,2	4,5	5,0	5,3	5,6	6,1	6,4	6,7
SIU Output #	1	4	7	10	13	16	19	22	25	28	31	34	37	40
2070 Output #	13	10	8	5	2	0	29	26	24	21	18	16	53	50
2070 Output Port	2.6	2.3	2.1	1.6	1.3	1.1	4.6	4.3	4.1	3.6	3.3	3.1	7.6	7.3
AMU Pin	C16	C17	C18	C19	C20	C21	C22	C23	C24	C25	C26	C27	C28	C29
AMU Channel	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Field Term	TR-1 1,2	TR-2 1,2	TR-3 1,2	TR-4 1,2	TR-5 1,2	TR-6 1,2	TR-7 1,2	TR-8 1,2	TR-9 1,2	TR-10 1,2	TR-11 1,2	TR-12 1,2	TR-13 1,2	TR-14 1,2
Function	Ph 1 Rd	Ph 2 Rd	Pd 2 DW	Ph 3 Rd	Ph 4 Rd	Pd 4 DW	Ph 5 Rd	Ph 6 Rd	Pd 6 DW	Ph 7 Rd	Ph 8 Rd	Pd 8 DW	Ov A Rd	Ov B Rd
SIU Pin	B2	A4	B5	A7	B8	A10	B11	A13	B14	A16	B17	A19	B20	A22
SIU Byte, Bit	2,1	2,4	2,7	3,2	3,5	4,0	4,3	4,6	5,1	5,4	5,7	6,2	6,5	7,0
SIU Output #	2	5	8	11	14	17	20	23	26	29	32	35	38	41
2070 Output #	14	11	32	6	3	34	30	27	33	22	19	35	54	51
2070 Output Port	2.7	2.4	5.1	1.7	1.4	5.3	4.7	4.4	5.2	3.7	3.4	5.4	7.7	7.4
AMU Pin	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29
AMU Channel	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Field Term	TR-1 3,4	TR-2 3,4	TR-3 3,4	TR-4 3,4	TR-5 3,4	TR-6 3,4	TR-7 3,4	TR-8 3,4	TR-9 3,4	TR-10 3,4	TR-11 3,4	TR-12 3,4	TR-13 3,4	TR-14 3,4
Function	Ph 1 Yel	Ph 2 Yel	Pd 2 PC	Ph 3 Yel	Ph 4 Yel	Pd 4 PC	Ph 5 Yel	Ph 6 Yel	Pd 6 PC	Ph 7 Yel	Ph 8 Yel	Pd 8 PC	Ov A Yel	Ov B Yel
SIU Pin	A3	B4	A6	B7	A9	B10	A12	B13	A15	B16	A18	B19	A21	B22
SIU Byte, Bit	2,2	2,5	3,0	3,3	3,6	4,1	4,4	4,7	5,2	5,5	6,0	6,3	6,6	7,1
SIU Output #	3	6	9	12	15	18	21	24	27	30	33	36	39	42
2070 Output #	15	12	9	7	4	1	31	28	25	23	20	17	55	52
2070 Output Port	2.8	2.5	2.2	1.8	1.5	1.2	4.8	4.5	4.2	3.8	3.5	3.2	7.8	7.5
AMU Pin	A16	A17	A18	A19	A20	C21	C22	C23	A24	A25	A26	A27	A28	A29
AMU Channel	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Field Term	TR-1 5,6	TR-2 5,6	TR-3 5,6	TR-4 5,6	TR-5 5,6	TR-6 5,6	TR-7 5,6	TR-8 5,6	TR-9 5,6	TR-10 5,6	TR-115,6	TR-12 5,6	TR-13 5,6	TR-14 5,6
Function	Ph 1 Grn	Ph 2 Grn	Pd 2 W	Ph 3 Grn	Ph 4 Grn	Pd 4 W	Ph 5 Grn	Ph 6 Grn	Pd 6 W	Ph 7 Grn	Ph 8 Grn	Pd 8 W	O A Grn	O B Grn



Note: For a typical signal installation, the Model 342 cabinet is the design standard.

Figure 925-3—Wiring Diagram for Dial-up Communications

Table 925 - 16 Model 346 ITS Cabinet Default Input Files Assignment Detail

Input File	Channel	Item	File Slot 1	2	3	4	5	6	7	8	9	10	11	12
1	Upper	SIU Pin	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16
		SIU Port	2,6	3,0	3.2	3,4	3,6	4,0	4,2	4,4	4,6	5,0	5,2	5,4
		SIU In #	7	9	11	13	15	17	19	21	23	25	27	29
		2070 In #	17	0	19	2	16	1	18	3	12	36	32	33
		2070 Port	3.2	1.1	3.4	1.3	3.1	1.2	3.3	1.4	2.5	5.5	5.1	5.2
		Function	Ph 1 Det	Ph 2 Det	Ph 3 Det	Ph 4 Det	Ph 5 Det	Ph 6 Det	Ph 7 Det	Ph 8 Det	Pre 1	Pre 3	Pd 2 Det	Pd 6 Det
		Fld Term	T-7 1,2	T-7 5,6	T-7 9,10	T-8 1,2	T-8 5,6	T-8 9,10	T-9 1,2	T-9 5,6	T-5 1,2	T-5 5,6	T-4 1,2	T-4 5,6
	Lower	SIU Pin	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19
		SIU Port	2,7	3,1	3,3	3,5	3,7	4.1	4,3	4,5	4,7	5,1	5,3	5,5
		SIU In #	8	10	12	14	16	18	20	22	24	26	28	30
		2070 In #	8	4	10	6	9	5	11	7	13	37	34	35
		2070 Port	2.1	1.5	2.3	1.7	2.2	1.6	2.4	1.8	2.6	5.6	5.3	5.4
		Function	Ph 2 Det	Ph 2 Det	Ph 4 Det	Ph 4 Det	Ph 5 Det	Ph 6 Det	Ph 7 Det	Ph 8 Det	Pre 2	Pre 4	Pd 4 Det	Pd 8 Det
		Fld Term	T-7 3,4	T-7 7,8	T-7 11,12	T-8 3,4	T-8 7,8	T-8 11,12	T-9 3,4	T-9 7,8	T-5 3,4	T-5 7,8	T-4 3,4	T-4 7,8
	Opto	SIU Pin	B25	A26	B26	A27								
		SIU Port	8,7	9,0	9,1	9,2								
		SIU In #	Opto In 1	Opto In 2	Opto In 3	Opto In 4								
		2070 In #	46	14	47	45								
		2070 Port	6.7	2.7	6.6	6.8								
		Function	Flsh Sen	MCE	Int Adv	S T								

Table 925-17 Required Surge Arrestors for Model 346 ITS Cabinet

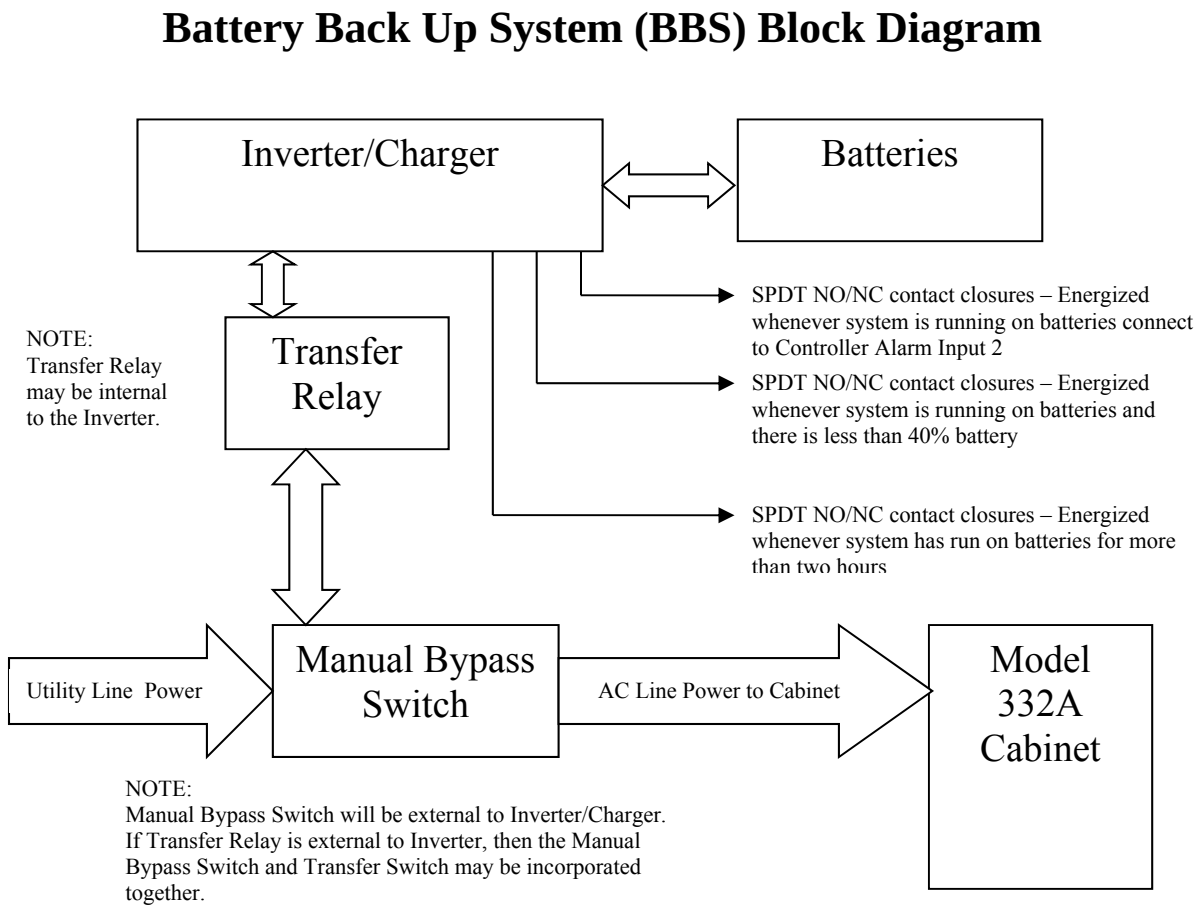
Field Terminal Block	Terminals	Required Arrestor
TB-4	1-12	Section 925.2.05.A.10.f
TB-5	1-4	Section 925.2.05.A.10.f
TB-5	5-12	Terminal Block Only Section 925.2.04.A.10.f
TB-7, TB-8, TB-9	1-12	Section 925.2.05.A.10.c

925.2.06 Battery Backup System

A. Requirements

This specification is for establishing the minimum requirements for a complete emergency battery backup system for use with Light Emitting Diode Traffic Signal Modules at intersections with 332 cabinets. The Battery Backup System (BBS) shall include, but not be limited to the following: Inverter/Charger, Power Transfer Relay, Batteries, a separate manually operated non-electric Bypass Switch and all necessary hardware and interconnect wiring. The BBS shall be capable of providing power for full run-time operation for an "LED –only" intersection (all colors: red, yellow, green and pedestrian heads) or flashing mode operation and intersection Red LED's. The BBS shall be designed for outdoor applications, in accordance with the CALTRANS TEES.

Figure 925-4 Battery Backup Block Diagram



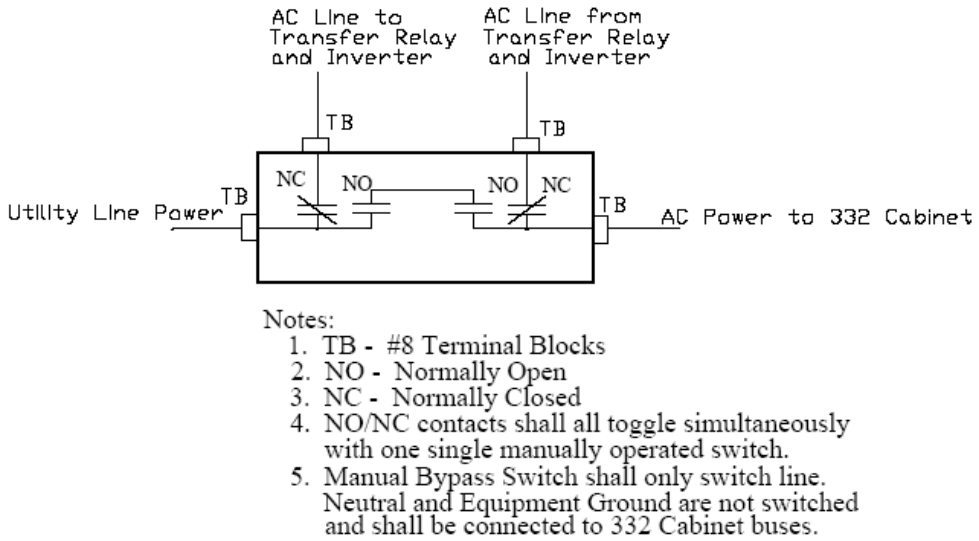
1. Operation:

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

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

c. The BBS shall include a Manual Bypass Switch which provides capability to transfer the power service to disable the BBS and operate only from the power service provided. The Manual Bypass Switch shall be as shown in Figure 925-5.

Figure 925 – 5 Manual Bypass Switch (Shown in normal BBS Mode)



d. The BBS shall provide the user with 3-sets of normally open (NO) and normally closed (NC) single-pole double-throw (SPDT) dry relay contact closures, available on a panel-mounted terminal block, rated at a minimum 120V/1A, and labeled so as to identify each contact. For typical configuration, see Figure 925-6.

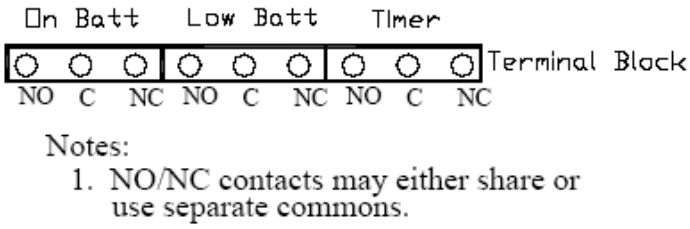
1) The first set of NO and NC contact closures shall be energized whenever the unit switches to battery power. Contact shall be labeled or marked “On Batt.”

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

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

4) Relay contact activation shall be annunciated on the front panel via a visual indication. This can be either discreet LED, or part of LCD screen, etc.

Figure 925 – 6 Relay Contacts (NO/NC) available on panel-mounted terminal block (typ)



e. Operating temperature for both the inverter/charger, power transfer relay and manual bypass switch shall be –37 °C (-35F) to +74 °C (+165 F).

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

g. The BBS shall use a temperature-compensated battery charging system. The charging system shall compensate over a range of 2.5 – 4.0 mV/ °C (5-8 F) per cell. The temperature sensor shall be external to the inverter/charger unit. The temperature sensor shall come with 3 meters (10 feet) of wire. Ensure temperature sensor can be mounted to battery with ring terminal to prevent losing connectivity.

h. Batteries shall not be recharged when battery temperature exceeds 50 °C (122 F) ± 3 °C (6 F).

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

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

k. BBS shall be compatible with CALTRANS Model 332A Cabinets, Model 170E Controllers, Model 2070 Controllers and cabinet components for full time operation.

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

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

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

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

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

2. Mounting/Configuration

NOTE: All references made to EIA rail or EIA 19" (482.6mm) rack shall conform to Electronic Industries Standards EIA-310-B, Racks, Panels, and Associated Equipment, with 10-32 "Universal Spacing" threaded holes.

a. General

1) Inverter/Charger Unit shall be shelf-mounted or rack-mounted on a standard EIA 19" rack. If the inverter/charger is mounted inside the 332A Cabinet (Configuration 1), a shelf shall be provided that supports the weight of the unit.

2) Power Transfer Relay and Manual Bypass Switch shall be mounted on EIA rail.

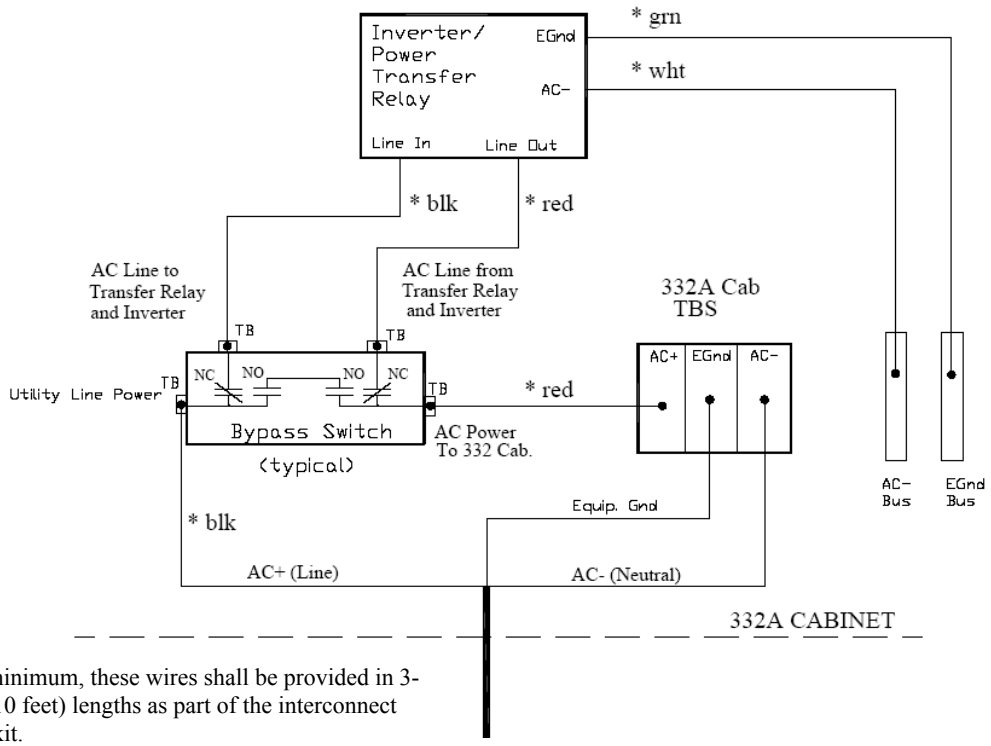
3) All interconnect wiring shall be provided between Power Transfer Relay, Bypass Switch and Cabinet Terminal Service Block and shall be no less than 3 meters (9'10") of UL Style 1015 CSA TEW with the following characteristics:

- AWG Rating: 6 AWG
- Stranding: 133 strands of 30 AWG tinned copper
- Rating: 600 V, 105 °C, PVC Insulation

4) Relay contact wiring provided for each set of NO/NC relay contact closure terminals shall be a minimum of 3 meters (10 feet) of UL Style 1015 CSA TEW 18 AWG wire, same ratings as above, except 16 strands of 30 AWG tinned copper. Wiring shall be of adequate length for particular installation.

5) Figure 925-7 provides clarification as to how BBS Power Transfer Relay and Manual Bypass Switch are interconnected with Model 332A Cabinets in order to ensure interchangeability between all BBS manufacturers.

Figure 925- 7 BBS Utility Power Connection Diagram

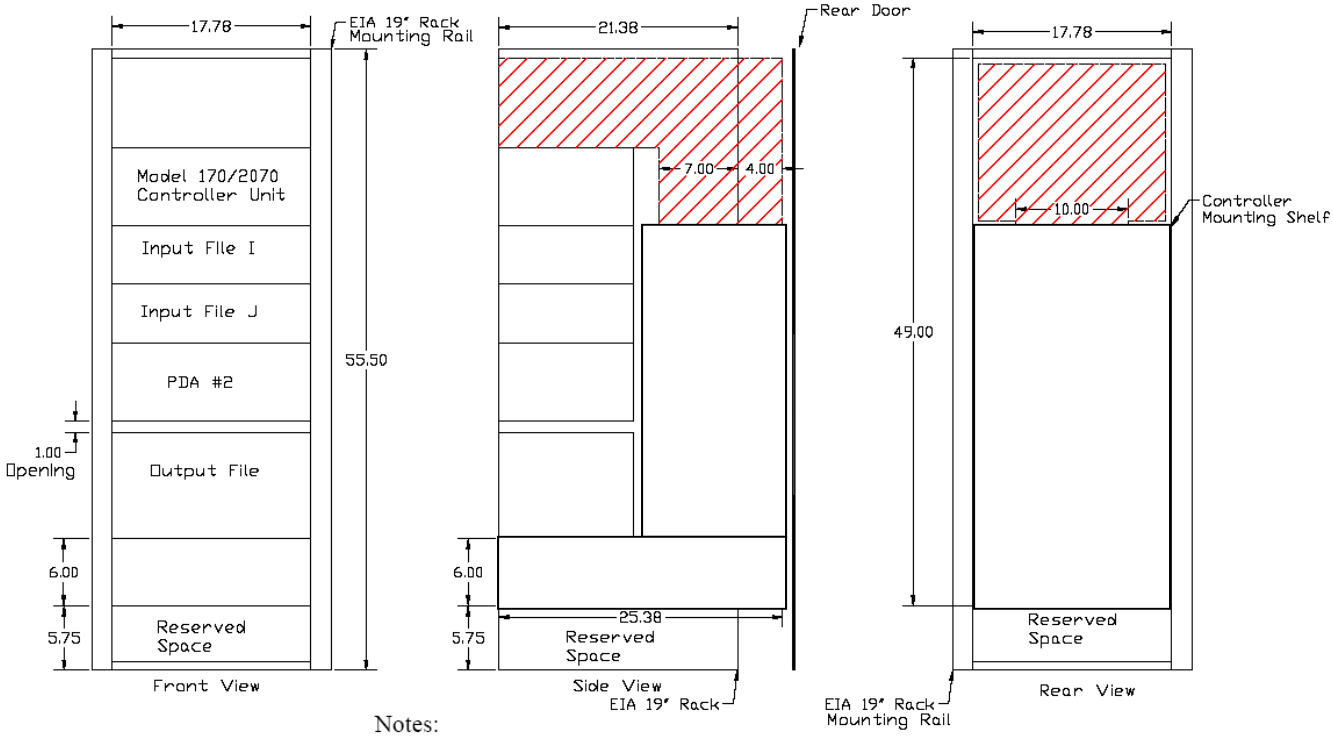


*As a minimum, these wires shall be provided in 3-meter (10 feet) lengths as part of the interconnect wiring kit.

6) All necessary hardware for mounting (shelf angles, rack, etc) shall be included in the bid price of the BBS. All bolts/fasteners and washers shall meet the following requirements:
   - Screw type: Pan Head Phillips machine screw
   - Size and Thread pitch: 10-32
   - Material: 18-8 stainless steel (Type 316 stainless steel is acceptable as an alternate)
   - Washer: Use one flat washer (18-8 stainless steel) under the head of each 10-32 screw (provided that the screws are properly tightened, lock washers are unnecessary.)
   - Number of screws per hinge bracket: Minimum of six (6) screws per hinge bracket spaced evenly along bracket, with one screw near each end.
7) There shall be two (2) basic BBS mounting options:
   a. Configuration 1 – The BBS (Inverter/Charger, Bypass Switch and Transfer Relay only) installed inside the 332A Cabinet, with the batteries installed in the externally mounted cabinet. See Figure 925-8 for location of inverter in 332A cabinet.
   b. Configuration 2 – The entire BBS, including batteries, installed inside the externally mounted cabinet.

Figure 925-8 BBS Mounting Diagram

For a typical Model 332A Cabinet



Notes:
Area inside of dashed lines represents available mounting locations for BBS.
Prescribed available mounting areas are approximate.
All dimensions shown are in inches.

8) External Cabinet
   a. The External Cabinet shall be used for housing batteries and/or BBS, which includes inverter/charger unit, power transfer relay, manually operated bypass switch, any other control panels, and all wiring and harnesses.
   b. The same Inverter/Charger, Power Transfer Relay and manually operated Bypass Switch that fits inside a typical fully equipped CALTRANS Model 332A Cabinet shall also be able to fit inside the externally mounted cabinet.

c. The External Cabinet shall be a NEMA 3R rated cabinet conforming to TEES, August 16, 2002 Chapter 7, Section 2-Housings for the construction and finish of the cabinet. The specific finish of the external cabinet shall match the finish of the 332A cabinet. Anti-Graffiti paint shall not be used. Two separate mounting installations shall be used. Refer to the project plans for the appropriate mounting installation.

- Mounting Installation Type A shall be typically used for installing at locations with existing 332 cabinet. This cabinet mounting installation shall attach the external cabinet to the side of the 332 cabinet in the relationship as shown in figure 925-9. Type A mounting installation shall use fasteners that meet the following requirements:
  - (Total of 8 bolts per cabinet with 2 flat washers per bolt and 1 K-lock nut per bolt)
  - Cabinet mounting bolts shall be:
  - 18-8 Stainless Steel Hex Head (Fully Threaded)
  - 3/8" – 16 X 1"
  - Washers shall be:
  - Designed for 3/8" bolt
  - 18-8 Stainless Steel 1" OD round flat type
  - K-lock washer shall be:
  - 18-8 Stainless Steel, Hex Nut Assembled with Free-Spinning Tooth Washer
  - 3/8" – 16 Screw size

  External Cabinet to 332A Cabinet couplings shall provide a conduit for power connections between the 332A Cabinet and External Cabinet. The couplings shall consist of three parts and meet the following requirements:
  - 2" Nylon Insulated, Steel Chase Nipple
  - 2" Sealing, Steel Locknut
  - 2" Nylon Insulated, Steel Bushing

  The external cabinet shall come provided with all bolts, washers, nuts and cabinet-cabinet coupler fittings provided, necessary for mounting the external cabinet to the 332A Cabinet.
- Mounting Installation Type B shall be typically used for locations where a new traffic controller cabinet and foundation are being installed. This cabinet installation shall provide the external battery cabinet as a base mount cabinet on the same foundation as the 332 cabinet. Connections between the cabinets shall be through conduit in the cabinet base. The external cabinet shall be installed in the same relationship as shown in Figure 925-9 to the 332 cabinet. The external cabinet shall be installed so that it is centered on the 30 inch left side of the 332 cabinet. Bolt BBS cabinet to pre-fab base. BBS cabinet opening shall be larger than the pre-fab base opening.

d. The specific dimensions and details of the external battery cabinet shall be as shown in Figures 925–10 through 925–12.

Figure 925-9 External BBS Cabinet Details

External Battery Cabinet

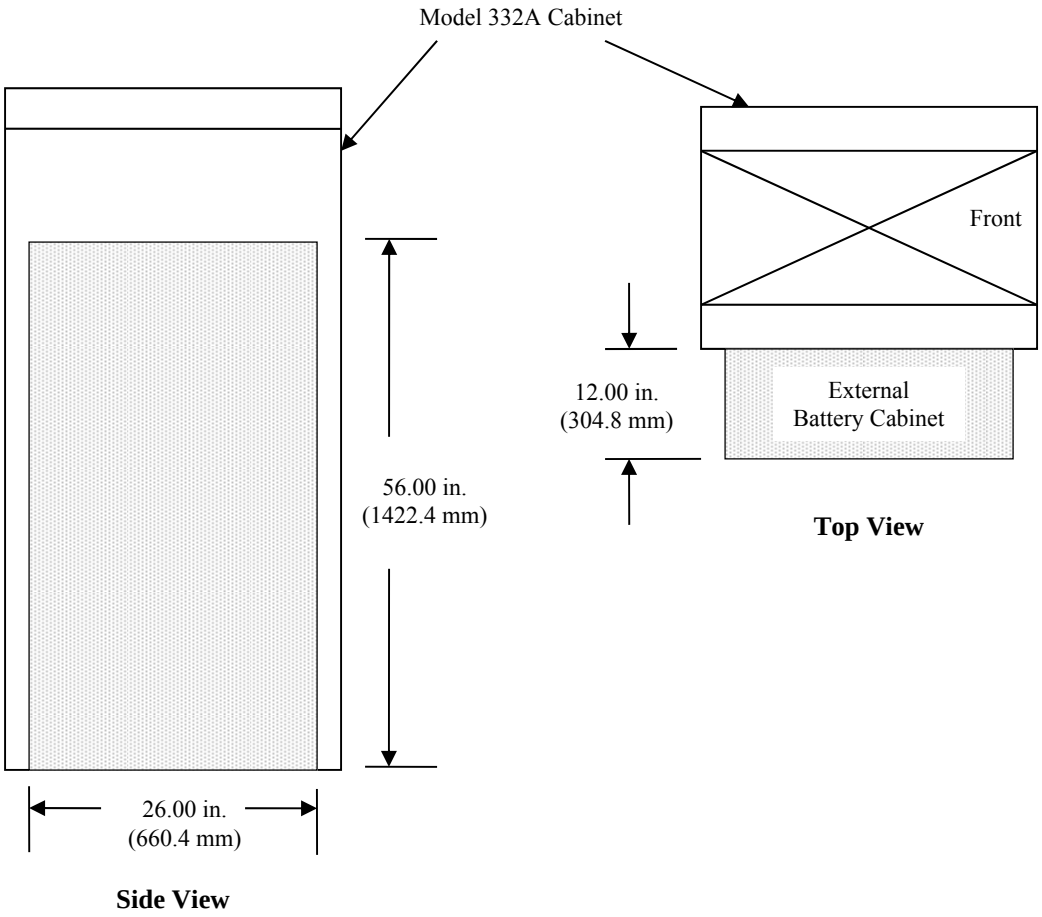
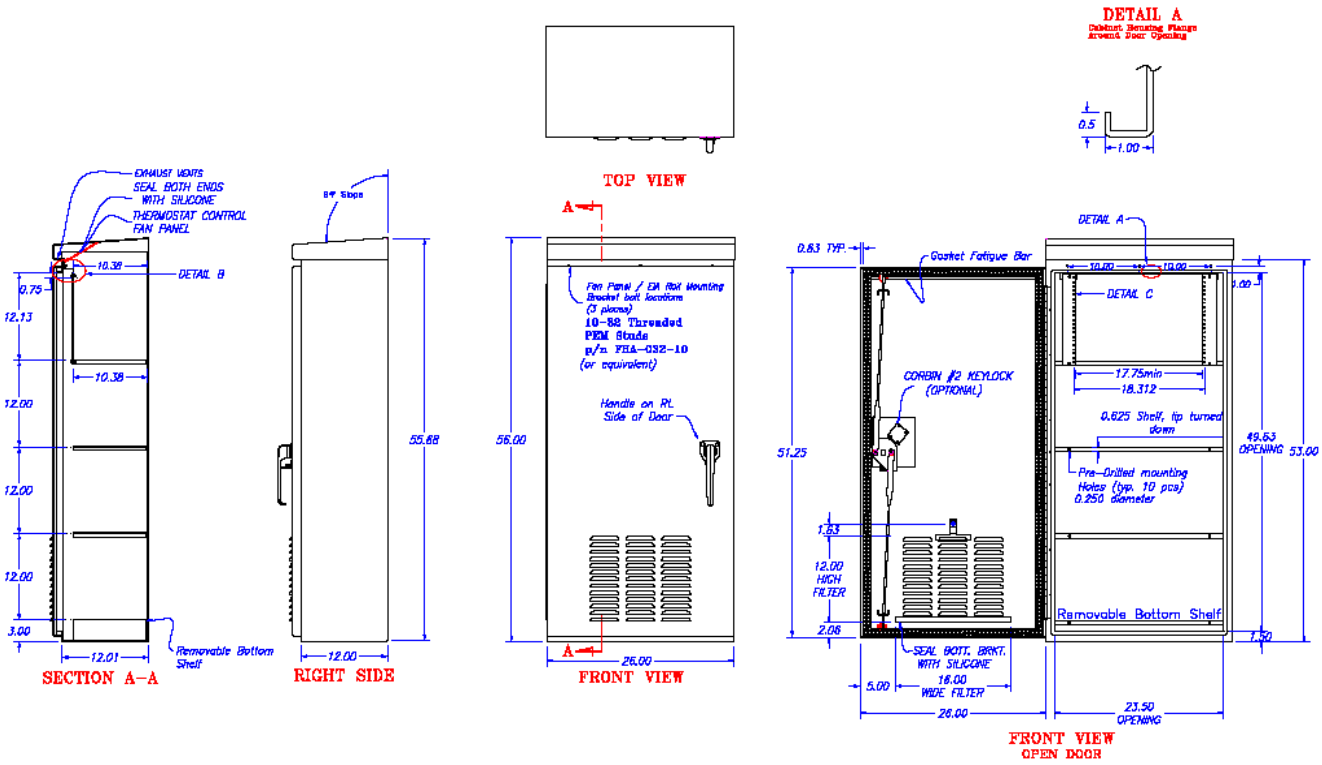


Figure 925-10 External BBS Cabinet Details

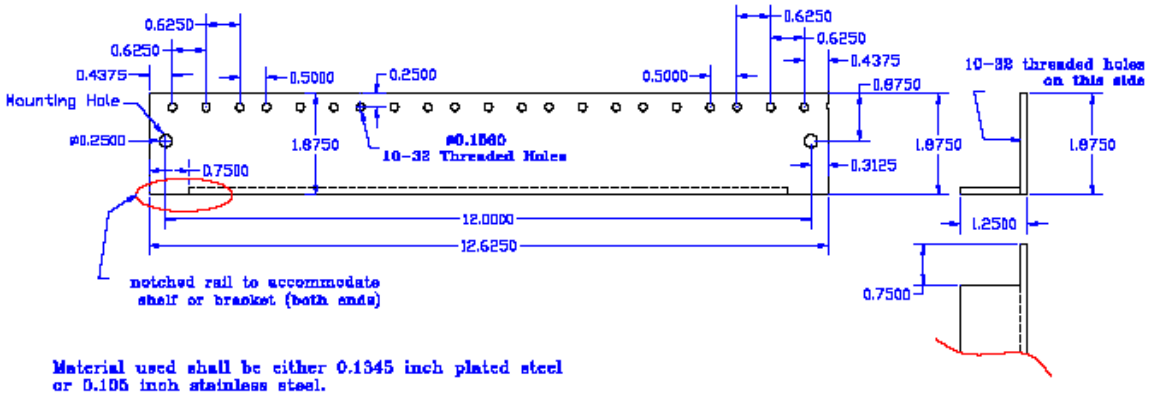
e. Four shelves shall be provided. There shall be a minimum of 304.8mm (12”) clearance between shelves. Each shelf shall be a minimum of 263.65mm (10.38”) X 635.0mm (25”), and capable of supporting a minimum of 57kg (125 lbs.). Shelf edges shall be turned down on all four sides for support and to provide a flat top surface. Shelves shall be predrilled with EIA rail mounting holes. Shelves shall provide a vertical “passageway” for wring in the rear of the cabinet on both the left and right.

f. The bottom shelf shall be capable of being removed.

Figure 925-11 EIA Rail for Mounting Inverter or PTR inside External BBS Cabinet



DETAIL C – EIA Angle Rail w/ EIA universal hole spacing
Refer to EIA-310-B



Material used shall be either 0.1345 inch plated steel or 0.105 inch stainless steel.

g. The External cabinet shall be ventilated through the use of louvered vents, filter, and one thermostatically controlled fan as per TEES Chapter 7 Section 2-Housings. The thermostat shall be accessible without removing the BBS controller.

h. External cabinet fan shall be AC operated from the same line output of the Manual Bypass Switch that supplies power to the 332 Cabinet. A 2-position terminal block shall be provided on the fan panel, along with 3 meters (10 feet) of connected hookup wire.

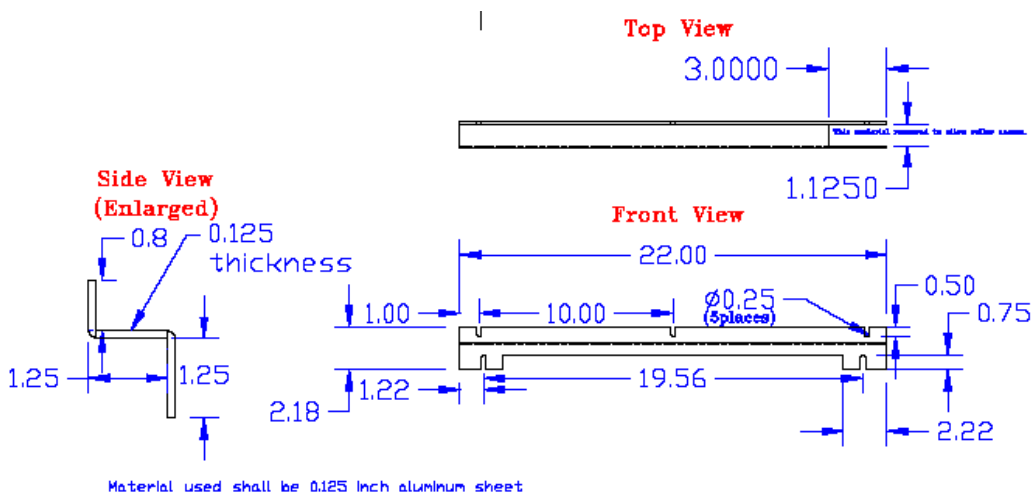
i. The door shall be attached to the cabinet through the use of either a continuous stainless steel piano hinge or four, two-bolts per leaf, hinges as per TEES Chapter 7 Section 2. The door shall use a padlock clasp or latch and lock mechanisms as described in the TEES, in order to lock the door.

j. Two EIA angle rails, per Detail C, Figure 925–11, along with all necessary mounting hardware (4 sets of 10-32 bolts and nuts with captive washers) shall be provided with the external cabinet (not installed). Rails shall be symmetric to allow for installation on either right or left sides of the cabinet. Mounting holes and bracket shall allow for EIA rail installation at any location in the external cabinet. The EIA mounting angle nominal thickness shall be either 0.1345 inch (3.4163mm) plated steel or 0.105 inch (2.667mm) stainless steel.

k. EIA rail mounting bracket shall be of continuous, one-piece design bolted into the cabinet to provide adequate support for rail-mounted equipment. See Figure 925–12.

l. Pressed in, flush-head threaded screw posts shall be inserted into the front face of the cabinet enclosure top sill. These threaded posts shall be used to mount both the fan panel and the EIA rail-mounting bracket. The screw posts shall be #10-32 thread size stud 0.625 inches in length. Refer to Figure 925–10, front views for mounting detail.

