MARYLAND TRANSPORTATION AUTHORITY
Baltimore, Maryland

Invitation for Bids

FRANCIS SCOTT KEY BRIDGE

Maryland
Transportation
Authority

Contract No. KB 430-000-006R

MD 695 /QUARANTINE ROAD INTERCHANGE IMPROVEMENTS

BALTIMORE CITY

June 2009

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NOTICE TO BIDDERS

A "Pre-Bidding Session" for the purpose of answering or obtaining answers to questions of parties interested in constructing the work relative to Right-of-Way, Utilities, Design, and Construction Details will be conducted at 9:00 am on July 14, 2009, in the Conference Room, 2nd Floor of Francis Scott Key Bridge Engineering/Finance Building at 300 Authority Drive in Dundalk, Maryland. While attendance at the Pre-Bid conference is not mandatory, this is the offerer's opportunity to raise questions and/or issues of concern regarding the Project.

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Notice to Bidders/Offerors

EMaryland Marketplace Fee

In order to take advantage of Maryland State and Local government contracting opportunities, vendors/contractors are encouraged to register with eMaryland Marketplace. The free registration provides a means for businesses to receive e-mail notification of upcoming contracting opportunities in their specified areas of interest and expertise.

For registration requirements, visit:

www.eMarylandMarketplace.com

NOTICE TO BIDDERS

Please review the checklist prior to submitting your bid on this Contract.

- When submitting your completed bid, do not separate the book. Submit the whole book including all addenda acknowledgment pages.
- Make sure that all addenda letters are attached outside of the front cover of the bid book.
- If the addendum has revised the Schedule of Prices, make sure that you have included the revised pages in your bid. Your price should reflect any and all changes.
- Prices must be written numerically and in words, unless approved substitute forms are used (Refer to GP-2.06). Don't leave any items blank.
- When tabulating your final price, make sure all your calculations are correct.
- Minority Business Enterprise Attachments A and B must be completed and submitted with your bid. If either of these attachments is missing your bid is non-responsive. Attachments C and D **should not** be submitted at time of bid.
  For additional information on how to complete the MBE Attachments, please see the insert named "Important Information regarding MBE Utilization and Bidding Requirements" located in the IFB.
- The Bid/Proposal Affidavit must be completely filled out and signed by all the parties as indicated.
- If Escrow is being offered in a contract, the contractor must indicate whether or not they wish to utilize an Escrow Account for Retained Funds on the provided form.
- A bid bond must accompany all bids of One Hundred Thousand Dollars ($100,000.00) or more. The bid bond document must be completely filled out and have an original Power of Attorney form attached.
- If the document is too large for the envelope that we have provided, you can place the document in another form of packaging that can be sealed and submitted. If the document is too large for the bid box, you should alert the receptionist.
- Make sure that your company's name, address, the contract number and the bid date appears on the front of the packaging.
- When submitting bid packages via US Mail, Federal Express, DHL, UPS or any other delivery service it is your responsibility to make sure that the bid reaches the bid box before the time deadline. It may be in your best interest to send the package 24 hours in advance of the deadline. Also, when sending packages this way, make sure that the labeling specifies that it is a bid submission.

IMPORTANT INFORMATION REGARDING MBE UTILIZATION AND BIDDING REQUIREMENTS

The Maryland Transportation Authority (the "Authority") has been forced to reject many recent bids/proposals due to bid submissions that were not in strict compliance with the stipulated MBE rules and regulations. The following checklist has been developed to highlight certain critical components of the MBE program requirements. This listing is not all-inclusive and the bidder **must** comply with all MBE rules and regulations listed throughout this entire proposal book.

Please read all of the instruction provided on Attachment A, B, C & D in its entirety before completing the forms.

Attachment A (Certified MBE Utilization and Fair Solicitation Affidavit) & Attachment B (MBE Participation Schedule) must be included with the submittal of the bid or offer. If the bidder or offeror fails to submit these forms with the bid/offer as required, the Procurement Officer **shall deem the bid non-responsive** or shall determine that the **offer is not reasonably susceptible** of being selected for award. MBE Prime Contractors must achieve the established MBE goal with other certified MBE contractors. A Prime MBE Contractor **can not** count itself as an MBE to obtain the goal.

ATTACHMENT A

When filling out Attachment A, make sure you complete the following:

- If the Prime Contractor can achieve the established overall goal and sub goals, you must check the appropriate box.
- If after making good faith efforts, you determine you can not achieve the established overall goal or subgoals, you must request a waiver by checking the appropriate box.
- If you do not request the waiver at time of bid and you **are not** meeting the established goal(s), your bid/offer will be considered **non-responsive or not reasonably susceptible of being selected for award.**
- Attachment A must be signed and dated.

ATTACHMENT B Part 2

When filling out Attachment B, make sure you have included the following:

- Prime Contractor's name, address and phone number.
- Project description.
- Project number/Solicitation Number.
- List the minority firm name(Column 1), certification number and MBE Classification (Column 2), Total sub contract dollar amount (Column 3) and NAICS Codes of the services to be performed or products to be supplied (Column 4)
- Clarify for each sub-contractor if it will provide services, is a supplier or will supply and install (Column 5)
- It is the Contractor's responsibility to ensure that the proposed subcontractors are certified to perform the proposed work. All Contractors are to submit an approvable MBE plan at time of bid. Approvable means, the subcontractors are certified in the applicable NAICS Codes through MDOT and can perform the proposed services for the required participation goal. Contractors pending MBE certification at time of bid are **not** eligible for participation. If you submit a firm that is not certified to perform the proposed services and your contract falls short of the established MBE goal, your firm will be considered **non-responsive or not reasonably susceptible of being selected for award.**
- Prime Contractors are strongly encouraged to check the MDOT database at www.mbe.mdot.state.md.us to see if the subcontractor is certified to perform the services and to make sure the subcontractor has not graduated from the listed NAICS codes. If you have questions after checking the data base, you may contact the Authority MBE Office at 410-537-1048 for further assistance.

  If you are using a supplier, the 60% rule applies. Please refer to the MBE Manual for the description of the 60% rule.

  Please provide details on how you arrived at the 60% on Attachment B (Column 5) (i.e. – $150,000.00 X 60% = $90,000.00).

- If you are requesting a third tier relationship, you must state that request on the Attachment B form (Column 1). Please note: Third Tier MBE/DBE subcontracting will be approved by the Authority only when the Authority is satisfied that there is no way except by Third Tier contracting that an MBE/DBE goal can be achieved.

Specifics as to why a Third Tier contracting agreement must be included.

- Attachment B must be signed and dated.

- If you are the apparent low bidder, you will receive a letter from the Authority requesting your MBE Attachment C (Outreach Efforts Compliance Statement) and Attachment D (Subcontractor Project Participation Affidavit). You will have ten (10) working days to submit the attachments to the Authority. If you requested a waiver at time of bid, all of the back up documentation that complies with COMAR 21.11.03.11, must be submitted within the ten working days with Attachments C & D.

- If the apparent low bidder fails to return the required documentation within the allotted ten (10) days, the Procurement Officer may determine that the apparent low bidder is not responsible and therefore not eligible for contract award.

OCCUPYING WETLANDS

The Contractor is hereby alerted to the importance of preserving wetland areas. The Administration, in conjunction with the various environmental agencies, has developed these Contract Documents so as to minimize or eliminate disturbance and damage to existing wetland areas. In order to accomplish this, the following must be rigidly adhered to:

(a) Prior to performing any work on the project, the areas of wetland will be identified and marked as directed by the Administration. All personnel of the Contractor or sub-contractors shall be alerted to these designated areas.

(b) The Contractor or sub-contractors shall not impact any wetland or waterway, whether it be permanently or temporarily unless otherwise stipulated in the permit application and approved as an authorized action by the appropriate regulatory agency. No fill shall be placed in these areas without a permit.

(c) If a Contractor or sub-contractor has to impact a wetland or waterway that is not covered by an existing wetland permit, they shall immediately notify the Engineer. The Engineer will notify the Environmental Programs Division to determine the extent of any permit modification. At that time the Environmental Programs Division will request a permit modification or submit a permit application.

(d) If the Contractor impacts any wetland or waterway for which they do not have a wetland permit, they shall be responsible for restoring the wetland areas and possibly mitigating the wetland impacts to the full satisfaction of the environmental agencies, which could include monetary compensation.

(e) The cost of restoration and mitigation of the impacted areas shall be at no additional cost to the Administration.

The importance of not abusing the wetland areas cannot be overemphasized. Abuse of wetland areas could jeopardize the operation of the total Contract and could be cause for a shut-down. If a shut-down occurs because of the Contractor's failure to secure the required permits (i.e. the Contractor's method of work includes impacts not approved by previously acquired permits), the Contractor's negligence or operations, all costs and damages to the Contractor and to the State will be at no additional cost to the Administration. Noncompliance with these requirements will not be considered for an extension of Contract time.

NOTICE TO ALL HOLDERS OF THIS CONTRACT DOCUMENT

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM (NCHRP) REPORT 350 IMPLEMENTATION SCHEDULE FOR DEVICES USED IN THE MAINTENANCE OF TRAFFIC

Except as otherwise specified in this Section, all items for the maintenance of traffic, including those listed under the following categories, shall be crashworthy in conformance with Level 3 or other Level as specified by the Engineer in conformance with the safety crash testing and performance criteria published in the National Cooperative Highway Research Program (NCHRP) Report 350, "Recommended Procedures for the Safety Performance Evaluation of Highway Features." When conformance with NCHRP Report 350 is required, the Contractor shall provide the Engineer with the manufacturers' certifications that the devices comply with the specified criteria.

Unless specifically waived by an attachment to these Contract Provisions, devices must be approved by the Office of Traffic and Safety.

Category 1 Devices

These devices are cones, tubular markers, flexible delineator posts, and drums, all without any accessories or attachments, which are used for channelization and delineation.

Category 2 Devices

These devices are Type I, II, and III barricades; portable sign supports with signs; intrusion alarms; and drums, vertical panels, and cones, all with accessories or attachments.

Category 3 Devices

(a) Truck Mounted Attenuators (TMAs).

(b) Temporary Barrier.

(1) Concrete Barrier.

(2) Traffic Barrier W Beam and Water Filled Barrier.

(c) Temporary End Treatments.

Category 4 Devices

These devices are area lighting supports, arrow panels, and portable variable message signs that are usually portable or trailer-mounted.

WORK ZONE DEVICES	IMPLEMENTATION SCHEDULE TO CONFORM TO NCHRP REPORT 350 CRITERIA
CATEGORY 1 Cones, tubular markers, flexible delineator posts, and drums (all without any accessories or attachments)	All devices shall conform to NCHRP Report 350 criteria.
CATEGORY 2 Type I, II, and III barricades; portable signs supports with signs; intrusion alarms; and drums, vertical panels, and cones (all with accessories or attachments)	All devices shall conform to NCHRP Report 350 criteria.
CATEGORY 3 (a) Truck Mounted Attenuators (TMA) (b) Temporary Barriers (1) Concrete Barrier (2) Traffic Barrier W Beam and Water Filled Barrier (c) Temporary End Treatments	All devices shall conform to NCHRP Report 350 criteria.
CATEGORY 4 Portable trailer mounted devices including area lighting supports, arrow panels, and changeable message signs	The Contractor may use devices that do not conform to NCHRP Report 350 criteria, until compliance dates are established. Use of these devices shall comply with the provisions of Part 6 of the MUTCD.

NOTICE TO ALL HOLDERS OF THIS CONTRACT DOCUMENT

HIGH VISIBILITY SAFETY APPAREL POLICY

BACKGROUND. Research indicates that high visibility garments have a significant impact on the safety of employees who work on highways and rights-of-way. In addition, high visibility garments may help to prevent injuries and accidents and to make highway workers more visible to the motoring public, which ultimately improves traffic safety.

STATEMENT OF POLICY.

(a) The High Visibility Safety Apparel Policy provides a standardized apparel program.

(b) The program seeks to improve the visibility of all persons who work on Administration highways and rights-of-way.

(c) All apparel shall contain the appropriate class identification label.

(d) Compliance with this policy is retroactive and becomes effective immediately. All affected employees shall receive high visibility apparel awareness training.

APPLICABILITY. This policy applies to all Administration employees and all other persons who work on Administration highways and rights-of-way. All workers shall wear, at a minimum, Class 2 ANSI/ISEA 107/2004 apparel.

(a) For Administration employees, this apparel shall have a fluorescent yellow-green background material color and be the outermost garment worn.

(b) Retro-reflective material color for Administration employee apparel shall be silver or white and be visible at a minimum distance of 1,000 feet. The retro-reflective safety apparel shall be designed to clearly recognize and differentiate the wearer from the surrounding work environment. The retro-reflective material may be contrasted by fluorescent orange background material not exceeding one and one half inches on either side of the retro-reflective material.

(c) For non-Administration employees, this apparel shall be either fluorescent orange-red or fluorescent yellow-green background material color and be the outermost garment worn.

(d) Retro-reflective material color for non-Administration employee apparel shall either be orange, yellow, white, silver, yellow-green, or a fluorescent version of these colors, and be visible at a minimum distance of 1,000 feet. The retro-reflective safety apparel shall be designed to clearly recognize and differentiate the wearer from the surrounding work environment.

REFERENCES.

(a) ANSI/ISEA 107/2004 standard – American National Safety Institute/International Safety Equipment Association

(b) MUTCD 2003 – Manual for Uniform Traffic Control Devices - Sections 6D.03B and 6E.02

(c) Visibility Research – The VCTR 1989 report concludes that fluorescent colors, when compared with non-fluorescent colors, enhance the daytime conspicuity of worker clothing.

DEFINITIONS.

(a) Apparel – The outermost high-visibility garment worn by employees who work on Administration highways and rights-of-way.

(b) Highways – All roads owned by the Maryland Department of Transportation and maintained by the Administration.

(c) High Visibility – The ability for workers to be distinguishable as human forms to be seen, day and night, at distances that allow equipment operators and motorists to see, recognize, and respond.

Maryland
Transportation
Authority

SP 1-1 PROJECT DESCRIPTION

CONTRACT NO.:	KB 430-000-006R
TITLE:	MD 695 / Quarantine Road Interchange Improvements
FACILITY:	Francis Scott Key Bridge
LOCATION:	Baltimore City
ADVERTISED:	June 30, 2009
PRE-BID MEETING:	**9:00 a.m. July 14, 2009** in the Conference Room at the Maryland Transportation Authority, 300 Authority Drive, 2nd Floor, Engineering Building, Baltimore, MD 21222
PROJECT CONTACT:	Project Manager: Mr. Doug Novocin (410) 537-7840 Contract Administration: Ms. Maggie Johnson (410) 537-7807
BIDS DUE:	**12:00 Noon, August 4, 2009** in the Bid Box on the 1st floor of the Maryland Transportation Authority, Engineering Building, 300 Authority Drive, Baltimore, MD 21222
CLASSIFICATION:	Class – E ($2,500,001 - $5,000,000)
CONTRACT TIME:	Four Hundred Fifty-Five (455) Calendar Days
LIQUIDATED DAMAGES:	$800/ calendar day
MINIMUM MBE GOALS:	Overall 30% Sub-goal African American Owned: 12% Sub-goal Woman Owned: 11%
BID DOCUMENTS:	**$75.00** - Bid documents can be purchased between 7:30am and 3:30pm, Mondays, Wednesdays, Thursdays and Fridays and between 10:00am and 4:00pm on Tuesdays at the Ticket Office located at the Francis Scott Key Bridge, Maryland Transportation Authority, Administration Building, 303 Authority Drive, Baltimore, MD 21222.

Location and Scope of Work

The work to be performed under this contract is located at the following Maryland Transportation Authority ("Authority") facilities:

a) Francis Scott Key Bridge Facility (I-695 in Baltimore City);

The MD 695/Quarantine Road Interchange lies within the southern –most portion of Baltimore City, near its boundary with Anne Arundel County. The project is to Widen three of the existing interchange ramps to add capacity, remove the ramp from Quarantine Road to eastbound I-695 (traffic will be directed to use the Fort Armistead Ramp to access eastbound I-695) and the Widening of the approach roadways to the Quarantine Road Bridge. The Project also includes the adding of a new traffic signal at the end of the ramp from eastbound I-695 to Quarantine Road, removing existing traffic signals and replacing them with new signals that are timed to reduce delays during peak-traffic periods and the construction of a new stormwater management facility to control storm water pollution.

Work on this contract includes but is not limited the following:

1. Grinding existing roadway
2. Overlay existing roadway
3. Traffic Barrier W-Beam
4. Remove existing curb and gutter
5. Saw cut existing shoulder
6. Remove and dispose of existing 6'-0" fence
7. Modified Type 'A' combination curb and gutter
8. Modified Type 'A' curb
9. 4" concrete sidewalk
10. Remove existing masonry
11. 8" Portland cement concrete pavement mix no. 6
12. Maintenance of Traffic
13. Storm Drain System
14. Stormwater Management facility
15. Erosion and sediment control
16. Traffic signalization
17. Landscaping

The Engineer will provide a list and priority of projects to the Contractor on a monthly basis. Within two (2) weeks of the assignment, the Contractor shall supply the following information:

a) The estimated time to receive all materials;
b) The estimated number of work days to complete the project; and

c) If requested by the Engineer, a lump sum cost proposal or a cost proposal based on a list of items supplied by the Engineer, which will include all labor, materials, equipment, and Subcontractors required to complete the project.

If an agreement on prices for projects that the Engineer has requested a cost proposal cannot be reached, the work will be performed by time and materials.

The Contractor shall furnish to the Engineer the names, addresses, phone numbers, pager numbers, etc. of at least two individuals who can be contacted by the Engineer and who are authorized to provide construction services in the event of an emergency as determined by the Engineer. One of these individuals shall be available at all times to be contacted within a maximum time period of two (2) hours.

The Authority reserves the right to terminate the Contract for any reason, including its own convenience, by giving prior written notice to the Contractor. Work shall be performed as directed by the Engineer and may not be on a continual basis.

SP 1-2 SPECIFICATIONS

All work on this project shall conform to the Maryland Department of Transportation, State Highway Administration's Specifications entitled, "Standard Specifications for Construction and Materials" dated July 2008, revisions thereof, or additions thereto, and the Special Provisions included in this Invitation for Bids.

SP 1-3 ORIGINAL FACILITY PLANS AND SITE VISITS

The original facility plans are on file at the Engineering/Finance Building of the Francis Scott Key Bridge and will be made available for inspection to prospective bidders. Parties interested in viewing the plans should contact Mr. Doug Novocin at (410) 537-7840. Parties interested in visiting the site should contact Mr. Charles Raycob at (410) 537- 7513.

SP 1-4 - PROMPT PAYMENT TO SUBCONTRACTORS

The prime Contractor is responsible for making timely payments to all Subcontractors and Suppliers and provide written certification as required in Section 17-106 of the State Finance and Procurement Article of the Annotated Code of Maryland, as amended.