Figure 925–12 EIA Rail Mounting Bracket for Mounting EIA Rails inside External BBS Cabinet



3. Maintenance, Displays, controls and Diagnostics

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

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

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

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

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

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

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

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

g. The BBS shall be equipped to communicate via Ethernet connection.

4. Battery System

a. Individual batteries shall be:

1.) Voltage rating: 12V type

2.) Group size: 24 maximum

3.) Batteries shall be easily replaced and commercially available off the shelf.

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

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

d. Batteries shall be certified by the manufacturer to operate over a temperature range of – 25 °C (-13F) to + 71°C (+160 F).

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

f. Batteries shall indicate maximum recharge data and recharging cycles.

g. Battery Harness

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

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

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

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

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

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

7) Battery terminals shall be covered and insulated with molded boots so as to prevent accidental shorting.

B. Fabrication

Refer to Subsection 925.2.04.B.1 for controller cabinet minimum fabrication Specifications.

C. Acceptance

General Provisions 101 through 150.

Each BBS shall be manufactured in accordance with a manufacturer Quality Assurance (QA) program. The QA program shall include two Quality Assurance procedures: (1) Design QA and (2) Production QA. The Production QA shall include statistically controlled routine tests to ensure minimum performance levels of BBS units built to meet this specification and a documented process of how problems are to be resolved. The manufacturer, or an independent testing lab hired by the manufacturer, shall perform Design Qualification Testing on new BBS system(s) offered, and when any major design change has been implemented on an existing design. A major design change is defined as any modification, material, electrical, physical or theoretical, that changes any performance characteristics of the system, or results in a different circuit configuration. Where a dispute arises in determining if a system is a new design or if the system has had a major design change, the State will make the final determination if Design Qualification Testing is required prior to production consideration.

Production Quality Control tests shall be performed on each new system prior to shipment. Failure to meet this requirements shall be cause for rejection. The manufacturer shall retain test results for seven years. Each BBS shall be given a minimum 100-hour burn-in period to eliminate any premature failures. Each system shall be visually inspected for any exterior physical damage or assembly anomalies. Any defects shall be cause for rejection.

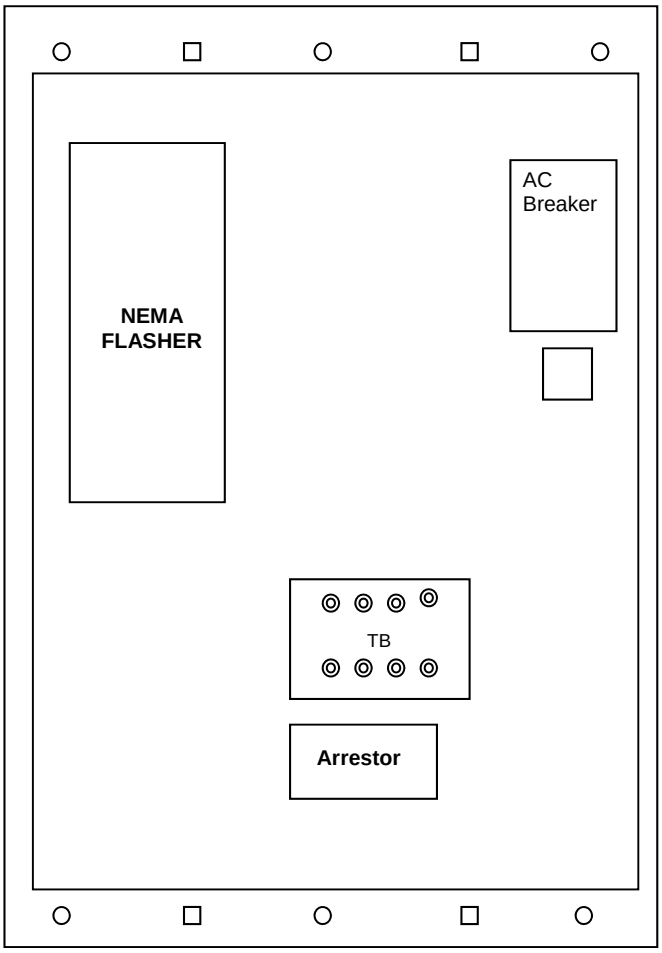
D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties. Manufacturers shall provide a two (2) year factory-repair warranty for parts and labor on the BBS from date of acceptance by the Department. Batteries shall be warranted for full replacement for two (2) years from date of purchase. The warranty shall be included in the total bid price of the BBS.

925.2.07 Flashing Beacon Assembly

A. Requirements

This specification is for a flashing signal cabinet, which consists of an aluminum cabinet containing a flasher assembly, Field connection terminal block, surge arrestor and circuit breaker wired in a manner to operate flashing beacons. Refer to Figure 925-13.



Note: Front view of cabinet Door Assembly not shown
No scale

Figure 925-13—Typical Flashing Signal Cabinet Layout

1. Cabinet Dimensions

Supply a NEMA Type 3R cabinet assembly with the following exterior dimensions:

	Minimum	Maximum
Height	14 inches (350 mm)	18 inches (450 mm)
Width	10 inches (250 mm)	14 inches (350 mm)
Depth	7 inches (175 mm)	10 inches (250 mm)

2. Flasher Unit

Supply a standard plug in two circuits NEMA flasher.

Ensure that the flasher is of all solid state construction, meets the requirements of the NEMA Standards and is rated at a minimum of 10 A per circuit.

Ensure that the flasher utilizes zero voltage turn-on and turn-off current and is capable of dimming outputs.

3. Surge Arrestor

   Supply a flasher cabinet that incorporates an AC surge arrestor to protect the internal components from lighting and over voltages on the AC service input.

   The requirements for the surge arrestor are:

Two Stage Arrestor	
Peak Surge Current	20000 A
Peak Surge Voltage @ 20KA	280 V
Clamp Voltage	280 V @ 20 kA
Continuous AC Voltage	120 V AC RMS
Response Time	<5 nsec
Operating Temp.	-40 ºF to 185 ºF (-40 ºC to 85 ºC)

4. Circuit Breaker

   Include a 15 A circuit breaker in the cabinet. The circuit breaker shall have the following characteristics.

   - Thermal Magnetic 1 pole 120/240 VAC at 50/60 Hz 15 A
   - Interrupting Rating of 10KA at 48 VDC
   - Wire Size 14 to 2 AWG
   - 35 MM Din Rail mounting

5. Terminal Block

   Include a four position terminal block in the cabinet for making field connections. Properly label all field terminal connections.

6. Construction

   Assemble the flasher assembly, terminal block, surge arrestor and circuit breaker in the cabinet as shown on the attached drawing.

   Wire all components together as a working unit, thus requiring only field connections to and from the AC power and flashing beacons.

B. Fabrication

Refer to Subsection 925.2.04.B.1 for controller cabinet minimum fabrication specifications.

C. Acceptance

General Provisions 101 through 150.

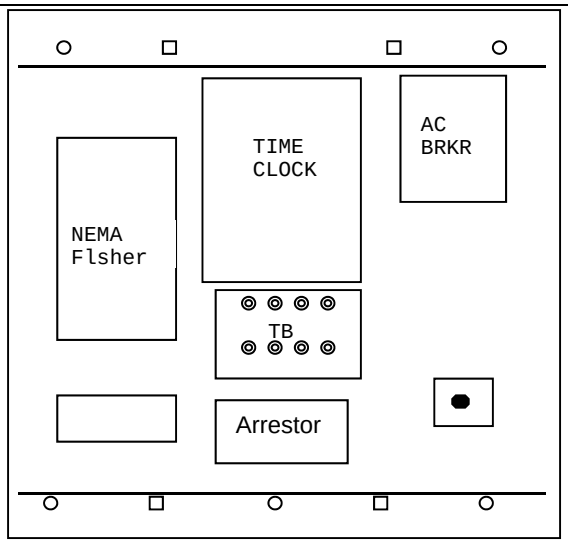
D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.08 Flashing Signal Cabinet With Time Clock

A. Requirements

This specification is for a flashing signal cabinet with time clock which consists of an aluminum cabinet containing a flasher assembly, time clock, field connection terminal block, surge arrestor and circuit breaker wired in a manner to operate school flashing beacons. Refer to Figure 925-14.



Note: Front view of cabinet Door Assembly not shown

No scale

Figure 925-14—Typical Flashing Cabinet with Time Clock Cabinet Layout

1. Cabinet Dimensions

Supply a NEMA Type 3R cabinet assembly with the following exterior dimensions:

	Minimum	Maximum
Height	14 inches (350 mm)	18 inches (450 mm)
Width	10 inches (250 mm)	14 inches (350 mm)
Depth	7 inches (175 mm)	10 inches (250 mm)

2. Flasher Unit

Supply a standard plug in, two circuits NEMA flasher.

Ensure that the flasher is of all solid state construction, meets the requirements of the NEMA Standards and is rated at a minimum of 10 A per circuit.

Ensure that the flasher utilizes zero voltage turn-on and turn-off current and be capable of dimming outputs.

3. Time Switch

Supply a time switch that meets the requirements of Subsection 925.2.09 of this specification.

4. Surge Arrestor

Supply flasher cabinets that incorporate an AC surge arrestor to protect the internal components from lighting and over voltages on the AC service input.

The requirements of the surge arrestor are as follows:

Two Stage Arrestor	
Peak Surge Current	20000 A
Peak Surge Voltage @ 20KA	280 V
Clamp Voltage	280 V @ 20 kA
Continuous AC Voltage	120 V AC RMS
Response Time	<5 nsec
Operating Temp.	-40 ºF to 185 ºF (-40 ºC to 85 ºC)

5. Circuit Breaker

Include a 15 A circuit breaker in each cabinet. The circuit breaker shall have the following characteristics.

- Thermal Magnetic 1 pole 120/240 VAC at 50/60 Hz 15 A

- Interrupting Rating of 10KA at 48 VDC
- Wire Size 14 to 2 AWG
- 35 MM Din Rail mounting

6. Terminal Block

   Include a four position terminal block in each cabinet for making field connections. Properly label all field terminal connections.

7. Construction

   Assemble the flasher assembly, terminal block, surge arrestor and circuit breaker in the cabinet as shown on the attached drawing.

   Wire all components together as a working unit, thus requiring only field connections of the AC power and flashing beacons.

B. Fabrication

Refer to Subsection 925.2.04.B.1 for controller cabinet minimum fabrication Specifications.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.09 Time Clock

A. Requirements

Supply time clocks that are single circuit, calendar programmable, solid state, fully self-contained units (RTC AP 22 or Eltec TC18 or equivalent) that meet the following Specifications:

1. Alphanumeric liquid crystal display.
2. Automatic daylight savings time and leap year compensation. Changes in the daylight savings time program made through the keypad do not require hardware modification.
3. Minimum twenty-four (24) hour capacitive back up. Battery back up is not acceptable.
4. Keypad entry programming without the use of any external devices such as a PC, external programming unit, another time switch, etc.
5. Operate on 95 to 135 V AC, 60 Hz line current.
6. SPDT relay output rated at 15 A.
7. Maximum size of 4.75 inches (121 mm) wide, 10.375 inches (2636 mm) high and 2 inches (50 mm) deep.
8. A programming manual is to be included with each unit.
9. Ability to do program transfer from unit to unit. Include program transfer cable with unit.
10. Ability to run minimum six (6) different day plans and minimum twenty five (25) different annual exception plans.Temperature range of -30º F (-34º C) + 165º F (74º C).

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.10 Self Tuning Loop Detector

A. Requirements

This specification sets forth the minimum acceptable design, operational and functional performance requirements for multi-channel, inductive loop vehicle detection systems.

1. General Requirements
   a. Mounting

      Ensure that the unit is configured for rack mount insertion into a NEMA (TS l or TS 2) card rack and/or CALTRANS Type 2070 cabinet input file.

   b. Environmental

      Ensure that the unit is in full compliance with the environmental tests, transient tests and size requirements of NEMA standard TS-l Section 15, TS-2 Section 6.5 and the California Type 2070 Specifications.

      Provide documentation from an independent laboratory, which certifies that the unit is in compliance with the above Specifications.

   c. LED Indicator

      Ensure that each channel includes two high visibility LED indicators; one for the detect state and the second to indicate the status of the fault monitor.

   d. Phase Indicator

      Ensure that each channel has an erasable write-on pad to aid in identification of the associated phase or function.

2. Operational Requirements
   a. Tuning

      Supply units that are fully digital and self-tuning.

      Ensure that each channel of the unit can automatically tune to any loop and lead in combination within two (2) seconds of application of power or when a reset signal is received.

      Ensure that the tuning circuit is designed so that drift, caused by environmental changes or changes in applied power, does not cause false actuations.

   b. Scanning

      Supply units that sequentially scan each channel (only one channel energized at any given time) to eliminate crosstalk from multiple loops in adjacent lanes and/or allow overlapped loops for directional control and/or allow use of multi-conductor homerun cable when connected to the same detector unit.

   c. Sensitivity Setting

      Ensure that each channel is equipped with front panel selectable sensitivity settings in presence and pulse modes.

   d. Frequency

      Supply units that have a minimum of three switch selectable operating frequencies.

   e. Inductance Range

      Ensure that each channel can tune to an inductive load from 50 to 2000 microhenries with a Q factor > 5.

   f. Grounded Loops

      Ensure that each channel can continue to operate with poor quality loop systems (Q>2) including those that have a single point short to ground.

   g. Fault Monitoring

      Supply units that constantly monitor the operation of each channel.

      Ensure that the unit detects shorted loops, open circuit loops or sudden changes in inductance (>25% of nominal).

      Ensure that each type of fault is indicated on a fault LED by a unique sequence of flashes until the fault is rectified.

      Ensure that while the channel is in the fault condition, the channel output remains in the detect state.

      When the fault is rectified, the fault LED continues to emit the sequence signifying the last fault detected, but the detect LED and output returns to normal operation.

   h. Failsafe Output

      Ensure that each channel output generates a continuous solid state output to the controller when power to the detector is removed.

i. Operational Modes

Supply units with each channel selectable for either pulse or presence modes and that meet the following requirements:

- Pulse Mode
- This setting provides a single output pulse (125 ms +/- 25) in response to a vehicle entering the loop.
- If a vehicle remains in the sensing zone in excess of two (2) seconds, the unit "tunes out" said vehicle.
- The channel is then capable of detecting another vehicle entering the same detection zone.
- Presence Mode
- The presence hold time is a minimum of four (4) minutes for small vehicles (motorcycles) and a minimum of sixty (60) minutes for automobiles.
- Ensure that the unit tunes out of continuous peak hour traffic over long or multiple small loops as long as there is vehicle motion in the sensing zone every ten (10) minutes.

j. Resets

Ensure that the channels are manually resettable by removing the power momentarily.

Ensure that the channels reset remotely when the voltage on Pin C falls below 8 V DC for a period > l5µs, and that the unit resumes normal operation within four (4) seconds after the application of power or after a reset signal of l5µs.

k. Field Tuning

Ensure that field adjustments to the operation of the detector do not require the use of a meter, circuit changes, special software or any substitutions, modifications or additions to the unit.

3. Performance Requirements

If testing should be required, provide the Department with a test unit and/or software within ten (10) calendar days of the request.

Should the unit fail to meet the design and/or performance requirements of this specification, the unit will be rejected.

Ensure that the units meet the following requirements:

a. Capable of detecting passage, holding presence and accurately counting all types of licensed motor vehicles when connected in various loop configurations and lead-in combinations without detecting vehicles in adjacent lanes.
   - Typical Loop Configurations with Lead-in of 5 feet (1.5 m) to 1,500 feet (1000 m) are:
   - 6 feet x 6 feet (1.8 m x 1.8 m)
   - 6 feet x 20 feet (1.8 m x 6 m)
   - 6 feet x 40 feet [(1.8 m x 12 m) standard or quadrupole]

b. Capable of responding to an inductance change of 0.02% and sense vehicles at speeds of up to 80 mph (130 km/h).

c. Not detect vehicles, moving or stopped, at distances greater than three feet for any loop perimeter.

d. Detect all vehicles over multiple turn and/or multiple loops that may he connected in series, parallel or series/parallel with homerun lengths from <5 feet (1.5 m) to > 1,500 feet (1,000 m).

4. Optional Features

In addition to the requirements listed in the previous sections, the units may be requested with any combination of the following optional features:

a. Option 1- Timing Features - Delay & Extension

When this option is specified, ensure that the unit incorporates the following features:

1) Delay Timing

Minimum selectable delay time of 1 to 30 seconds in minimum 1-second increments for each channel.

2) Extension Timing

Minimum selectable extension time of 0.5 to 10 seconds in minimum 0.5-second increments for each channel.

b. Option 2 - Advanced Features

When the option for advanced features is specified, supply units that incorporate the following advanced features:

1) Serial Port Interface

When the serial port interface is specified, equip the detector with a front and rear panel RS 232 port for the transmission of data. Provide Windows 95 compatible software for interfacing with the detector.

2) PC Interface

Ensure that PC software, when connected directly to the unit through the front panel RS 232 port, provides a screen to display the following loop system operating characteristics, on a per channel basis, for system setup, data collection and diagnostics.

- Loop Status
- Loop Inductance (μH)
- Loop Frequency (kHz)
- Inductance Change (nH)
- Last Fault: Open, Shorted, >25% □L
- Fault Occurrence: Date & Time
- Vehicle Count

3) Speed, Volume & Occupancy

The software, when connected directly to the unit, is capable of collecting and storing speed, volume and occupancy data from each detector channel.

The software allows assignment of loop-to-loop distances to enable accurate speed and vehicle length measurements.

The speed volume and occupancy information is uploaded and stored in the vendor-supplied software.

Upon request, supply the necessary information/protocols to allow the Department to write custom software to retrieve speed, volume and occupancy data.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.11 Loop Sealant

A. Requirements

Furnish and install loop sealant according to Subsection 833.2.09, “Polyurethane Sealant for Inductive Loops”. For a list of sources, see QPL 75.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.12 Vehicle Signal Heads

A. Requirements

Supply vehicle signal heads that are 12 inches (300 mm) in diameter for traffic signal control applications. For ramp metering systems supply both 12 inches (300 mm) and 8 inches (200 mm) as per the Plans.

Ensure that the 8 inch (200mm) or 12 inch (300 mm) polycarbonate vehicle signal heads meet the current ITE specification on Vehicle Traffic Control Signal Heads with the following modifications and / or clarifications:

1. Unless otherwise approved by the Engineer or as noted on the Plans, supply signal heads with the following exterior color scheme:
   - Signal Housing - Highway Yellow.
   - Front Face including Doors and Visors: Flat Black
2. Provide housing and housing door that are one piece injection molded ultraviolet and heat stabilized polycarbonate resin with the color impregnated in the material.
3. Terminate the wiring from each signal section in the top section of the head assembly. Ensure that the cable jacket is a minimum of 6 inches inside the signal head assembly.
4. Provide the appropriate Vehicle Signal LED Signal in each section either Circular or Arrow Module.
5. Provide an effective seal with the LED module to make the assembly weather tight.
6. Mount one aluminum reinforcing support plate in the top of the red section of each three and four section signal head for the installation of mounting hardware.
7. All five section heads or heads equipped with 2-way mounting hardware shall have aluminum mounting support plates installed in the top and bottom of the red section/sections for mounting hardware.
8. Install a support plate between each section of all signal heads. Place these plates such that there is a plate in the bottom of and/or top of any sections where sections adjoin to another section.
9. Provide Signal Heads that use stainless steel hardware and are weather tight. Ensure signal heads that are supplied are sealed for mounting in all possible configurations.
10. Provide Signal Heads that have housing door that “positively” latches using two eyebolts and wing nuts. Ensure the Signal door has hinge lugs molded on one side and two latch jaws are molded on the other side.
11. Provide signal heads that provide a positive method of holding the lens such that the lens does not rotate. Ensure the lens is weather tight. Lens clips which do not apply firm pressure to the lens gasket to avoid rotation are not acceptable. When constructing side by side signal sections ensure that both doors can open at the same time (butterfly). When doors are open ensure that the door will remain attached to housing. Ensure bottom section has drainage holes.

B. Fabrication

Refer to ITE Standards for material composition and finish Specifications.

C. Acceptance

Refer to ITE Standards for material composition, finish Specifications, and wind loading requirements.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.13 Pedestrian Signal Head

A. Requirements

Provide each section with a visor encompassing the top and sides of the signal face of a size and shape adequate to shield the lens from external lighted sources.

An acceptable option is a “Z-crate” or louver type visor for mounting over the Pedestrian signal face.

Construct the housing of one piece cast aluminum alloy with two integrally hinge lugs, screw slots and openings at each end. Construct the door of one piece cast aluminum alloy with two hinge lugs cast on top of the door and two latch

points cast on the bottom. Provide hinge pins of stainless steel to attach the door to the housing and two eye bolts and wing nuts on the other side of the door.

Ensure that the door is provided with a neoprene gasket capable of making a weather resistant, dustproof seal when closed. Supply Pedestrian signal heads with a black face and a yellow body, unless otherwise specified on the Plans.

Ensure that Pedestrian indications are distinguishable to the Pedestrian both day and night and at all distances from 10 feet (3 m) to the full width of the areas to be crossed.

Use symbols that are 12 inches (300 mm) high. Use only internal illumination.

Ensure that when illuminated, the "HAND" symbol is Portland Orange and the "PERSON" symbol is Lunar White, meeting the ITE Standards. Ensure that an opaque material obscures all areas of the face or lens, except for the message. Ensure that when not illuminated, the symbols are not to be distinguishable by Pedestrians at the far end of the crosswalk they control.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.14 Optically Programmed Signal Head

A. Requirements

Supply signal heads that permit the visibility zone of the indication to be determined optically and require no hoods or louvers.

The projected indication may be selectively visible or veiled anywhere within 15 degrees of the optical axis.

Ensure that no indication results from external illumination and that one light unit does not illuminate a second. The components of the optical system include the lamp, lamp collar, optical limiter-diffuser, and objective lens.

Ensure that the optical system accommodates projection of diverse, selected indications to separate portions of the roadway such that only one indication will be simultaneously apparent to any viewer.

Ensure that the projected indication conforms to ITE transmittance and chromaticity Standards.

1. Construction

a. Provide an LED Lamp Module that is a direct replacement for the incandescent lamp. Ensure the Lamp modules are on the latest CALTRANS QPL for LED Programmed Visibility Modules. Ensure the unit provided operates over the voltage range of 80 to 135 VAC and the temperature range of -40 C (-40 F) to 74 C (165 F). Provide modules that conform to the applicable portions of section 925.2.15. Ensure the unit provides a minimum luminous intensity of 500 candela and does not exceed 18 watts at 25 C (77 F).

   Couple the lamp to the diffusing element with a collar including a specular inner surface. The diffusing element may be discrete or integral with the convex surface of the optical limiter.

b. Supply an optical limiter with an accessible imaging surface at focus on the optical axis for objects 900 to 1,200 feet (270 to 360 m) distance and permit an effective veiling mask to be variously applied as determined by the desired visibility zone.

   Ensure that the optical limiter is provided with positive indexing means and is composed of heat-resistant glass.

c. Ensure that the objective lens is a high-resolution planar incremental lens hermetically sealed within a flat laminate of weather resistant acrylic or approved equal.

   Supply a lens that is symmetrical in outline and that may be rotated to any 90-degree orientation about the optical axis without displacing the primary image.

2. Mounting
   a. Supply signals that mount to standard 1.5 inch (38 mm) fittings as a single section, as a multiple section face, or in combination with other signals.

      Provide signal sections with an adjustable connection that permits incremental tilting from 0 to 10 degrees above or below the horizontal while maintaining a common vertical axis through couplers and mounting.

      Ensure that terminal connections permit external adjustment about the mounting axis in 5-degree increments.
   b. Ensure that the signal is mountable with ordinary tools and capable of being serviced with no tools.

      Supply attachments such as back plates or adapters that conform and readily fasten to existing mounting surfaces without affecting water and light integrity of the signal. Supply heads with tri-studs for mounting.
3. Electrical

   Supply lamp fixtures that comprise a separately accessible housing and integral lamp support indexed ceramic socket and self-aligning, quick release lamp retainer.

   Ensure that electrical connection between case and lamp housing can be accomplished with an interlock assembly, which disconnects lamp holder when opened. Include a covered terminal block for clip or screw attachment of lead wires for each signal section.

   Use concealed No. 18 AWG, stranded and coded wires to interconnect all sections to permit field connection within any section.
4. Photo Controls

   Ensure that each signal includes integral means for regulating its intensity between limits as a function of the individual background illumination.

   Ensure that lamp intensity is not less than 97% of uncontrolled intensity at 10 750 lux, and reduces to 15 + 2% of maximum at less than 10.75 lux.

   Ensure that response is proportional and essentially instantaneous to any detectable increase of illumination from darkness to 10 750 lux, and damped for any decrease from 10 750 lux.

   Ensure that the intensity controller is comprised of an integrated, directional light sensing and regulating device interposed between lamp and line wires.

   Ensure that it is compatible with 60 Hz input and responsive within the range 105 to 135 V AC.

   Output may be phase controlled, but ensure that the device provides nominal terminal impedance of 1,200 Ω open circuit and a corresponding holding current.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.15 LED Signal Modules

A. Requirements

This specification covers Type 1 Light Emitting Diode (LED) red, green and yellow modules for vehicle signals for both Circular and Arrow indications. It also covers LED Pedestrian “HAND & PERSON” signal modules.

1. General Requirements All Modules

   Ensure that Type 1 LED signal module include a LED circuit board with LEDs and required circuit components, 36 inch (900 mm) 16 AWG wire leads with strain relief and spade terminals, a rigid housing, and a one piece neoprene gasket.

   Supply Type 1 LED signal modules that are watertight when mounted in the traffic signal housing.

   Submit life data on the LEDs from the LED Signal Module manufacturer to calculate the expected useful life.

   Supply modules with permanent markings of date of manufacture and date of installation.

Ensure that the Type 1 LED signal modules utilize the same mounting hardware that is used to secure the incandescent lens and gasket assembly.

2. Optical All Modules

Provide test data from an independent laboratory to verify that the performance of the product meets current ITE requirements.

Ensure that the individual LEDs are wired such that a catastrophic failure of one LED will result in the loss of not more than 5% of the signal module light output.

The failure of a single LED in a string or cluster of LED's causes loss of light from only that LED, not the entire string or indication.

Provide control circuitry that prevents the current flow through the LEDs in the "off" state to avoid any false indications as may be perceived by the human eye during daytime and nighttime hours.

Ensure that the LED signal module is operationally compatible with existing or new supplied conflict monitors (NEMA TS-1, NEMA TS-2, Model 210, Model 2010, ITS Cabinet CMU and AMU)..

Ensure that the LED Signal Module is operationally compatible with existing or new supplied load switches.

3. Electrical All Modules

Supply LED signal modules that operate over the temperature range of –40 ºF to 165 ºF (-40 °C to 74 ºC).

Ensure that the power factor is 90% or greater, at nominal rated voltage, at 77 ºF (25 °C), after 60 minutes of operation. Provide modules that do not exceed the maximum power consumption as shown in Table 925-18.

Table 925-18 Maximum Power Consumption (in Watts) at 25 C (77 F) & 74 C (165 F)

Vehicle Indications	**Red**		**Yellow**		**Green**	
Temperature	**25 C**	**74 C**	**25 C**	**74 C**	**25 C**	**74 C**
12 Inch (300 mm) Circular	11	17	22	25	15	15
8 Inch (200 mm) Circular	8	13	13	16	12	12
12 Inch (300 mm) Arrow	9	12	10	12	11	11
Pedestrian Indications	**Hand**				**Man**	
Temperature	**25 C**	**74 C**	**25 C**	**74 C**	**25 C**	**74 C**
12 Inch (300 mm)	10	12			9	12

Ensure that the total harmonic distortion (THD) is less than 20% at rated voltage, at 77 ºF (25 °C) and that all LED traffic signal modules are in compliance with FCC noise regulations.

Ensure that the LED signal modules operate on line voltage, 120 V AC nominal, and are able to operate over the voltage range of 80 V AC to 135 V AC. Power Supply must be integral to the module.

Provide transient voltage suppression rated at 1,500 W for 1 millisecond and fusing with a maximum rating of 2 A to minimize the effect and repair cost of an extreme over voltage situation or other failure mode.

Ensure the lens of the modules that are polymeric and are not frosted have a surface coating to provide front surface abrasion resistance. Ensure the Red and Yellow section module lens are tinted to correspond with the wavelength (chromaticity) of the LED. Ensure Green Section modules are clear.

Ensure the modules allow a reduction of the intensity of the light output in response to an input from the traffic signal controller. Ensure the minimum light output when dimmed is not less than 30% of the minimum maintained luminous intensity as defined in the applicable Signal Head Module.

4. Circular Signal Modules

Supply LED Circular Signal Modules that fit in standard incandescent vehicle traffic signal housings and meet the Performance Specification of the ITE Vehicle Traffic Control Signal Heads: LED Circular Signal Supplement. In case of conflict, this specification shall govern. Before delivery of any modules supply certification that module is to be in compliance with these specifications. In addition substantiating documentation must be supplied from an independent test laboratory to show the product has passed design qualification testing in accordance with section 6.4 of the ITE Vehicle Traffic Control Signal Heads: LED Circular Signal Supplement. Ensure the report includes a Minimum Maintained Luminous Intensity chart for the module being provided that uses the same horizontal and vertical angles as shown in Table 1 of the ITE Vehicle Traffic Control Signal Heads: LED Circular Signal Supplement. Ensure all modules are provided with a signed copy of the production and test and inspection as detailed in section 6.3 of the ITE Vehicle Traffic Control Signal Heads: LED Circular Signal Supplement.

Supply lenses for that are made of ultraviolet stabilized polycarbonate. Ensure that the external lens surface is smooth, with no raised features, to, minimize the collection of dirt, diesel smoke, and other particulate contaminates, and to facilitate periodic cleaning.

Ensure that Circular Signal Modules have prominent and permanent markings to designate the proper orientation of the signal module in the traffic signal housing. This marking should be an up arrow or the word “UP” or “TOP”.

Ensure Circular Signal Module meets the photometric requirements as indicated and described in the ITE VTCSH LED Circular Signal Supplement.

Supply Red and Yellow LEDs that utilize AllnGap technology, either AS (Absorbing Substrate or TS (Transparent Substrate) and do not exhibit degradation of more than 30% of their initial light intensity following accelerated life testing (operating at 185 F (85 C) and 85% humidity, for 1000 hours). AlGaAs technology is not acceptable.

Supply Green LEDs that utilize gallium nitride technology.

5. Vehicle Arrow Signal Modules

Supply LED Arrow Signal Modules that fit in standard incandescent vehicle traffic signal housings and meet the Performance specification of ITE Vehicle Traffic Control Signal- LED Vehicle Arrow Traffic Signal Supplement.

Ensure that Arrow Signal Modules provided are omni directional and marked as OD so that they may be rotated at any angle. Ensure the Arrow modules Photometrics support the luminous intensity as indicated in table 925-19.

Before delivery of any modules supply certification that module is to be in compliance with these specifications. In addition substantiating documentation must be supplied from an independent test laboratory to show the product has passed design qualification testing in accordance with section 6.4 of the ITE Vehicle Traffic Control Signal Heads: LED Circular Signal Supplement. Ensure the report includes a Minimum Maintained Luminous Intensity chart for the module being provided that uses the same horizontal and vertical angles as shown in Table 1 of the ITE Vehicle Traffic Control Signal Heads: LED Vehicle Arrow Traffic Signal Supplement. Ensure all modules are provided with a signed copy of the production and test and inspection as detailed in section 6.3 of the ITE Vehicle Traffic Control Signal Heads: LED Vehicle Arrow Traffic Signal Supplement.

Supply lenses for that are made of ultraviolet stabilized polycarbonate. Ensure that the external lens surface is smooth, with no raised features, to, minimize the collection of dirt, diesel smoke, and other particulate contaminates, and to facilitate periodic cleaning. Supply Red and Yellow LEDs that utilize AllnGap technology, either AS (Absorbing Substrate or TS (Transparent Substrate) and do not exhibit degradation of more than 30% of their initial light intensity following accelerated life testing (operating at 185° F (85° C) and 85% humidity, for 1000 hours). AlGaAs technology is not acceptable.

Supply Green LEDs that utilize gallium nitride technology.

Bi-Modal signal heads shall meet the standards for both Yellow and Green LEDs mentioned above.

Supply LED Arrow Signal Modules that fit in standard incandescent vehicle traffic signal housings and meet the “ITE Vehicle Traffic Control Signal Heads Part 3: Light Emitting Diode (LED) Vehicle Traffic Signal Modules”. Use Table 925-19 for all references to minimum maintained Intensity values. Ensure the LED arrow modules meet the required luminous intensity as shown in Table 925-19.

Table 925-19 Minimum Maintained Luminous Intensity Values for Arrow LED Indications

Angle					Angle				
Ver	Hor	12 inch (300 mm)			Ver	Hor	12 inch (300 mm)		
+	+ or -	Red	Yellow	Green	-	+ or -	Red	Yellow	Green
2.5	2.5	56.8	141.6	73.9	2.5	2.5	56.8	141.6	73.9
	7.5	47	117.1	61.1		7.5	47	117.1	61.1
	12.5	32.1	80.1	41.8		12.5	32.1	80.1	41.8
	17.5	18.2	45.3	23.7		17.5	18.2	45.3	23.7
	22.5	8.5	21.2	11.1		22.5	8.5	21.2	11.1
	27.5	3.3	8.2	4.3		27.5	3.3	8.2	4.3
7.5	2.5	47	117.1	61.1	7.5	2.5	47	117.1	61.1
	7.5	38.9	97	50.6		7.5	38.9	97	50.6
	12.5	26.7	66.5	34.7		12.5	26.7	66.5	34.7
	17.5	15.1	37.7	19.7		17.5	15.1	37.7	19.7
	22.5	7.1	17.7	9.2		22.5	7.1	17.7	9.2
	27.5	2.8	6.9	3.6		27.5	2.8	6.9	3.6
12.5	2.5	32.1	80.1	41.8	12.5	2.5	32.1	80.1	41.8
	7.5	26.7	66.5	34.7		7.5	26.7	66.5	34.7
	12.5	18.3	45.7	23.9		12.5	18.3	45.7	23.9
	17.5	10.5	26.1	13.6		17.5	10.5	26.1	13.6
	22.5	5.0	12.4	6.4		22.5	5.0	12.4	6.4
	27.5	-	-	-		27.5	-	-	-
17.5	2.5	18.2	45.3	23.7	17.5	2.5	18.2	45.3	23.7
	7.5	15.1	37.7	19.7		7.5	15.1	37.7	19.7
	12.5	10.5	26.1	13.6		12.5	10.5	26.1	13.6
	17.5	6.0	15.0	7.8		17.5	6.0	15.0	7.8
	22.5	2.9	7.2	3.8		22.5	2.9	7.2	3.8
	27.5	-	-	-		27.5	-	-	-
22.5	2.5	8.5	21.2	11.1	22.5	2.5	8.5	21.2	11.1
	7.5	7.1	17.7	9.2		7.5	7.1	17.7	9.2
	12.5	5.0	12.4	6.4		12.5	5.0	12.4	6.4
	17.5	2.9	7.2	2.8		17.5	2.9	7.2	2.8
	22.5	-	-	-		22.5	-	-	-
	27.5	-	-	-		27.5	-	-	-
27.5	2.5	3.3	8.2	4.3	27.5	2.5	3.3	8.2	4.3
	7.5	2.8	6.9	3.6		7.5	2.8	6.9	3.6
	12.5	-	-	-		12.5	-	-	-
	17.5	-	-	-		17.5	-	-	-
	22.5	-	-	-		22.5	-	-	-
	27.5	-	-	-		27.5	-	-	-

6. Pedestrian Signal Modules

Supply LED Pedestrian Traffic Signal Modules that fit in standard pedestrian one section signal head manufactured in accordance with the ITE Pedestrian Traffic Control Signal Indications (PTCSI) housings and meet the ITE Pedestrian Traffic Signal Modules specification.

Ensure that the Pedestrian Indications for the “Hand” and “Man” are filled in so as to provide a solid indication. Do not supply Pedestrian Indications for the Hand and Man that are “outlines”.