This contract requires the Contractor to make payment to all Subcontractors within ten (10) days of receiving payment from the Maryland Transportation Authority ("Authority").

Each month, the construction Project Engineer will review the current pay items with the prime Contractor and all involved Subcontractors to ensure that all work satisfactorily completed

within specifications is included in the monthly progress payment. For payment purposes, the same quantity totals used to compute the payment to the prime Contractor will be the basis for payment to the Subcontractor.

If the Subcontractor does not receive payment within the required ten (10) days, the Subcontractor shall notify the Project Engineer in writing of the amount in dispute including the item numbers and payment quantity for each. The Project Engineer will then notify the Director of Construction of the dispute. The Director of Construction or his representative will verbally contact the prime Contractor within 48 hours to ascertain whether or not a performance dispute exists which necessitates non-payment to the Subcontractor. If a performance dispute exists, the prime Contractor must demonstrate that there is a valid basis to withhold payment from the Subcontractor. If the prime Contractor withholds payment from a Subcontractor, the prime Contractor shall provide to the Subcontractor written notice of the withholding of payment. The notice shall detail the reasons for withholding payment as well as the amount. A copy of the notice shall be provided to the Surety and the Authority. If no valid dispute exists, the prime Contractor will be directed to make immediate payment to the Subcontractor. The Subcontractor will be responsible for notifying the Director of Construction if this payment is not made. Upon receipt of notification, the Director of Construction will schedule a meeting with the Contractor and Subcontractor to verify and discuss the non-payment issue. This meeting will be held at the Authority's offices within two (2) working days of the MdTA's contact with the subcontractor. If it is determined that the prime Contractor has withheld payment to the Subcontractor without cause, further progress payments to the prime Contractor will be withheld until the Subcontractor is paid. In addition, the MdTA may order a suspension of work or other administrative actions as it sees fit.

If an action is taken as stated above the Contractor shall notify the Authority's Project Engineer when payment is made. After the Authority's Project Engineer verifies that payment has been made to the Subcontractor the Authority shall release withheld progress payments.

Nothing in this Special Provision shall be construed to prevent the Subcontractor from pursing a claim with the surety under the prime Contractor's payment bond at any time.

SP 1-5 WORK HOURS

Refer to Section 104 "Maintenance of Traffic" and contract plans for lane and shoulder closures.

The Contractor shall cooperate with any other Contractors that are on site during the term of the project, as stated in GP-5.06 of the Standard Specifications. If the Contractor is directed to move off a bridge/work site once its operations have begun because of unforeseen event, it will be compensated in accordance with the specifications.

Except for maintenance of traffic restrictions, the Contractor will be permitted to work twenty-four (24) hours a day, seven (7) days a week. However, no lane or bridge closures will be permitted during high winds (greater than 25 mph), rain, snow or other precipitation events when water, ice or snow is on the roadway or when there is the potential for fog, as determined by the Authority. Nighttime construction noise shall not be allowed unless directed by the Engineer.

SP 1-6 INSURANCE

TC-5.01 INSURANCE

Section TC 5.01 of the Standard Specifications is supplemented as follows:

1. The Contractor shall not commence work under this contract until he has obtained all of the minimum amounts of insurance required by these Special Provisions and the insurance has been approved by the Engineer. The Contractor shall furnish to the Maryland Transportation Authority ("Authority") duly executed certification of all required insurance on forms satisfactory to the Authority. The certificates of insurance shall state that it is in force and cannot be cancelled, release or non-renewed except upon thirty (30) days prior written notice, registered mail to the Authority. All Contractors' insurance policies, with the exception of the Worker's Compensation and Employer's Liability, shall be endorsed to provide as additional insureds the Maryland Transportation Authority and the State of Maryland.

2. The Contractor shall purchase and maintain such insurance as is specified herein which will provide the Authority, its members, employees and agents, as well as the Contractor from claims which may arise out of or as a result of the Contractor's operations under this contract, whether such operations be by the Contractor, by any subcontractor, by anyone directly or indirectly employed by any of them or by anyone whose acts any of them may be liable. This insurance shall be maintained in full force until the Contract has been accepted by the Authority and final payment is made.

3. The Authority requires the following minimum levels of insurance coverage for this contract:

   a) Worker's Compensation and Employer's Liability

   The Contractor shall, at all times, maintain and keep in force such insurance as will protect him from claims under the Worker's Compensation Act of the State of Maryland and maintain and keep Employer's Liability Insurance at a limit of $100,000. The Contractor shall also maintain United States Long Shore and Harbors Act coverage, if such exposure exists.

b) Comprehensive General Liability Insurance

The Contractor shall maintain Comprehensive General Liability Insurance in the amount of at least One Million Dollars ($1,000,000) Combined Single Limit for Bodily Injury Liability and Property Damage Liability Insurance per occurrence and in the aggregate. Such insurance shall specifically include the Comprehensive General

Liability Broad Form Endorsement and indicate explosion, collapse, and underground damage coverage.

c) Comprehensive Automobile Liability Insurance

The Contractor shall maintain Comprehensive Automobile Liability Insurance (including all automotive equipment owned, operated, rented, or leased), in the amount of at least Five Hundred Thousand ($500,000) Combined Single Limit for bodily injury and property damage.

d) Additional Insurance

The Contractor shall also procure and keep in effect:

Excess liability (umbrella coverage) in excess of and applicable to the coverage in the Comprehensive General Public Liability and Property Damage Insurance, "X, C, U" and Comprehensive Automobile Insurance in the amount of at least Two Million Dollars ($2,000,000) for each occurrence.

4. Accident Notification - The Contractor shall send a written report to the Engineer and to the Maryland transportation Authority within twenty-four (24) hours of any accident or other event arising in any manner from the performance of the contract which results in or might result in personal injury or property damage.

5. Failure to comply with these Special Provisions may lead to termination from default/convenience.

6. There will be no special payment for the insurance as required by this contract and all costs incidental thereto shall be included in the (Lump Sum for "Mobilization", (refer to Section 108), or if the Contract does not include such an item, the insurance costs are to be included in pay items for the Proposal.

SP 1-7 MINORITY BUSINESS ENTERPRISE REGULATIONS GOVERNING CONSTRUCTION CONTRACTS IN EXCESS OF $50,000 EFFECTIVE JULY 1, 2001

GP – 7.29 of the General Provisions is supplemented as follows:

MBE participation goal for this contract is as indicated in these Special Provisions.

The Contractor shall:

1. Identify specific work categories appropriate for subcontracting;

2. At least 10 days before bid opening, solicit Minority Business Enterprises, through written notice that:

   a) Describe the categories of work: and,

   b) Provide information regarding the type of work being solicited and specific instructions on how to submit a bid.

3. Attempt to make personal contact with Minority Business firms:

4. Assist Minority Business Enterprises to fulfill bonding requirements or to obtain a waiver of these requirements:

5. Upon acceptance of a bid, provide the Maryland Transportation Authority (MdTA) with a list of Minority Businesses with whom the Contractor negotiated, including price quotes from Minority and Non-minority firms.

Third Tier Subcontracting:

Third Tier MBE/DBE Subcontracting will be approved by MdTA only when MdTA is satisfied that there is no way except by Third Tier contracting that an MBE/DBE goal can be achieved. The Contractor's written request must be submitted prior to contract award and contain specifics as to why a Third Tier contracting agreement is being requested.

Waivers:

If for any reason the bidder/offerer is unable to achieve the specified overall contract goal or subgoals for each certified MBE classification, the bidder/offerer must request, in writing, on Attachment A, (Certified MBE Utilization and Fair Solicitation Affidavit), a waiver a time of bid.

Strict adherence regarding documentation of the rationale for the waiver request and documentation of "Good Faith Efforts" of the Contractor are required for consideration of any waiver. For additional information on waivers, please see ***COMAR 21.11.03.11***

Criminal Fraud Provisions:

All Contractors are reminded that Criminal Fraud Provision and Administrative Sanctions may be imposed for failure to achieve and maintain established MBE/DBE goals.

SP 1-8 PROGRESS SCHEDULE REQUIREMENTS

Refer to Section 109 of the Standard Specifications.

SP 1-9 CORPORATE REGISTRATION

A foreign corporation is any corporation not incorporated under the Laws of the State of Maryland. All foreign corporations, prior to performing any services for the Authority, must register with the Maryland State Department of Assessment and Taxation in compliance with Subtitle 2, Title 7, of the Corporations and Associations Article of the Annotated Code of Maryland. Compliance is required of the successful vendor as well as the proposed subcontractors.

To accomplish the required registration, a foreign corporation must request and complete "Qualification Application Forms" which can be obtained from the Department of Assessment and Taxation, State Office Building, Room 803, 301 West Preston Street, Baltimore, Maryland 21201. Forms can be obtained via the Maryland Department of Assessments and Taxation web site at e-mail address: www.dat.state.md.us.

The Contractor will be responsible for documenting compliance with the aforesaid. This documentation will be required prior to the execution of a contract with the successful bidder.

SP 1-10 CONTRACTOR'S EMPLOYEE IDENTIFICATION

The Contractor shall provide to the Authority, a list containing the following for Contractor and all sub-contractors that would be working at the site. This shall include trucking companies who would come to the site on a repetitive basis for supply or remove materials:

Name of Company
Name and title of contact person
Address of the Company
Phone Number
Facsimile number
E-Mail address of contact person (if any)

All Contractor's employees, including employees of subcontractors, on this project, present at the site, shall be in possession of a valid employee identification card provided by the Employer,

which shall contain a photograph and identify the employee by name and job title. The employee must produce the said identification if required by the Engineer or the Authority Police.