Ensure that Pedestrian Signal Modules have prominent and permanent markings to designate the proper orientation of the signal module in the pedestrian signal housing. This marking should be an up arrow or the word “UP” or “TOP”.

Ensure Pedestrian Signal Module meets the photometric requirements as indicated and described in the ITE PTCSI LED Pedestrian Traffic Signal Module Specification.

Supply Portland Orange LEDs that utilize AllnGap technology, either AS (Absorbing Substrate or TS (Transparent Substrate) and do not exhibit degradation of more than 30% of their initial light intensity following accelerated life testing (operating at 185° F (85° C) and 85% humidity, for 1000 hours). AlGaAs technology is not acceptable.

Supply White LEDs that utilize InGaN technology.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Ensure that LED traffic signal modules and LED Pedestrian modules are performance warranted to be in compliance with the minimum intensity values as shown in Table 925-19. Provide independent laboratory test results indicating that LED indications satisfy the minimum intensity Standards for LED traffic signal modules, measured at 120 V AC and 165 ºF (74 °C), for a period of five (5) years.

Ensure that the manufacturer's name, part number, date code, and electrical characteristics of the LED signal module is visible on the assembly, and that each LED signal module is identified for warranty purposes.

925.2.16 LED Pedestrian and Countdown Signal Module

A. Requirements

This specification covers LED traffic signal module designed as a retrofit replacement for the message bearing surface of nominal 16" x 18" (400 mm x 450 MM) traffic signal housing built to the PTSCI Standard. The message bearing surface of the module consists of an overlapping "Hand" and "Man" Symbols with a numerical display of numbers from 00 to 99.

1. General Requirements

Ensure that the unit supplied meets the applicable portions of section 925.15 of this specification.

Ensure that the message numbers "00" to "99" are a minimum of 9 inches (228 mm) in height and consist of two rows of LEDs.

Ensure the module fits in the Pedestrian Signal Housing without modification to the housing and requires no special tools for installation.

Supply LED signal modules that are watertight when mounted in the traffic signal housing.

Supply life data from the LED Signal Module manufacturer to calculate the expected useful life

Supply modules with permanent markings for date of manufacture and date of installation.

2. Optical

Provide test data from an independent laboratory to verify that the performance of the product meets current ITE requirements.

Ensure that the individual LEDs are wired such that a catastrophic failure of one LED will result in the loss of not more than 5% of the signal module light output.

The failure of a single LED in a string causes loss of light from only that LED, not the entire string or indication.

Provide control circuitry that prevents the current flow through the LEDs in the "off" state to avoid any false indications as may be perceived by the human eye during daytime and nighttime hours.

Ensure that the LED signal module is operationally compatible with existing or new supplied conflict monitors (NEMA TS-1, NEMA TS-2, Model 210, Model 2010, ITS Cabinet CMU and AMU.

Ensure that the LED Signal Module is operationally compatible with existing or new supplied load switches.

Ensure that the intensity of the LED signal module does not vary by more than 10% over the allowable voltage range as specified in the electrical section below.

Ensure that the LED signal modules maintain not less than 90% of the required intensity, as defined by the ITE intensity Standards for LED traffic signal modules.

Ensure that each module provides an average luminous of at least 3750 candela per square meter of lighting surface for the “Hand" and 5300 candela per square meter for the Man symbol.

Ensure this over the temperature range of –40 ºF to 165 ºF (–40 ºC to + 74 ºC) at 120 V AC, when new and after four (4) years of field installation.

Provide an exterior lens which is uniform and frosted to reduce sun phantom effect.

3. Electrical

Supply LED signal modules that operate over the temperature range of –40 ºF to 165 ºF (-40 °C to 74 ºC).

Ensure that the power factor is 90% or greater, at nominal rated voltage, at 77 ºF (25 °C), after 60 minutes of operation.

Ensure that the total harmonic distortion (THD) is less than 20% at rated voltage, at 77 ºF (25 °C) and that all LED traffic signal modules are in compliance with FCC noise regulations.

Ensure that the LED signal modules operate on line voltage, 120 V AC nominal, and are able to operate over the voltage range of 80 V AC to 135 V AC.

Provide transient voltage suppression rated at 1,500 W for 1 millisecond and fusing with a maximum rating of 2 A to minimize the effect and repair cost of an extreme over voltage situation or other failure mode.

Ensure the modules allow a reduction of the intensity of the light output in response to an input from the traffic signal controller. Ensure the minimum light output when dimmed is not less than 30% of the minimum maintained luminous intensity as defined in the applicable ITE Signal Head Module.

4. Operation

Supply LED Modules which start counting when the flashing “Don’t Walk” Indication starts and will countdown to “0” when the steady “Don’t Walk” signal turns on. Ensure that the countdown numbers remain continuously illuminated through the flashing don’t walk interval. Ensure that the unit maintains a consistent countdown during a short power failure (i.e. Traffic Controller does not restart). Ensure that if Traffic Controller restarts that the countdown timer display is turned off until one full pedestrian clearance Cycle is timed. Ensure that the unit will turn off the counter if the steady Don’t Walk Display starts while the countdown timer is displaying a number other than 00.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Ensure that LED traffic signal modules and LED Pedestrian modules are performance warranted to be in compliance with the latest ITE and CALTRANS minimum intensity Standards for LED traffic signal modules, measured at 120 V AC and 165 ºF (74 °C), for a period of five (5) years.

Ensure that the manufacturer’s name, part number, date code, and electrical characteristics of the LED signal module is visible on the assembly, and that each LED signal module is identified for warranty purposes.

925.2.17 Blank-Out Signs

A. Requirements

Ensure that each sign provides a clearly visible and definable legend for 500 feet with ample safety factors.

Provide hardware to mount the sign on standard 1.5 inch (38 mm) pipe brackets or to mount directly to signal mast arms or span wire or as outlined in the Plans.

Ensure LED blank-out signs conform to the requirements of section 925.2.15 for LED modules and optical requirements.

Supply blank-out signs capable of displaying one message at a time in one direction.

1. Case

Use a case formed from aluminum extrusion F1-6-E and a special aluminum door frame angle.

For Alloy 6063-T5, ensure that the wall is at least 0.075 inches thick and the corners and joints are at least 0.080 inches (2 mm) thick.

Use filler arc for all welding. Ensure all hinges and fastening hardware, nuts, bolts, fasteners on the housing and internal components are stainless steel

Use a BR-type take-apart door hinge and draw bolt. Furnish one P-15 1.5 inch (38 mm) hub on the top surface.

Prime the entire case with zinc chromate, bake the inside with two coats of non-yellowing white, and paint the outside with two coats of highway yellow.

2. Electrical

   Ensure that all blank-out signs are LED and conform to current ITE Standards. Supply all signs with the necessary mounting hardware to provide for mounting as shown on the Plans. Provide mounting for one way or two way configurations.

   Obtain approval for messages and letter dimensions from the Engineer.

3. Sun Phantom Screen

   Attach to each sign a heavy-duty aluminum louver-type sun phantom screen covering the entire sign face. Slant the louvers down enough to eliminate the sun glare without obstructing the view of the sign face.

4. Painting

   Paint the signal surfaces, inside and out, with two coats of oven-baked enamel in addition to the primer coat. Paint the non-illuminated portions of the signal face black. Paint the housings, brackets, fittings, etc. highway yellow.

5. Lens

   Use a fabricated, three-section Plexiglas lens clear face, with or without legend, which can accept a silk-screened legend on the first surface. Provide a thickness of at least 0.31 inches (8 mm).

6. Legend

   Acceptable legends are as follows***:***

   Text:

   - NO LEFT TURN
   - NO RIGHT TURN
   - SIGNAL AHEAD
   - NO TURNS

   Symbols:

   - NO LEFT TURN SYMBOL
   - NO RIGHT TURN SYMBOL

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.18 Lane-Use Control Signal

A. Requirements

Ensure that all signals are LED and conform to current ITE Standards. Supply all signals with the necessary mounting hardware to provide for mounting as shown on the Plans. Provide mounting for one way or two way configurations.

1. General Requirements

   a. Weight

      Ensure that one-way units weigh not more than 50 pounds (23 kg) and two-way units weigh not more than 60 pounds (27 kg), regardless of messages.

   b. Color

Ensure that the color of lane-use control signal indications is clearly visible for 0.25 mile (0.38 km) at all times under normal atmospheric conditions. Provide lane-use control signals with a visibility angle of a minimum of 60 degrees.

c. Housing

Ensure that the housing of each signal is polycarbonate or a one-piece corrosion resistant aluminum alloy die casting or equal and meets current related ASTM Specifications.

Ensure that all configurations are balanced to provide a plumb hanging unit. Ensure that all components are readily and easily accessible from the open door.

d. Housing door

Ensure that the housing door is one-piece corrosion resistant aluminum or polycarbonate and meets current related ASTM Specifications.

Provide two substantial door hinges with stainless steel hinge pins. Ensure hinges are on the left side of each section with a latch boss on the right side.

Provide stainless steel dual eye bolt latches or similar approved devices to securely close and latch the housing door. Equip the housing or door with a continuous molded neoprene gasket to make the interior of the unit dustproof and waterproof.

e. Wiring

Provide each signal housing with a complete terminal board. Ensure that one side of terminal strip accommodates socket leads and the other side accommodates field wires. Ensure that the terminal board provides totally separate wiring of each symbol.

Ensure each lamp is separately wired to a terminal block located in each housing. Provide each lamp holder socket with color-coded leads.

For combination symbols, color-code socket leads separately to distinguish between red “X”, yellow “X” or downward arrow symbols. Provide leads that are No. 14 AWG type THW, 600 V AC, and fixture wire with 194 ºF (90 °C) thermoplastic insulation.

f. Visors

Provide visors not less than 12 inches (300 mm) long for multiple unit and 7 inches (175 mm) long for single unit signals for each signal face.

Ensure that the visors are constructed of sheet aluminum or polycarbonate and encompass the top and sides of each section.

g. Painting

Paint all signal surfaces, inside and out, with two coats of oven baked enamel in addition to the primer coat. Paint the insides of the visors flat black.

The non-illuminated portions of the signal face black or dark gray and all housings, brackets and fittings highway yellow.

h. Hardware and fittings:

Supply all necessary fittings, pipe brackets, hangers, hubs, etc. for the type of mounting specified. Ensure all fittings are aluminum or galvanized coated to prevent rust and corrosion.

i. Sun -phantom screen

Provide each signal face with a screen, which substantially counteracts sun phantom effect.

2. Signal Display

Ensure that the symbols, which are on an opaque black or dark gray background, meet ITE requirements and are blacked out when not illuminated.

3. LED Optical System

a. Ensure that the LEDs supplied for the lane use control signal meet the Specifications for a type module as required in section 925.2.14. Ensure that each separate color indication in a sign face is illuminated by independent LEDs

b. Ensure that the green arrow indication does not utilize the same termination points as any “X" indication.

c. Ensure that total power required for any single indication does not exceed 250 W.

d. Ensure that all modules are contained behind a water tight signal face or lens assembly.

e. Ensure that the entire optical system is weatherproof and is not vulnerable to extremes in temperature or moisture.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.19 Pedestrian Push Button Station

A. Requirements

Ensure that Pedestrian push buttons are of tamperproof construction and consist of a direct push type button and single momentary contact switch in cast aluminum housing. The pushbutton cover shall also be of cast aluminum. The housing and cover shall be free of voids, pits, dents, molding sand excessive foundry grinding marks. Exterior surface shall be smooth and cosmetically acceptable, free of molding fins, cracks and other exterior blemishes.

Provide housing and cover with an alodine conversion coating so as to provide a proper base for paint adhesion. Finish the housing with baked enamel and paint the push button housing and Pedestrian heads highway yellow (unless otherwise specified by the Engineer).

The assembly shall be capable of being mounted to a flat or curved surface. Ensure the assembly includes the appropriate sign as shown in the Plan Details.

Ensure that any screws or bolts are stainless steel and vandal proof. Provide the unit with a 0.5 inch (13 mm) threaded opening with plug.

Ensure that the assembly is weatherproof and so constructed that when properly installed, it will be impossible to receive an electrical shock under any weather condition.

Ensure that Pedestrian Pushbuttons are integrated with a sign as shown in the standard details. Provide the sign size as indicated on the Plans. GDOT will allow an adapter of cast aluminum. GDOT will allow one of three options:

1. The use of a 9 inch (229 mm) by 15 inch (381 mm) cast aluminum plate adapter to upgrade existing push button station, 9 inch (229 mm) by 12 inch (305 mm).
2. Push button station assembly 9 inch (229 mm) by 15 inch (381 mm) sign w/round pushbutton adapter.
3. The use of a 9 inch (229 mm) by 15 inch (381 mm) cast aluminum plate adapter to upgrade existing push button station, 5 inch (127 mm) by 7 inch (178 mm).

Ensure that the Pedestrian Push Button sign adapter plate is, die-cast aluminum and separate, such that it is interchangeable.

Ensure that the Pedestrian Push Button sign adapter assembly be, die-cast aluminum and attached, prior to shipping.

The plate shall be finished with highway yellow baked enamel paint (unless otherwise specified by the Engineer).

Ensure the button assembly is configured to be a mechanical switch with ball and 2 inch (50 mm) mushroom plunger.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01D for Materials Warranties.

925.2.20 Signal Head Back Plate

A. Requirements

Ensure that each back plate is designed to properly shield a traffic signal head from background distractions for better visibility.

Design the back plates to extend beyond the signal head to a minimum of 6 inches (150 mm) on all sides and have all corners rounded with minimum 2 inch (50 mm) radii.

Construct the back plates from UV stabilized polycarbonate, ABS plastic, or metal material. Ensure that polycarbonate back plates are at least 0.15 inches (4 mm) thick; ABS back plates are at least 0.05 inches (1 mm) thick; metal back plates are at least 0.06 inches (1.5 mm) thick. All back plates shall be constructed with a finished color of flat black.

Design the back plates with predrilled holes to provide for simple attachment to the specified brand, size and configuration of traffic signal head with all mounting hardware included.

Ensure that the back plates do not interfere with the signal mounting hardware. Ensure that the back plates include louvers.

Ensure back plates project a rectangular appearance at night by having a 2 inch (50mm) yellow fluorescent TP IX retroreflective strip along the back plate perimeter.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.21 Signal Head Visors

A. Requirements

Typically, visors are one piece tunnel type and removable unless specified otherwise in the signal Plans.

Ensure that visors are polycarbonate and at least 9 inches (225 mm) deep for 12 inch (300 mm) heads. Special angle visors are full circle with the long side at least 18 inches (450 mm) deep. Ensure that visors provide a positive method of attaching to the door of the signal head that do not allow rotation. An acceptable method is to provide tabs that use stainless steel screws.

Unless otherwise specified by the Engineer, provide black signal head visors.

If special tools are required for visor adjustment, provide one set per project. Coordinate delivery of tools with District Signal Engineer.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.22 Signal Head Louvers

A. Requirements

Ensure that louvers (with the vanes oriented vertically) are directional with a 7-degree cutoff right of center. Rotating the louver 180 degrees will produce a 7-degree cutoff left of center.

Provide twelve-inch (300 mm) louvers with 5 vanes. Finish all louvered surfaces in flat black. Ensure that programmable louvers are directional with a 7-degree cutoff and that all louver surfaces have a flat black finish.

Ensure that the units can be installed and programmed in accordance with the manufacturer's instruction on visors that are recommended by the manufacturer.

Have the programmable louver display approved by the Engineer prior to placing the signal in stop and go operation.

If special tools are required for louver adjustment, provide one set per project. Coordinate delivery of tools with District Signal Engineer. B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.23 Hardware For Mast Arm Mounting

A. Requirements

Ensure that signal heads are rigidly mounted to the mast arm. Provide mounting hardware that is in accordance with the following:

4. Adjustability

   Ensure the mounting bracket is completely adjustable such that it allows; rotational adjustment about the bracket axis; vertical adjustment; rotational adjustment about the Mast Arm; and rotational adjustment from the vertical plane.

5. Attachment

   Ensure the bracket is provided with air-craft grade galvanized steel cables with stainless steel fastening hardware and make a minimum of two wraps around to fasten the bracket to the arm. Ensure the bracket is easily adjustable to fit all sizes of round, elliptical or other shaped structure without special tools or equipment.

6. Signal/Sign Accommodations

   Ensure the bracket attaches to the signal or sign to assure maximum rigidity. When clamping the signal top and bottom, ensure a standard bracket accommodates all major signal manufacturers signal for 3, 4 and 5 section signal head configurations.

7. Wiring

   All electrical wiring shall be completely concealed with the bracket. The vertical support shall be a gusseted "C" shaped extruded aluminum tube to accommodate the signal cable regardless of vertical positioning of the tube.

8. Materials

   The upper and lower arms shall be cast 319 aluminum or equivalent. The lower arm shall be internally threaded to accommodate the threaded vertical support tube. Ensure the lower arm is furnished with plastic covers which slide and snap into place. Both arms shall have 72 tooth serrations cast into the arm to assure a positive lock with signal housing and shall be secured about their rotational axis with setscrews. Ensure the arms have a tri-bolt arrangement for attachment to the signal housing.

   Ensure the vertical support is gusseted tube extruded from 6063-T6 aluminum. Ensure the tube includes a vinyl closure strip.

   Ensure the mast arm clamp assembly is cast from 713 aluminum alloy or equivalent. Provide an assembly that allows for 360 degrees of rotation with no internal bracing obstructing the center opening. Provide two air-craft grade galvanized steel cables that have minimum tensile strength of 100,000 PSI (690 MPa).

   Ensure that each bracket is complete with all necessary bolt, washers, gaskets and miscellaneous items to allow assembly of the signal to the bracket and the bracket to the mast arm. Ensure all aluminum parts have an Aldine finish. All non stainless steel parts shall have a yellow zinc di-chromate or galvanize finish.

This item will be approved upon submittal of catalog cuts. Refer to Standard Detail Drawings for additional information.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01D for Materials Warranties.

925.2.24 Hardware For Signal Head Pole Mounting

A. Requirements

Ensure this item consists of hardware adequate for the specific mounting. As a minimum provide the following hardware. 1 ½ inch pipe nipples of die cast aluminum that are a minimum of 12 inches (300 mm) and threaded with 1 ½ inch NPS threads on either end. On the upper and lower arm there shall be a serrated 72 tooth boss with set screw. Use a tri-stud adaptor to attach the signal housing to the mounting hardware. The upper arm shall have a neoprene gasket to provide weather tight fit. Hub plates for pole mounting shall be provided and they shall be appropriate for the particular mounting (round or flat). Hardware shall die cast aluminum alloy 380 or extruded. All die cast parts shall be cleaned in an alkaline cleaning compound Extruded parts shall have an alodine conversion coating to provide proper base for paint adhesion. The assembly is to be painted federal yellow and baked in an oven. Ensure the assembly is provided with all required hardware. All other hardware shall be stainless steel.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

Ensure that this item consists of hardware as shown in the standard details.

This item will be approved upon submittal of catalog cuts.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.25 Balance Adjuster

A. Requirements

Ensure this item consists of hardware that is cast from 316 Stainless Steel or 65-45-12 Ductile Iron or equivalent. Ensure castings are free of voids, pits, dents, molding sand and excessive grinding marks. Exterior surface shall be cosmetically acceptable and free of molding fins, cracks and other exterior blemishes. All hardware shall be supplied and be stainless steel or galvanized.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

Ensure this item consists of hardware as shown in the Standard Details. This item will be approved upon submittal of catalog cuts.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.26 Hardware For Mounting ~~12 Inch (300 mm)~~ Pedestrian Head

A. Requirements

Ensure this item meets the same criteria as 925.2.24.A and is in accordance with the Standard Details.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

Ensure this item consists of hardware as shown in the Standard Details. This item will be approved upon submittal of catalog cuts.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.27 Pedestal Pole

A. Requirements

The Pedestal poles support vehicle signal heads, pedestrian signal heads, IVDS and push button. Furnish Pedestal poles according to type and overall length.

Pedestal pole for vehicle display for one lane ramp metering operation shall be constructed to support one 12” (300 mm) signal head and one 8” (200 mm) signal head assembly as shown in the Plans.

Pedestal pole for ramp meter advance warning sign and flashing beacon shall be constructed to meet the sign manufacturer’s structural requirements. Pedestal pole mounting adapter shall rigidly attach to the sign case’s structural bracing. Cable entrance to the sign case shall be through the inside of the pole.

1. Ensure that all poles are made of one continuous piece of bare finish spun aluminum from top to base connection for the entire height of the pole.

   The shaft, of appropriate shape, may or may not be uniformly tapered from butt to tip. A pole used to support only a traffic signal may be tapered.

2. Fabricate pole caps, when required, of cast material, and secure in place with set-screws.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.28 Pedestal Pole Base

A. Requirements

Ensure that all design radii are smooth and intact. Ensure that the exterior surface finish is smooth and cosmetically acceptable by being free of molding fins, cracks and other exterior blemishes.

Fabricate from new aluminum ingot. Do not use scrap materials.

Minimum requirements are as follows:

ALUMINUM ALLOY NO.	319
ELONGATION [% IN 2 IN. (50 mm)]	2.5
TENSILE STRENGTH, KSI (MPa)	34 (234)
BRINELL HARDNESS	85
YEILD STRENGTH, KSI (MPa)	19 (131)
SHEAR STRENGTH, KSI (MPa)	232 (1600)

1. Ensure this item consists of square cast aluminum with bare finish, and has a minimum weight of 21 pounds (9.5 kg). Thread the upper end to receive a 4 inch (100 mm) National Pipe Thread (NPT) pipe shaft.
2. Design the base so that it may be fastened to a foundation with four (4) 0.75 inch (19 mm) anchor bolts located 90 degrees apart on the bottom of the base. Provide slots in the bottom of the base 1.5 inch (38 mm) wide and 2.5 inches (63 mm) long measured along the circumference of the bolt circle, allowing a proper fit even if the bolts are placed slightly off center.
3. Design the base to accommodate bolt circles of a minimum of 12 inches (300 mm) through a maximum of 14.5 inches (363 mm) and anchor bolts with a minimum of 0.63 inches (16 mm) through 1 inch (25 mm) diameter.
4. Design the base with a removable plastic door. Ensure that the door opening is free of burrs and sharp edges and is no less that 8.5 inches (213 mm) square. Attach the door to the base using one socket button head screw to prevent unauthorized entry.

5. Ensure that the base meets or exceeds current AASHTO breakaway requirements. Provide test reports from an FHWA approved independent laboratory certifying that the base has been tested and meets all applicable requirements. In addition, supply a statement of certification from the FHWA stating such tests have been accepted and approved.
6. In order to prove structural soundness, provide a certification from a recognized independent structural laboratory certifying that the base will withstand a bending moment of 10,750 ft-lbs (14 575 N-m).
7. Ensure that the door is injection molded from ABS plastic to deter vandalism and theft, and has the following properties:

TEST	ASTM METHOD	VALUE
Tensile @ Yield [0.13 inches (3 mm)]	D638	6600 psi (45 500 kPa)
Flexural @ Yield	D790	11,000 psi (75 850 kPa)
Rockwell Hardness	D785	101 (R Scale)
Notched Izod	D256	5 ft-lb./in. (0.03 N-m/mm)

8. Ensure that the door exhibits the following properties:
   - Has an edge thickness of 0.25 inches (6 mm) and a minimum thickness of 0.156 inches (4 mm)
   - Contains flame-retardant material, meeting or exceeding underwriters laboratories UL 94 test H.B
   - Gray aluminum tone in color, unless otherwise specified
   - Contains ultra-violet inhibitors and stabilizers for protection against UV degradation
   - Is injection molded with a smooth front finish
   - Has flat and straight surfaces without blisters, buckling or warping; have reinforcing ribs
   - Contains two (2) injection molded lugs on the bottom of the door with slots of the proper width and depth to fit the base door opening.
9. Supply the base with a set of four (4) anchor bolts, 0.75 inch (19 mm) diameter by 18 inches (450 mm) in length, material per ASTM A 572A 572M, Galvanized per ASTM A 153/A 153M. Supply (1) hex nut and (1) flat washer with each bolt.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

General Provisions 101 through 150.

925.2.29 Pedestal Pole Foundation Anchor Assembly

A. Requirements

Provide Foundation Anchor assembly that is 4 inches (100 mm) in diameter by 56 inches (1400 mm) with a single helical blade and a square fixed baseplate with combination underside holt-head retainer and dirt scrappers allowing flush- mount with the ground.

Provide Baseplate that is steel and conforms to ASTM A-36 material. Provide pipe with helical blade that is manufactured from ASTM A-53ERW Grade B Steel. Ensure 4 inch pipe has 2 inch (50 mm) by 3 inch (75mm) entrance hole 18 inches below the steel plate. Ensure the anchor assembly is hot dipped galvanized finish after fabrication and complies with ASTM A-123.

Ensure base plate has four slotted mounting holes to fit bolt circles from 7 ¾ inch (195mm) to 14 ¾ inch (375 mm. Provide 4 slotted mounting hole with a ¾ inch keyhole slot to permit bolt installation and replacement from the top surface without digging under the baseplate.

Ensure assembly is furnished with;

- Quantity of four ¾ inch(20 mm) -10NC x 3 inch(75 mm) square head galvanized ASTM 325 anchor bolts;
- Quantity of four ¾ inch(20 mm) plain flat galvanized washers;
- Quantity of four 3/16 inch(5 mm) thick galvanized plate washers;
- And, quantity of four ¾ inch (20 mm) galvanized hex nuts.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.30 Timber Poles

A. Requirements

Ensure that all timber poles meet the requirements of Section 861. Poles must be inspected and tested by the GDOT Office of Materials and Research and hammer stamped by the inspector.

Ensure that all poles have a brand or stamp 10 feet (3 m) from the butt that notes the type wood, date of manufacture, manufacturer, class and length.

Ensure that all timber poles that have guy attachments or support span wire or arms that suspend signal heads over the roadway or sidewalk are Class II.

Poles that support loop lead-in, messenger or communications cable that does not have guy attachments may be Class IV size.

Ensure that all poles meet the requirements in the table below unless otherwise noted on the traffic signal Plans or list of materials.

		Minimum Circumference
Class	**Nominal Length, ft (m)**	**At 6 feet (2.4 m) from butt, in. (mm)**
II	30 (9)	34.0 (850)
II	35 (10.5)	36.5 (913)
II	40 (12)	38.5 (963)
II	45 (13.5)	40.5 (1013)
II	50 (15)	42.0 (1050)
IV	30 (9)	29.5 (738)
IV	35 (10.5)	31.5 (788)
IV	40 (12)	33.5 (838)
IV	45 (13.5)	35.0 (875)

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.31 Traffic Signal Pull Box

A. Requirements

Ensure traffic signal pull boxes are matched assemblies consisting of boxes and covers from the same manufacturer.

For all pull boxes except Types 4 and 5, use pull boxes manufactured in a single unit for the full depth required in the size in an open bottom configuration. Do not use stacked pull boxes.

For pull boxes Types 4 and 5, use stacked pull boxes as shown in the Plans, where the top unit is open bottom and the bottom unit is closed bottom manufacture. In the bottom unit provide a drain hole.

Provide pull boxes that are non-metalic and gray or tan color.

Ensure that pull boxes meet all requirements of ANSI 77 2007 or current edition Tier 15. Provide compliance test documentation.

Provide a ¼-inch (6 mm) galvanized wire mesh between the gravel base and the open bottom box or closed bottom box drain hole for all pull box types.

Use Type 1 pull boxes [12 inches x 12 inches (300 mm x 300 mm)] for loop lead-ins. When loop lead-ins and splices and other cables are required, use Type 2 pull boxes [11 inches x 18 inches (275 mm x 450 mm)] or Type 3 pull boxes [17 inches x 30 inches (425 mm x 750 mm)]. Use Type 4, 4S, 5, 5S, 6 and 7 pull boxes for fiber optic cable. Furnish one-piece covers for all pull boxes except Types 5, 5S, and 7. Furnish two-piece covers for Types 5, 5S, and 7.

Furnish covers with a skid-resistant surface with a minimum coefficient of friction of 0.5 when tested in accordance with ASTM C1028.

Furnish covers with stainless steel hold-down bolts, minimum size 3/8-16.

Furnish covers with the logo “TRAFFIC SIGNAL” for pull box Types 1, 2 and 3, and with other pull box types when installed for traffic signal cabling at a traffic signal.

Unless otherwise shown in the Plans or installed for traffic signal cabling at a traffic signal, furnish covers with the logo “GDOT COMMUNICATIONS” for pull box Types 4, 4S, 5, 5S, 6 and 7.

Furnish pull box Types 4, 5, 6 and 7 with factory-installed cable racks and rack hooks.

Cable racks and rack hooks shall be hot-dipped galvanized steel.

Each cable rack rail shall be minimum 24 inches (600 mm) in length with rack hook mounting holes on the entire length. Install two racks on each of the pull box long side walls. For Type 4 and 5 pull boxes only, each cable rack rail may be comprised of two minimum 12 inch (300 mm) units installed on the stacked box side walls.

Mount cable racks to the side walls using minimum 3/8-16 stainless steel hardware.

Furnish a minimum of four rack hooks, minimum 6 inch length (150 mm), per pull box. Furnish an additional four rack hooks for each through cable stored in the pull box. Furnish an additional two rack hooks for each splice closure stored in the pull box.

Furnish Types 6 and 7 pull boxes with factory-installed non-metallic conduit terminators for Sch. 40 and SDR11 2-inch (53 mm) of the quantity and location as shown in the Plans, or for a different conduit size if shown in the Plans. Terminator bodies shall be manufactured from high-impact polystyrene or approved equivalent.

When joining conduits of dissimilar materials, furnish an airtight and watertight conduit adhesive intended for direct-contact underground use.

Refer to the Standard Detail Drawings and the Traffic Signal Design Manual for further information.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.32 Prefabricated Controller Cabinet Base

A. Requirements

Provide controller cabinet bases that are precast polymer concrete and grey in color. Ensure the prefabricated controller cabinet base has the correct bolt pattern for the cabinet(s) to be installed. Provide prefabricated controller cabinet bases with UNC inserts as shown on plans. UNC inserts shall be stainless steel and be designed for a minimum of 15 foot-pounds (20 N-m) of torque.

Ensure that prefabricated controller cabinet bases are designed to withstand wind loading of 125 mph (200 km/h) with the cabinets as shown in the Plans mounted. Ensure that prefabricated controller cabinet bases are designed for a minimum static vertical load of 5,000 pounds (2262 kg)over a 10 inch (254 mm) by 10 inch (254 mm) by 1 inch (25 mm) thick distribution plate and withstand a tested load of 7,500 pounds (3394 kg). Ensure that prefabricated controller cabinet bases are designed for a minimum lateral load of 1800 pounds (814 kg) over an 18 inch (457 mm) by 24 inch (610 mm) by 1 inch (25 mm) steel plate applied to the longest side and shall withstand a tested load of 2700 pounds (1222 kg). The prefabricated controller cabinet base shall withstand a 50 foot-pound impact administered with a 12-pound weight having a “C” tup without puncture or splitting, in accordance with ASTM D2444. The prefabricated controller cabinet base shall meet the requirement of ASTM D543 Section 7, Procedure 1. Provide a copy of all test reports from a certified lab along with the materials certification package.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.33 Loop Lead-In Cable

A. Requirements

Ensure that loop detector lead-in cable is No. 18 AWG, 3-pair shielded cable that meets IMSA specification #50-2.

Ensure that identification markings are stamped on the jacket.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.34 Loop Detector Wire

A. Requirements

Ensure that loop detector wire, meets IMSA specification 51- -3 and is 14 AWG.

For special applications loop detection wire that meets IMSA specification 51-7, 14 AWG, may be used as directed by the Engineer.

Stamp identification markings on the cable jacket.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.35 Aerial & Duct Signal Cable

A. Requirements

Ensure that aerial or duct (conduit) No. 14 AWG, stranded, 7-conductor, with black polyethylene (PE) jacket and 600 V AC rating meets IMSA specification #20-1. Use conductors that are straight, not twisted pairs.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.36 Self-Supporting Twisted Pair Aerial Signal Communications Cable

A. Requirements

Ensure that self-supporting, figure eight, aerial signal communications cable, No. 19 AWG, stranded 6-pair conductors is rated at 600 V AC and meet IMSA specification #20-4-1984.

Use conductors that are twisted pairs with copper tape shield under a black PE jacket. Ensure that messenger strand is 0.25 inch (6 mm), 7-strand and conforms to ASTM A 475 Siemens-Martin grade or better with a Class A coating.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.37 Underground Feeder Cable, Type UF

A. Requirements

Ensure that underground feeder cable, Type UF w/ground has two (2) conductors with pvc/nylon jacket and a minimum 600 V AC rating per UL #493. Two-conductor, No. 6 AWG wire may be used.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.38 Messenger & Guy Strand (Span Wire)

A. Requirements

Ensure that all messenger and guy strand (span wire) conforms to ASTM A 475 Extra High Strength grade or better with a Class A coating, 7-wire span wire.

Ensure ¼-inch (6 mm) Messenger & guy strand shall be used to support interconnect cable or as tether spans.

Messenger & guy strand 0.31 inch (7 mm) shall be used only where it is essential to match an existing 0.31inch (7 mm) span wire that will not be replaced as part of a new installation.

Ensure all span wire for signal heads, blank out sign, optically programmed heads, lane control signs, standard, aerial or sidewalk guys uses a minimum Messenger & guy strand 0.38 inch (9 mm) as a minimum size.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.39 Power Disconnect Box

A. Requirements

Ensure that all power disconnect boxes are NEMA 3R 240 V AC, 60 Amp Phase 1(metal non-fused 2 pole). Ensure the disconnect box is supplied with a padlock keyed as per directions of District Signal Engineer. Provide power disconnect box that is not fused and does not have a circuit breaker. Supply with a service grounding kit.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.40 Cable Ties

A. Requirements

Ensure that all cable ties are nylon, ultraviolet resistant black and consist of the following as a minimum:

Nominal Length	**8 inches (200 mm)**
Width	**0.30 inches (7 mm)**
Tensile Strength	**120 pounds (55 kg)**

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.41 Lashing Rod

A. RequirementsEnsure that all lashing rods are sized in accordance with messenger and cable(s) diameters to be supported. Provide lashing rods that are of the same material as the messenger or guy strand.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.42 Stainless Steel Lashing Wire

A. Requirements

Provide lashing wire that is type 316 stainless steel with 0.045 inch (1 mm) diameter.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.43 Guy Guards

A. Requirements

Ensure that all guy guards are high impact resistant PVC with ultraviolet stabilizers added for retention of color. Ensure that insulators attach to the guy so that they cannot easily be removed. Use guy guards which are yellow unless otherwise directed.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.44 Guy Strain Insulators

A. Requirements

Ensure guy strain insulators are protected from the environment including the effects of voltage, ultraviolet rays, and acid rain by a fully bonded, electrically tack-free, and impenetrable silicone rubber sheath. Each insulator shall be UL proof tested, and permanently marked to show date of test.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.45 Universal Closure Kit

A. Requirements

Supply a Universal Signal Closure Kit to seal the signal head at either the top or bottom. Ensure that the kit will fit any manufacturer's signal head (top or bottom) without the use of special tools or modification.

1. Ensure that the gasket is 60-70 durometer neoprene.

2. Ensure that Closure Cap is injection molded ABS plastic. The plastic is to be loaded with UV stabilizers.
3. Ensure that Adapter Bar is made so that it will secure the closure cap and compensate for varying thickness of signal heads.
4. Provide two # 10 (9mm) screws to fit any manufacturer's signal head. Ensure that one screw is 0.75 inches (19 mm) in length and the second screw is 1 inch (25 mm) in length.
5. Pack each assembly in a clear plastic bag. Mark the bag with the manufacturer's name and part number. Include the Universal Signal Closure Kit in a package containing the span wire clamp and Tri-Stud wire entrance fitting.
6. Ensure that the Closure Cap is molded to closely match the color of the signal head (Federal Yellow). The adapter bar and screws are to be zinc plated steel.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.46 Cast Aluminum Span Wire Clamp

A. Requirements

Provide Span Wire Clamps that are cast from Aluminum Alloy 713 or equivalent, free of voids, pits, dents, molding sand and excessive foundry grinding marks. Ensure that all design radii are smooth and intact.

Provide an exterior surface finish that is smooth and cosmetically acceptable, free of molding fins, cracks and other exterior blemishes. Ensure that span wire clamps are fabricated from aluminum ingot with minimum requirements as follows:

ALUMINUM ALLOY No.	713
YIELD STRENGTH, ksi (MPa)	25 (172)
TENSILE STRENGTH, ksi (MPa)	35 (240)
BRINELL HARDNESS	75
ELONGATING [% in 2 inches (50 mm)]	3

1. Ensure that the Span Wire Clamp can accommodate cables 0.25 inch (6 mm) to 0.63 inch (16 mm) diameter.
2. Ensure that the weight is less than 1.75 pounds (0.8 kg) with hardware.
3. Ensure that the Span Wire Clamp have a minimum overall length of 7 inches (175 mm).
4. Ensure that the Span Wire Clamp have a centerline dimension from cable to clevis pin of 2 inches (50 mm) [+/- 0.5 inches (13 mm)].
5. Ensure that the Span Wire Clamp have a cast aluminum cable bar to protect the cable when tightening the U-bolts.
6. Ensure that the Span Wire Clamp have a mounting opening of 0.75 inches (19 mm) [+/- 0.03 inches (0.8 mm)].
7. Ensure that the Span Wire Clamp have 0.5 inch (13 mm) - 13 NPT U-bolts with 0.5 inch (13 mm) lock washers and nuts.
8. Ensure that the clevis pin are 0.63 inch (16 mm) diameter with a length of 2.25 inches (56 mm) and secured with a hump back stainless steel cotter pin.
9. Ensure that the Clamp and Cable Bar have an Alodine 1200 conversion coating to help resists oxidation.
10. Ensure that the Clevis Pin and hardware are galvanized per ASTM 123/A 123M or stainless steel.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.47 Cast Aluminum Tri-Stud Span Wire Entrance Fitting

A. Requirements

Ensure that the Tri-Stud Span Wire Entrance Fittings are cast from Aluminum Alloy 713 or equivalent, free of voids, pits, dents, molding sand and excessive foundry grinding marks.

Ensure that the all design radii are smooth and intact. Ensure that the exterior surface finish is smooth and cosmetically acceptable, free of molding fin, cracks and other exterior blemishes.

Ensure that the material is fabricated from aluminum ingot with minimum requirements as follows:

ALUMINUM ALLOY No.	713
YIELD STRENGTH, ksi (MPa)	25 (172)
TENSILE STRENGTH, ksi (MPa)	35 (240)
BRINELL HARDNESS	75
ELONGATION [% in 2 inches (50 mm)]	3

1. Ensure that the Tri-Stud Span Wire Entrance fitting has a mounting support at the top of the wire entrance 0.69 inches (17 mm) thick [+/- 0.07 inches (1.5 mm)].
2. Ensure that the Tri-Stud Span Wire Entrance fitting weight is not less than 1.75 pounds (0.8 kg) with hardware.
3. Ensure that the mounting support has at least six (6) clevis openings for adjustment with suspension bracing between every two (2) openings.
4. Ensure that the Tri-Stud Span Wire Entrance has a minimum of 0.5 inch (13 mm) diameter throughout for wire access and that wire access is free of burrs and casting webs.
5. Ensure that the Wire Entrance opening is recessed and has a neoprene grommet with sealed membrane sections.
6. Ensure that the signal head attachment end is serrated and has a minimum of 3-signal head centering bosses extending 0.19 inches (5 mm) from the serrations.
7. Ensure that the serrations have a 72-tooth design to match the signal head.
8. Ensure that three (3) stainless steel studs are cast into the wire entrance fitting. Ensure that the studs are 0.31 inches (7 mm) and extend 1.5 inches (38 mm) [+/- 0.13 inches (4 mm)] beyond the serrations. Provide each Tri-Stud span wire entrance fitting with a Tri-Stud hardware kit.
9. Ensure that the Tri-Stud Span Wire Entrance Fitting has an alodine conversion coating to provide a proper base for paint adhesion. Ensure that the assembly matches display housing (per plans) and baked in a drying oven after painting.
10. Ensure that the all Hardware is galvanized or stainless steel.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.48 Bull Rings

A. Requirements

Provide bull rings that are galvanized weldless steel 0.63 inch (16 mm) diameter. Submit catalog cuts for approval.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.49 Ramp Meter Enforcement Device

A. Requirements

For each metered lane, provide one ramp meter enforcement device mounted on the back of one signal per lane and wired directly to the red signal display, (Refer to 647.3.05.L). This installation shall include a Red 44 LED Array (allnGaP), Pixel housing, 6061 aluminum powder coated swivel bracket, 2 inch lens, with an aluminum hood. Mounted and adjusted as per the Plans.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

925.2.50 Vinyl Electrical Tape

A. Requirements

Ensure electrical tape used is flame retardant, cold and weather resistant. Provide tape that is rated for 600 volts and for use between 0 F (-18 C) and 176 F (80 C).

Ensure tape is 0.0085 inches (0.2 mm) thick and meets the requirements of UL 510 and Mil-I-24391. Provide tape that remains flexible with abrasion resistance.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

Refer to Subsection 925.2.01.D for Materials Warranties.

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

PLAN OF PROPOSED
P. I. NO: 0011440
COUNTY: TALBOT

FEDERAL ROUTE: N/A
STATE ROUTE: N/A

IS LOCATED: 100 % WITHIN CONGRESSIONAL DISTRICT NO. 2

IS LOCATED: 100 % WITHIN TALBOT COUNTY

WASHINGTON IS COUNTY NO. 263

MID-POINT COORDINATES (32°44'54.1"N, 84°25'34.5"W): (EAST) ZONE

COMPLETED PLANS:

LENGTH OF PROJECT IN MILES	
	TOTAL
NET LENGTH OF PROJECT	8.90
NET LENGTH OF EXCEPTIONS	00.00
GROSS LENGTH OF PROJECT	8.90

PRESENT TRAFFIC: 1780 AADT

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7/9/2014
USER:nwilkinson
GPLOT-V8
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T:\0011440 TIA\DGN\0011440_01-001.dgn
GRMCOV

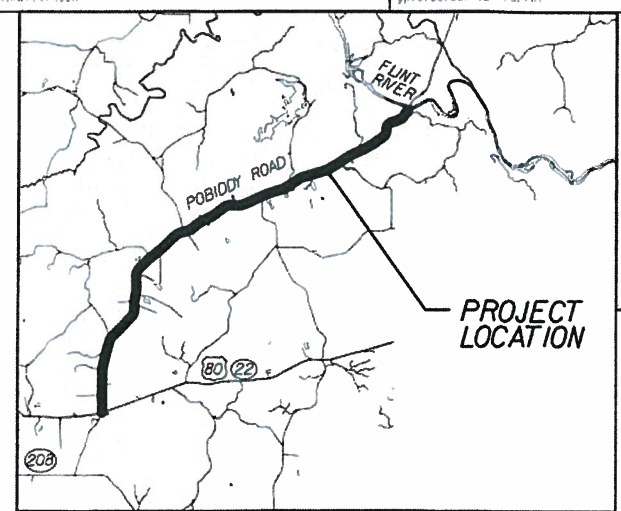
STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
GA	0011440	1	10

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

PLAN AND PROFILE OF PROPOSED
POBIDDY RD RESURFACING AND IMPROVEMENTS

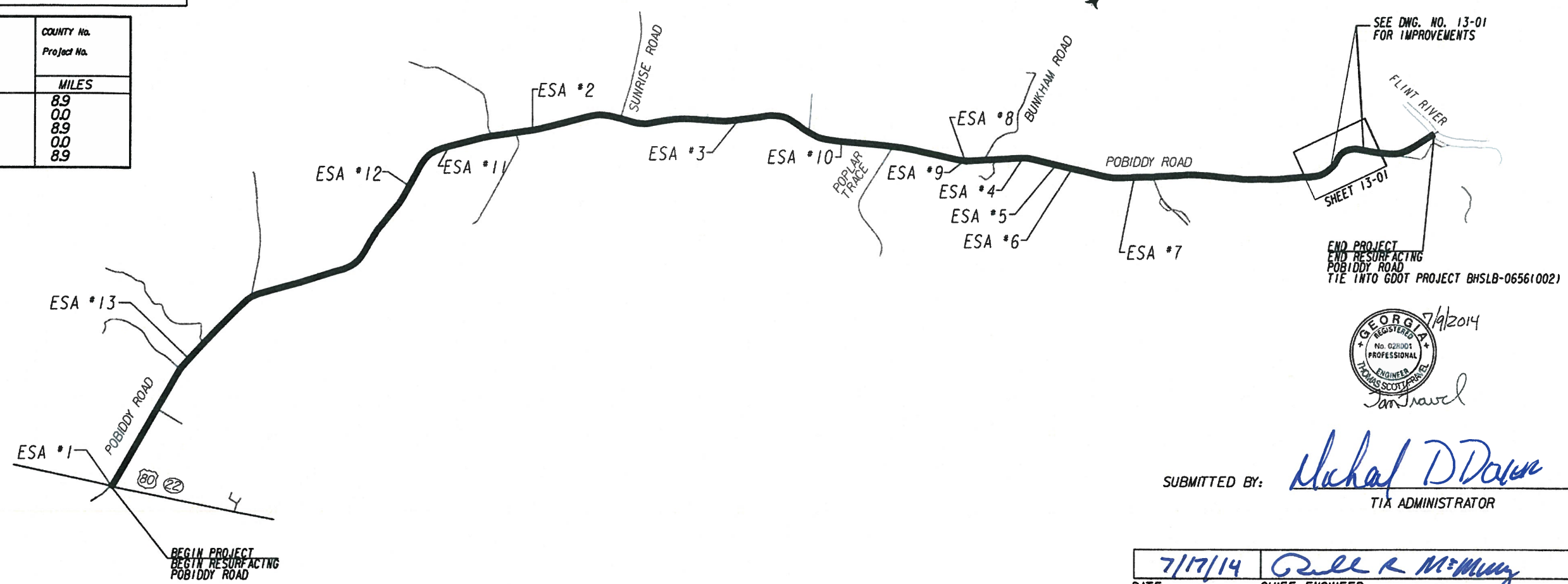
T.I.A. PROJECT NO.: RC08-000087

P.I. NO.: 0011440



LOCATION SKETCH

LENGTH OF PROJECT	COUNTY No. / Project No.
	MILES
NET LENGTH OF ROADWAY	8.9
NET LENGTH OF BRIDGES	0.0
NET LENGTH OF PROJECT	8.9
NET LENGTH OF EXCEPTIONS	0.0
GROSS LENGTH OF PROJECT	8.9



GEORGIA REGISTERED No. 02R001 PROFESSIONAL ENGINEER THOMAS SCOTT PRACH
7/9/2014

SUBMITTED BY: Michael D Dover
TIA ADMINISTRATOR

DATE	CHIEF ENGINEER
7/17/14	Paul R McMurry

PLANS COMPLETED 07-09-2014	
REVISIONS	

THE DATA, TOGETHER WITH ALL OTHER INFORMATION SHOWN ON THESE PLANS OR IN ANYWAY INDICATED THEREBY, WHETHER BY DRAWINGS OR NOTES, OR IN ANY OTHER MANNER, ARE BASED UPON FIELD INVESTIGATIONS AND ARE BELIEVED TO BE INDICATIVE OF ACTUAL CONDITIONS. HOWEVER, THE SAME ARE SHOWN AS INFORMATION ONLY, ARE NOT GUARANTEED, AND DO NOT BIND THE DEPARTMENT OF TRANSPORTATION IN ANY WAY. THE ATTENTION OF BIDDER IS SPECIFICALLY DIRECTED TO SUBSECTIONS 102.04, 102.05, AND 104.03 OF THE SPECIFICATIONS.

THIS PROJECT HAS BEEN PREPARED USING THE HORIZONTAL GEORGIA COORDINATE SYSTEM OF 1984 (NAD 1983)/94 WEST ZONE, AND THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988.

PLANS PREPARED AND SUBMITTED BY:

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DESIGN CONSULTANT

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N.T.S.

DRAWING NO. 01-01

5/20/2011

GENERAL NOTES
P. I. NO: 0011440
COUNTY: TALBOT

1. ALL REFERENCES IN THIS DOCUMENT, WHICH INCLUDES ALL PAPERS, WRITINGS, DOCUMENTS, DRAWINGS, OR PHOTOGRAPHS USED, OR TO BE USED, IN CONNECTION WITH THIS DOCUMENT, TO THE STATE HIGHWAY DEPARTMENT OF GEORGIA, STATE HIGHWAY DEPARTMENT, GEORGIA STATE HIGHWAY DEPARTMENT, HIGHWAY DEPARTMENT, OR DEPARTMENT WHEN THE CONTEXT THEREOF MEANS THE STATE HIGHWAY DEPARTMENT OF GEORGIA, SHALL BE DEEMED TO MEAN, THE DEPARTMENT OF TRANSPORTATION.
2. THE DATA, TOGETHER WITH ALL OTHER INFORMATION SHOWN ON THESE PLANS, OR IN ANY WAY INDICATED THEREBY, WHETHER BY DRAWINGS OR NOTES, OR IN ANY OTHER MANNER, ARE BASED UPON FIELD INVESTIGATIONS AND ARE BELIEVED TO BE INDICATIVE OF ACTUAL CONDITIONS. HOWEVER, THE SAME ARE SHOWN AS INFORMATION ONLY, ARE NOT GUARANTEED AND DO NOT BIND THE DEPARTMENT OF TRANSPORTATION IN ANYWAY. THE ATIENTION OF THE BIDDER IS SPECIFICALLY DIRECTED TO SECTIONS 102.04, 102.05, AND 104.03 OF THE SPECIFICATIONS.
3. GEORGIA STANDARDS HAVE BEEN REFERENCED IN THE PLANS FOR THE CONTRACTOR'S INFORMATION. IF COPIES OF THE GEORGIA STANDARDS ARE DESIRED, CONTACT THE G. D.O.T. AREA ENGINEER.
4. IN PREPARATION OF THE ROADWAY PRIOR TO RESURFACING, BLADE THE EXISTING SHOULDERS NO LOWER IN ELEVATION THAN THE EXISTING PAVEMENT OR SHOULDER. SHOULDER MATERIAL DISPLACED BY THE CLEANING OPERATION PRIOR TO RESURFACING SHALL BE REMOVED AND DISPOSED OF AT AN APPROVED DISPOSAL SITE OFF D.O.T. RIGHTOF-WAY. THE COST OF THIS WORK SHALL BE INCLUDED IN THE OVERALL BID PRICE.
5. THE WIDTH OF PAVING TURNOUTS FOR SIDEROADS AND DRIVES SHALL BE AS REQUIRED TO PROVIDE A SMOOTH AND WELL DRAINED TRANSITION TO AND FROM PUBLIC ROADS AND DRIVEWAYS AS APPROVED BY THE ENGINEER.
6. FLARES TO BE RESURFACED WILL REQUIRE NO ADDITIONAL BASE MATERIAL.
7. PLACE LEVELING COURSE AS EITHER SPOT LEVELING OR FULL WIDTH LEVELING OR BOTH AT THE DIRECTION OF THE ENGINEER.
8. PERFORM ALL PATCHING AS DIRECTED BY THE ENGINEER, PRIOR TO LEVELING AND RESURFACING OPERATIONS.
9. CONSTRUCTION WASTE OR DEBRIS SHALL BE PREVENTED FROM BEING ALLOWED TO FALL OR BE PLACED INTO THE EXISTING WATERWAYS. THE COST FOR THIS WORK SHALL BE INCLUDED IN THE OVERALL BID PRICE OF THE PROJECT.
10. ALL DRAINAGE STRUCTURES WITHIN THE LIMITS OF THE PROJECT WILL BE MAINTAINED THROUGHOUT THE DURATION OF THE PROJECT. ANY DEBRIS THAT GOES IN DRAINAGE STRUCTURES AS A RESULT OF THE CONSTRUCTION OPERATION WILL BE CLEANED OUT AT NO ADDITIONAL COST TO THE DEPARTMENT.
11. RESTRIPE ALL EXISTING ROADWAY WITH THERMOPLASTIC MARKINGS AT EXISTING LOCATIONS ON ROADWAY AND AS CURRENTLY MARKED. RESTRIPE ALL EXISTING ROADWAY MARKINGS ON SIDE ROADS TO THE END OF THE NEW RESURFACED SECTION. ALSO, RESTRIPE OR PAINT (WHERE NOT EXISTING) STOP BARS AT ALL PAVED SIDE ROADS AND STREETS. REFERENCE PAVEMENT MARKING DETAILS AND NOTES IN THE PLANS FOR LOCATING EDGE LINES.
12. ALL NEW HIGHWAY SIGNS SHALL BE TYPE I MATERIAL WITH HIGHLY REFLECTIVE TYPE 9 SHEETING.
13. NEW SIGNS SHALL BE INSTALLED IN ACCORDANCE TO THE MUTCD AND GDOT STDS AND DETAILS.
14. RAISED PAVEMENT MARKERS PER GDOT CONSTRUCTION DETAILS T-15A SHALL BE INSTALLED ON THE PROJECT.
15. TEMPORARY STRIPING IS REQUIRED IN ACCORDANCE WITH SECTION 150.04 OF THE GEORGIA SPECIFICATIONS. PLACEMENT OF PERMANENT PAVEMENT MARKINGS SHALL NOT BEGIN UNTIL THE FINAL SURFACE COURSE HAS BEEN COMPLETED FOR FIFTEEN (15) CALENDAR DAYS AND WILL BE COMPLETED WITHIN FORTY FIVE (45) CALENDAR DAYS AFTER THE SURFACE COURSE HAS BEEN COMPLETED. FAILURE TO PLACE PERMANENT PAVEMENT MARKINGS AS SPECIFIED WILL RESULT IN LIQUIDATED DAMAGES TO BE ASSESSED IN ACCORDANCE WITH SUBSECTION 108.08 OF THE SPECIFICATIONS.
16. REHABILITATE THE EARTH SHOULDERS IN ACCORDANCE WITH DETAILS AND NOTES IN THE PLANS. THE FILLING SHALL INCLUDE GRADING, FURNISHING AND PLACEMENT OF BORROW MATERIAL. FILLING WORK SHALL BE PERFORMED AND PAID FOR IN ACCORDANCE WITH SECTION 210 OF THE SPECIFICATIONS EXCEPT AS NOTED IN DETAILS.
17. COMPLETE EARTH SHOULDER FILLING WORK WITHIN THIRTY (30) CALENDAR DAYS AFTER COMPLETION OF RESURFACING ROADWAY. FAILURE TO COMPLETE EARTH SHOULDER FILLING WORK WITHIN THIS TIME FRAME WILL RESULT IN LIQUIDATED DAMAGES ASSESSED IN ACCORDANCE WITH SECTION 108.08 OF THE SPECIFICATIONS.
18. GRASS ALL AREAS OF EARTH SHOULDER FILLING. GRASSING SHALL BE PERFORMED AND PAID FOR IN ACCORDANCE WITH SECTION 700 OF THE SPECIFICATIONS.
19. ALL BORROW AND WASTE SITES FOR THIS PROJECT SHALL BE ENVIRONMENTALLY APPROVED PRIOR TO CONSTRUCTION ACTIVITIES OCCURING IN THEM. ALL COMMON FILL OR EXCESS MATERIAL DISPOSED OUTSIDE THE PROJECT RIGHT OF WAY SHALL BE PLACED IN EITHER A PERMITIED SOLID WASTE FACILITY, A PERMITIED INERT WASTE LANDFILL OR IN AN ENGINEERED FILL. SEE SECTION 201 OF THE STANDARD SPECIFICATION AND SUPPLEMENTS THERETO FOR ADDITIONAL INFORMATION.
20. THIS PROJECT DOES NOT REQUIRE A NOI.
21. BELOW IS A TABLE LISTING ENVIONMENTALLY SENSITIVE AREAS (ESA'S). THE CONTRACTOR SHALL ENSURE THAT ALL CONSTRUCTTION RELATED ACTIVITIES IN PLACES ADJACENT TO ESA'S (EASEMENTS, STAGING, VEHICULAR USE, BORROW OR WASTE ACTIVITIES, CONSTRUCTION TRAILER PLACEMENT AND STAGING) BE RESTRICTED TO THE EXISTING RIGHT-OF-WAY. NO CLEARING ACTIVITIES WILL BE PERMITTED WITHIN THE ESA'S. THE CONTRACTOR SHALL INSTALL ORANGE BARRIER FENCING AT THE ESA'S TO ENSURE THAT THE ESA'S ARE NOT ADVERSELY IMPACTED DURING PROJECT CONSTRUCTION.

ESA TABLE:

ESA Number	Type	Start OBF Latitude/Longitude Points	Stop OBF	N_Start	E_Start	N_End	E_End
ESA #1	Historic Tree	-84.281971 W 32.412587 N	-84.281976 W 32.412540 N	978,755.29	2,202,603.47	978,708.42	2,202,603.47
ESA #2	Cemetery	-84.270943 W 32.441022 N	-84.270762 W 32.441152 N	995,347.08	2,208,656.66	995,477.11	2,208,812.97
ESA #3	Historic Tree	-84.26.0344 W 32.44.4645 N	-84.260263 W 32.444691 N	998,992.05	2,214,303.40	999,041.53	2,214,371.11
ESA #4	Historic Tree	-84.242254 W 32.452183 N	-84.242368 W 32.452134 N	1,002,550.27	2,222,925.91	1,002,494.93	2,222,825.00
ESA #5	Historic Tree	-84.240939 W 32.452551 N	-84.241049 W 32.452530 N	1,002,897.90	2,223,957.77	1,002,864.50	2,223,843.98
ESA #6	Historic Trees	-84.240939 W 32.452551 N	-84.240094W 32.452771 N	1,002,916.45	2,224,049.30	1,003,134.91	2,224,779.42
ESA #7	Ephemeral Stream	-84.394982 W 32.759677 N	-84.395214 W 32.759546 N	1,003,852.26	2,226,398.09	1,003,803.87	2,226,327.78
ESA #8	Ephemeral Stream	-84.411175 W 32.753303 N	-84.411367 W 32.75320 N	1,001,545.03	2,221,415.35	1,001,507.66	2,221,356.54
ESA #9	Ephemeral Stream	-84.41173 W 32.753282 N	-84.411586 W 32.753342 N	1,001,559.73	2,221,288.83	1,001,537.21	2,221,244.11
ESA #10	Ephemeral Stream	-84.423531 W 32.749212 N	-84.423762 W 32.749131 N	1,000,064.22	2,217,613.70	1,000,034.27	2,217,542.52
ESA #11	Ephemeral Stream	- 84.459060 W 32.731326 N	-84.459269 W 32.731166 N	993,586.16	2,206,672.34	993,527.13	2,206,608.43
ESA #12	Ephemeral Stream	-84.461075 W 32.726703 N	-84.461074 W 32.726568 N	991,907.06	2,206,048.13	991,856.71	2,206,048.78
ESA #13	Ephemeral Stream	-84.471819 W 32.703720 N	-84.471861 W 32.703563 N	983,554.81	2,202,720.29	983,496.22	2,202,706.83

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POBIDDY ROAD

DRAWING No. 04-01

GENERAL NOTES
P. I. NO: 0011440
COUNTY: TALBOT

22. CLEARING OF RIGHT OF WAY WORK CONSISTS OF CLEARING, REMOVING AND DISPOSING OF ALL VEGETATION AND DEBRIS IN AREAS OUTSIDE THE CONSTRUCTION LIMITS AS SPECIFIED, EXCEPT SUCH OBJECTS AS ARE DESIGNATED BY THE ENGINEER TO REMAIN OR TO BE REMOVED IN ACCORDANCE WITH THE PLANS OR OTHER SECTIONS OF THE SPECIFICATIONS. THIS WORK ALSO INCLUDES THE PRESERVING (FROM INJURY OR DEFACEMENT) VEGETATION AND OBJECTS DESIGNATED TO REMAIN. DO NOT DISTURB GRASS AREAS AND DO NOT CONDUCT ANY GRUBBING OPERATIONS ON ANY AREAS.

A. CLEARING CONSISTS OF THE REMOVAL FROM 30 FEET ON EITHER SIDE OF THE CENTERLINE AND PROPER DISPOSAL OF ALL EXPOSED OBJECTIONABLE MATTER WITHIN THE CLEARING LIMITS SHOWN ON THE DETAIL. OBJECTIONABLE MATTER INCLUDES TREES, BRUSH, LOGS, DECAYED VEGETABLE MATTER, POLES, STUBS, RUBBISH, REFUSE DUMPS, SAWDUST PILES, AND OTHER DEBRIS RESTING ON THE GROUND SURFACE OR IN PAVED DITCHES AND PLUMES. DO NOT DISTURB LANDSCAPED AREAS UNLESS DIRECTED OTHERWISE BY THE ENGINEER.

B. PRIOR TO COMMENCEMENT OF ANY CLEARING OPERATIONS, ESTABLISH THE CLEARING LIMITS BY PLACING A STAKE LINE ALONG THE CLEARING LIMITS AS DIRECTED BY THE CLEARING DETAIL. ENSURE THIS STAKE LINE REMAINS IN PLACE AND VISIBLE FOR THE DURATION OF THE PROJECT. ENSURE THE STAKE LINE CONSISTS OF A MINIMUM 36" (900 MM) WOODEN STAKES TOPPED WITH ORANGE FLAGGING TAPE AND INSTALLED AT A MAXIMUM OF 100 FT (30 M) ON CENTER. IF THE STAKES ARE DAMAGED AT ANY TIME, REESTABLISH THE STAKE LINE IMMEDIATELY BEFORE CLEARING OPERATIONS RESUME.

C. REMOVE ALL TREES, BRUSH, STUMPS AND ROOTS PROJECTING THROUGH OR APPEARING ON THE SURFACE OF THE GROUND BY CUTTING OR GRINDING TO WITHIN 4" OF THE SURROUNDING GROUND SURFACE. REMOVE AND HAUL OFF ALL EXISTING VEGETATION DEBRIS AND DEBRIS PRODUCED BY REMOVAL PROCESS, INCLUDING MULCH MATERIAL, TO FACILITATE GRASSING OPERATIONS, UNLESS SPECIFIED OTHERWISE ON THE PLANS. TREES OUTSIDE THE LIMITS OF CLEARING SHALL HAVE ALL TREE BRANCHES THAT EXTEND WITHIN THE LIMITS OF CLEARING AREA REMOVED BACK TO THE BRANCH BARK RIDGE AT THE TREE TRUNK.

D. TREAT ALL STUMPS (EXCEPT PINE STUMPS) WITH A HERBICIDE THAT CONTAINS A MINIMUM 13.6% OF THE ACTIVE INGREDIENT TRICLOPYR. HERBICIDES USED ON STUMPS SHALL HAVE AN APPROVED DYE FOR INSPECTION PURPOSES. TREAT STUMPS INCLUDING ENTIRE CUT AREA AND THE SIDES OF STUMP UNTIL WET. APPLY THE HERBICIDE IMMEDIATELY OR WITHIN 15 MINUTES OF CUT. ALLOW THE HERBICIDE TWO WEEKS TO ADSORB INTO ROOT SYSTEM BEFORE GRINDING STUMP. PERFORM ALL HERBICIDE APPLICATIONS UNDER THE DIRECT SUPERVISION OF A PERSON WHO HAS A COMMERCIAL PESTICIDE LICENSE WITH CATEGORY 27-RIGHT OF WAY PEST CONTROL. APPLY HERBICIDES ONLY DURING PROPER WEATHER CONDITIONS. ENSURE THAT HERBICIDE STORAGE, APPLICATION, STORAGE AND DISPOSAL IS IN ACCORDANCE WITH ALL MANUFACTURER'S RECOMMENDATIONS AND ALL LOCAL, STATE AND FEDERAL REGULATIONS.

ALONG WITH HERBICIDE APPLICATION, TREAT VEGETATION IN AREAS TO BE CLEARED AS FOLLOWS:

1. WOODY TYPES
CUT INVASIVE WOODY PLANTS FLUSH WITH THE GROUND IN MOWABLE AREAS AND 3 INCHES (75 MM) OR LESS IN HEIGHT IN NONMOWABLE AREAS. TREAT ALL STUMPS ACCORDING TO SUBSECTION 202.3.05.B.4 OF THIS SPECIFICATION.

2. VINE TYPES
SPRAY INVASIVE VINES DURING THE GROWING SEASON WITH A HERBICIDE THAT IS LABELED TO CONTROL THE SPECIFIC SPECIES. APPLY THE SPRAY ACCORDING TO THE MANUFACTURER'S RECOMMENDATIONS. OBTAIN THE ENGINEER'S APPROVAL OF THE HERBICIDE PRIOR TO ITS USE. SPRAY FOLIAGE THAT IS WITHIN 4 FEET OF THE GROUND. NO FOLIAR SPRAY SHALL BE ABOVE 4 FOOT HIGH. CUT VINES THAT EXTEND ABOVE 4 FEET AND TREAT AS WOODY PLANTS.

3. GRASS TYPES
SPRAY INVASIVE GRASSES WITH A HERBICIDE THAT IS LABELED TO CONTROL THE SPECIFIC SPECIES. APPLY THE SPRAY ACCORDING TO THE MANUFACTURER'S RECOMMENDATIONS. OBTAIN THE ENGINEER'S APPROVAL OF HERBICIDE PRIOR TO ITS USE.

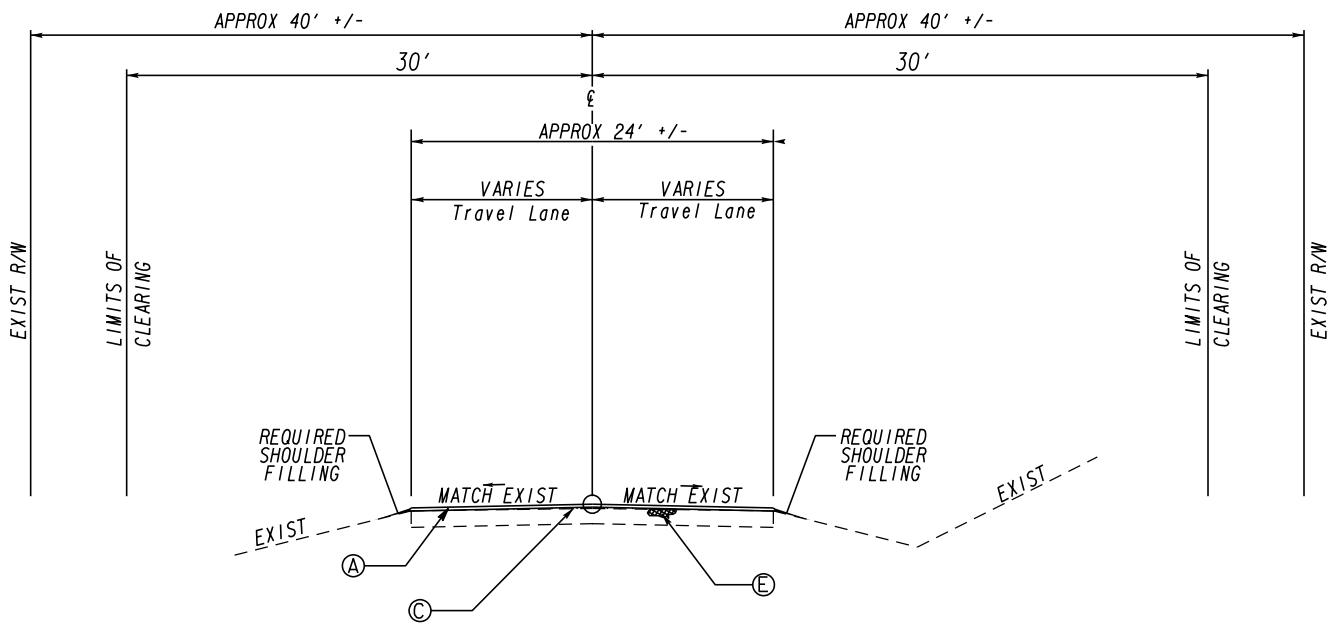
E. RESTORE ORIGINAL GRADES FOR ANY AREA THAT IS DISTURBED BY THIS OPERATION. GRASS AND PLACE WOOD FIBER BLANKET, TYPE II ON ALL AREAS DISTURBED BY THE WORK. FOR ALL DISTURBED AREAS, ENSURE THAT FINAL STABILIZATION OCCURS PRIOR TO COMPLETION OF A WORKDAY OR PRIOR TO A RAIN EVENT, WHICHEVER COMES FIRST. USE WOOD FIBER BLANKET THAT MEETS THE REQUIREMENTS OF SECTION 713. APPLY THE BLANKET AT THE APPLICATION RATE OF 3,000 LBS./ACRE (3.4 MG/HA) FOR 4:1 OR FLATTER SLOPES, 3,600 LBS./ACRE (4.1 MG/HA) FOR SLOPES BETWEEN 4:1 AND 2:1, AND 4,000 LBS./ ACRE (4.5 MG/HA) FOR SLOPES STEEPER THAN 2:1. APPLY GRASS SEED WITH THE WOOD FIBER MULCH. FERTILIZER AND LIME WILL NOT BE REQUIRED AT TIME OF SEEDING. UPON SEED GERMINATION, APPLY FERTILIZER AND LIME AS REQUIRED BY SECTION 700. GROUND PREPARATION OF MOWABLE AREAS SHALL BE LIGHTLY RAKED OR SCARIFIED AND GROUND PREPARATION OF NON-MOWABLE AREAS SHALL BE WALKED WITH A CLEATED TRACK DOZER. PLANT GRASS AS SPECIFIED AND APPLY GRASS SEED PER THE TABLE BELOW:

AREA	TYPE GRASS FEED	APPLICATION RATE
MOWABLE AREAS	COMMON BERMUDA	20 LBS/ACRE (22 KG/HA) 10 LBS (11 KG) HULLED 10 LBS (11 KG) UNHULLED
	ELYMUS CANADENSIS (PRAIRIE WILDRYE)	[5 LBS/ACRE (6KG/HA)-ADD IF SEEDING BETWEEN AUG. 1 TO FEB. 28]
NON-MOWABLE AREAS	COMMON BERMUDA	20 LBS/ACRE (22 KG/HA) 10 LBS (11 KG) HULLED 10 LBS (11 KG) UNHULLED
	ELYMUS CANADENSIS (PRAIRIE WILDRYE)	[5 LBS/ACRE (6KG/HA)-ADD IF SEEDING BETWEEN AUG. 1 TO FEB. 28]

PRAIRIE WILDRYE SHALL BE PLANTED AS A NURSE (TEMPORARY) GRASS DURING THE TIMES SPECIFIED ABOVE. COMMON BERMUDAGRASS SHALL BE THE PERMANENT GRASS REQUIRED ON MOWABLE AND NON-MOWABLE AREAS UPON FINAL ACCEPTANCE.

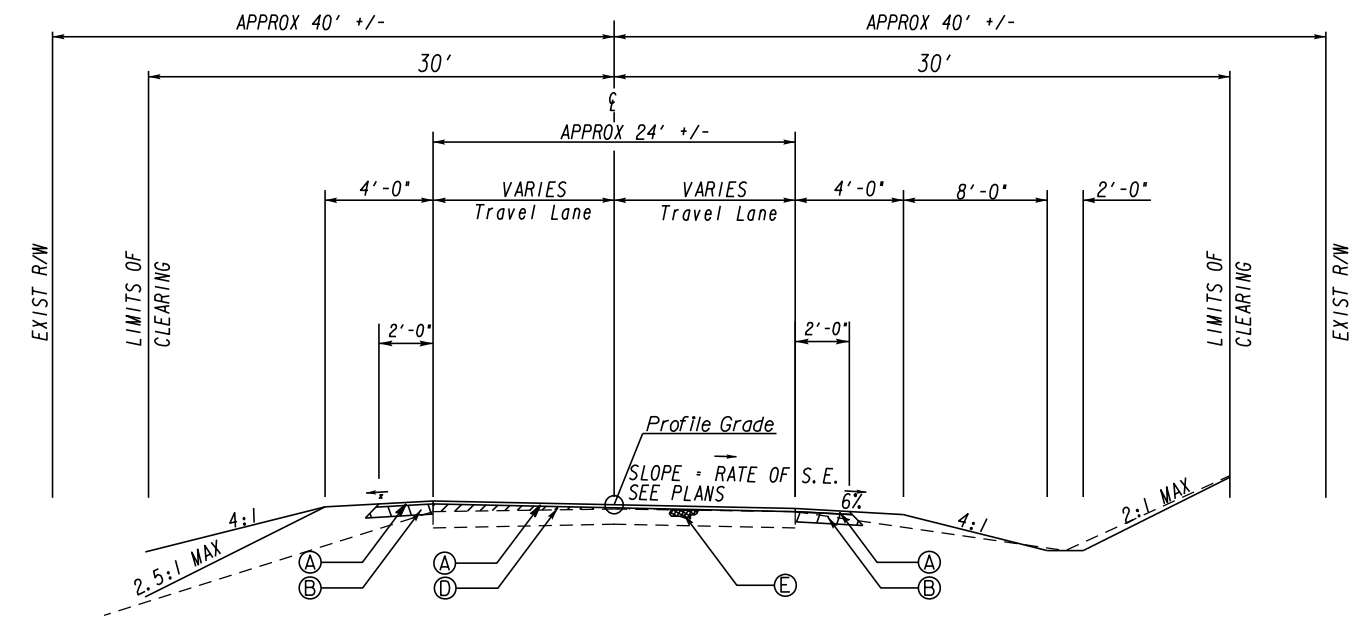
F. ANY MATERIAL SALVAGED BY THE CONTRACTOR FROM THE REMOVAL OF TIMBER WILL BECOME THE PROPERTY OF THE CONTRACTOR AND SHALL BE REMOVED FROM THE RIGHT OF WAY. THE CONTRACTOR IS STRONGLY ENCOURAGED TO OBTAIN A SUBCONTRACTOR EXPERIENCED IN TIMBER OPERATIONS TO PERFORM CLEARING OF VEGETATION AS SPECIFIED IN THE CONTRACT. DISPOSE OF MATERIALS FROM INVASIVE PLANTS OFF THE RIGHT OF WAY IN A MANNER THAT DOES NOT ALLOW PROPAGATION OF THE PLANTS. DEPOSIT ALL OTHER MATERIAL IN AN APPROVED DISPOSAL SITE OFF THE RIGHT OF WAY. BURNING WILL NOT BE PERMITTED ON THE RIGHT OF WAY. OBTAIN SUITABLE AREAS FOR BURNING OR DISPOSING OF THE COMBUSTIBLE MATERIAL AT NO ADDITIONAL EXPENSE TO THE DEPARTMENT. ENSURE THAT ALL DISPOSAL AREAS ARE APPROVED BY THE DEPARTMENT AND DISPOSED AS SPECIFIED. WHEN A DISPOSAL AREA IS LOCATED ON PRIVATE PROPERTY, PRESENT TO THE ENGINEER WRITTEN AUTHORITY, SIGNED BY THE PROPERTY OWNER, GRANTING THE CONTRACTOR AND THE DEPARTMENT PERMISSION TO USE THE AREA FOR THE PURPOSE INTENDED. RECLAIM THE DISPOSAL AREA ACCORDING TO SECTION 160.