When working in or around the Authority's buildings, said employees identification shall be displayed at all times.

While working on the transportation facility projects of the Authority, Contractor's personnel shall have an ID decal displayed on their hardhat. These decals will be provided by the Authority. All Contractor's vehicles shall have a parking decal, attached to the rear view mirror.. These parking decals will also be provided by the Authority and a distribution list will be maintained. AT the time of project completion these decals shall be returned to the Authority. Requests for hardhat and rearview mirror decals shall be made to the Construction Section before the beginning of construction and should include the number required of each type of decal.

All costs associated with ID's will not be paid for separately and shall be incorporated under other items of payment in the contract.

GENERAL PROVISIONS
GP-SECTION 1
DEFINITIONS AND TERMS

GP 1.03 – ORGANIZATIONAL DEFINITIONS

Revise the definitions of Administration to read as follows:

Administration – The word "Administration" shall mean "Maryland Transportation Authority".

Except for Office of Materials and Research, all references to the Maryland State Highway Administration's offices and positions shall mean the Authority's corresponding offices and positions.

GENERAL PROVISIONS
GP-SECTION 2
BIDDING REQUIREMENTS AND CONDITIONS

GP 2.04 SITE INVESTIGATION

Revise the paragraph to read as follows:

The Contractor acknowledges that he has investigated and satisfied himself as to the conditions affecting the work, including but not restricted to those bearing upon transportation, disposal, handling, and storage of materials, availability of labor, water, electric power, roads, and uncertainties of weather, river stages, tides, or similar physical conditions at the site, and confirmation and conditions of the ground, the character of equipment and facilities needed preliminary to and during prosecution of the work. The Contractor further acknowledges that he has satisfied himself as to the character, quality and quantity of surface and subsurface materials or obstacles to be encountered insofar as the information is reasonably ascertainable from an inspection of the site, including all exploratory INFORMATION IN POSSESSION OF THE STATE, as well as from information presented by the drawings and Specifications made part of this contract. Any failure by the Contractor to acquaint himself with the available information may not relieve him from responsibility for estimating properly the difficulty or cost of successfully performing the work. The State assumes no responsibility for any conclusions or interpretations made by the Contractor on the basis of the information made available by the State.

GENERAL PROVISIONS
GP-SECTION 2
BIDDING REQUIREMENTS AND CONDITIONS

GP-2.06 PREPARATION OF THE BID

GP9 **ADD**: After paragraph (a), the following.

The Contractor may elect to submit his bid on forms he has generated in the development of his bid. These may be submitted in lieu of the schedule of prices bid forms furnished by the Administration in the Invitation for Bids. These forms shall emulate the forms currently furnished by the Administrations and, as a minimum, contain the following information.

(1) State Contract No.
(2) State Item Nos.
(3) State's Proposed Quantities
(4) Description of Items
(5) Unit Price
(6) Total Cost of Each Item
(7) Total Bid Amount

The document shall be 8-1/2 x 11 inches, and oriented in a landscape format. The font size shall be no less than 10 points with horizontal lines dividing each item. Any addendum which revised items or quantities shall be noted on all affected schedule of prices sheets. Any special bid requirements that are noted in the schedule of prices shall also be listed on the form.

Should the Contractor elect to submit bids on the Contractor's own forms, the Contractor shall submit a sample of the form to the Administration at least two weeks prior to the scheduled opening of bids. The use of Contractor generated forms shall be approved, in writing, prior to their use. If the Contractor's forms were previously approved in writing on another Administration project and have not changed, they need not be resubmitted for this project.

Sample forms shall be submitted to:

Ms. Linda McGill, CPPB
Chief Procurement Officer
Maryland Transportation Authority
300 Authority Drive
Baltimore, MD 21222

GENERAL PROVISIONS
GP-SECTION 2
BIDDING REQUIREMENTS AND CONDITIONS

GP 2.23 - BID PROTESTS

Section GP 2.23 of the General Provisions is supplemented as follows:

The Board of Public Works does not have the jurisdiction to consider protests relating to this solicitation or an award of this contract under this solicitation.

All protests relating to this solicitation, the selection, and/or award must be filed in writing with the Authority's Procurement Officer, within the time limitations set forth in COMAR 21.10.07 and 21.10.02. Bid protests shall be filed not later than 7 days after the basis for protest is known, or should had been known, whichever is earlier. Oral protests will not be considered.

The specific details of the protest procedures shall be followed by aggrieved actual or prospective bidders or offerors are contained in COMAR 21.10.

GENERAL PROVISIONS
GP SECTION 4
SCOPE OF WORK

GP 4.10 - WARRANTY OF CONSTRUCTION

GP 4.10 of the Standard Specifications is revised to read as follows:

Delete: The first paragraph in its entirety.

Insert: The following:

The Warranty as defined under paragraphs A through G in GP 4.10 (Warranty of Construction) shall apply to this Maryland Transportation Authority contract unless specified elsewhere in this Invitation for Bids.

GENERAL PROVISIONS
GP SECTION 5
CONTROL OF WORK

GP 5.12 - FAILURE TO MAINTAIN ENTIRE PROJECT

Delete: Section GP 5.12 in its entirety

Insert: Revise the paragraph to read as follows:

Failure on the part of the Contractor, at any time, to RESPOND TO the provisions of GP 5.11 above, will result in the procurement officer's immediately notifying the Contractor to comply with the required maintenance provisions. In the event that the Contractor fails to PROCEED WITH CORRECTIONS TO UNSATISFACTORY MAINTENANCE SO AS TO CONFORM TO THE PROVISIONS OF GP 5.11 within 4 hours of receipt of such notice, the procurement officer MAY NOTIFY THE CONTRACTOR TO SUSPEND ALL OTHER WORK ON THE CONTRACT UNTIL SUCH TIME AS THE UNSATISFACTORY MAINTENANCE IS CORRECTED. In the event that the Contractor fails to RESPOND TO unsatisfactory maintenance within 4 hours after receipt of such notice, the procurement officer will immediately proceed with adequate forces and equipment to maintain the project, and the entire cost of this maintenance will be deducted from monies due the Contractor ON THE NEXT MONTHLY ESTIMATE.

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GENERAL PROVISIONS
GP SECTION 8
PROSECUTION AND PROGRESS

GP 8.09 - LIQUIDATED DAMAGES

Delete: Section GP 8.09 in its entirety

Insert: Time is an essential element of the Contract and it is important that the work be vigorously prosecuted until completion.

For every calendar day that the contract remains uncompleted after the expiration of the contract time specified herein, or amended by extra work authorization, change orders or supplemental agreements, the Contractor will be liable for Liquidated Damages. The amount of Liquidated Damages shall be as specified in Contract Time and Bonding. This amount shall be deducted from any money due the Contractor, not as a penalty, but as Liquidated Damages. Damages in excess of any retained percentage shall be paid to the Authority by the Contractor.

Refer to Contract time and Bonding sheet contained elsewhere herein. See Table of Contents.

GENERAL PROVISIONS
GP SECTION 9
PAYMENT

GP 9.05 LATE PAYMENTS

ADD the following:

(e) Payments will be made within thirty (30) days of the date when the contract amount becomes due and payable or the date of receipt of a proper invoice, whichever is later. The State's failure to remit payment within forty-five (45) days from that date may entitle the Contractor to interest at the rate of 10% per annum beginning on the 31st day.

TERMS AND CONDITIONS
TC SECTION 4
CONTROL OF WORK

TC 4.01 - SHOP PLANS AND WORKING DRAWINGS

Section TC 4.01 of the Specifications is amended to add:

All shop plans and working drawings for this project shall be submitted to:

Maryland Transportation Authority
Engineering Division
300 Authority Drive
Baltimore, Maryland 21222-2200
ATTN: Mr. Doug Novocin, P.E.

The Contractor shall allow a minimum of four (4) weeks turn around time on all drawings from the date they are received by the Authority. All shop plans and working drawings shall be reviewed and approved by the Contractor prior to submitting for approval to the Maryland Transportation Authority and shall be submitted by the general Contractor only. No drawings sent to the Authority directly by subcontractors, fabricators, etc. will be accepted. Ten (10) sets of drawings shall be submitted for approval.

Acceptance of a material source by the Engineer does not constitute approval of the material as a substitute as an "equal". Submission of a material as an "or equal" must be done in accordance with the following paragraphs:

All shop drawings, regardless if "Submitted as Specified" or "Submitted as Equal to Specified", shall be furnished with complete, specific, detailed information from the manufacturer or supplier or the material or equipment the Contractor proposes to furnish, in which the requirements of the Specifications are clearly shown to be met. This shall include a point by point comparison with the detail requirements of the Specifications.

When any article is specified by trade name of manufacturer with or without the clause "or equal", it is intended to establish the quality of the article. If the Contractor proposes to use material or equipment of another manufacturer as an "or equal" to material or equipment specified, all shop drawings shall conform to the following requirements, conditions, and procedure:

1. Substitution of equipment or materials other than those specified will be considered, providing, in the opinion of the Engineer, such equipment or material is equal to, or better than specified. The decision of the Engineer with respect to approval or disapproval of any material or equipment proposed to be substituted as an "or equal" is final. The Contractor shall have no claim of any sort by reason of such decision.