G. PAYMENT FOR GENERAL NOTE #22 INCLUDING REQUIREMENTS A THROUGH G UNDER CLEARING OF RIGHT OF WAY, COMPLETED AND ACCEPTED, WILL BE PAID FOR UNDER GRADING COMPLETE. THE PAYMENT WILL BE FULL COMPENSATION FOR ALL WORK SPECIFIED INCLUDING GRASSING, PLACEMENT OF WOOD FIBER BLANKET IN THE CLEARED AREAS, FERTILIZER AND LIME REQUIREMENTS AND FINAL CLEANUP AS REQUIRED.



TS-1

BEGINNING OF PROJECT TO STA. 447+00.00
STA. 459+09.45 TO END OF PROJECT

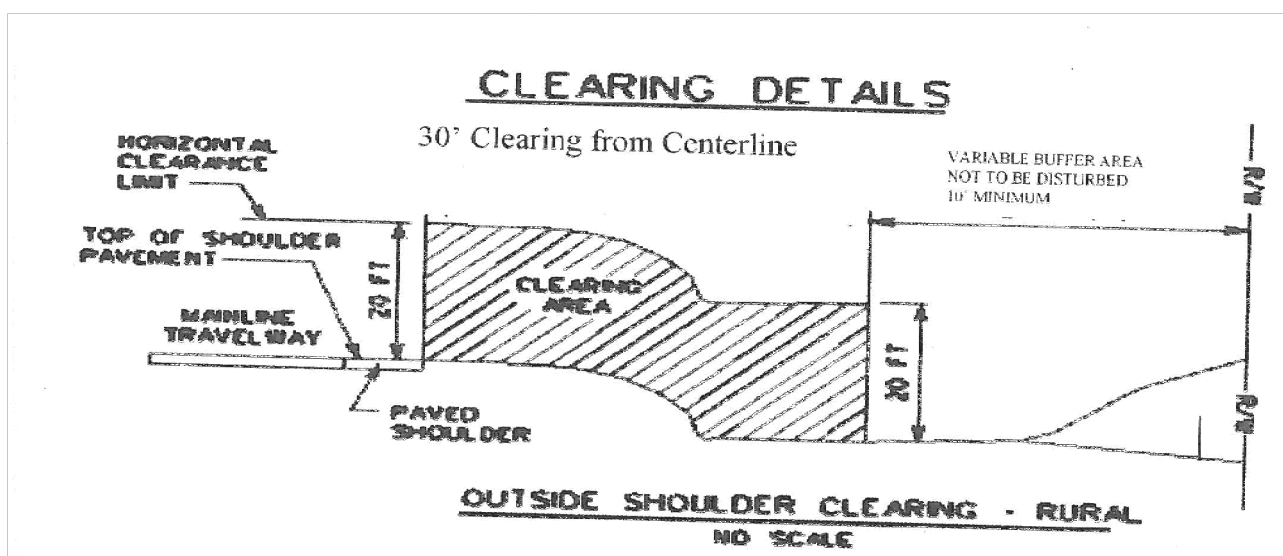


TS-2
STA. 447+00.00 TO STA. 459+09.45

Ⓐ RECYCLED ASPHALTIC CONCRETE 9.5 mm SUPERPAVE, 135 LBS/SY (TP 1, GP 1 OR BL 1, INCL BM & HL)
Ⓑ RECYCLED ASPHALTIC CONCRETE 19 mm SUPERPAVE, 440 LBS/SY (GP 1 OR 2, INCL BM & HL)
Ⓒ LEVELING, 35 LBS/SY
Ⓓ LEVELING, AS REQUIRED
Ⓔ DEEP PVMT PATCHING, 25 mm SUPERPAVE, 440 LBS/SY, AS DIRECTED BY ENGINEER

* SHOULDER TO SLOPE AT 6%. HOWEVER THE ALGEBRAIC DIFFERENCE IN PAVING SLOPE & SHOULDER SLOPE IS TO NOT EXCEED 8%.

** SEE CROSS SECTIONS FOR SLOPE AND WIDTH.



NOTES: MEASURE ALL VERTICAL CLEARANCE HEIGHTS TO 20 FEET FROM ACTUAL GROND ELEVATION.
* - VEGETATED BUFFER AREA. DO NOT PERFORM ANY WORK IN THIS AEA.

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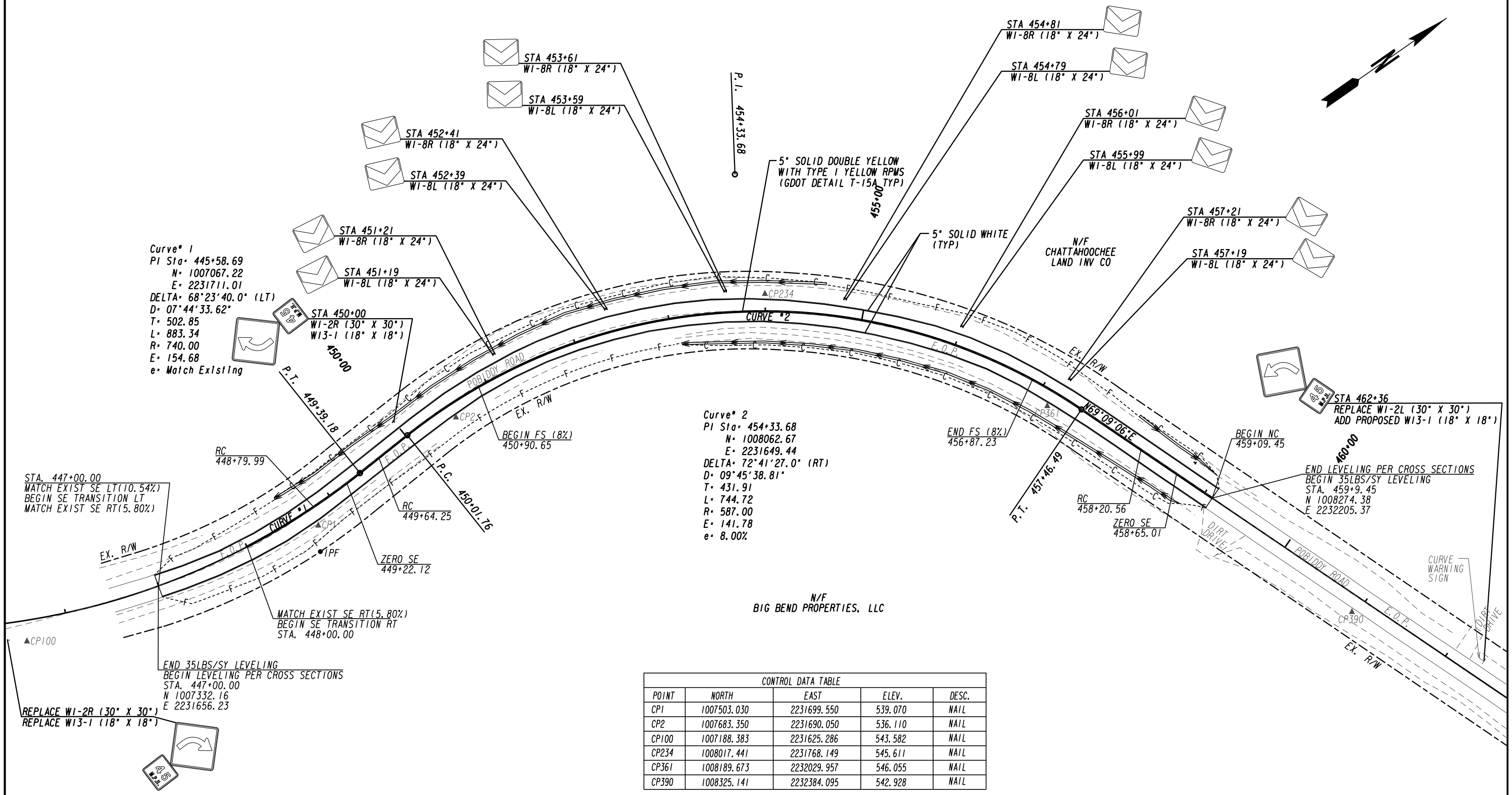

CONTROL DATA TABLE				
POINT	NORTH	EAST	ELEV.	DESC.
CP1	1007503.030	2231699.550	539.070	NAIL
CP2	1007683.350	2231690.050	536.110	NAIL
CP100	1007188.383	2231625.286	543.582	NAIL
CP234	1008017.441	2231768.149	545.611	NAIL
CP361	1008189.673	2232029.957	546.055	NAIL
CP390	1008325.141	2232384.095	542.928	NAIL

PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS

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0 50 100 200

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Pobiddy Road

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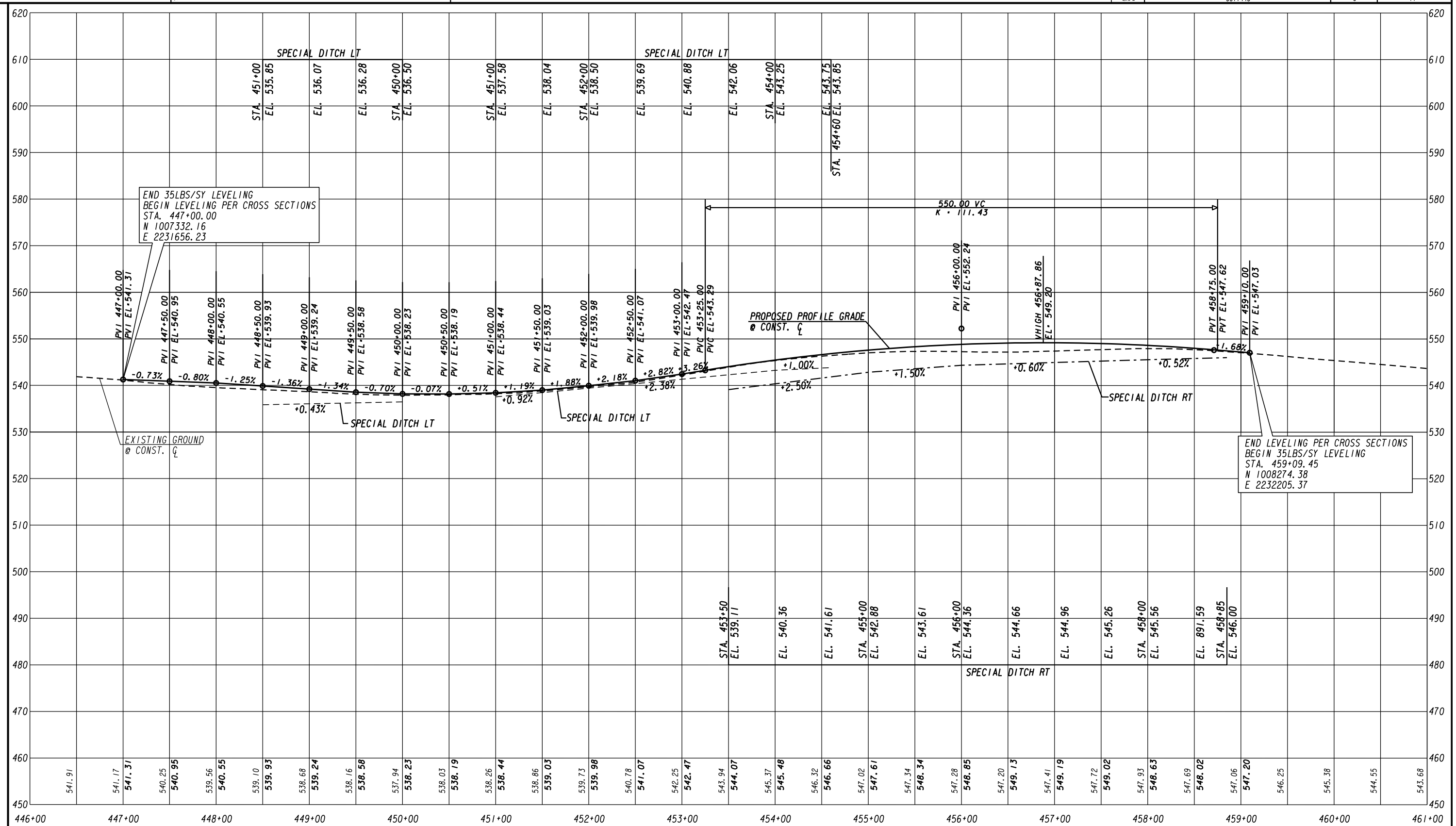

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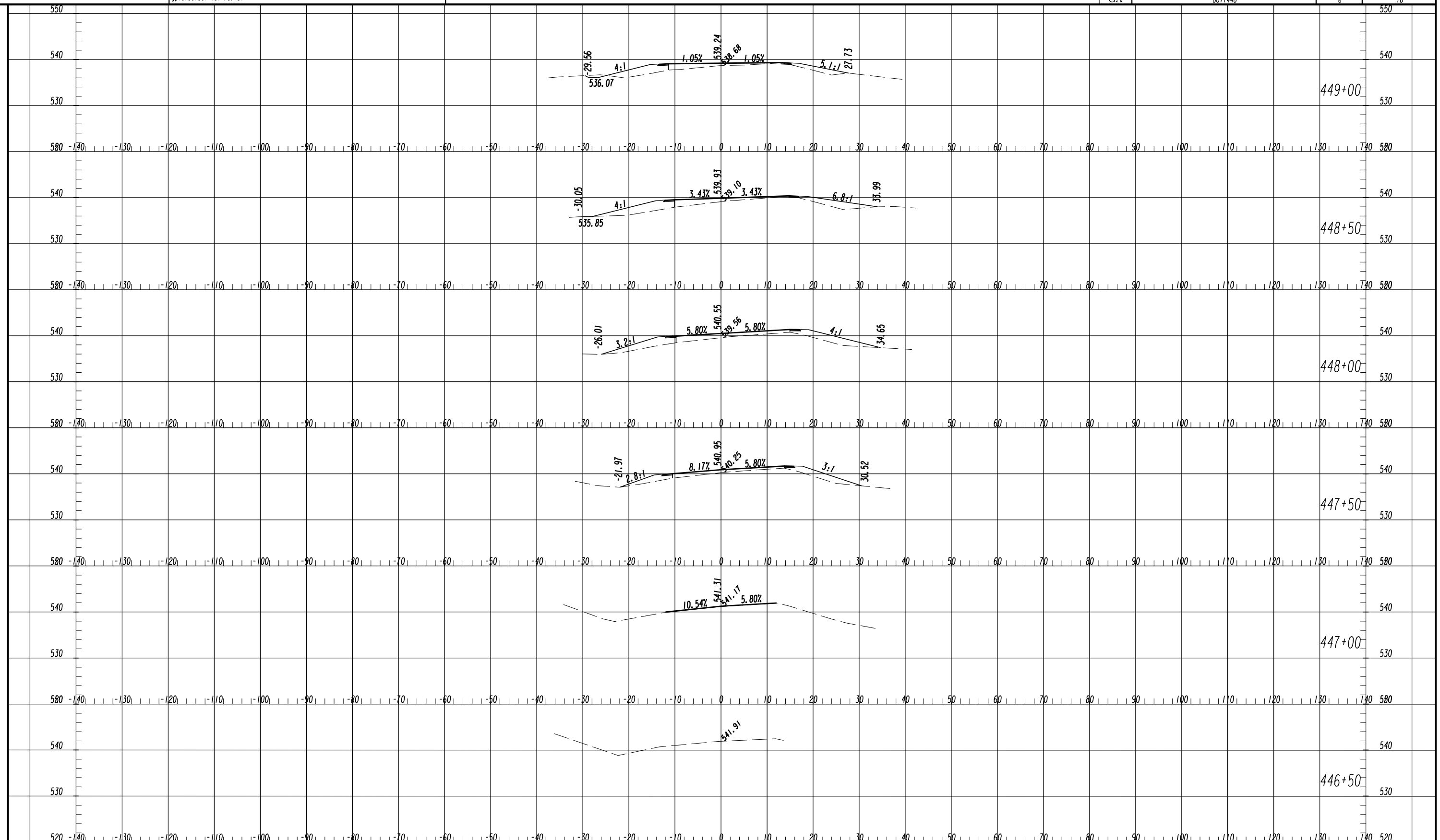

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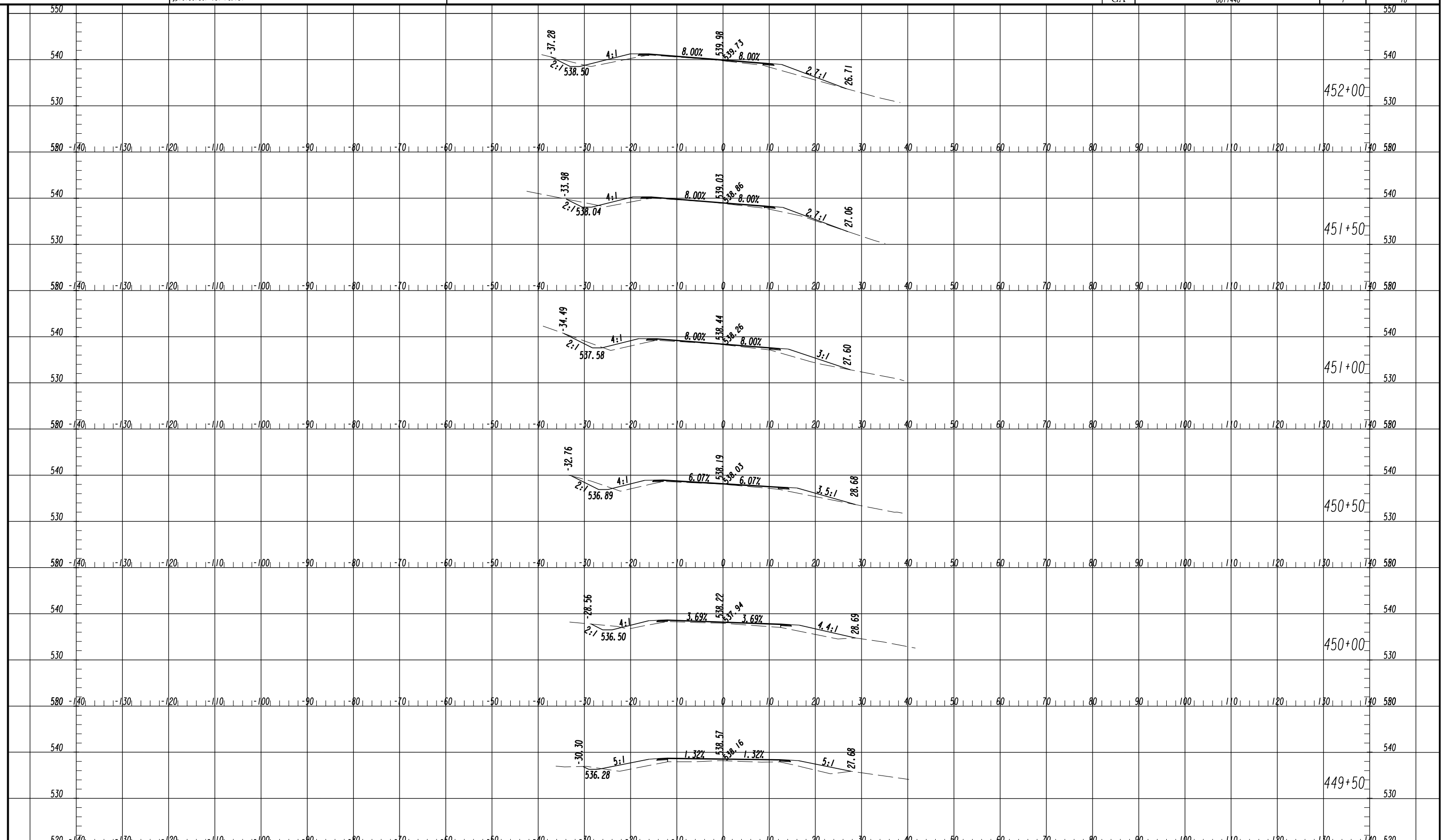

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23-02

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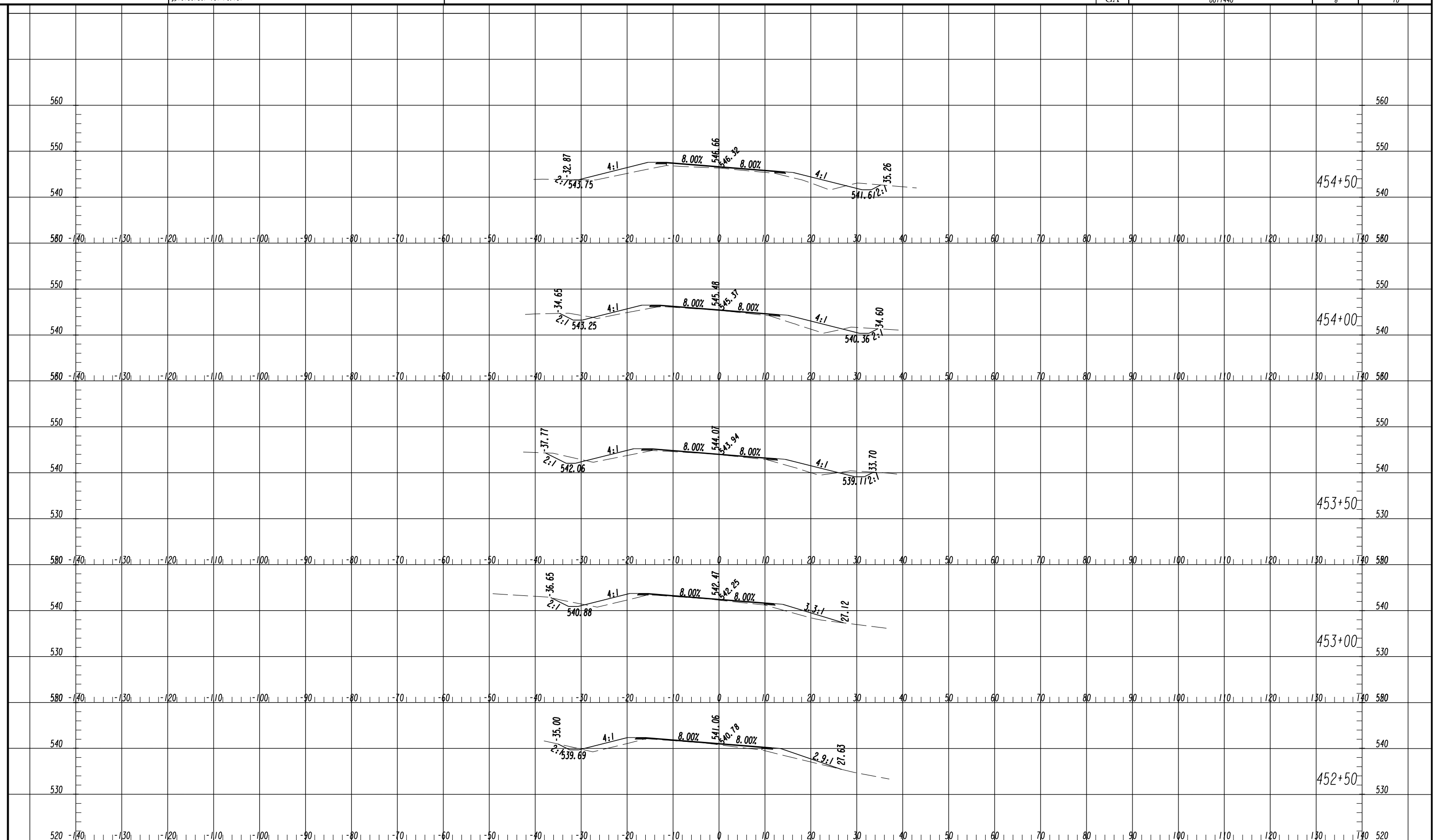

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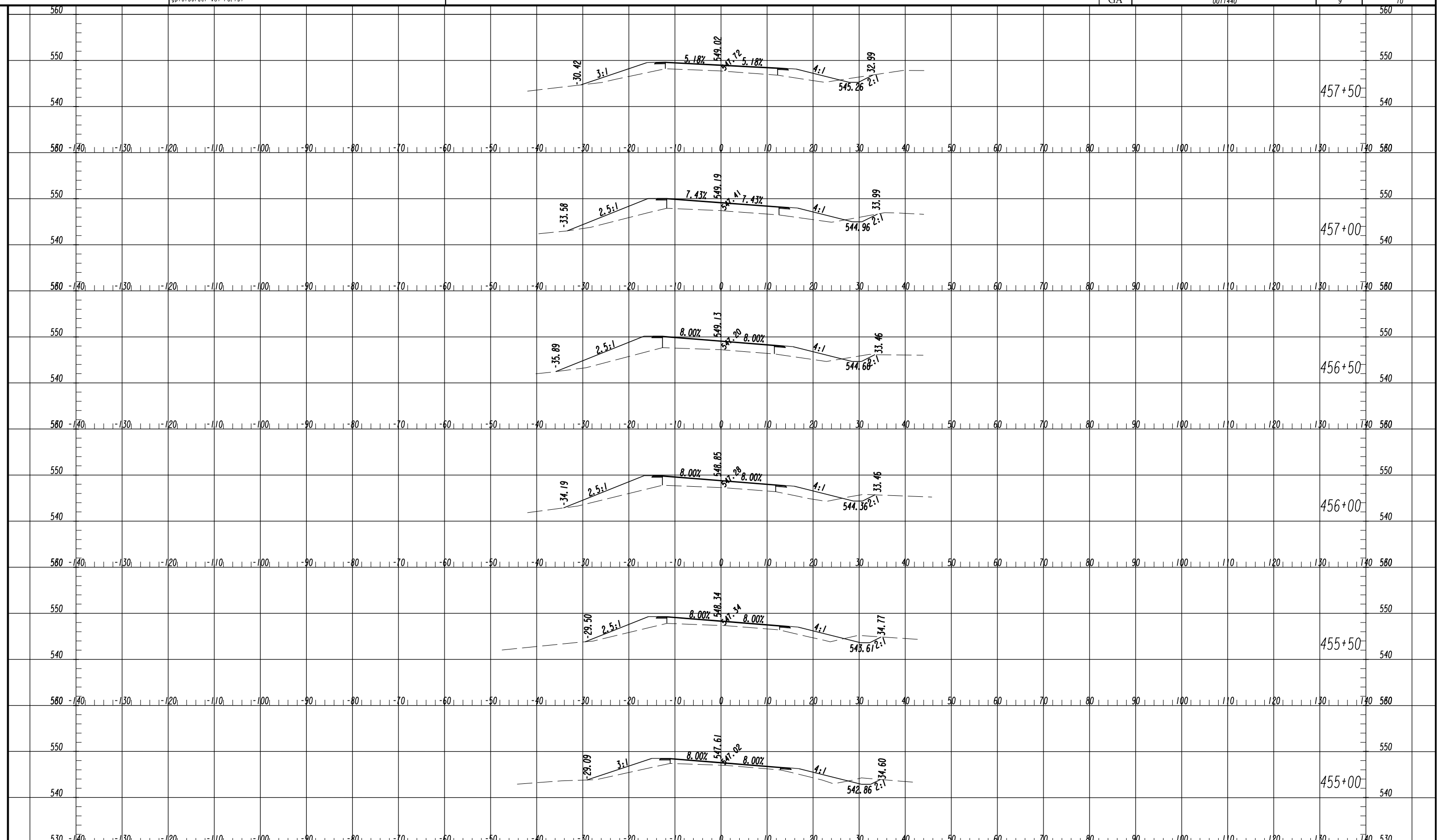

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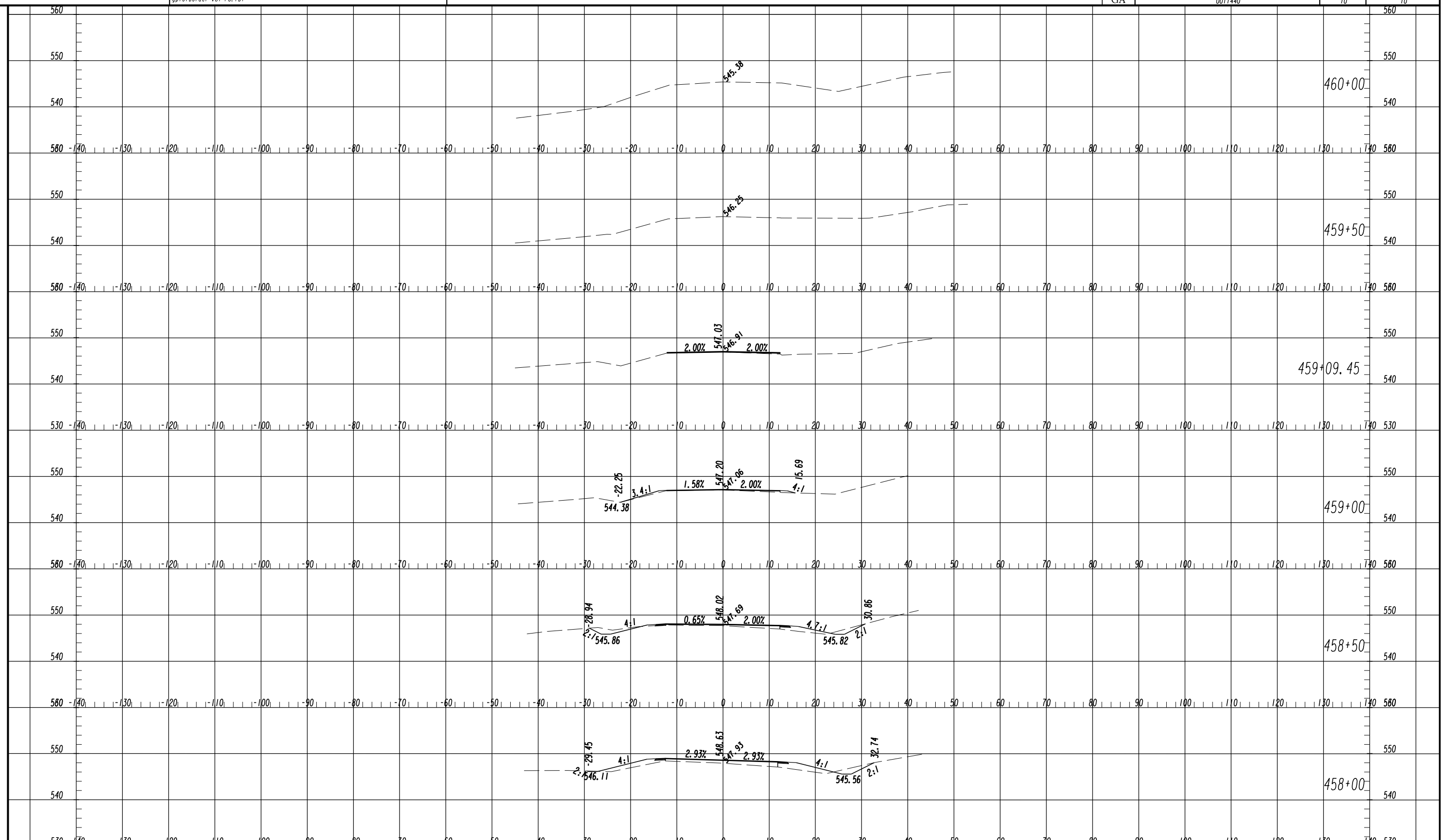
DRAWING No.
23-04

308

11/30/2011 SUXSEW



PLANS PREPARED AND SUBMITTED BY:

AEI

AMERICAN ENGINEERS, INC.
www.aei.cc

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1634 White Circle, Suite 101
Marietta, GA 30066
(770) 421-8422

PROFESSIONAL ENGINEERING

DESIGN CONSULTANT

1" = 10' HORIZ.
1" = 10' VERT.

REVISION DATES

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION

OFFICE:

CROSS SECTIONS

POBIDDY ROAD

DRAWING No.
23-05

309

11/30/2011 SUXSEW

P. I. NO: 0011440

COUNTY: TALBOT

DETAILED ESTIMATE

ITEM NO.	DESCRIPTION	UNIT	QUANTITY
150- 1000	TRAFFIC CONTROL - PI 0011440	LS	LS
163- 0232	TEMPORARY GRASSING	AC	1
163-0240	MULCH	TN	29
163-0300	CONSTRUCTION EXIT	EA	2
163- 0529	CNST/REM TEMP SED BAR OR BLD STRW CK DM	LF	7500
165- 0010	MAINT OF TEMP SILT FENCE, TP A	LF	50000
165-0071	MAINT OF SEDIMENT BARRIER - BALED STRAW	LF	3750
165-0101	MAINT OF CONST EXIT	EA	2
171 - 0010	TEMPORARY SILT FENCE, TYPE A	LF	100000
210-0100	GRADING COMPLETE - PI 0011440	LS	LS
402 - 1802	RECYL AC PATCHING , INCL BM&HL	TN	1100
402 - 1812	RECYL AC LEVELING , INC BM&HL	TN	3750
402-3100	REC AC 9.5 MM SP,TPI , GP10RBL1 , INCL BM&HL	TN	9400
402 - 3190	RECYL AC 19 MM SP, GP 1 OR 2 , INC BM&HL	TN	120
413-1000	BITUM TACK COAT	GL	13100
636-1033	HWY SIGNS , TPIMAT , REFL SH TP 9	SF	64
636-2070	GALV STEEL POSTS, TP 7	LF	72
636-2090	GALV STEEL POSTS, TP 9	LF	39
643-8200	BARRIER FENCE (ORANGE) , 4 FT	LF	3500
653-2501	THERMO SOLID TRAF ST , 5 IN , WH	LM	17.80

635-2502	THERMO SOLID TRAF ST, 5 IN YE	LM	17.80
654-1001	RAISED PVMT MARKERS TP 1	EA	1200
700-6910	PERMANENT GRASSING	AC	2
700-7000	AGRICULTURAL LIME	TN	4
700-8000	FERTILIZER MIXED GRADE	TN	2
700-8100	FERTILIZER NITROGEN CONTENT	LB	400
713-3012	WOOD FIBER BLANKET, TP II , SHOULDERS	SY	50000
716-2000	EROSION CONTROL MATS , SLOPES	SY	2200

EROSION CONTROL PLAN
FOR MAINTENANCE RESURFACING PROJECTS

This plan has been established to identify the proper procedure and techniques to be utilized during land disturbing activities associated with roadway maintenance projects. Erosion and sediment loss will be minimized by limiting land disturbing activities to less than one (1) acre of exposed material at a given time and providing immediate stabilization. This stabilization is accomplished by a best management practice that requires a hydroseeding application, which includes a mixture of bonded fiber matrix, Polyacrylamide (PAM), grass seed, lime and fertilizer. The implementation of this BMP provides both a temporary and permanent stabilization. This method along with proper installation has proven successful in reducing sediment loss. The hydroseeding application is listed as a Type II Wood Fiber Blanket within the contract.

By Federal Highway definition, the shoulder area serves as part of the roadway by providing a safe recoverable area for errant motorists. Additionally, the shoulder provides a drainage area which allows water to sheet flow away from the roadway surface as standing water can potentially present a hazard to motorist. The contractor is required to provide a Level 1A certified Worksite Erosion Control Supervisor (WECS) who shall be onsite at all times during land disturbing activities. State waters may or may not be identified in these contracts. This certified individual shall be able to identify these waters and use sound conservation and engineering practices, along with safe and effective changes to operation, in order to reduce and minimize erosion and impact to these waters and surrounding environment. Extreme caution shall be used while filling adjacent to or perpendicular to a live stream and/or culverts. The contractor shall immediately apply the Type II Wood Blanket for permanent stabilization in these areas. The contractor shall also use sound judgment when scheduling work during or with the threat of any inclement weather. In the event of rain, a Type I Wood Fiber Blanket (mat) shall be utilized as permanent stabilization in case of this type emergency. The Type II Wood Fiber Blanket referenced above requires a 24 hour drying time after application and shall not be applied to saturated soil.