2. If the Contractor proposes to substitute materials or equipment as "or equal" to those specified, it shall be his responsibility to furnish, in addition to the information discussed above, a point by point comparison of the material or equipment specified under the Contract and that proposed to be substituted. The burden of responsibility in furnishing this information is with the Contractor.

If incomplete or irrelevant data is submitted as evidence of compliance with this section of the Specifications, the data will be returned and the request for approval will be denied.

TERMS AND CONDITIONS
TC SECTION 4
CONTROL OF WORK

TC-4.02 FAILURE TO ADEQUATELY MAINTAIN PROJECT.

16 **ADD**: To the existing paragraph.

Additionally, an appropriate deduction will be made from the Contractor's next progress estimate for each day or portion thereof that Maintenance of Traffic deficiencies exist, and will continue until the deficiencies are satisfactorily corrected and accepted by the Engineer. Any portion of a day will be assessed a full day deduction. The deduction will be equal to a prorata share of the lump sum price bid for Maintenance of Traffic or an amount prorated from the Engineer's estimate, whichever is more. The amount prorated will be the per diem amount established by using the working days (based upon calendar dates when required) divided into the total value of the bid item or the Engineer's estimate of that item, whichever is more.

The above noted deduction will be assessed on the next progress estimate if:

> The Contractor does not take action to correct the deficiencies and properly assume the responsibilities of maintaining the project (as determined by the Engineer) within four hours of receiving a notice to comply with the required maintenance provisions.

The deduction will be equal to the daily prorated share of the lump sum price bid for Maintenance of Traffic or $1,000.00 per day, whichever is more for each day or portion thereof that the deficiencies exist, and will continue until the deficiencies and proper assumption of the required maintenance provisions are satisfactorily corrected and accepted by the Engineer. The amount of monies deducted will be a permanent deduction and are not recoverable. Upon satisfactory correction of the deficiencies, payment of the Maintenance of Traffic lump sum item will resume.

TERMS AND CONDITIONS
TC SECTION 5
LEGAL RELATIONS AND PROGRESS

TC-5.01 INSURANCE.

17 **DELETE:** The first three paragraphs under TC-5.01 in their entireties.

INSERT: The following.

The requirement of GP-7.14 (Liability Insurance) to submit Certificate of Insurance prior to starting work is modified for Administration Contracts to require the certificate of insurance to be submitted prior to the execution of the Contract.

The Contractor shall maintain in full force and effect third party legal liability insurance necessary to cover claims arising from the Contractor's operations under this agreement which cause damage to the person or property of third parties. The insurance shall be under a standard commercial general liability (CGL) form endorsed as necessary to comply with the above requirements; or other liability insurance form deemed acceptable by the State. The State of Maryland shall be listed as an additional named insured on the policy. The limit of liability shall be no less than $1,000,000 per occurrence/$2,000,000 general aggregate. The insurance shall be kept in full force and effect until all work has been satisfactorily completed and accepted. The policies shall be endorsed to provide 30 days notice of cancellation or non-renewal to:

Director of Construction
Maryland Transportation Authority
304 Authority Drive
Baltimore, Maryland 21222

TERMS AND CONDITIONS
TC SECTION 7
PAYMENT

29 **DELETE:** TC-7.02 PAYMENT ALLOWANCES FOR STORED MATERIALS in its entirety.

INSERT: The following.

TC-7.02 PAYMENT ALLOWANCES FOR STORED MATERIALS.

When the Contractor requests payment allowance for materials, the following terms and conditions shall apply:

(a) For superstructure members delivered on the project site, an allowance of 100 percent of the material cost plus freight charges as invoiced may be made provided the cost does not exceed 90 percent of the Contract price of the applicable Contract item. The allowance will be based upon validated invoices or bills for material including freight charges, and a copy thereof shall be made a part of the documented records for the project.

(b) For reinforcement steel, piling, pipe, traffic barrier, signs and sign assemblies, and other nonperishable material in storage on the project, but excluding aggregates, cement, seed, plants, fertilizer or other perishable items, an allowance of 100 percent of the invoiced cost of the material plus freight charges to the Contractor may be made provided the cost does not exceed 90 percent of the Contract price of the applicable Contract item. Such material shall be delivered and stock-piled at the project site, and have been tested by the Administration and found to have conformed to the Specifications or have been accepted under an approved certification program prior to the allowance.

(c) No allowance will be made for fuels, form lumber, falsework, temporary structures or other materials of any kind which will not become an integral part of the finished construction.

No payment for stored material will be made if it is anticipated that the material will be incorporated into the work within 30 days of the written request.

Only end product manufactured material or fully fabricated products that are awaiting installation or incorporation into the finished work are eligible for prepayment. Components, elements, or ingredients of a finished product are not eligible for prepayment.

(d) Material for which an allowance is requested shall be stored in an approved manner in areas within the State of Maryland where damage is not likely to occur. If any of the stored materials are lost or become damaged in any manner, the Contractor shall be responsible for repairing or replacing the damaged materials. The value of the

lost or damaged material will be deducted from the Contractor's subsequent estimates until replacement has been accomplished. The request for allowances for any materials stored on private property within the State of Maryland shall be accompanied by a release from the owner and/or tenant of such property agreeing to permit the removal of the materials from the property without cost to the State of Maryland.

The material shall be clearly marked with the Administration's Contract number on individual units. If the material is normally shipped to the project in bundles or other forms of packaging, the Administration's Contract number shall be clearly marked or affixed to the package. When the material is not stored at the actual project site, the material shall be physically separated by fencing or equivalent barrier from other materials stored at the same site. The material shall be accessible to the Administration at all times.

When it is considered impractical to store materials on the actual project, the Engineer may approve storage areas in the vicinity of the actual project which will be considered at the project site.

When storage of the materials within the State of Maryland is not practical, approval shall be obtained from the District Engineer for storage elsewhere. Storage of materials outside the State of Maryland will be subject to the conditions set forth in this provision and limited to materials exceeding twenty-five thousand dollars ($25 000), which are designed and fabricated exclusively for use on a specific project.

(e) Material for which payment has been made, either wholly or partially, shall not be removed from the approved location until such time that it is to be incorporated into the work unless authorized by the Engineer.

(f) The Contractor shall submit a written request for payment to the District Engineer at least two weeks prior to the estimate cutoff date established by the District Engineer. The following items shall accompany the written request for payment:

(1) Consent of surety specifying the material type and the item(s) in which the material is to be used.

(2) Validated invoices with the signature of an officer of the company supplying the material showing actual cost.

(3) A notarized statement from the Contractor attesting that the invoices as submitted do not include charges or fees for placing, handling, erecting or any other charges or markups other than the actual material cost, sales tax(es), if applicable, and freight charges.

(4) Bills of lading showing delivery of the material. The request for allowances for any materials stored on property outside the State of Maryland shall be accompanied by a release from the owner or tenant of such property agreeing to

permit verification by the Inspector that the material is stored at the approved location, and to permit the removal of the materials from the property without cost to the State of Maryland.

(5) Inspection test reports, certifications and/or a written statement from the Inspector attesting to the inspection and approval of the material.

Upon receipt of the above by the District Engineer and verification by the Inspector that the material is stored at the approved location, the District Engineer will authorize payment.

(6) A statement explaining why the material can not be stored on the project, if the Contractor is requesting to store material at a location other than the project site. The statement shall include the methods of storage, separation, and identification to be used by the Contractor. The Contractor shall provide a method of inventory control and withdrawal satisfactory to the Administration which shall be used by the Contractor to monitor materials not stored on the project.

(7) A breakdown of the Contract line item bid unit price showing the relationship of the cost of the stored material to the costs of all other materials, labor, and components of the work included in the Contract line item unit price bid by the Contractor.

Upon receipt of the above by the District Engineer and verification by the Inspector that the material is stored at the approved location, the District Engineer will authorize payment.

The Contractor shall pay the material provider the amount shown on the invoice within 10 calendar days of receipt of payment from the Administration. Evidence of payment shall be provided to the Administration. Failure to make invoice payments as specified will be cause to deduct the monies from future estimates and/or deny future stored materials payment requests.

Copies of all pertinent data shall be made by the Contractor and distributed to the Inspector for retention as part of the documented records for the project.

TC-7.03 FORCE ACCOUNT WORK.

(e) Subcontracting.

35 **ADD:** The following to the end of the paragraph.

"or five hundred dollars ($500) which ever sum is greater."

DELETE: TC-7.05 PROGRESS PAYMENTS Subsection (a) (3) Variable Retainage

INSERT: The following.

(3) **VARIABLE RETAINAGE.** The Contract will be subject to a variable retainage based upon the Authority's performance evaluations of the Contractor.

Those qualifying may have retainage reduced upon request of the Contractor with consent of surety. This request must be processed through the Construction Manager. If at any time during the performance of the project, the evaluation of the Contractor changes, retainage reduction may be reconsidered.

Contractors with "A" evaluations for the last two years may be reduced from 5 percent to 2.0 percent upon request after 15 percent project completion. Project completion percentage will be based upon actual work completed (excluding monies paid for stored materials). An interim evaluation of the current project must be completed and must be an "A". Contractors with "A" evaluations for the last two years may petition to have all retainage at that point released upon completion of a significant milestone. Retainage will continue at 2.0 percent until the next milestone of completion of the contract.

Contractors with "B" evaluations or any combination of "A" and "B" evaluations for the last two years may be reduced from 5 percent to 2.5 percent at 50 percent project completion and remain at that level until released upon final payment. Project completion percentage will be based upon actual work completed (excluding monies paid for stored materials). An interim evaluation of the current project shall be completed and shall be an "A" or "B".

Contractors with "C" evaluations or any combination of "C" and "D" evaluations for the last two years will begin and remain at 5 percent for the life of the project. An interim evaluation of the current project shall be completed and shall be a "C" or better rating.

Contractors with a "D" evaluation for the last two years will begin at 5 percent. Project performance will be evaluated monthly. Should the contractor performance remain at the "D" level, to protect the State's interest 10% of the progress payment will be withheld until performance improves to a "C".

New Bidders. Contractors who have not been previously rated by the Authority may be eligible for a reduction in retainage. To be eligible, their past performance on highway and bridge work shall be documented by the government agency with whom they had a contract and their performance shall be documented on Authority forms.

All other Contractors who do not fit into the above criteria would require a 5 percent retainage throughout the life of the Contract.

CATEGORY 100
PRELIMINARY

SECTION 103 — ENGINEERS OFFICE

CONSTRUCTION. 103.03

144 **DELETE:** 103.03.06 Microcomputer System for all Offices in its entirety.

INSERT: The following.

Microcomputer System for all Offices. 103.03.06

(a) Desktop Unit.

(1) IBM compatible with an Intel or AMD processor.

(2) Minimum microprocessor speed of 3.0 GHz.

(3) Minimum hard drive storage of 80 GB (gigabyte).

(4) Minimum of 2 GB RAM (Random Access Memory).

(5) Enhanced 101 key keyboard with wrist rest.

(6) Super Video Graphics Accelerator (SVGA).

(7) Modem 56K BPS, ITU V.92 compliant – required for remote dial-in to the computer to provide MCMS system administration.

(8) Mouse with mouse pad.

(9) One CD-RW drive [re-writable CD-ROM].

(b) Operating System. Minimum Microsoft® Windows XP – all Microsoft Windows Critical Updates shall be installed prior to computer set up in the field office.

(c) Video Monitor. Flat-Panel LCD Monitor conforming to Energy Star requirements with a minimum screen size of 17 in.

(d) Printer. B&W Laser Jet Printer with a minimum resolution of 1200 DPI (dots per in.) and a minimum of 8 MB of RAM. Inkjets will not be accepted. Printer shall have a minimum print speed of 15 PPM (pages per minute).

(e) Software.

(1) Microsoft® Office 2007 Professional for Windows™ or later.

(2) Symantec® pcAnywhere32 for Windows™ version 12.0 or later.

(3) Antivirus software shall be installed and configured to perform an automatic update when the microcomputer system connects to the internet. Antivirus software approved for SHA web email: *Norton, McAfee, Sophos, or ETrust.

(*Norton Internet Security includes both Antivirus and a Personal Firewall).

(f) Internet Access. The microcomputer system shall be provided with unlimited Internet service approved by the Engineer. Where available internet high-speed service [DSL or cable] must be provided. With DSL or cable internet service an external Router device and firewall software are required to protect the computer from security intrusions. With DSL a Dual Outlet Modular Adapter [single-line RJ11] will be required to connect the DSL modem and the 56k dial-up modem to the same line.

(g) Accessories.

(1) Uninterruptible power supply (UPS).

(2) Standard computer workstation with minimum desk space of 60 X 30 in. and a swivel type office chair, padded with arm rests.

(3) 8-1/2 X 11 in. xerographic paper to be supplied as needed.

(4) Toner or ink as needed for printer.

(5) Maintenance agreement to provide for possible down time.

(6) Physical security system to deter theft of computer components.

(7) Three 1GB USB Flash Drive storage devices.

(8) Blank recordable CD-R media for re-writable CD-ROM drive to be supplied as needed.

(h) Notes.

(1) The microcomputer system shall be completely set up ready for use on or before the day the Engineers office is to be occupied.

(2) All software stated above shall be supplied on original disks with manuals and be retained in the construction field office for the duration of the Contract.

(3) If for any reason the system fails to operate, the system shall be replaced or repaired within 48 hours.

(4) When the microcomputer system is no longer required, the Construction Management software system including original user/operator guide manuals, program disks, and all data files (including those stored on external media: USB flash drives, CD-R's, ZIP disks, etc.) will be removed by the Engineer and delivered to the District Engineer and become the property of the

Administration. The remaining microcomputer system shall remain the property of the Contractor.

(5) Type 'C' and Type'D' Engineer's Office shall have two (2) complete microcomputer systems.

148 **ADD:** The following after 103.03.08 Office Requirements.

103.03.09 Recyclable Materials (Paper, Bottles, Cans, Etc.). The Administration's Environmental Stewardship Plan includes recycling initiatives at the Administration's construction sites and encourages recycling of all suitable material at all Engineers Offices and Contractor's site facilities.

While recycling is encouraged at all sites, the Administration is requiring recycling at the Type D Engineers Office as well as the Contractors facilities at the location of the Type D Engineers Office. The Contractor shall provide the containers as well as arrange for the removal of the recycled material from the site. Recycling will not be measured but the cost will be incidental to the Type D Engineers Office.

CATEGORY 100
PRELIMINARY

SECTION 100-01 – CONTINGENT MISCELLANEOUS REPAIRS

100-01.01 DESCRIPTION. An allowance of $100,000 has been included in the proposal book to perform miscellaneous repairs assigned by the Engineer within the limit of the Francis Scott Key Memorial Bridge facility. The scope of repairs will be determined by the Engineer.

This item will only be used if necessary and will not be used without approval of the Engineer.

400-02.02 MATERIALS. Not applicable.

400-02.03 CONSTRUCTION. Not applicable.

400-02.04 MEASUREMENT AND PAYMENT. All work performed under this item will be measured and paid for in accordance with TC-7.03 of the Standard Specifications. If the Contractor and the Engineer can agree upon unit prices or other method of payment, the agreed upon method of measurement and payment shall then be used. There is no guarantee that any or this entire item will be used during the term of the Contract.

CATEGORY 100
PRELIMINARY

SECTION 100.02 – PUBLIC INFORMATION MEDIA CAMPAIGN

100.02.01 DESCRIPTION

A contingent allowance of $50,000 has been included in the Proposal Form for a media campaign to be conducted jointly by the Authority and the Contractor or his Subcontractor that has been determined to be necessary during the project.

The Contractor shall submit a written time and material cost for each subtask of the Campaign, for the Authority's review and/or approval prior to commencing any phase of the Campaign. In lieu of this method, the Authority may direct the Contractor or his Subcontractor to perform the work in accordance with the requirements of "Force Account Work", Section GP 9.02 of the Specifications.

100.02.04 MEASUREMENT AND PAYMENT

All costs incurred under the item "Public Information Media Campaign" will be paid for on the basis of agreed upon price for each task or approved force account records submitted in accordance with Section GP 9.02 of the Standard Specifications and, with the authorization of the Authority. The approved amounts shall be full compensation for all labor, equipment, materials and other related expenses and incidentals (printing, travel, etc.) necessary to complete each task as directed by the Authority.

CATEGORY 100
PRELIMINARY

SECTION 104 — MAINTENANCE OF TRAFFIC

104.01 TRAFFIC CONTROL PLAN (TCP).

104.01.01 DESCRIPTION.

149 **DELETE:** The fourth paragraph sentence "Refer to contract Documents for Work Restrictions." in its entirety.

INSERT: The following.

Work Restrictions. The Engineer reserves the right to modify or expand the methods of traffic control or working hours as specified in the Contract Documents. Any request from the Contractor to modify the work restrictions shall require written approval from the Engineer at least 72 hours prior to implementing the change. The Contractor shall submit a copy of the original work restrictions with the written request.

Work is not permitted on Saturdays or Sundays.

Work is not permitted on the holidays, or work day preceding and following holidays indicated below with an "X":

- ☒ New Year's Day, January 1
- ☐ Martin Luther King's Birthday, the third Monday in January
- ☐ President's Day, the third Monday in February
- ☒ Easter Weekend
- ☒ Memorial Day, the last Monday in May
- ☒ Independence Day, July 4
- ☒ Labor Day, the first Monday in September
- ☐ Columbus Day, the second Monday in October
- ☐ Veteran's Day, November 11
- ☒ Thanksgiving Day, the fourth Thursday in November
- ☒ Christmas Day, December 25

ALLOWABLE LANE CLOSURE SCHEDULES		
Time of Day	Day of the Week	Allowed closures
MD 695		
Continuous	Monday- Sunday	Shoulder Closure
7:00 PM-6:00 AM	Monday-Sunday	Single Lane Closure
Quarantine Road		
Continuous	Monday- Sunday	Shoulder Closure
7:00 PM-6:00 AM	Monday- Sunday	Single Lane Closure
Quarantine Road Interchange Ramps		
Continuous	Monday- Sunday	Shoulder Closure
7:00 PM-6:00 AM	Sunday-Thursday	Single Lane Closure

149 **ADD:** The following after the last paragraph, "Any monetary savings...and the Administration."

When closing or opening a lane on freeways, expressways, and roadways with posted speed $\geq$ 55 mph, a work vehicle shall be closely followed by a protection vehicle (PV) during installation and removal of temporary traffic control devices. The PV shall consist of a work vehicle with approved flashing lights, a truck-mounted attenuator (TMA) with support structure designed for attaching the system to the work vehicle, and arrow panel (arrow mode for multilane roadways and caution mode on two-lane, two-way roadways) The work vehicle size and method of attachment shall be as specified in the TMA manufacture's specification as tested under NCHRP Test Level 3.