The initial cutting of shoulder build up prior to the roadway resurfacing operation will be kept to a minimum and excess material shall be removed daily without disturbance to remaining vegetation. The filling operation associated with replacing a safe shoulder transition within these type projects should not disturb any existing natural vegetation which is allowed to remain in place. This operation shall be kept to a limit of less than one (1) acre of exposed soil. Permanent stabilization must be installed as soon as practical and once the areas have been permanently stabilized with the required hydroseeding application the contractor may continue. **At the end of each day, the WECS shall ensure a continuous, 100 percent coverage of the bonded fiber matrix application has been applied to all exposed areas. At the beginning of each work day, the contractor shall review previously installed stabilization measures for the entire project and repair any damaged or deficient areas prior to initiating additional land disturbing activities.**

Fill areas and contractors equipment shall not encroach on natural watercourses, waters of the State, or adjoining property. Equipment must cross streams by the means of an existing roadway culverts and bridges. Refueling or routine servicing of equipment shall not be performed within 200 foot of any state water or natural water course. The contractor shall also be responsible for stabilization of equipment staging areas and areas utilized for loading and off-loading of equipment. These areas will be included into the total disturbance allowed. The contractor shall be responsible for obtaining permission from the property owner if these staging areas are outside the State rights-of-way. Regardless, these areas should be kept to a minimum and the WECS shall ensure proper daily stabilization.

For projects that include shoulder paving, the operation shall be performed as follows: milling type equipment shall be used to trench the existing shoulder; waste material shall be discharged directly into trucks and removed from the shoulder and roadway and properly disposed of in accordance with all local, state and federal regulations.

Shoulder paving material shall be placed into the open trench to the level of the adjoining pavement in the same working day.

The following GDOT special provisions and specification sections relate specifically to maintenance resurfacing projects. This detail is intended to serve as a reduced erosion control plan for these type projects and to serve as a map to the specifications should further information be required.

Section 161, Control of Soil Erosion and Sedimentation (July 15, 2008)

A) As stated in section 161.3.05.I, General Requirements; no more than 1 acre of exposed earth shall be allowed at any time.
B) Wood Fiber Blanket, Type II is required daily for permanent stabilization.
C) In case of a rain event, Wood Fiber Blanket, Type I, will be installed and is for emergency use only.

Section 700, Grassing (October 23, 2008)

A) As stated in section 700.3.05 D.1, Construction; liquid lime is required during the hydroseeding operation at a rate of 2.5 gallons per acre.
B) D.2 requires mixed grade fertilizer at 1,200 lbs per acre
C) 700.3.05 J; is the application of Polyacrylamide (PAM) for permanent stabilization.

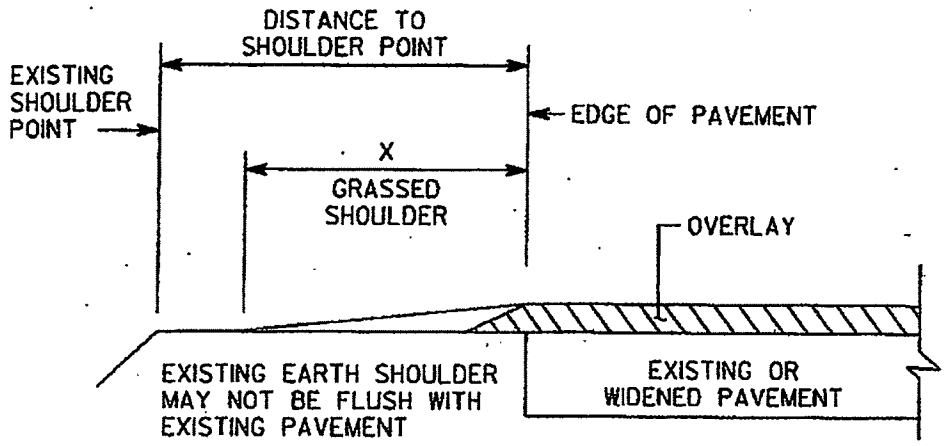
Section 713, Organic and Synthetic Material Fiber Blanket (October 31, 2005)

A) Section 713.1.01 defines the Wood Fiber Blanket, Type II and the 100 percent coverage requirement.
B) The bonded fiber matrix is applied at a rate of 3000 lbs per acre as stated in section 713.2.D

The Special Provision (Construction Details for Resurfacing and Shoulder Widening Projects) should be referred to for Maintenance resurfacing projects which include shoulder extension paving. (March 11, 2005)

A) Section C, Shoulders; states that trenching consists of the removal, satisfactory disposal and replacement of existing shoulder material. This operation is required to be completed to the level of existing pavement in the same working day.

EARTH SHOULDER FILLING



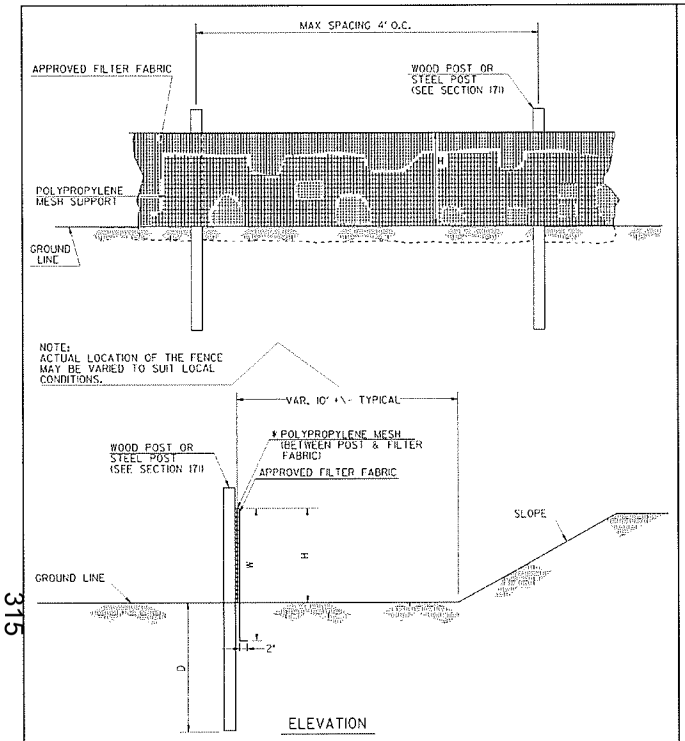
X = 4'-0" OR DISTANCE TO SHOULDER POINT, WHICHEVER IS THE LESSER WITH A MINIMUM OF 1'-0" REQUIRED AT ALL LOCATIONS

TYPICAL SECTION

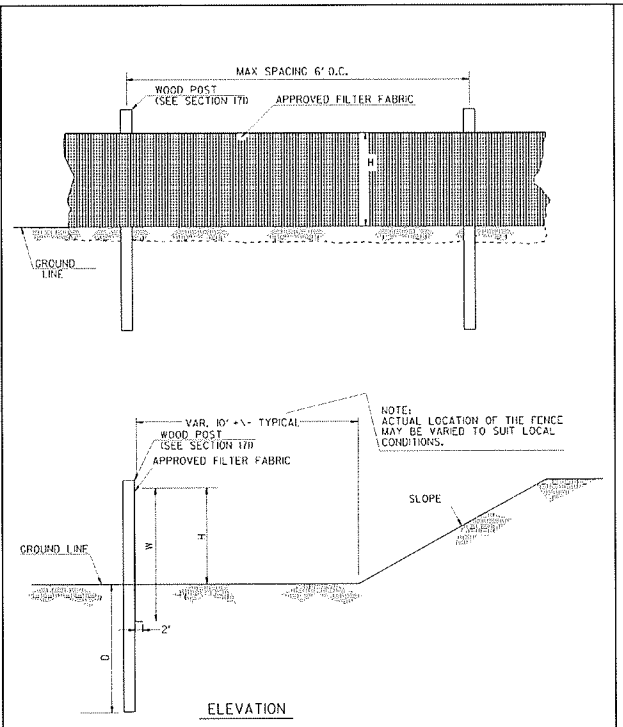
SHOULDER FILLING
NOT TO SCALE

(1) FILL EXISTING EARTH SHOULDER AT VARIABLE DEPTH AS REQUIRED TO PROVIDE A SMOOTH GRADE FROM THE NEW EDGE OF PAVEMENT ELEVATION TYING INTO EXISTING EARTH SHOULDER.
(2) ALL GRADING, INCLUDING ANY BORROW MATERIAL, SHALL BE INCLUDED IN PRICE BID FOR GRADING PER MILE.

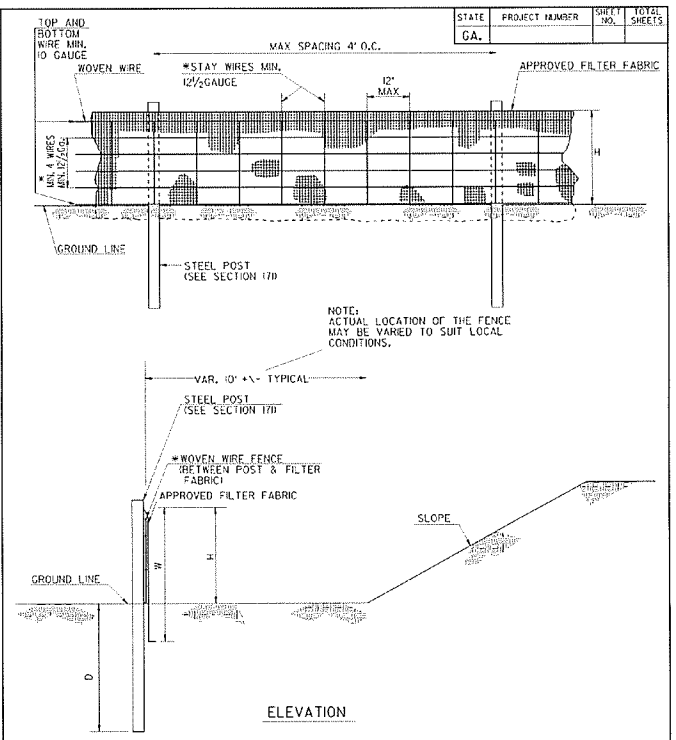
6



SINGLE ROW TYPE C SILT FENCE WITH POLYPROPYLENE MESH SUPPORT



SINGLE ROW TYPE A SILT FENCE



SINGLE ROW TYPE C SILT FENCE WITH WOVEN WIRE SUPPORT

STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
GA.			

FENCE TYPE	POST LENGTH	H	D	W	TYPICAL USES
TYPE "A"	4 FT.	2'-4"	1'-6"	3'-0"	
TYPE "C"	4 FT.	2'-4"	1'-6"	3'-0"	AT BRIDGE END ROLLS, DOUBLE ROW ALONG STREAMS, WETLANDS AND ENVIRONMENTALLY SENSITIVE AREAS FOR USE OF THIS MATERIAL IN FABRIC CHECKDAMS SEE D-24D.

NOTES:

1. WIRE STAPLES SHALL BE AT LEAST 17 GAUGE, WITH LEGS AT LEAST ½ INCHES LONG AND A CROWN AT LEAST ¾INCHES WIDE. NAILS SHALL BE AT LEAST 14 GAUGE, 1INCH LONG , WITH BUTTON HEADS AT LEAST ¾ INCHES WIDE.
2. NAILS OR STAPLES SHALL BE EVENLY PLACED WITH AT LEAST 5 PER POST FOR TYPE A FENCE AND 4 PER POST FOR TYPE C FENCE.
3. THE VERTICAL WIRES FOR THE WOVEN WIRE SUPPORT FENCE SHALL HAVE A MAXIMUM SPACING OF 12 INCHES. THE TOP AND BOTTOM WIRES SHALL BE AT LEAST 10 GAUGE AND ALL OTHER WIRES SHALL BE AT LEAST 12½ GAUGE.
4. TEMPORARY SILT FENCE INSTALLATION IS DIFFERENT THAN THE SILT RETENTION BARRIER INSTALLATION.
5. SEE SECTION 171 FOR SILT FENCE SPECIFICATIONS.
6. SEE SECTION 894 FOR FENCING SPECIFICATIONS.
7. SEE OPL-36 FOR A LIST APPROVED SILT FENCE FABRIC.
8. TEMPORARY SILT FENCE SHALL NOT BE PLACED WITHIN STATE WATERS UNLESS PERMITTED.

DATE	REVISION	BY

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

CONSTRUCTION DETAILS

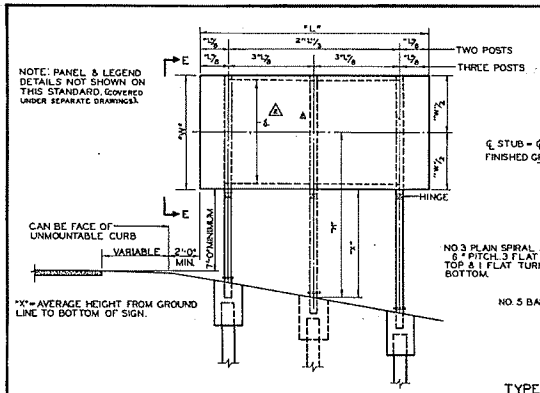
TEMPORARY SILT FENCE

NO SCALE

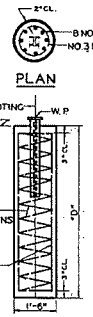
REV. AND REDRAWN JAN. 2011

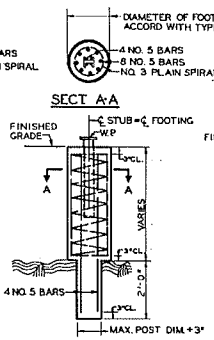
NUMBER
D-24A
(SHEET 1 OF 4)

STATE	PROJECT NUMBER	SHEET NO	TOTAL SHEETS
GA.			



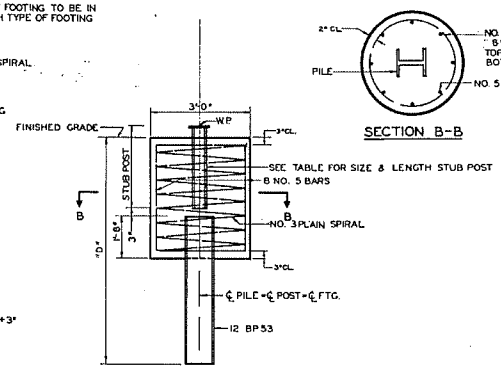
TYPICAL SIGN ERECTION DETAILS





TYPE 1 FOOTING DETAILS
(USE DETAIL "A" IF ROCK IS ENCOUNTERED)

NOTE: STUB POST SIZE SAME AS FOR SIGN POST.

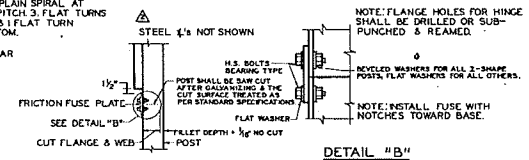


*TYPE 3 FOOTING DETAILS

*FOR TYPE 3 FOOTINGS WITH LESS THAN 4'-8½" EARTH COVER TO ROCK, BUILD FOOTINGS ACCORDING TO DETAIL "A". THE DIAMETER OF THE UPPER CONCRETE PORTION OF THE FOOTING WILL BE 3'-0". SHOULD 4'-8½" OR MORE OF EARTH COVER EXIST BUT LESS THAN "D" SECURELY SOCKET PILE INTO ROCK STRATA 1'-0"±. PILE SHALL BE EXTENDED INTO CONCRETE 1'-6".

IN CASE THE PILE CAN NOT BE SECURELY SOCKETED INTO ROCK 1'-0"±, THE SIGN MAY BE MOVED UP TO 50 FEET UP OR DOWN THE ROAD TO OBTAIN A BETTER FOUNDATION.

SECTION B-B

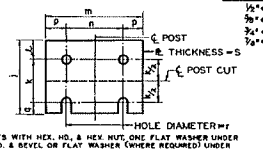


TYPICAL SIDE VIEW OF HINGE

DETAIL "B"

FABRICATOR NOTE: IMPORTANT—ALL FRICTION FUSE BOLTS SHALL BE TIGHTENED IN THE SHOP FOLLOWING A METHOD APPROVED BY THE ENGINEER. TIGHTENING SHALL BE TO SUCH A DEGREE AS TO OBTAIN THE FOLLOWING MINIMUM RESIDUAL TENSIONS IN EACH BOLT.

BOLT SIZE	MIN. RESIDUAL BOLT TENSION
½"Φ	12,050 LBS.
⅝"Φ	19,200 LBS.
¾"Φ	28,400 LBS.
⅞"Φ	39,050 LBS.



USE H.S. BOLTS WITH HEX. HD., & HEX. NUT, ONE FLAT WASHER UNDER EACH BOLT HD. & BEVEL OR FLAT WASHER (WHERE REQUIRED) UNDER EACH NUT.

FUSE PLATE DETAIL
(SEE TABLE FOR DIMENSIONS)

DESIGN DATA

ADAPTED FROM THE STATE HIGHWAY DEPARTMENT OF TEXAS, DESIGN
- WIND VELOCITY AS SHOWN.

POST SIZE	BASE CONNECTION DATA TABLE: BOLT SIZE & TORQUE	a	b	c	d	e	f	g	h	i	FUSE PLATE DATA TABLE: j	k	ℓ	m	n	p	q	r	s	BOLT DIA.	STUB POST DATA: STUB LENGTH	STUB PROJECTION
S 3x5.7	½"Φ x 2½" TORQUE = 200' #	SEE DETAIL									3⅛"	1½"	1⅛"	2⅜"	1½"	⅝"	½"	⅝"	¼"	½"Φ	1'-6"	3½"
S 4x7.7											3⅛"	1½"	1⅛"	2⅜"	1½"	⅝"	½"	⅝"	¼"	½"Φ	1'-8"	3½"
W 6x9	⅝"Φ x 2¾" TORQUE = 450' #	5"	2"	1¼"	2¾"	1⅛"	¾"	½"	¼"	3/32	3¾"	2"	1⅛"	4"	2¼"	⅞"	⅞"	¾"	⅜"	⅝"Φ	2'-0"	3"
W 6x12											3¾"	2"	1⅛"	4"	2¼"	⅞"	⅞"	¾"	⅜"	⅝"Φ	2'-0"	3"
W 6x15											4½"	2½"	1⅛"	6"	3½"	1¼"	¾"	13/16"	½"	¾"Φ	2'-6"	3"
W 8x18											4½"	2½"	1½"	5¼"	2¾"	1¼"	¾"	13/16"	½"	¾"Φ	2'-6"	3"
W 8x21	¾"Φ x 3½" TORQUE = 750' #	6"	2¼"	1⅜"	3½"	1¼"	1"	¾"	9/16	13/32	4⅝"	2½"	1½"	5¼"	2¾"	1¼"	⅞"	15/16"	⅝"	⅞"Φ	3'-0"	2½"
W 10x22											5⅜"	3"	1½"	5¾"	2¾"	1½"	⅞"	15/16"	⅝"	⅞"Φ	3'-0"	2½"
W 10x26											5⅜"	3"	1½"	5¾"	2¾"	1½"	⅞"	15/16"	⅝"	⅞"Φ	3'-0"	2½"
W 12x26											5⅜"	3"	1½"	6½"	3¼"	1½"	⅞"	15/16"	⅝"	⅞"Φ	3'-0"	2½"

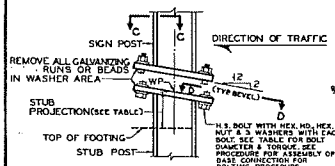
PROCEDURE FOR ASSEMBLY OF BASE CONNECTION

1. ASSEMBLE POST TO STUB WITH BOLTS & WITH ONE FLAT WASHER ON EACH BOLT BETWEEN PLATES.
2. SHIM AS REQUIRED TO PLUMB POST.
3. TIGHTEN ALL BOLTS TO THE MAXIMUM POSSIBLE WITH A 12" TO 15" WRENCH TO BED WASHERS & SHIMS & TO CLEAN BOLT THREADS. THEN LOOSEN EACH BOLT IN TURN & RETIGHTEN IN A SYSTEMATIC ORDER TO THE PRESCRIBED TORQUE. (SEE TABLE)
4. BURR THREADS AT JUNCTION WITH NUT USING A CENTER PUNCH TO PREVENT NUT LOOSENING.

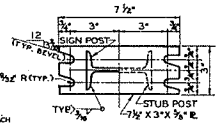
GENERAL NOTES

1. SPECIFICATIONS - GEORGIA STANDARD AND FOR SPECIAL PROVISIONS.
2. ALL CONCRETE SHALL BE CLASS "A".
3. ALL STRUCTURAL STEEL SHALL BE A.S.T.M. DESIGNATION A-36 & SHALL BE GALV AFTER FABRICATION IN ACCORDANCE WITH A.S.T.M. SPECIFICATION A-123 & A-153 (EXCEPT AS NOTED AT FUSE PLATES). ALL HOLES SHALL BE DRILLED ⊕ & ALL CUTS SHALL PREFERABLY BE SAW CUTS. FLAME CUTTING WILL BE PERMITTED PROVIDED ALL EDGES ARE GROUND FLAT & SMOOTH. STEEL ℄'s SHALL BE A-36.
4. ALL HIGH STRENGTH BOLTS, NUTS, & WASHERS SHALL CONFORM TO A.S.T.M. A-325. TIGHTEN THE HIGH STRENGTH BOLTS IN THE BASE CONNECTION ONLY TO THE TORQUE SHOWN IN THE TABLE. DO NOT OVERTIGHTEN.
5. POSTS MUST BE PLUMB & LOCATED AS SPECIFIED.
6. THE FACE OF ALL FLANGES OF POSTS SHALL BE IN THE SAME PLANE.
7. SIGN FACES SHALL BE ORIENTED TO AVOID SPECULAR REFLECTION ORDINARILY BY A SLIGHT TURNING AWAY FROM THE ROADWAY OF APPROXIMATELY 3 DEGREES. CARE SHALL BE TAKEN TO KEEP THE ADJUSTMENT SMALL SO AS TO MAINTAIN ADEQUATE REFLECTIVE VALUES.
8. EXCAVATION—DURING EXCAVATION, SURROUNDING SOIL SHALL REMAIN UNDISTURBED. ANY BACKFILLING REQUIRED SHALL BE DONE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS.
9. FOR FIELD REPAIR OF DAMAGE TO SPELTER COATING DUE TO WELDING OR OTHER CAUSES, SEE THE STANDARD SPECIFICATIONS.
10. OTHER REQUIREMENTS—FOR GENERAL NOTES & CONTRACT REQUIREMENTS, SEE SPECIAL PLANS, SUPPLEMENTAL SPECS. & SPECIAL PROVISIONS.
11. PILES SHALL CONFORM TO THE STANDARD SPECIFICATIONS.

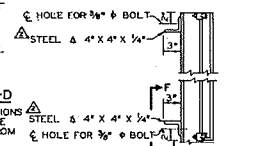
⊕ EXCEPT AS NOTED.



SIGN POST AND STUB POST
ELEVATION FOR S SHAPES



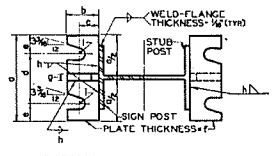
SECTION C-C



SECTION D-D

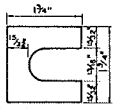
SECTIONS SHOWN ARE FOR INSTALLATIONS ON RIGHT SHOULDER & IN GORE. PLATE SLOT BEVELS ARE OPPOSITE HAND FROM THAT SHOWN FOR INSTALLATIONS ON LEFT SHOULDER.

STEEL ℄ DETAIL
SECTION E-E



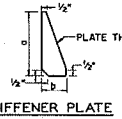
SECTION G-G SECTION H-H
(SEE TABLE FOR DIMENSIONS)

NOTE: SECTIONS SHOWN ARE FOR INSTALLATIONS ON RT. SHOULDER & IN GORE. PLATE SLOT BEVELS ARE OPPOSITE HAND FROM THAT SHOWN FOR INSTALLATION ON LT. SHOULDER.

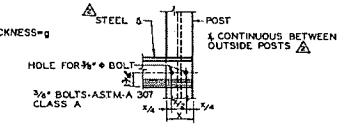


FURNISH 2, .012" THICK & 2, .032" THICK SHIMS PER POST. SHIMS SHALL BE FABRICATED FROM BRASS SHIM STOCK OR STRIP CONFORMING TO A.S.T.M.-B 36.

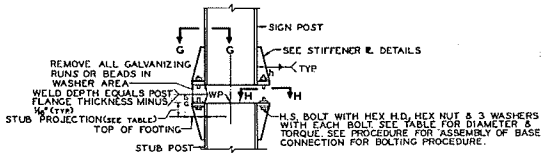
SHIM DETAIL



STIFFENER PLATE DETAIL
(SEE TABLE FOR DIMENSIONS)



SECTION F-F



SIGN POST AND STUB POST
ELEVATION FOR S AND W SHAPES

BY	REVISIONS	DATE
R.W.C.	℄ BAR DESIGNATION ADDED	3-10-71
H.W.C.	CH. ℄ BARS TO ½" & REV. NOTE	10-7-77
R.R.U.	UPDATED BEAM SIZE	10-28-81

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

STANDARD
ERECTION AND FOUNDATION DETAILS
FOR SPECIAL ROADSIDE SIGNS
BREAKAWAY TYPE POSTS

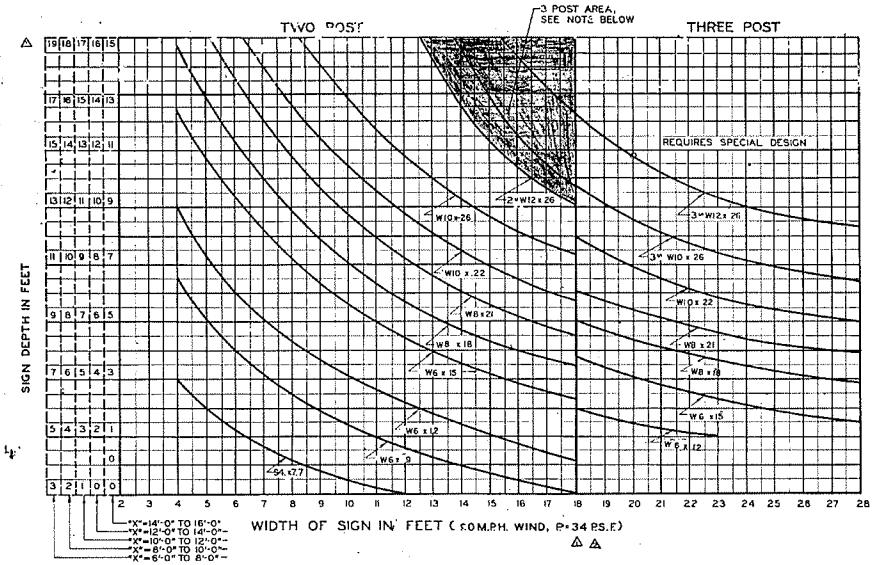
NO SCALE — JULY 1970

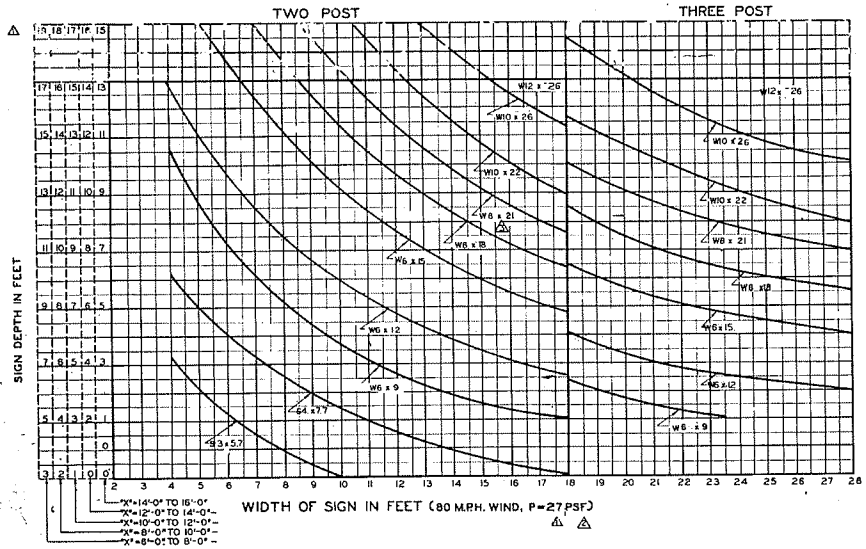
DESIGNED H.W.C. — DRAWN MGH — TRACED CCG — CHECKED H.H.L.

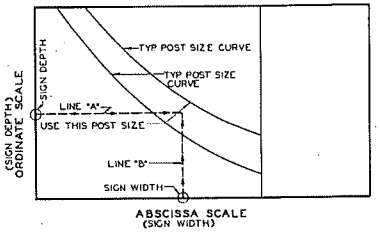
SUBMITTED R. E. Chapman Jr. BRIDGE ENGINEER
APPROVED J. P. Bacon Jr. STATE HIGHWAY ENGINEER

NUMBER 9054A

STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
GA.			



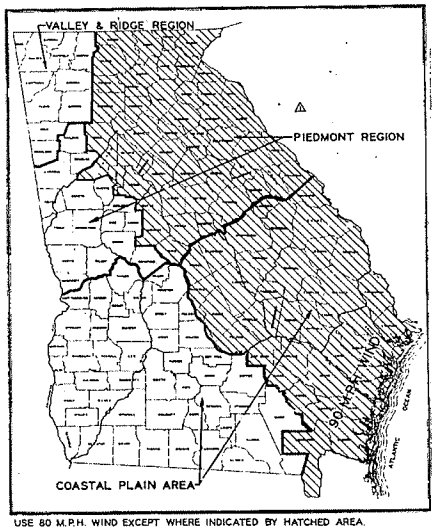




PROCEDURE TO FIND POST SIZE

1. DETERMINE SIGN WIDTH & DEPTH.
2. DETERMINE "X" DIMENSION USING GA. STD. NO. 9054-A
3. DETERMINE PROPER "X" COLUMN & READ UP ORDINATE SCALE UNTIL REACHING CORRECT SIGN DEPTH (STEP 1) IN THAT COLUMN. TURN 90° TO ORDINATE SCALE & PROJECT A LINE PARALLEL TO THE ABSCISSA SCALE. (LINE "A")
4. READ ALONG ABSCISSA SCALE TO CORRECT SIGN WIDTH. TURN 90° TO ABSCISSA SCALE & PROJECT A LINE (LINE "B") TO INTERSECT LINE "A". THE NO. OF POSTS SHALL BE DETERMINED BY WHICH AREA THE POINT FALLS WITHIN. THE SIZE SHALL BE THAT OF THE LARGER OF THE TWO POST SIZE CURVES THE INTERSECT POINT FALLS BETWEEN.

*WHEN A SIGN FALLS WITHIN THE TWO POST SECTION OF THE CHART ABOVE THE 2"W12x26 CURVE, THAT SIGN SHALL REQUIRE THREE POSTS & SHALL BE PLOTTED TO ONE OF THE TWO LINES WHICH HAVE BEEN EXTENDED FROM THE THREE POST SECTION.



USE 80 M.P.H. WIND EXCEPT WHERE INDICATED BY HATCHED AREA.

REVISIONS	BY	DATE
GENERAL REVISION	H.W.C.	10-27-77
UPDATE BEAM SIZE	R.M.U.	10-28-81
CHK. 2 & IN 8121 FOR 80 M.P.H.	R.M.U.	3-26-82

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

STANDARD
ERECTION AND FOUNDATION DETAILS FOR SPECIAL ROADSIDE SIGNS BREAKAWAY TYPE POSTS

NO SCALE — JULY 1970

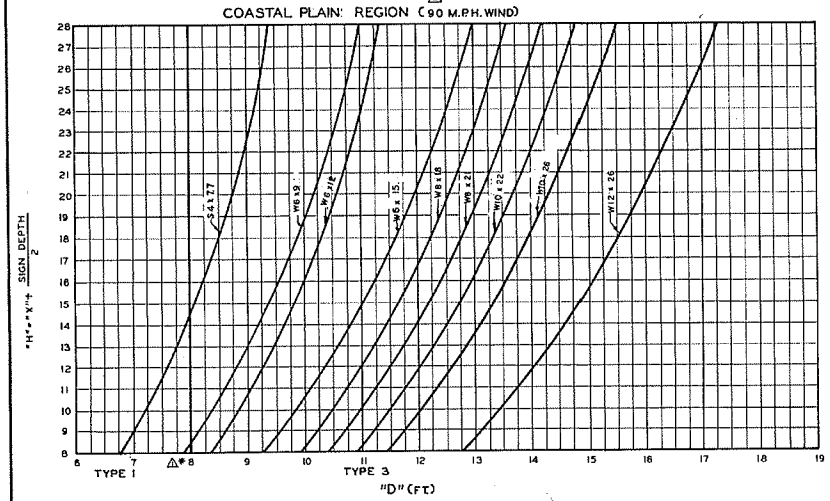
DESIGNED HWC
DRAWN MGN
TRACED CCG
CHECKED

SUBMITTED R. L. Chapman Jr. BRIDGE ENGINEER
APPROVED J. D. Bacon Jr. STATE HIGHWAY ENGINEER

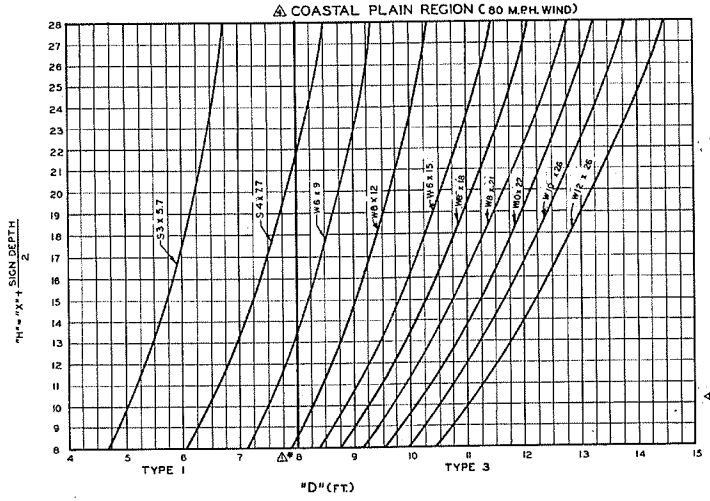
NUMBER 9054-B

STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
GA.			

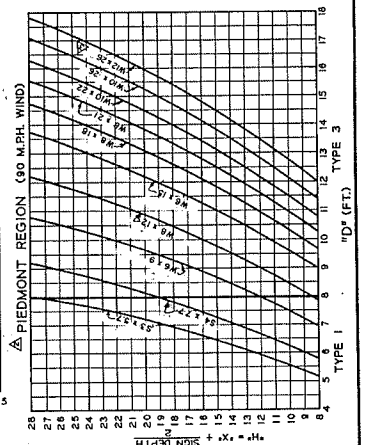
△ △ COASTAL PLAIN REGION (90 M.P.H. WIND)



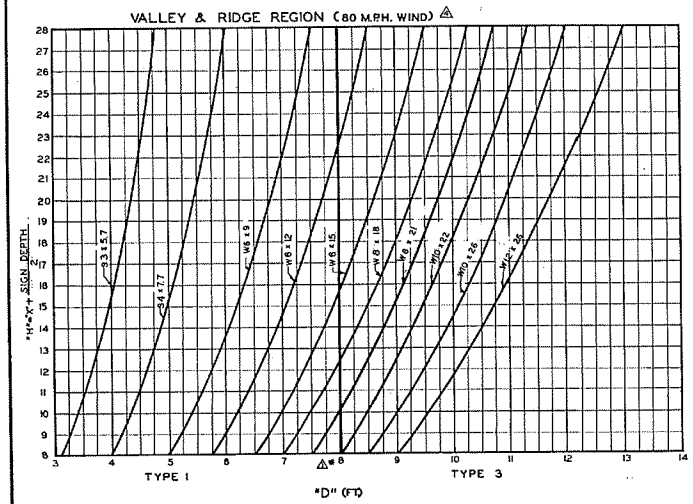
△ COASTAL PLAIN REGION (80 M.P.H. WIND)



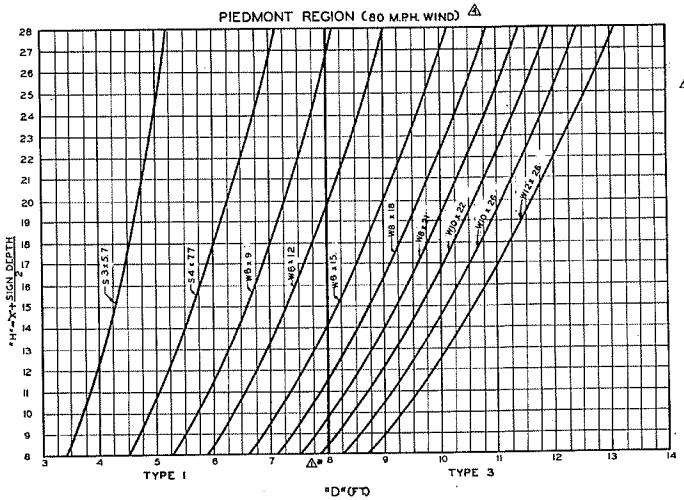
△ PIEDMONT REGION (80 M.P.H. WIND)



VALLEY & RIDGE REGION (80 M.P.H. WIND) △

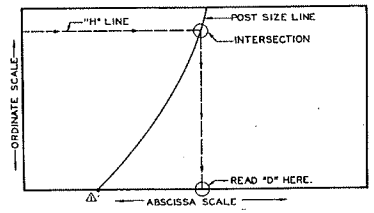


PIEDMONT REGION (80 M.P.H. WIND) △



PROCEDURE TO FIND FOOTING DEPTH

1. DETERMINE REGION SIGN IS LOCATED IN FROM GA. STD. NO. 9054-B.
2. DETERMINE "H" ("H"="X"+½ SIGN DEPTH) USING GA. STD. NO. 9054-A.
3. DETERMINE POST SIZE FROM GA. STD. NO. 9054-B.
4. ON PROPER CHART (STEP 1) READ UP ORDINATE SCALE TO PROPER "H" (STEP 2). THEN READ across ABSCISSA SCALE TO CORRECT POST SIZE. "D" (FOOTING DEPTH) CAN BE READ FROM ABSCISSA SCALE DIRECTLY BELOW INTERSECTION OF POST SIZE LINE & "H" ORDINATE.
5. △ #5. FOR FOOTING DEPTHS BELOW 8', USE TYPE 1 FOOTING, FOR FOOTING DEPTHS 8' & ABOVE, USE TYPE 3 FOOTING.
6. △ 6. FOOTING DEPTH "D" SHALL BE READ TO THE NEXT HIGHER 3 INCH INCREMENT, WHEN "D" FALLS BETWEEN 3 INCH INCREMENTS.