When a temporary lane or shoulder closure is in effect, work shall begin within one hour after the lane is closed. Any delay greater than one hour with no work in progress shall require the Contractor to remove the lane closure at no additional cost to the Administration. The Contractor's Traffic Manager shall attend Pre-Construction and Pre-Paving Meetings and shall discuss traffic control and the Traffic Control Plan including procedures to be implemented for lane closures.

All closures shall be in conformance with the approved TCP and under the direction of the Contractor's Traffic Manager and the Engineer.

Workers and equipment, including temporary traffic control devices needed for setting up a lane closure or restriction, are prohibited in the lane or shoulder to be closed or restricted before the time permitted in the Contract work restrictions unless otherwise noted below or as approved by the Engineer.

Temporary traffic control devices to be used for lane/shoulder closure may be placed on the shoulder of the roadway by workers no earlier than ___ minutes prior to actual time lane/shoulder closure or restriction is permitted. Temporary traffic signs may be displayed to traffic at this time.

Workers shall not enter a lane open to traffic. Workers may be present on shoulders to prepare for lane closure setup no earlier than ___ minutes prior to actual time lane/ shoulder closure or restriction is permitted.

All temporary lane or shoulder closures shall be restored at the end of the closure period and no travel lane shall be reduced to less than 10 ft. Prior to opening the closed lane or shoulder, the Contractor shall clear the lane or shoulder of all material, equipment, and debris.

Failure to restore full traffic capacity within the time specified will result in a deduction being assessed on the next progress estimate in conformance with the following. This is in addition to the requirements specified in TC-4.02.

ELAPSED TIME, MINUTES	DEDUCTION
1 - 5	$ 50.00
Over 5	$ 50.00 per Minute (In addition to the Original 5 minutes)

104.01.04 MEASUREMENT AND PAYMENT

ADD: the following:

Maintenance of Traffic will not be measured but will be paid for at the Contract lump sum price bid. The payment will be full compensation for all labor (including Traffic Manager), material and equipment (for which a bid item has not been established), and any incidentals necessary to complete the work.

The cost shall also include all required equipment and set ups shown on the maintenance of traffic standards, as well as removal of all traffic control set ups.

CATEGORY 100
PRELIMINARY

SECTION 104 — MAINTENANCE OF TRAFFIC

166 **DELETE**: Section 104.11 TEMPORARY PAVEMENT MARKINGS. in its entirety.

INSERT: The following.

104.11 TEMPORARY PAVEMENT MARKINGS.

104.11.01 DESCRIPTION. This work shall consist of furnishing, installing, and removing temporary pavement markings as specified in the Contract Documents or as directed by the Engineer. These markings shall include lines, letters, numbers, arrows, and symbols.

104.11.02 MATERIALS.

(g)	Removable Preformed Pavement Marking Material	Refer to the
(h)	Nontoxic Lead Free Waterborne Pavement Markings	Contract Documents
(i)	Black Out Tape	QPL

104.11.03 CONSTRUCTION.

104.11.03.01 Quality Assurance/Quality Control. Quality control testing shall be completed by the Contractor's Administration certified technicians. The Engineer will complete the quality assurance checks in conformance with MSMT 729 by performing the Nighttime Visibility Evaluations.

104.11.03.02 Warranty Period. The Contractor shall maintain and be responsible for any defects in the pavement markings for a period of 180 days from the date of application. The Contractor shall replace the pavement markings as necessary within this period as directed by the Engineer at no additional cost to the Administration. Refer to GP-5.11.

104.11.03.02 Application and Removal. The pavement markings shall be applied in conformance with the manufacturer's recommendations and the Contract Documents. Markings shall be applied in the same direction as the flow of traffic. The markings shall be located as specified in the Contract Documents or as directed by the Engineer.

Pavement markings may be applied to either new or existing paved surfaces. When applied to newly paved surfaces, the markings shall be placed before traffic is allowed on the pavement.

Nontoxic lead free waterborne pavement markings shall be used for all temporary pavement markings except for the final surface. However, the Contractor may use removable preformed pavement markings at no additional cost to the Administration.

When at the "end of season", the temperatures are too low to allow the placement of removable tape on the final surface, a written exception request may be submitted to the Engineer to allow the use of nontoxic lead free waterborne paint in lieu of removable tape until the following striping season.

When it is appropriate to shift lanes, all nonapplicable pavement markings within the travel way and adjacent to the travel way as directed by the Engineer shall be completely removed.

Surface Condition. Prior to application of pavement markings, the pavement surface shall be clean, dry, and free of all contaminants, including curing compound, dirt, and loose particles. Residual pavement markings shall be removed. Loose or poorly constructed markings shall also be removed.

Pavement Marking Removal. All removable preformed pavement markings shall be completely removed prior to application of the permanent markings. On stage construction or final surfaces of portland cement concrete pavements, any objectionable adhesive residue shall be removed by water blasting or other methods as may be approved by the Engineer. Open flame is prohibited to remove adhesive residue, or any pavement markings. The Contractor shall remove all nonapplicable pavement markings so that there is no damage to the existing or final surface.

Retroreflectance. The initial retroreflectance readings for temporary pavement markings shall be a minimum of 250 and 150 millicandellas/lux/square meter for white and yellow, respectively. The Engineer will monitor the pavement markings in conformance with MSMT 729 during the Contractor's 180 day period of responsibility.

104.11.04 MEASUREMENT AND PAYMENT. Payment for Removable Preformed Pavement Markings, Removal of Removable Preformed Pavement Markings, Nontoxic Lead Free Waterborne Pavement Marking Paint, and the Removal of Existing Pavement Markings will be measured and paid for using one or more of the items listed below and as specified in the Contract Documents.

The payment will be full compensation for furnishing, placing, complete removal of lines, letters, numbers, arrows, symbols, and the removal of all residue. In addition, payment will cover maintenance and replacement during the 180 day period, and for all material, labor, equipment, tools, and incidentals necessary to complete the work. Removal and replacement of temporary pavement markings required beyond the 180 day period will be measured and paid for at the Contract unit price for the pertinent temporary pavement marking item.

Temporary markings replaced during the 180 day period as a result of plowing (as determined by the Engineer) will be paid for at the Contract unit price for the pertinent temporary marking item.

(a) Nontoxic Lead Free Waterborne Pavement Marking Paint-in width specified-per linear foot.

(b) Removable Preformed Pavement Line Markings-in width specified-per linear foot.

(c) Removable Preformed Letters, Symbols, Arrows, and Numbers per each.

(d) Removal of Removable Preformed Pavement Markings-any width-per linear foot.

(e) Removal of Removable Preformed Letters, Symbols, Arrows and Numbers per each.

(f) Removal of Existing Pavement Line Markings-any width per linear foot.

(j) Removal of Existing Letters, Symbols, Arrows, and Numbers per each.

(k) Black Out Tape Lines-in width specified-per linear foot.

(i) Removal of Black Out Tape Lines-any width-per linear foot.

CATEGORY 100
PRELIMINARY

SECTION 104 – MAINTENANCE OF TRAFFIC

104.25 TEMPORARY ROADWAY LIGHTING

104.25.01 DESCRIPTION. This work shall consist of furnishing, installing, operating, maintaining, moving and removing Temporary Roadway Lighting. Temporary Lighting shall be required at Decision Points (Gores, Merge Areas and Exit Areas). Temporary Lighting shall consist of a combination of temporary lighting units described herein, reuse of existing roadway lighting, temporary underground or overhead wiring, and temporary construction electrical services. The Contractor is encouraged to make operational the permanent lighting as soon as possible to minimize the use of temporary lighting.

104.25.02 MATERIALS.

Traffic Materials	Section 950

104.25.03 CONSTRUCTION.

General – Active "Decision Points" shall be illuminated as specified herein during all times from sunset to sunrise. Before any existing roadway lighting adjacent to "Decision Points" may be taken out of service a Temporary Lighting Plan must be submitted to and approved by MdTA and all required lighting equipment and materials must be available and ready for operation.

The Contractor shall coordinate the Temporary Lighting Design with the phases of the Maintenance of Traffic Design.

The Contractor shall coordinate actual location of all Temporary Lighting pole locations and/or underground and overhead temporary wiring required for Temporary Lighting with all underground and overhead utilities. Provide all necessary underground locating prior to digging or placing poles. Any damage occurred to another system during installation of the Temporary Lighting shall be Contactor's total responsibility to replace or repair and shall include all fees, fines, and penalties.

The Contractor shall furnish, install and put into operational condition the permanent lighting as designed as soon as possible. The Temporary Lighting shall not be removed until the permanent lighting is operational.

Temporary Lighting Plans – At least sixty days prior to the installation of the Temporary Lighting the Contractor shall submit a temporary lighting plan to MdTA for review and approval. The Temporary Lighting Plan shall include the following:

a. Layout drawings showing location of temporary lighting equipment, including both typical spacing and lateral placement.

b. Description of lighting equipment to be used.

c. Description of electrical power source.

d. Specific technical details on all lighting fixtures to be provided, including power rating and photometric charts.

e. Details of any hoods, louvers, shields, or other means to control glare.

f. Lighting calculations confirming that the illumination requirements will be met by the layout plan.

The layout drawings shall be on standard size plan sheets and at an appropriate scale to adequately describe the work. Layout drawings must be submitted and approved for all Phases of Construction for Contract.

In addition to the plan sheets, the Contractor shall submit catalog cuts giving the specific brand names, model numbers and ratings of the lighting equipment. The submittal shall include power ratings, photometric data, and lighting level and uniformity calculations.

Lighting Levels and Uniformity-Temporary lighting design shall be 0.9 average maintained footcandles for Mainlines and 0.6 average maintained footcandles for Ramps and non-critical areas with an average/minimum uniformity ratio of 4 to 1 and a veiling luminance ratio of 0.4 (Lvmax/Lavg).