EXAMPLE

△	UPDATED BEAM SIZE	10-26-81	DATE
△ △ △	REVISIONS		
	NOTE REMOVED & NOTE & ⊗ ADDED	10-14-70	
	ADDED TABLE & REV. WIND.	10-1-77	
	CORR. PIED. REG. CHART	11-29-77	

R.M.U. B.T. H.W.C. H.W.C. R.M.U.

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

STANDARD
ERECTION AND FOUNDATION DETAILS FOR SPECIAL ROADSIDE SIGNS BREAKAWAY TYPE POSTS

NO SCALE

JULY 1970

DESIGNED HWC
DRAWN MGN
TRACED CCG
CHECKED HJL

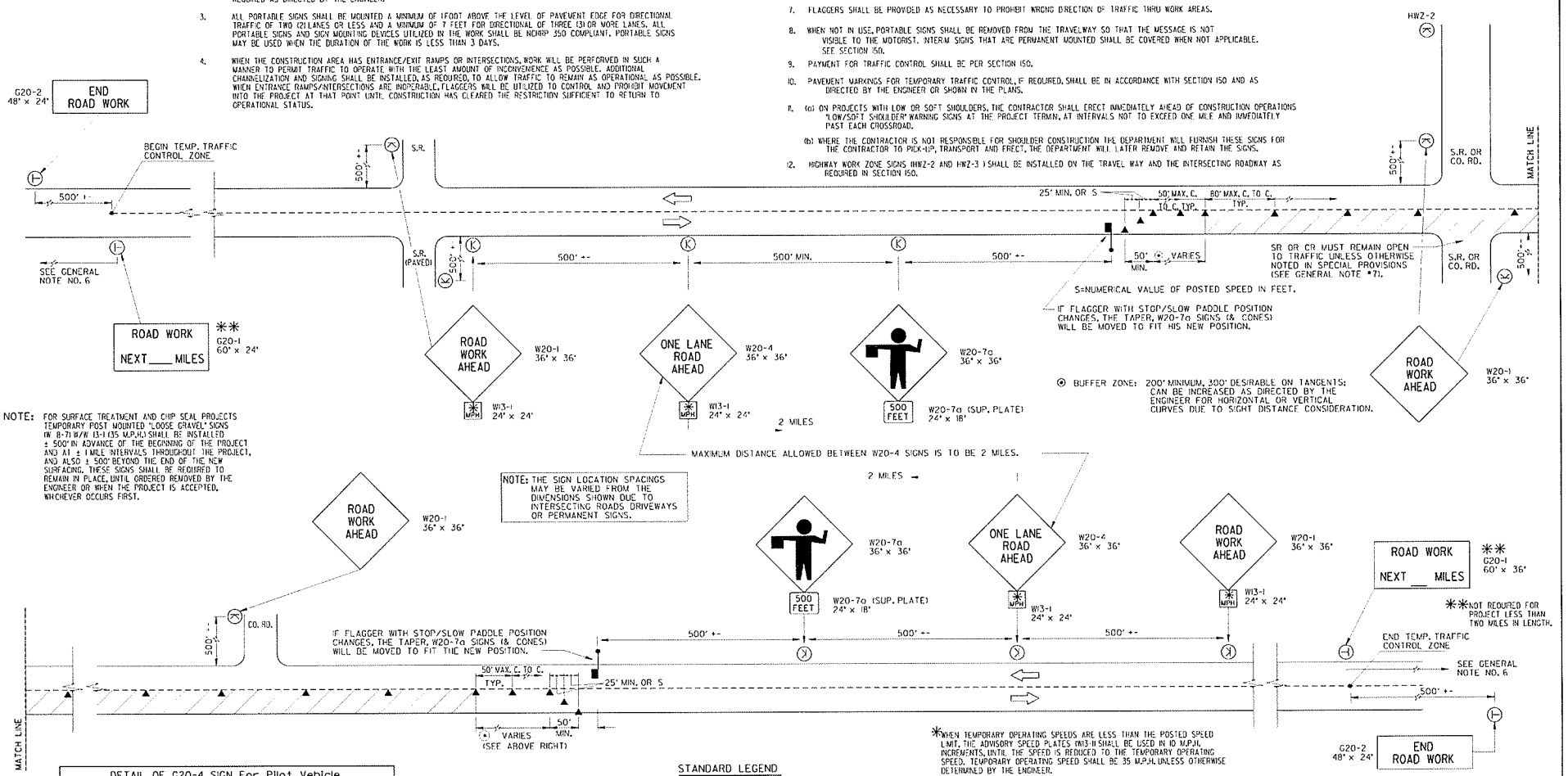
SUBMITTED R. L. Chapman Jr. DIRECTOR OF ENGINEERING
APPROVED J. C. Macomber STATE HIGHWAY ENGINEER

NUMBER 9054C

STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
GA.			

GENERAL NOTES:

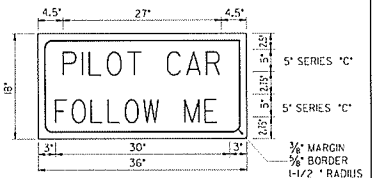
1. ALL TRAFFIC CONTROL DEVICES SHALL BE MADE AND ERECTED IN ACCORDANCE WITH THE DETAILS SHOWN ON THE PLANS; THE MUTCD; THE GEORGIA STANDARD SPECIFICATIONS, AND/OR SPECIAL PROVISIONS. (SEE SECTION 150)
2. ALL TRAFFIC CONTROL DEVICES SHALL BE AS SHOWN, OR AS DIRECTED BY THE ENGINEER. ADDITIONAL DEVICES MAY BE REQUIRED AS DIRECTED BY THE ENGINEER.
3. ALL PORTABLE SIGNS SHALL BE MOUNTED A MINIMUM OF 1FOOT ABOVE THE LEVEL OF PAVEMENT EDGE FOR DIRECTIONAL TRAFFIC OF TWO (2) LANES OR LESS AND A MINIMUM OF 7 FEET FOR DIRECTIONAL OF THREE (3) OR MORE LANES. ALL PORTABLE SIGNS AND SIGN MOUNTING DEVICES UTILIZED IN THE WORK SHALL BE NCHRP 350 COMPLIANT. PORTABLE SIGNS MAY BE USED WHEN THE DURATION OF THE WORK IS LESS THAN 3 DAYS.
4. WHEN THE CONSTRUCTION AREA HAS ENTRANCE/EXIT RAMPS OR INTERSECTIONS, WORK WILL BE PERFORMED IN SUCH A MANNER TO PERMIT TRAFFIC TO OPERATE WITH THE LEAST AMOUNT OF INCONVENIENCE AS POSSIBLE. ADDITIONAL CHANNELIZATION AND SIGNING SHALL BE INSTALLED, AS REQUIRED, TO ALLOW TRAFFIC TO REMAIN AS OPERATIONAL AS POSSIBLE. WHEN ENTRANCE RAMPS/INTERSECTIONS ARE INOPERABLE, FLAGGERS WILL BE UTILIZED TO CONTROL AND PROHIBIT MOVEMENT INTO THE PROJECT AT THAT POINT UNTIL CONSTRUCTION HAS CLEARED THE RESTRICTION SUFFICIENT TO RETURN TO OPERATIONAL STATUS.
5. FOR NIGHT TIME OPERATIONS, DRUMS SHALL HAVE, FOR THE LENGTH OF THE TAPER ONLY, A SIX (6") INCH ORANGE REFLECTIZED TOP STRIPE ON EACH DRUM IN THE TAPER AS REQUIRED IN SECTION 150. SPACING OF DEVICES SHALL BE AS SHOWN. DURING DAYLIGHT HOURS, CONES (28" MIN.) MAY BE USED IN ADVANCE OF AND THROUGHOUT WORK AREA.
6. SIGNS SHOWN HERE ARE IN ADDITION TO ALL ADVANCE WARNING SIGNS REQUIRED IN SECTION 150.
7. FLAGGERS SHALL BE PROVIDED AS NECESSARY TO PROHIBIT WRONG DIRECTION OF TRAFFIC THRU WORK AREAS.
8. WHEN NOT IN USE, PORTABLE SIGNS SHALL BE REMOVED FROM THE TRAVELWAY SO THAT THE MESSAGE IS NOT VISIBLE TO THE MOTORIST. INTERIM SIGNS THAT ARE PERMANENT MOUNTED SHALL BE COVERED WHEN NOT APPLICABLE. SEE SECTION 150.
9. PAYMENT FOR TRAFFIC CONTROL SHALL BE PER SECTION 150.
10. PAVEMENT MARKINGS FOR TEMPORARY TRAFFIC CONTROL, IF REQUIRED, SHALL BE IN ACCORDANCE WITH SECTION 150 AND AS DIRECTED BY THE ENGINEER OR SHOWN IN THE PLANS.
11. (a) ON PROJECTS WITH LOW OR SOFT SHOULDERS, THE CONTRACTOR SHALL ERECT IMMEDIATELY AHEAD OF CONSTRUCTION OPERATIONS "LOW/SOFT SHOULDER" WARNING SIGNS AT THE PROJECT TERMIN, AT INTERVALS NOT TO EXCEED ONE MILE AND IMMEDIATELY PAST EACH CROSSROAD.
    (b) WHERE THE CONTRACTOR IS NOT RESPONSIBLE FOR SHOULDER CONSTRUCTION THE DEPARTMENT WILL FURNISH THESE SIGNS FOR THE CONTRACTOR TO PICK-UP, TRANSPORT AND ERECT. THE DEPARTMENT WILL LATER REMOVE AND RETAIN THE SIGNS.
12. HIGHWAY WORK ZONE SIGNS (HWZ-2 AND HWZ-3) SHALL BE INSTALLED ON THE TRAVEL WAY AND THE INTERSECTING ROADWAY AS REQUIRED IN SECTION 150.



NOTE: FOR SURFACE TREATMENT AND CHIP SEAL PROJECTS TEMPORARY POST MOUNTED "LOOSE GRAVEL" SIGNS (W 8-7) W/W (3-1 (35 M.P.H.) SHALL BE INSTALLED ± 500' IN ADVANCE OF THE BEGINNING OF THE PROJECT AND AT ± 1 MILE INTERVALS THROUGHOUT THE PROJECT, AND ALSO ± 500' BEYOND THE END OF THE NEW SURFACING. THESE SIGNS SHALL BE REQUIRED TO REMAIN IN PLACE, UNTIL ORDERED REMOVED BY THE ENGINEER OR WHEN THE PROJECT IS ACCEPTED, WHICHEVER OCCURS FIRST.

NOTE: THE SIGN LOCATION SPACINGS MAY BE VARIED FROM THE DIMENSIONS SHOWN DUE TO INTERSECTING ROADS DRIVEWAYS OR PERMANENT SIGNS.

DETAIL OF G20-4 SIGN For Pilot Vehicle
IF REQUIRED OR USED ON PROJECT



STANDARD LEGEND

- STRIPED DRUM
- PERMANENT TYPE POST MOUNTED SIGN (7' MOUNT HEIGHT)
- TEMPORARY POST MOUNTED SIGN - (7' MOUNT HEIGHT)
- PORTABLE MOUNTED SIGN - MINIMUM HEIGHT OF 1FT. ABOVE THE EDGE OF PAVEMENT; INSTALLED AS PER NCHRP 350 TESTING REQUIREMENTS.
- WORK AREA
- TRAFFIC CONE - 28" MIN. - DAYTIME USE ONLY
- FLAGGER WITH STOP-SLOW PADDLE

G.D.	REVISED FLAGS AND REV. GENERAL NOTES, REV. SIGN G20-2A TO G20-2.	BY	3-30-06 DATE

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

STANDARD TRAFFIC CONTROL DETAIL FOR LANE CLOSURE ON TWO-LANE HIGHWAY

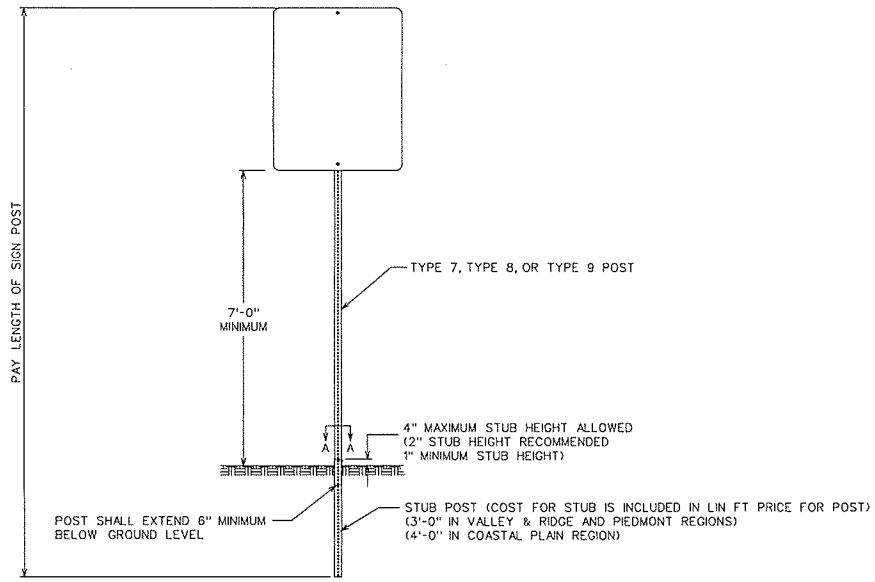
NO SCALE

REV. & REDR. JULY, 1999

DES. ..... (SUBMITTED) STATE ROAD & AIRPORT DESIGN ENGINEER
DRW. .....
TRA. ..... (APPROVED) CHIEF ENGINEER
CHK. .....

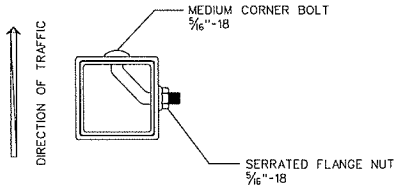
NUMBER 9102

STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
GA.			



FRONT VIEW

POST	STUB SIZE
TYPE 7	2¼" x 2¼"
TYPE 8	2¾" x 2¾"
TYPE 9	2½" x 2½"



SECTION A-A

SIGN POST SELECTION CHART

70 MPH Wind Load Chart • 15% Gust Factor

	SLIP BASE NOT REQUIRED				GROUND MOUNTED BREAKAWAY SIGN SUPPORT REQUIRED				
	TYPE 7 2" 14 ga.		TYPE 9 2-1/4" 14 ga	TYPE 8 2-1/2" 12 ga.	TYPE 8 2-1/2" 12 ga.		TYPE 8 w/TYPE 9 Insert* 2-1/2" 12 ga. W/2-1/4" 14 ga.		
Sign Centroid	1 Post	2 Post	1 Post	1 Post	2 Post	3 Post	1 Post	2 Post	3 Post
	SQUARE FOOTAGE				SQUARE FOOTAGE				
6'	13.50	27.00	19.25	30.00	60.00	90.00	49.25	98.50	147.75
7'	11.60	23.20	16.50	25.75	51.50	77.25	42.25	84.50	126.75
8'	10.15	20.30	14.45	22.55	45.10	67.65	37.00	74.00	111.00
9'	9.00	18.00	12.85	20.00	40.00	60.00	32.85	65.70	98.55
10'	8.10	16.20	11.55	18.00	36.00	54.00	29.55	59.10	88.65
11'	7.40	14.80	10.50	16.40	32.80	49.20	26.90	53.80	80.70
12'	6.80	13.60	9.65	15.00	30.00	45.00	24.65	49.30	73.95
13'	6.25	12.50	8.90	13.85	27.70	41.55	22.75	45.50	68.25
14'	5.80	11.60	8.25	12.90	25.80	38.70	21.15	42.30	63.45
15'	5.00	10.00	6.45	10.10	20.20	30.30	16.55	33.10	49.65
16'	4.70	9.40	6.05	9.45	18.90	28.35	15.50	31.00	46.50
17'	4.40	8.80	5.70	8.90	17.80	26.70	14.60	29.20	43.80
18'	4.15	8.30	5.40	8.40	16.80	25.20	13.80	27.60	41.40
19'	3.95	7.90	5.10	7.95	15.90	23.85	13.05	26.10	39.15
20'	3.75	7.50	4.85	7.55	15.10	22.65	12.40	24.80	37.20

SIGN CENTROID IS DISTANCE FROM GROUND LEVEL TO BOTTOM OF SIGN *PLUS* HALF THE HEIGHT OF SIGN.
EXAMPLE: 24" X 48" SIGN THAT IS 7 FEET FROM GROUND TO BOTTOM OF SIGN. ADD HALF OF 48" (24" OR 2 FT) *PLUS* 7 FT. = 9' CENTROID.

SIGN PLATE SHALL NOT EXCEED 48" IN WIDTH ON A SINGLE POST.

* TYPE 9 INSERT SHALL BE A CONTINOUS POST INSERTED INTO THE TYPE 8 POST WHERE REQUIRED. THE INSERT POST SHALL EXTEND FROM THE BOTTOM OF THE SLIP BASE UPPER ASSEMBLY TO 4" BELOW THE BOTTOM OF THE SIGN. THE INSERT POST SHALL NOT EXTEND ABOVE THE BOTTOM OF THE SIGN. PAYMENT FOR THE INSERT POST SHALL BE PER LINEAR FOOT OF TYPE 9 POST.

GROUND MOUNTED BREAKAWAY SIGN SUPPORT WILL BE MEASURED AND PAID FOR SEPARATELY. THE COST FOR THIS WORK SHALL INCLUDE THE UPPER AND LOWER ASSEMBLY, STUB POST, CLASS "A" CONCRETE, ALL HARDWARE NECESSARY TO COMPLETE THE INSTALLATION, AND BE INCLUDED IN THE BID PRICE SUBMITTED FOR ITEM 636-3010.

DATE	REVISIONS

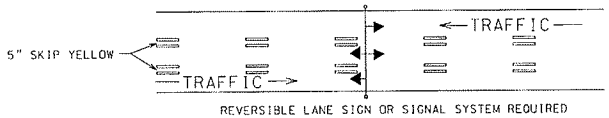
GEORGIA DEPARTMENT OF TRANSPORTATION
OFFICE OF TRAFFIC SAFETY & DESIGN

TYPE 7, 8, AND 9
SQUARE TUBE POST
INSTALLATION DETAIL

NO SCALE JULY 2002

T-3A

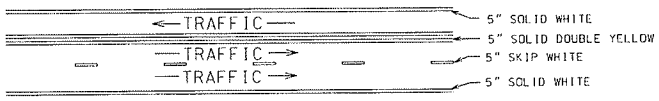
STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
GA.			



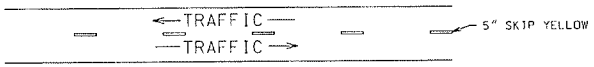
REVERSIBLE LANE SIGN OR SIGNAL SYSTEM REQUIRED

TWO-WAY TRAFFIC WITH A REVERSIBLE CENTER LANE

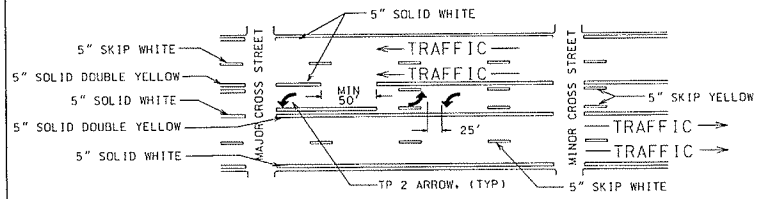
TWO-WAY TRAFFIC WHERE MOTORISTS IN A SINGLE LANE ARE PERMITTED TO PASS



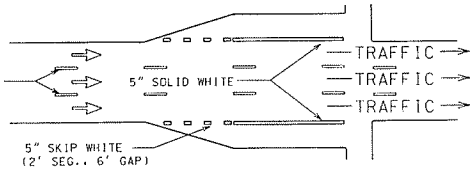
TWO-WAY TRAFFIC WHERE MOTORISTS IN A SINGLE LANE ARE NOT PERMITTED TO PASS



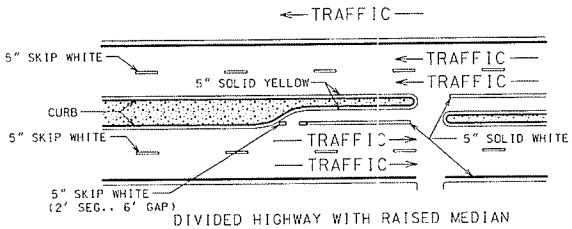
TWO-LANE, TWO-WAY TRAFFIC WITH PASSING PERMITTED



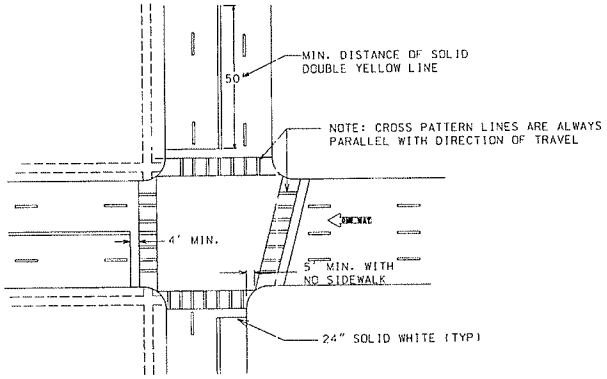
MULTI-LANE, TWO-WAY TRAFFIC WITH SINGLE LANE, TWO-WAY LEFT TURN CHANNELIZATION



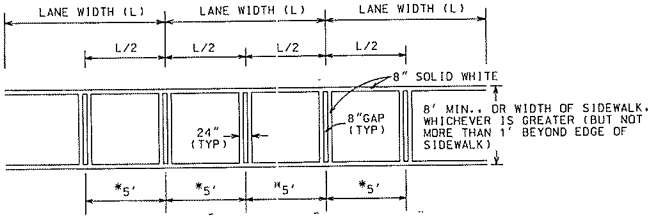
ONE-WAY TRAFFIC WITH ADDED TURN LANES



DIVIDED HIGHWAY WITH RAISED MEDIAN



TYPICAL LOCATION OF CROSSWALKS AND STOP BARS



*USE WHERE THE LANE WIDTH EXCEEDS 12' OR WHERE LANE LINES HAVE BEEN OMITTED

CROSSWALK DETAIL

GENERAL NOTES:

1. SPACING BETWEEEN DOUBLE LINES SHALL BE EQUAL TO THE LINE WIDTH.
2. EDGE LINES SHALL BE PLACED A MINIMUM OF 4 INCHES FROM THE NORMAL EDGE OF PAVEMENT.

DATE	REVISIONS

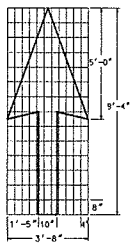
GEORGIA DEPARTMENT OF TRANSPORTATION
OFFICE OF TRAFFIC SAFETY & DESIGN

DETAILS OF PAVEMENT MARKING PLACEMENT NON-LIMITED ACCESS ROADWAY

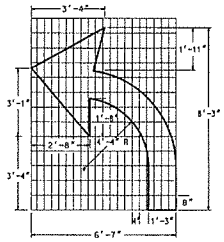
NO SCALE JANUARY 2000

T-11A

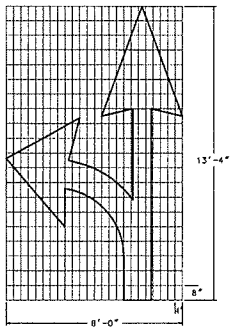
STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
GA.			



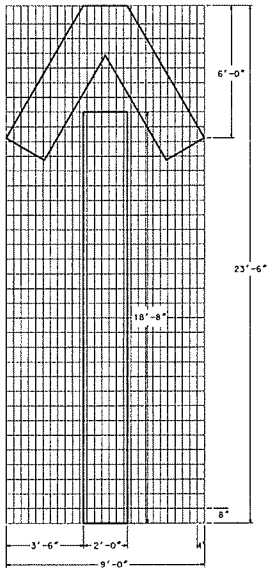
PAVEMENT MARKING, ARROW, TYPE 1
WHITE
(12.0 SQ. FT.)



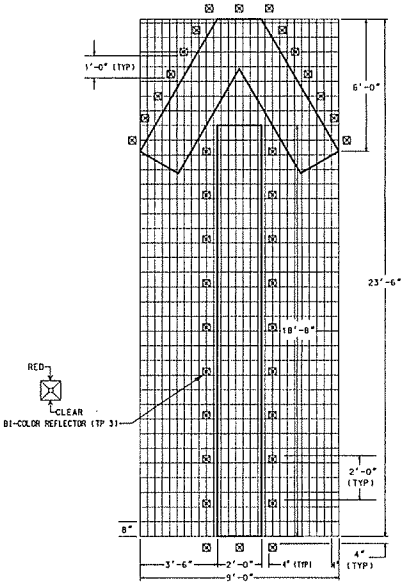
PAVEMENT MARKING, ARROW, TYPE 2
WHITE
(16.0 SQ. FT.)



PAVEMENT MARKING, ARROW, TYPE 3
WHITE
(28.5 SQ. FT.)

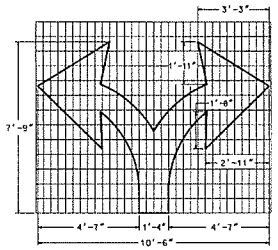


PAVEMENT MARKING, ARROW, TYPE 4
WHITE
(64.5 SQ. FT.)

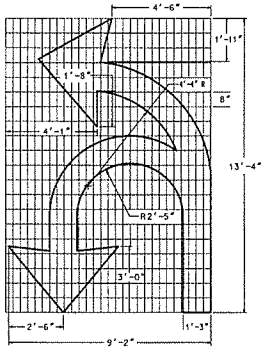


PAVEMENT MARKING, ARROW, WRONG WAY
WHITE
(64.5 SQ. FT.)

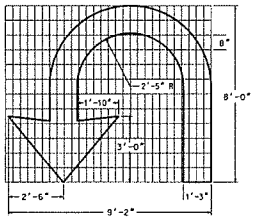
ARROW- WHITE REFLECTORIZED PAINT THERMOPLASTIC, AS SPECIFIED BY GEORGIA STANDARD SPECIFICATIONS, SECTION 655.



PAVEMENT MARKING, ARROW, TYPE 5
WHITE
(25.5 SQ. FT.)



PAVEMENT MARKING, ARROW, TYPE 6
WHITE
(42.0 SQ. FT.)



PAVEMENT MARKING, ARROW, TYPE 7
WHITE
(26.0 SQ. FT.)

DATE	REVISIONS
4-11-00	CHANGED LOCATION OF RPMs ON WRONG WAY ARROW

GEORGIA DEPARTMENT OF TRANSPORTATION
OFFICE OF TRAFFIC SAFETY & DESIGN

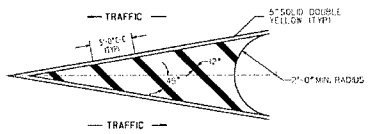
DETAILS OF
PAVEMENT MARKINGS-ARROWS

NO SCALE JANUARY 2000

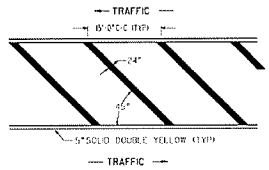
T-12B

COUNTY	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS

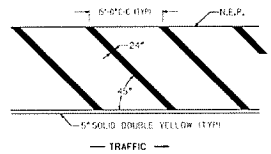
DETAIL "A" (YELLOW)



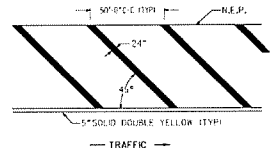
DETAIL "B" (YELLOW)



DETAIL "C" (YELLOW)



DETAIL "D" (YELLOW)



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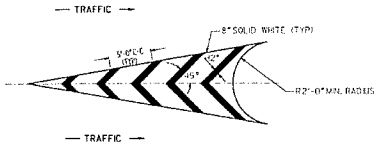
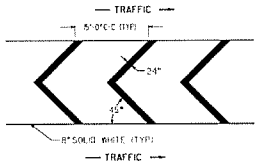


DETAIL "B" (WHITE)



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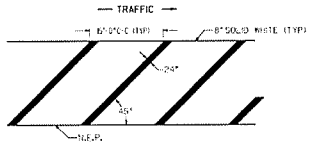
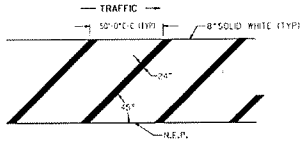


DETAIL "D" (WHITE)



GENERAL NOTES:

1. FOR YELLOW STRIPING. THE SQUARE YARDS SHOWN ON PLAN. SUMMARY AND DETAILED ESTIMATE SHEETS INCLUDE THE AREA WITHIN THE BORDERS AND THE 5" SOLID DOUBLE YELLOW BORDER.
2. FOR WHITE STRIPING. THE SQUARE YARDS SHOWN ON PLAN. SUMMARY AND DETAILED ESTIMATE SHEETS INCLUDES THE AREA WITHIN THE BORDERS AS WELL AS THE 8" SOLID WHITE BORDER.

GEORGIA
DEPARTMENT OF TRANSPORTATION

- NO SCALE -

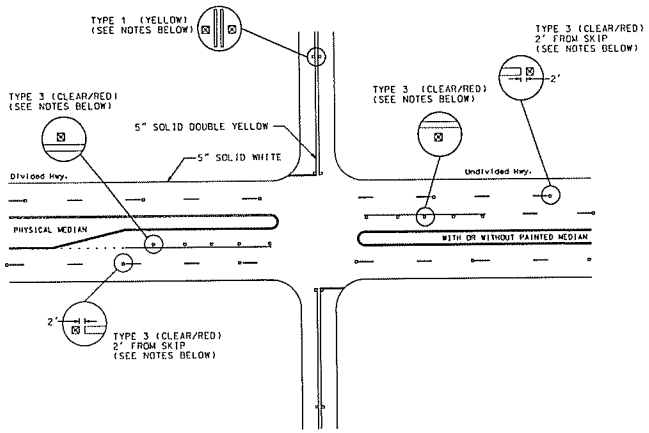
DATE	REVISIONS
6/25/04	Modified general note 1
1/18/05	CHANGED BORDER
11/21/08	Modified general note 1

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE: TRAFFIC OPERATIONS
SIGNING AND MARKING PLANS

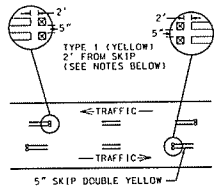
DETAIL OF PAVEMENT MARKING HATCHING
JANUARY 2000

NUMBER T-14

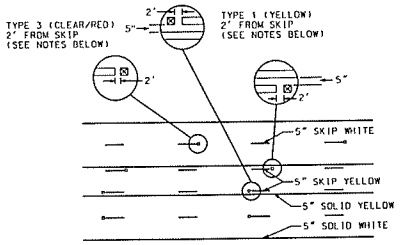
STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
GA.			



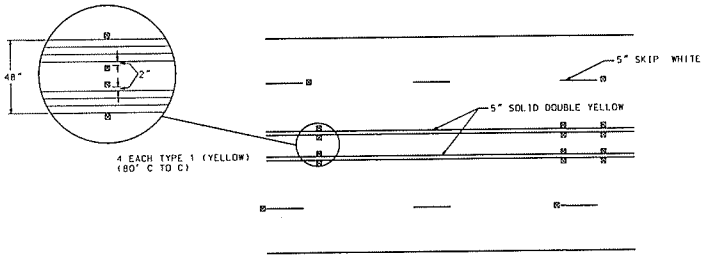
DIVIDED / UNDIVIDED HIGHWAY



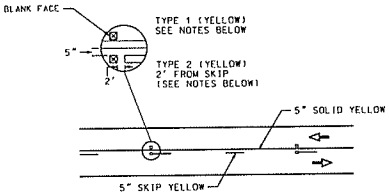
REVERSIBLE LANE



TWO WAY LEFT TURN LANE



4'-0" STRIPED FLUSH MEDIAN



NO PASSING ZONE

GENERAL NOTES:

1. RAISED PAVEMENT MARKERS SHALL BE SPACED EVERY 80 FT UNLESS OTHERWISE SPECIFIED.
2. ON SOLID WHITE TURN BAY LINES, SPACING SHALL BE 20 FT.
3. RAISED PAVEMENT MARKERS SHALL BE OFFSET 5 INCHES FROM SOLID LANE LINES.
4. CLEAR FACE OF TYPE 3 RAISED PAVEMENT MARKERS SHALL BE ORIENTED TOWARD ONCOMING TRAFFIC.
5. ON HORIZONTAL CURVES WHERE AT LEAST 3 MARKERS CANNOT BE SEEN AT ONE TIME USING NORMAL SPACING, MARKERS SHALL BE PLACED 40 FT.

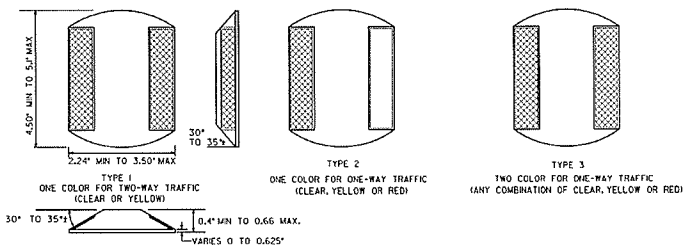
DATE	REVISIONS
9-4-03	NO PASSING ZONE RPM'S
1-13-04	NO PASSING ZONE RPM'S

GEORGIA DEPARTMENT OF TRANSPORTATION
OFFICE OF TRAFFIC SAFETY & DESIGN

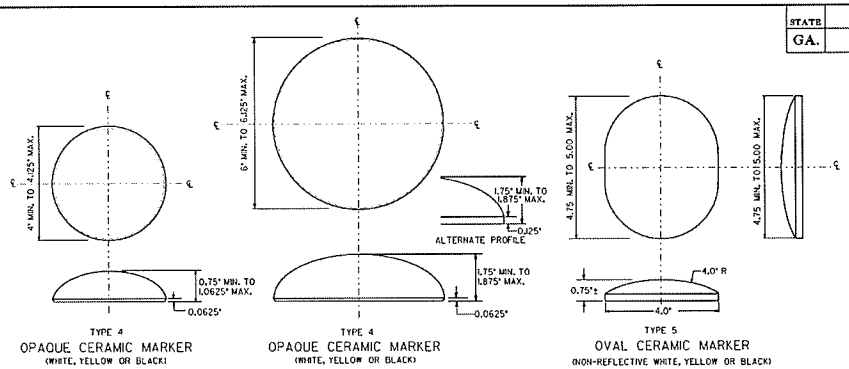
DETAILS OF
RAISED PAVEMENT MARKER LOCATION
NON-LIMITED ACCESS ROADWAY
NO SCALE JANUARY 2000

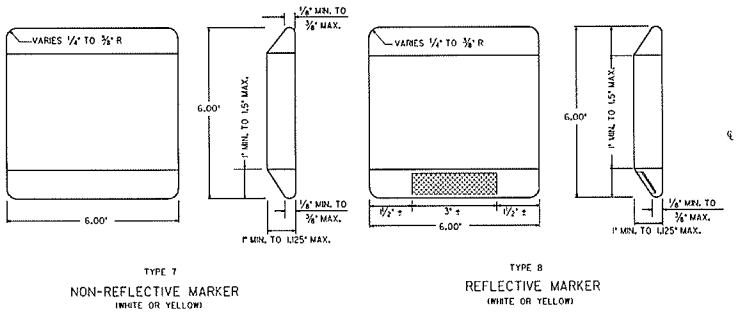
T-15A

STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
GA.			

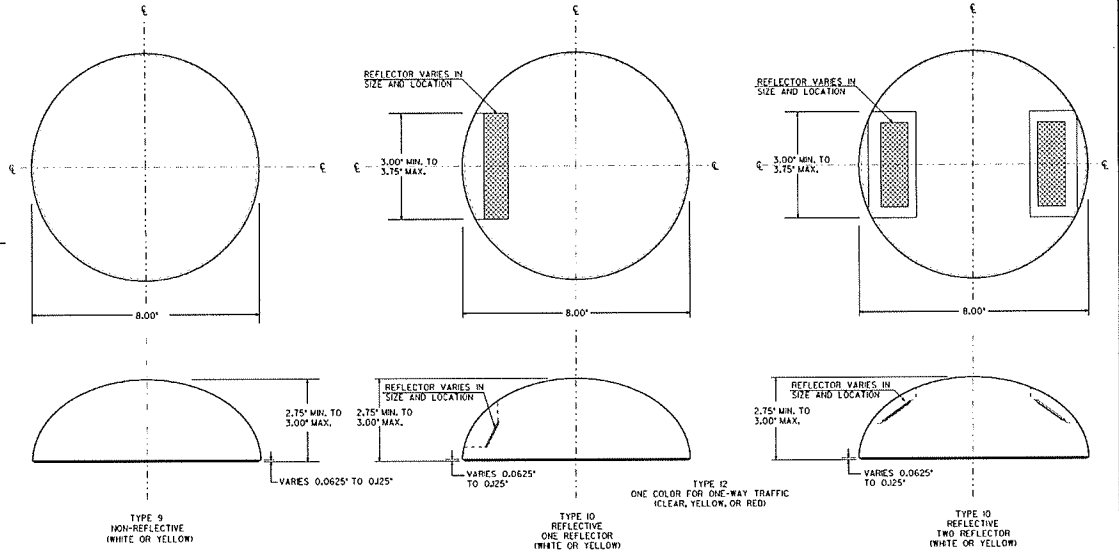


RAISED REFLECTIVE MARKERS

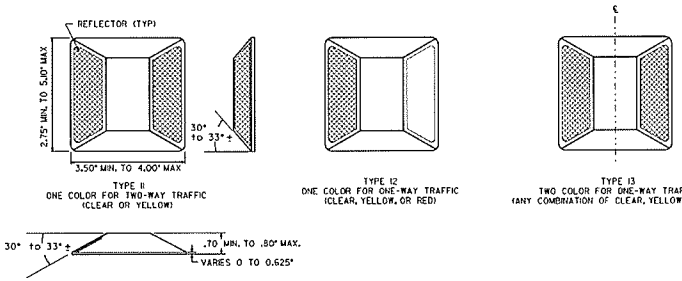




CERAMIC JIGGLE BAR MARKER



CERAMIC CHANNEL MARKER



ALTERNATE RAISED REFLECTIVE MARKERS

GENERAL NOTES:

1. SPECIFICATIONS: GEORGIA STANDARD, CURRENT EDITION, AND SUPPLEMENTS THERE TO.
2. THE CONTRACTOR SHALL USE RAISED PAVEMNT MAKER SOURCES AS LISTED IN OPL 76.
3. COLORS FOR REFLECTIVE ELEMENTS SHALL BE EITHER CLEAR, YELLOW, OR RED AS SPECIFIED.
4. THE SHELL OF THE REFLECTIVE MARKERS SHALL BE OF ONE COLOR OR OF A COMBINATION OF TWO COLORS, WHICH SHALL BE THE SAME AS THE REFLECTIVE ELEMENT.
5. THE SURFACE OF OPAQUE CERAMIC MARKERS SHALL BE GLAZED AND OF THE COLOR SPECIFIED IN THE PLANS WITH A WHITE, VITREOUS, CERAMIC BASE.
6. COLORS FOR ALL RAISED PAVEMENT MARKERS SHALL BE AS SPECIFIED IN THE PLANS.

DATE	REVISIONS
9-22-11	REV. DIMENSIONS, ADDED
	NOTES TO MARKERS
	AND REV. GEN. NOTES.

GEORGIA DEPARTMENT OF TRANSPORTATION
OFFICE OF TRAFFIC SAFETY & DESIGN

DETAILS OF
RAISED PAVEMENT MARKERS

NO SCALE JANUARY 2000

T-15C

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

TRANSPORTATION INVESTMENT ACT OF 2010 SPECIAL PROVISION: FOR PROJECTS FUNDED 100% WITH SPECIAL DISTRICT TRANSPORTATION SALES AND USE TAX PROCEEDS COLLECTED PURSUANT TO THE TRANSPORTATION INVESTMENT ACT OF 2010

Project No.: 0011440

P.I. Number.: 0011440

Counties: Talbot

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1. THE CONTRACTOR AND SURETY ACKNOWLEDGE THAT THE PROJECT IS 100% FUNDED WITH SPECIAL DISTRICT TRANSPORTATION SALES AND USE TAX PROCEEDS COLLECTED PURSUANT TO THE TRANSPORTATION INVESTMENT ACT OF 2010 AND THAT THE DEPARTMENT'S PAYMENT OBLIGATIONS RELATED TO THE PROJECT ARE STRICTLY LIMITED AS SET FORTH HEREIN. THE CONTRACTOR AND SURETY FURTHER ACKNOWLEDGE THAT NO ENTITY OF THE STATE OF GEORGIA OTHER THAN THE DEPARTMENT HAS ANY PAYMENT OR OTHER OBLIGATIONS TO THE CONTRACTOR AND SURETY RELATED TO THE PROJECT.

2. THE OBLIGATION OF THE DEPARTMENT TO PAY OR REIMBURSE ANY INCURRED COST IS EXPRESSLY LIMITED TO THE AMOUNT OF SPECIAL DISTRICT TRANSPORTATION SALES AND USE TAX PROCEEDS REMITTED TO THE DEPARTMENT BY THE GEORGIA STATE FINANCING AND INVESTMENT COMMISSION (GSFIC) AND DESIGNATED BY THE DEPARTMENT FOR THE PROJECT. THIS CONTRACT DOES NOT OBLIGATE THE DEPARTMENT TO MAKE ANY PAYMENT TO THE CONTRACTOR FROM ANY FUNDS OTHER THAN THOSE MADE AVAILABLE TO THE DEPARTMENT FROM THE SPECIAL DISTRICT TRANSPORTATION SALES AND USE TAX PROCEEDS BY GSFIC AND DESIGNATED BY THE DEPARTMENT FOR THE PROJECT. IN THE EVENT THE FUNDS MADE AVAILABLE TO THE DEPARTMENT FROM THE SPECIAL DISTRICT TRANSPORTATION SALES AND USE TAX PROCEEDS ARE INSUFFICIENT FOR THE PROJECT AS DESIGNATED BY THE DEPARTMENT, THE DEPARTMENT'S PAYMENT OBLIGATIONS SHALL NOT EXCEED THE AVAILABILITY OF SUCH SPECIAL DISTRICT TRANSPORTATION SALES AND USE TAX PROCEEDS. IN SUCH AN EVENT, THE DEPARTMENT SHALL HAVE THE RIGHT AT ITS SOLE DISCRETION TO TERMINATE THIS CONTRACT WITHOUT FURTHER OBLIGATION OF THE DEPARTMENT TO THE EXTENT THAT THE

OBLIGATIONS EXCEED THE AVAILABILITY OF SUCH THE SPECIAL DISTRICT TRANSPORTATION SALES AND USE TAX PROCEEDS FOR THE PROJECT AS DESIGNATED BY THE DEPARTMENT OR THE DEPARTMENT MAY DETERMINE IN ITS SOLE DISCRETION THAT A SUSPENSION PERIOD SHOULD BE INSTITUTED AS SET FORTH IN SPECIFICATION 108.06. THE DEPARTMENT'S CERTIFICATION AS TO THE AVAILABILITY OF THE SPECIAL DISTRICT TRANSPORTATION SALES AND USE TAX PROCEEDS AS DESIGNATED BY THE DEPARTMENT FOR THE PROJECT SHALL BE CONCLUSIVE.

3. Any payments shall be made to the Contractor after receipt of such transportation sales and use tax proceeds from GSFIC by the Department. The parties agree that the provisions of the Georgia Prompt Pay Act, O.C.G.A. § 13-11-1 *et seq.*, do not control and that the Contractor waives any and all rights it may have under said Act. The Contractor is still required to comply with the Prompt Payment Special Provision regarding the payment of its subcontractors.

4. All provisions of this Specification shall be incorporated by and into any subcontracts entered into by the Contractor with its subcontractors.

5. **DBE, SMALL BUSINESS AND VETERAN OWNED BUSINESS**
On May 17, 2012, the Department, acting by and through its Board, passed a resolution in which it: (1) reaffirmed its commitment to Title VI of the 1964 Civil Rights Act of nondiscrimination in the delivery and management of Transportation Investment Act funded projects; and (2) encouraged the use of Disadvantaged Business Enterprises (DBE) (including minority and woman owned businesses), small businesses, and veteran owned businesses in any project that is funded in whole or in part by Transportation Investment Act funds, and encouraged wherever practical and feasible, the local government or governments that manage Transportation Investment Act funded projects to include the same in its delivery and management of a project.

   Reference to this resolution shall be included in all subcontracts entered in by the Contractor related to this Project.

   While there is no DBE, small businesses or veteran owned businesses goal required, the Contractor is required to provide the following information monthly to the Department regarding whether it utilized any DBE (as defined in forth in 49 CFR Part 26), small business (as defined in 13, CRR Part 121) or veteran owned, along with the following information:

   1) The names and addresses of DBE firms, small businesses or veteran owned businesses committed to participate in the Contract;
   2) A description of the work each DBE firm, small business or veteran owned business will perform; and
   3) The dollar amount of the participation of each DBE firm, small business or veteran owned business participating.

6. The following is added to Section 101.01:

Abbreviation	Term
GSFIC	Georgia State Financing and Investment Commission
TIA	Transportation Investment Act of 2010

7. Specification 104.03.E is deleted in its entirety and replaced with the following:

E. Changes to Original Length or Cost of Project

The Engineer has the authority to extend or reduce the total length or total cost of the Project by as much as 20 percent, except as provided herein. The provisions of Subsection 104.03.C, covering overruns or underruns of certain Pay Items apply also to overruns or underruns in quantities resulting from an extension or reduction in the length of the Project. If the Project is extended in length, an Extension Agreement will be executed. If the Extension Agreement calls for Pay Items already in the Contract, the Unit Prices for such Items will not be changed except as provided in Subsections 104.03.A, 104.03.B and 104.03.D. New work for which no Unit Prices have been Bid will be paid for as Extra Work as defined in Subsection.

The Engineer may reduce the total length or total cost of the Project by more than 20 percent based upon the availability of special district transportation sales and use tax proceeds remitted to the Department by GSFIC and designated by the Department for the Project. The Department's certification as to the availability of the special district transportation sales and use tax proceeds as designated by the Department for the Project shall be conclusive.

8. Section 105.09 is deleted in its entirety and replaced with the following:

105.09 Authority and Duties of the Resident Engineer

The Resident Engineer, regardless of his administrative title, is the Engineer designated by the Department to be the direct representative of the Chief Engineer. The Resident Engineer has immediate charge of the engineering details of each construction Project, and is responsible for the administration and construction of the Project. Such administration includes the designation of subordinates to represent him and make routine decisions. The Resident Engineer has the authority to reject defective material and to suspend any work that is being improperly performed. The TIA Program Manager may be designated in writing by the Department as the Resident Engineer.

9. Section 105.13.B.2 is deleted in its entirety and replaced with the following:

   2. The Department will be liable only for those delay damages caused by or arising from acts or omissions on the part of the Department which violate legal or contractual duties owed to the Contractor by the Department. The Contractor assumes the risk of damages from all other causes of delay. Furthermore, the Department will not be liable for delay damages or consequential damages caused by, arising from, or resulting from a stoppage of The Work or a suspension period of The Work as a result of the lack of special district transportation sales and use tax proceeds remitted to the Department by GSFIC and designated by the Department for the Project. The Department's certification as to the availability of the special district transportation sales and use tax proceeds as designated by the Department for the Project shall be conclusive.

10. The following subsection is added to Section 105.13:

H. Limitation of Recovery.

Any additional compensation recoverable under this Section will be subject to the availability of special district transportation sales and use tax proceeds remitted to the Department by GSFIC and designated by the Department for the Project. The Department's certification as to the availability of the special district transportation sales and use tax proceeds as designated by the Department for the Project shall be conclusive.

11. Specification 108.03, second paragraph, is deleted in its entirety and replacing with the following:

The Contractor shall furnish the Engineer, for approval, a Progress Schedule immediately following the receipt of the Notice to Proceed. Unless otherwise specified, the schedule shall be prepared on an acceptable critical path schedule which shall be used as the basis for establishing the controlling items of work and as a check on the progress of The Work.

12. Section 108.06 Temporary Suspension of Work is deleted in its entirety and replaced with the following:

The Engineer has the authority to suspend The Work wholly or in part, for as long as he may deem necessary, because of unsuitable weather, lack of special district transportation sales and use tax proceeds remitted to the Department by GSFIC and designated by the Department for the Project, or other conditions considered unfavorable for continuing The Work, or for as long as he may deem necessary by reason of failure of the Contractor to carry out orders given, or to comply with any provisions of the Contract. No additional compensation will be paid the Contractor because of suspension except as specifically set forth below. If it becomes necessary to stop The Work for an indefinite period, the Contractor shall store all materials in such a way that they will not impede the traveling public unnecessarily or become damaged in any way, and he shall take every precaution to prevent damage or deterioration of The Work done; provide suitable drainage of the roadway, erect temporary structures where necessary, and install all necessary safety features. The Work shall be resumed when conditions are favorable or when corrective measures satisfactory to the Engineer have been applied; when, and as ordered by the Engineer in writing. The Contractor shall not stop The Work without authority.

If The Work is stopped by the lack of special district transportation sales and use tax proceeds remitted to the Department by GSFIC and designated by the Department for the Project or any temporary or permanent injunction, court restraining order, process or judgment of any kind, directed to either of the parties hereto, then such period or delay will not be charged against the Contract Time nor shall the Department be liable to the Contractor on account of such delay or termination of work.

SUSPENSION PERIOD FOR LACK OF SPECIAL DISTRICT TRANSPORTATION SALES AND USE TAX PROCEEDS:

If The Work is stopped and a suspension period is instituted by the Department in writing as a result of the lack of special district transportation sales and use tax proceeds remitted to the Department by GSFIC and designated by the Department for the Project, such suspension shall last for a maximum of ninety (90) days.

Traffic control, erosion control, other safety concerns, demobilization and remobilization in preparation for or during the suspension period may be considered Extra Work at the sole discretion of the Department. Any payment for this Extra Work will be contingent upon the availability of such special district transportation sales and use tax proceeds as determined by the Department in its sole discretion, and will be subject to the priority policy contained in the Department's TIA Invoice Process, which may be amended from time to time.

This Contract does not obligate the Department to make any payment to the Contractor for said Extra Work from any funds other than from available special district transportation sales and use tax proceeds as designated by the Department for the Project.

After this ninety (90) day period, if special district transportation sales and use tax proceeds as designated by the Department for the Project are available or anticipated to be available, including for any acceptable costs incurred prior to the preparation for or during the suspension period, as determined in the sole discretion of the Department, the Contractor will be directed by the Department to either (1) continue The Work under the Contract or (2) agree to a new suspension period as determined by the Department.

After this ninety (90) day period, if special district transportation sales and use tax proceeds as designated by the Department for the Project are not available or anticipated to be available, the Contractor will have the ability to terminate the contract with thirty (30) days of written notification from the Department. If the Contractor does not terminate the contract, then the Department will have the option in its sole discretion to:

(1) terminate this Agreement at any time upon written notification by the Department to the Contractor; or

(2) suspend the work permanently. If the work is suspended permanently by the Department, the Agreement will terminate immediately upon the earlier of the following:

(i) the Contractor has been paid or reimbursed for all outstanding invoices related to traffic control, erosion control, other safety concerns, demobilization and remobilization in preparation for or during the suspension period that has been approved by the Department as Extra Work, and for any acceptable costs incurred prior to the preparation for or during the suspension period, said payment or reimbursement made from any subsequently collected transportation sales and use taxes which the Department has designated in its sole discretion for the Project and said Extra Work. The Contractor will only be reimbursed actual costs associated with this Extra Work or any work completed prior to the preparation for or during the suspension period as approved by the Department and waives any and all claims for delay damages, those damages set forth in 105.13.B.8, or other associated damages. Any payment or reimbursement made for this Extra Work during the permanent suspension period will be made by joint check payable to the Contractor and its Suret(ies).

or

(ii) the TIA Program ceases, as determined by the Department in its sole discretion.

To the extent practically possible, the Department will provide written notification to the Contractor that The Work is going to be stopped either permanently or during a suspension period as the result of the lack of special district transportation sales and use tax proceeds three (3) months prior to the date of The Work stoppage.

The Department's certification as to the availability of the special district transportation sales and use tax proceeds as designated by the Department for the Project shall be conclusive.

The contract time will be extended to reflect the length of the suspension period and any resulting delays. No damages for delay or consequential damages will be recoverable as a result of any suspension period.

The provisions of Specification 104.05.B do not apply during a suspension period for lack of special district transportation sales and use tax proceeds

13. Section 109.07.A is deleted in its entirety and replaced with the following:

A. General

Subject to availability of special district transportation sales and use tax proceeds remitted to the Department by GSFIC and designated by the Department for the Project, at the end of each calendar

month, the total value of Items complete in place will be estimated by the Engineer and certified for payment. Such estimate is approximate only and may not necessarily be based on detailed measurements. Value will be computed on the basis of Contract Item Unit Prices or on percentage of completion of Lump Sum Items.

When so requested by the Contractor and approved by the Engineer, Gross Earnings of $500,000.00 or more for work completed within the first 15 days of any month will be certified for payment on a semi-monthly basis subject to the conditions and provisions of Subsection 109.07.A, Subsection 109.07.B.6, Subsection 109.07.C, Subsection 109.07.D, Subsection 109.07.E, and Subsection 109.07.F.

The Department's certification as to the availability of the special district transportation sales and use tax proceeds as designated by the Department for the Project shall be conclusive.

14. 109.09 Termination Clause, is deleted in its entirety and replaced with the following:

A. General

The Department may, by written notice, terminate the Contract or a portion thereof for the Department's convenience when the Department determines that the termination is in the State's best interest, or when the Contractor is prevented from proceeding with the Contract as a direct result of one of the following conditions:

1. An Executive Order of the President of the United States with respect to the prosecution of war or in the interest of national defense.
2. The Engineer and Contractor each make a determination, that, due to a shortage of critical materials required to complete the Work which is caused by allocation of these materials to work of a higher priority by the Federal Government or any agency thereof, it will be impossible to obtain these materials within a practical time limit and that it would be in the public interest to discontinue construction.
3. An injunction is imposed by a court of competent jurisdiction which stops the Contractor from proceeding with the Work and causes a delay of such duration that it is in the public interest to terminate the Contract and the Contractor was not at fault in creating the condition which led to the court's injunction.

   The decision of the Engineer as to what is in the public interest and as to the Contractor's fault, for the purpose of Termination, shall be final.
4. Orders from duly constituted authority relating to energy conservation.
5. The lack of special district transportation sales and use tax proceeds remitted to the Department by GSFIC and designated by the Department for the Project.

B. Implementation

When, under any of the conditions set out in Subsection A of this Section, the Contract, or any portion thereof, is terminated before completion of all Items of Work in the Contract, the Contractor shall be eligible to receive some or all of the following items of payment, subject to availability of special district transportation sales and use tax proceeds remitted to the Department by GSFIC and designated by the Department for the Project, with the Department's certification as to the availability of the special district transportation sales and use tax proceeds as designated for the Project being conclusive:

1. For the actual number of units of Items of Work completed, payment will be made at the Contract Unit Price.
2. Reimbursement for organization of the Work and moving equipment to and from the job will be considered where the volume of work completed is too small to compensate the Contractor for these expenses under the Contract Unit Prices. However, the Engineer's decision as whether or not to

reimburse for organization of the Work and moving equipment to and from the job, and in what amount, shall be final.

3. Acceptable materials, obtained by the Contractor for the Work, that have been inspected, tested, and accepted by the Engineer, and that are not incorporated in the Work will, at the request of the Contractor, be purchased from the Contractor at actual cost as shown by receipted bills and actual cost records at such points of delivery as may be designated by the Engineer. This will include any materials that have been delivered to the project site or that have been specifically fabricated for the project and are not readily usable on other projects. It will not include materials that may have been ordered, but not delivered to the project site and that are readily usable on other projects (e.g., guard rail, stone, lumber, etc.).
4. For Items of Work partially completed, payment adjustments including payments to afford the Contractor a reasonable profit on work performed, may be made as determined by the Engineer based upon a consideration of costs actually incurred by the Contractor in attempting to perform the Contract.
5. No payment will be made, and the Department will have no liability, for lost profits on Work not performed. In particular, the Department will not be liable to the Contractor for all profits the Contractor expected to realize had the Project been completed, nor for any loss of business opportunities, nor for any other consequential damages.
6. In order that the Department may make a determination of what sums are payable hereunder, the Contractor agrees that, upon termination of the Contract, it will make all of its books and records available for inspection and auditing by the Department.

   To be eligible for payment, costs must have been actually incurred, and must have been recorded and accounted for according to generally accepted accounting principles, and must be items properly payable under Department policies. Where actual equipment costs cannot be established by the auditors, payment for unreimbursed equipment costs will be made in the same manner as is provided in Subsection 109.05 for Force Account Work. Idle time for equipment shall be reimbursed at standby rates. In no case will the Contractor be reimbursed for idle equipment after the Engineer has advised the Contractor the equipment is no longer needed on the job. Refusal of the Contractor to allow the Department to inspect and audit all of the Contractor's books and records shall conclusively establish that the Department has no liability to the Contractor for any payment under this provision, and shall constitute a waiver by the Contractor of any claim for damages allegedly caused by breach or termination of the Contract. The amount payable under this provision, if any, is to be determined by the Engineer, whose determination will be final and binding.
7. The sums payable under this Subsection shall be the Contractor's sole and exclusive remedy for termination of the Contract.

C. Termination of a Contract

Termination of a Contract or a portion thereof shall not relieve the Contractor of his responsibilities for any completed portion of the Work, nor shall it relieve his Surety of its obligation for and concerning any just claims arising out of the Work performed.

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

P.I. No.: 0011440

County: Talbot

Construction Details for Resurfacing and Widening Projects

A. General

Perform patching, according to Plan details and the applicable portions of Section 400.

The provisions of Sections 104 and 105 apply when patching operations necessitate traffic control in construction areas.

B. Spot Patching and Replacement of Existing Base

1. Complete all removal and patching operations at any one site within the same day.
2. Hand spreading and compaction using mechanical tampers will be required in areas inaccessible to conventional equipment.
3. Patching is paid for according to the Plans and Proposal. Payment includes all removal and replacement work necessary to complete the Item.

C. Shoulders

No shoulder construction will be required on Projects that have no widening or new shoulder paving, except where additional shoulder work is shown on the Plans.

For Projects involving pavement widening or paved shoulder construction, the cost of trenching and shoulder construction or reconstruction of the existing shoulders is included in the overall bid submitted.

Ensure trenching and shoulder construction conforms to the following requirements:

1. Trenching consists of the removal, satisfactory disposal and replacement of existing shoulder materials. Ensure trench dimensions are according with Plan details.
   Remove and dispose of all materials excavated from the trench widening operation. Excess material is to be disposed of at an approved soil disposal site. Compact subgrade under widening sections to 95% of the theoretical density as determined by GDT 7, GDT 67, or GDT 24.
2. Where trenching is necessary for widening or paved shoulder construction, complete all operations at any one site to the level of the existing pavement in the same working day.

Revised May 20, 2013

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

Project No.: 0011440

P.I. No.: 0011440

Section 105.04 - Coordination of Plans, Specifications, Supplemental Specifications, and Special Provisions
Transportation Investment Act (TIA) Project

Delete Subsection 105.04 and substitute the following:

105.04 Coordination of Plans, Specifications, Supplemental Specifications, and Special Provisions

These *Standard Specifications*, the Supplemental Specifications, the Plans, Special Provisions, and all supplementary documents are essential parts of the Contract, and a requirement occurring in one is as binding as though occurring in all. They are intended to be complementary and to describe and provide for a complete work.

In cases of discrepancy, the governing descending order will be as follows:

1. Transportation Investment Act of 2010 Special Provision
2. Special Provisions
3. Project Plans including Special Plan Details
4. Supplemental Specifications
5. Standard Plans including Standard Construction Details
6. Standard Specifications

Calculated dimensions will govern over scaled dimensions.

The Contractor shall take no advantage of any apparent error or omission in the Plans or Specifications. In the event the Contractor discovers such an error or omission, he shall immediately notify the Engineer. The Engineer will then make such corrections and interpretations as may be deemed necessary for fulfilling the intent of the Plans and Specifications.

A. Specifications of Other Organizations

When work is specified to be done or when materials are to be furnished according to the published specifications of organizations other than the Department, the latest specifications published by those organizations at the time bids are received shall apply unless otherwise specified.

AASHTO Interim Specifications and ASTM Tentative Specifications will be considered effective on date of issue.

B. Item Numbers

The first three digits of any Item Number in the itemized Proposal designates the Specification section under which the Item shall be constructed.

3. Perform widening operations on only one side of the existing traveled roadway at a time within any one- half-mile (800 m) stretch.

D. Other Work

The Department reserves the right to perform, with its own forces, any maintenance or construction work as may be necessary on or near The Work covered by the Contract.

E. Enforcement

If the requirements of this Specification are not achieved, the Engineer will cease all Work being performed and may withhold any monies due, or which may become due until the above requirements have been met.

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

P.I. No.: 0011440

County: Talbot

Section 108 – Prosecution and Progress

Add the following to Subsection 108.08:

C. Intermediate Completion Schedule

An overall Completion Date has been established. However, it is necessary to complete certain portions of The Work at an earlier time.

The following items of work and corresponding intermediate completion times are required:

Complete Paving Operations

1. Failure to complete all paving operations (eg., shoulder clipping, patching, milling, leveling, resurfacing, etc.) within One Hundred Twenty (120) calendar days, from the start of any of the paving operations, will result in the assessment of Liquidated Damages at a rate of $200 per calendar day.

2. Failure to complete all work, with the exception of Permanent Pavement Markings, by August 31, 2015 will result in the assessment of Liquidated Damages at a rate of $200 per calendar day.

These rates are cumulative and in addition to Liquidated Damages that may be assessed in accordance with Subsection 108.08 for failure to complete the overall project.

First Use: June 21, 2013
(Office of TIA)

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

P.I. No.: 0011440

County: Talbot

Section 150 – Traffic Control

Add to Section 150.03 the following:

150.03.O Transportation Investment Act (TIA) Signs

TIA Logo Signs

The Department will provide to the Contractor, two (2) 36"X48" TIA Logo Signs. The signs shall be installed by the Contractor on each end of the Project, prior to beginning The Work. The signs shall be removed by the Contractor when the Contract Time Charges are stopped by the Department. Upon removal, the signs will be returned to the Department or its Agent. The cost for installation, maintenance and removal of the signs shall be included in the overall price bid for ITEM 150-1000 Traffic Control.

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

Section 713—Organic and Synthetic Material Fiber Blanket

Delete Section 713 and add the following:

713.1 General Description

This work includes furnishing and placing straw, excelsior, coconut fiber, wood fiber, or synthetic blankets over previously prepared and grassed (temporary or permanent) areas as shown on the Plans or as directed by the Engineer.

713.1.01 Definitions

- Straw Blanket: A machine-produced blanket of clean, weed-free, consistently thick straw from agricultural crops. The straw is evenly distributed over the entire area of the blanket.
- Excelsior Blanket: A machine-produced mat of curled wood excelsior. Eighty percent consists of 6 in (150 mm) or longer fiber evenly distributed over the entire blanket.
- Coconut Fiber Blanket: A machine-produced blanket of 100 percent coconut fiber evenly distributed over the entire blanket.
- Wood Fiber Blanket:

  Type I—A machine-produced blanket manufactured with reprocessed wood fibers to a consistent thickness.

  Type II—A hydraulically applied bonded fiber matrix which upon drying, adheres to the soil in the form of a continuous 100 percent coverage, biodegradeable erosion control blanket
- Synthetic Fiber Blanket—A machine produced uniform blanket of ultraviolet degradable polypropylene staple fibers reinforced with ultraviolet degradable polypropylene netting.

713.1.02 Related References

A. Standard Specifications

General Provisions 101 through 150.

B. Referenced Documents

General Provisions 101 through 150.

713.1.03 Submittals

Use approved materials from QPL 62 without further testing. Otherwise, submit materials for testing before use.

713.2 Materials

Use blankets that meet the following requirements for placement on slopes and waterways. For a list of organic material fiber blankets, see QPL 62.

A. Straw Blanket

Use blankets at least 48 in (1.2 m) wide and at least 3/8 in (9 mm) thick with a minimum dry weight of 0.5 lb/yd² (270 g/m²) and a stitch pattern and row spacing of no more than 2 in (50 mm).

Have the top side covered with a photo-degradable plastic mesh having a maximum mesh size of 1/2 in by 1/2in (13 mm by 13 mm). Sew the mesh to the straw with biodegradable thread.

Use this blanket on slopes only.

B. Excelsior Blanket

Use a smolder-resistant blanket with the top side clearly marked. Use a blanket at least 48 in (1.2 m) wide and 1/4 in (6 mm) thick with a minimum dry weight of 0.8 lb/yd² (430 g/m²) and a stitch pattern and row spacing of no more than 2 in (50 mm).

- Slopes: Have the top side covered with a photo-degradable plastic mesh having a maximum mesh size of 1-1/2 by 3 in (38 by 75 mm).
- Waterways: Have the top and bottom sides of the blanket covered with a photodegradable plastic mesh having a maximum mesh size of 1 ½ x 3 in (38 x 75 mm), sewn to the fiber with biodegradable thread or otherwise bonded as approved by the Engineer.

C. Coconut Fiber Blanket

Use a blanket at least 48 in (1.2 m) wide and 1/4 in (6 mm) thick with a minimum dry weight of 0.5 lb/yd² (270 g/m²) and a stitch pattern and row spacing of no more than 2 in (50 mm). Use the blanket in waterways only.

Ensure that both sides of the blanket are covered with a photo-degradable plastic mesh with a maximum of 5/8 by 5/8 in (19 by 19 mm). Have the mesh sewn to the fiber with a breakdown-resistant synthetic yarn.

D. Wood Fiber Blanket

Type I

- Use a machine produced blanket manufactured to a consistent thickness using reprocessed wood fibers.
- Use a blanket at least 48 in (1.2 m) wide with a minimum dry weight of 0.35 lb/yd^2 (190 g/m^2).
- Ensure that the top side of the blanket is covered with a photo-degradable plastic mesh with a maximum of 5/8 x 3/4 in (16 x 19 mm) securely bonded to the mat.
- Ensure the fibers do not contain a growth that inhibits germination.
- Use Type I blanket on shoulder construction on resurfacing projects.

Type II

For Shoulder Construction on Resurfacing Projects

- Ensure the bonded fiber matrix is composed of long strand wood fibers or cellusosic-based fibers held together by a bonding agent, which, upon drying, becomes insoluble and non-dispersable.
- Apply the matrix at the following at the rate of 3000 lbs/acre (3.4 Mg/ha) for shoulder construction on resurfacing projects.
- Do not apply the bonded matrix on saturated soils or immediately before, during or after rainfall. Allow the matrix to dry for at least 24 hours after installation. After drying period, ensure that the bonded fiber matrix does not inhibit the germination or growth of plants beneath and through the formed matrix blanket and that it does not form a water insensitive crust.
- If bonded fiber matrix is to be used, the application of straw mulch for grassing operations is not required.

E. Synthetic Fiber Blanket

Use a blanket having a minimum net size of 5/8 x 3/4 inch (16 x 19 mm). Ensure the netting is securely bonded to the blanket and that the blanket conforms to the following physical properties:

PROPERTY	MINIMUM VALUE	TEST METHOD
Weight	1 oz/sq. yd (34 g/m^2)	
Roll Width	48 inch (1.2 m	
Tensile Strength Length	6 lbs./in	ASTM D 1682 [6" (150 mm) strip)]

Use Synthetic fiber blanket on slopes only.

F. Net-free Excelsior Blanket

Use only on 4:1 and flatter slopes.

Use a smolder-resistant blanket at least 48 in (1.2m) wide and ¼ in (6mm) thick with a minimum dry weight of 0.73 lb/yd² (390 g/m²).

Use a blanket consisting of curled, interlocking, Aspen fibers with a cross section of 0.038± 0.010 in X 0.018± 0.003 in (0.97±0.25mm X 0.45±0.08mm). Ensure that a minimum of 80% of the fibers are at least 6 in (150mm) long. Ensure that the fibers are stiched with biodegradable thread in a 2 in X 4 in ± 0.5 in (50mm X 100mm ±13mm) pattern.

G. Anchoring Staples

Use anchoring staples made from minimum 11-gauge wire, formed into a U shape. Ensure that the legs are at least 6 in (150 mm) long and the crown at least 1 in (25 mm) wide. Use staples rigid enough to penetrate the soil without distortion.

713.3 Construction Requirements

713.3.01 Personnel

General Provisions 101 through 150.

713.3.02 Equipment

General Provisions 101 through 150.

713.3.03 Preparation

Before placing the blanket, complete the grassing operations, smooth the area, and remove stones, lumps, roots, or other material that would prevent the blanket from laying snugly on the soil.

713.3.04 Fabrication

General Provisions 101 through 150.

713.3.05 Construction

A. Placing Blanket

Place blankets or mats vertically on slopes, beginning at the top of the slope and extending to the bottom of the slope. Horizontal installation of the blankets is not permitted.

Place the blanket within 24 hours after planting and before rain or watering. Place the blanket on slopes and waterways as follows:

1. On Slopes

   Unroll the blanket with the netting on top and the fibers contacting the soil over the entire slope. When using two or more blankets to cover an area, overlay the joint 4 in (100 mm) and staple through the joint. Overlap the ends of the blanket at least 6 in (150 mm) with the upgrade section on top and staple through the overlap.

2. In Waterways

In waterways, ditches, flumes, and channels unroll the blanket with netting sewn on both sides and place in contact with the soil beginning at the downstream terminal and progressing upstream of the blanket according to the Construction Detail for Permanent Soil Reinforcing Mat.

Allow a longitudinal seam only if the blankets overlap at least 6 in (150 mm) and are securely stapled. Overlap ends of the blanket at least 6 in (150 mm) with the upgrade section on top.

Insert 12 in (300 mm) of the upslope end of the first row of blankets into a 6 in (150 mm) deep anchor slot. Staple the blanket in the slot bottom, backfill the slot, and solidly tamp.

B. Stapling

Drive staples vertically into the ground to anchor the plastic mesh. Place the staples approximately 2 yd (2 m) apart on each side of the blanket and add one row in the center alternately spaced between each side staple.

Where blankets lay side to side, place each staple so that half of the staple anchors mesh from each blanket.

At the beginning of a blanket, space staples approximately 12 in (300 mm) apart in a row.

C. Steep Slopes

The Engineer may specify additional staples or check slots in waterways where slopes are steep or large water volumes and/or velocities are anticipated.

713.3.06 Quality Acceptance

General Provisions 101 through 150.

713.3.07 Contractor Warranty and Maintenance

Maintain the blanket installation throughout the life of the Contract. If before Final Acceptance any staples become loose or lift up or if the blanket becomes loose, torn, or undermined, then fix the problem by reshaping, regrassing, refertilizing, or replacing damaged areas. Repairs are done without additional compensation.

713.4 Measurement

Straw blanket excelsior blanket, coconut fiber blanket, or synthetic blanket, installed and accepted is measured for payment by the square yard (meter) as specified in Section 716 Erosion Control Mats (Slopes). Wood Fiber Blanket Type I & Type II (shoulders) will be measured for payment by the square yard (meter). Laps and blanket in the anchor slots are not measured. They are considered incidental to the work.

713.4.01 Limits

General Provisions 101 through 150.

713.5 Payment

The preliminary preparation of the areas on which the blanket is to be placed, including seeding or sodding, will be paid for under the appropriate Contract Items.

Straw blanket excelsior blanket, coconut fiber blanket, Type I wood fiber blanket (slopes) or synthetic fiber blanket will be paid for at the Contract Unit Price per square yard (meter) under Item 716 Erosion Control Mats (Slopes). Wood Fiber Blanket Type I & Type II (shoulders) will be paid for by the square yard (meter). Payment is full compensation for the construction of the Item including all laps, materials, equipment, tools, labor, incidentals, and maintenance.

Payment will be made under:

Item No. 713	Wood fiber blanket Type I (shoulders)	Per square yard (meter)
Item No. 713	Wood fiber blanket Type II (shoulders)	Per square yard (meter)
Item No. 716	Erosion Control Mats, Slopes	Per square yard (meter)