Equipment- All lighting equipment will be furnished as required and retained by the Contractor after the work is completed. Material and equipment used shall be in good operating condition and in compliance with applicable safety and design codes, and maintained in good operating order throughout the project duration until permanent lighting of Decision Points is operational.

Wood Pole Lighting Units – The Contractor shall furnish all the materials for each temporary lighting unit including but not limited to, 50 ft (15 m) Class III Wood Poles, Triplex Service Cable Dead End Attachments, Mast Arm 12 ft (3.6 m), High Pressure Sodium Luminaire with photoelectric control and lamp; and perform such and related work including installation, relocation, and/or removal of wood pole lighting units, temporary construction electric services on

wood pole, electric service equipment, electrical hand holes, manholes, grounding, and electrical cable and wire, consisting of Triplex Service Cable and/or temporary underground direct burial cable, and installation, relocation, and/or removal of mast arms and luminaries, as required for a complete and operating system.

The poles shall be 50 ft (15 m) Class III Wood Poles. The pole shall be set with the bottom approximately seven feet below grade. The nominal mounting height of the luminaire shall be 40' (12.2 m) above the roadway.

The mounting bracket arms shall be aluminum or galvanized steel and be suitable for attachment to wooden poles. The arms are to be fastened to the poles by means of galvanized bolts. The bolts shall pass thru the mounting flange of the support arm, thru the pole and have a galvanized washer and nut on the other end.

Where Temporary Lighting of this type is required to be removed or relocated conform to Standard Specification Section 823 for Description and Construction.

All wiring for the electric service installation and the wiring for the individual luminaries shall be the responsibility of the Contractor. All electrical work and testing required for Temporary Lighting shall conform to Standard Specification Section 820 – General Electrical Work and Testing.

Reuse of Existing Lighting Poles and Luminaries – The Contractor is encouraged to re-use and maintain existing roadway lighting poles, luminaries, and branch circuits where MOT phasing allows to meet Temporary Lighting levels and uniformity described herein. This shall include all necessary re-lamping, re-ballasting of existing roadway lighting poles. If necessary and if existing underground wiring can not be maintained provide temporary overhead and/or underground direct buried feeders; with all associated wood poles, cables, wires, hardware, trenching and manholes, etc. as required to maintain a complete and safe electrical system for operating the existing roadway lighting poles and luminaries.

It shall be the contractors responsibility to field locate, mark, test, and document all existing roadway lighting cables to be reused as part of the road way Temporary Lighting. At completion of project the existing cable may be abandoned in place as long as it is documented on red line construction drawings and each end of each cable shall be disconnected, taped, labeled and tag as "ABANDONED CABLE".

Where Temporary Lighting is required to be removed or relocated conform to Standard Specification Section 823 for Description and Construction.

Temporary Lighting Control Cabinets and relocated existing electrical services and lighting control cabinets – The Contractor shall provide Temporary Lighting Control Cabinets and/or relocate existing electrical services and lighting control cabinets to temporary locations for duration of Contract as required for Reuse of Existing Lighting Poles and Luminaries.

Temporary Construction Electric Services and Electric Service Equipment – The Contractor shall provide Temporary Construction Electric Services and Electric Service as required for Temporary Lighting. Materials and Construction for Temporary Construction Electric Services and Electric Service shall conform to Standard Specification 823 and 950. Provide suitable protection for electric service equipment. Contractor shall coordinate with MdTA and BGE and provide all necessary management efforts for arranging Temporary Construction Electric Services for Temporary lighting. Monthly electric bills will be paid by MdTA.

Portable Generators - The Contractor shall provide portable generators to furnish adequate AC power to operate all required lighting equipment if utility provided service is not available. All wiring shall be weatherproof and installed according to local, State, Federal and OSHA requirements. All power sources shall be equipped with a Ground-Fault Circuit Interrupter to prevent electric shock.

Light Meter - The Contractor shall furnish, for the use of the Engineer, two (2) photometers capable of measuring the level of illuminance. This photometer shall be available to the Engineer as necessary to check the adequacy of illumination. Contractor shall maintain light meter and certifications of calibration.

Equipment Mounting- Mountings shall be designed so that light fixtures can be aimed and positioned as necessary to reduce glare and to provide the required illuminance.

Glare Control-All lighting provided under this item shall be designed, installed and operated to avoid glare that interferes with traffic on the roadway or that causes annoyance or discomfort for residences adjoining the roadway. The Contractor shall locate, aim and adjust the lighting fixtures to provide the recommended level of illuminance and uniformity without the creation of objectionable glare. MdTA shall be the sole judge of when glare exceeds acceptable levels, either for traffic or for adjoining residences.

The Contractor shall provide shields, visors or louvers on luminaires as necessary to reduce objectionable levels of glare. As a minimum, the following requirements shall be met to avoid objectionable glare on roadways open to traffic in either direction:

a. Pole mounted luminaires shall be aimed either generally parallel or perpendicular to the roadway.

b. All luminaires shall be aimed such that the center of the beam axis is no greater than 60 degrees above the vertical.

c. No luminaires shall be permitted that provide a luminous intensity greater than 20,000 cd at an angle of 72 degrees above the vertical.

Continuous Operation- The Contractor shall provide sufficient fuel, spare lamps, generators and qualified personnel to ensure that all required Temporary Lighting will operate continuously from sunset to sunrise.

It is the intent to provide a continuously operating Temporary Lighting system. Should an operation problem be reported to the Contractor at any time during use of the system, the Contractor shall have 4 Hours after receipt of notification to rectify the problem to the Engineer's satisfaction. Failure of the Contractor to rectify Temporary Lighting deficiency will result in deduction of $500 per day payment for each day the Temporary Lighting system is not satisfactorily operating. To this end, the Contractor shall designate an on-site representative, other than the Project Superintendent, who shall be the contact person on all issues related to the Temporary Lighting system. The Contractor shall also designate a Manufacturer's Representative to be on call for technical assistance or as otherwise necessary.

104.25.04 MEASUREMENT AND PAYMENT. Temporary Lighting shall not be measured but shall be paid for at the contract lump sum price for Temporary Roadway Lighting. The lump sum payment shall be full compensation for all equipment, labor, materials, tools, wire, conduit, service installations, meter installations, meter applications, furnishing fuel, installation, relocation, maintaining light assemblies, cost for any movement and set up to another location, final removal from the project and incidentals necessary to provide, install, operate and maintain Temporary Lighting.

CATEGORY 100
PRELIMINARY

SECTION 107 CONSTRUCTION STAKEOUT

187 **107.03 CONSTRUCTION.**

ADD: 107.03.10 Highway Traffic Signals. For installation of Highway Traffic Signals, the Contractor shall arrange a meeting with the Engineer and representatives from the Traffic Operations Division to stakeout all items indicated on the sketches, plans, and in the Special Provisions. This meeting shall occur prior to any work after the notice to proceed. No work shall proceed before the stakeout is approved by the Engineer.

188 **107.04 MEASUREMENT AND PAYMENT.**

ADD: Intersection Utility Stakeout. Intersection Utility Stakeout for Traffic Control Devices will not be measured but the cost will be incidental to other pertinent items specified in the Contract Documents.

CATEGORY 100
PRELIMINARY

SECTION 108 – MOBILIZATION

108.01 Description

Add the following:

The Maryland Transportation Authority has no property available to the Contractor for offices, storing materials, equipment and personnel for this project.

CATEGORY 100
PRELIMINARY

SECTION 113 — DIGITAL CAMERA

113.01 DESCRIPTION. This work shall consist of furnishing a new or like new digital camera with a Color Inkjet Printer for use by Administration personnel. The digital camera and printer shall be delivered to the Engineer at the time of the Notice to Proceed. They shall remain operational and not be returned to the Contractor until final acceptance of the entire project, in conformance with GP-5.13.

113.02 MATERIALS.

(a) **Digital Camera.** The digital camera shall meet the following requirements and be furnished with the specified accessories.

(1) Windows 2000, ME, XP compatible operating system

(2) Photo Suite, Photo Deluxe, Picture Works, Photo Shop, or similar Photo Managing Software

(3) 4.0 megapixel image resolution (minimum)

(4) 3X optical zoom (minimum)

(5) Two (2) sets of rechargeable batteries

(6) SmartMedia Card or memory stick (512 MB minimum)

(7) Pop-up or built-in flash modes

(8) All items required for quick downloading

(9) Auto-quick focus

(10) Lens Cover, Shoulder Strap, and Carrying Case

(11) AC adapter and Battery Charger

(b) **Color Inkjet Printer.** The printer shall conform to the following minimum requirements;

(1) Resolution of 2400 x 1200 DPI (dots per inch).

(2) Print speed of 17 PPM (pages per minute) for black and white and 13 PPM for color.

(3) Memory 8 MB.

(4) Duty cycle of 5,000 pages/month.

Office-jets and Bubble-jets will not be accepted.

113.03 CONSTRUCTION. Not applicable.

113.04 MEASUREMENT AND PAYMENT. The digital camera will not be measured but the cost will be incidental to the Contract price for Maintenance of Traffic unless otherwise specified in the Contract Documents. If the digital camera or printer becomes defective, is stolen, or for any other reason does not function as intended, it shall be replaced with an approved camera or printer at no additional cost to the Administration. A nonfunctioning or stolen camera or printer shall be replaced within eight hours after the Engineer notifies the Contractor.

Ownership of the camera and printer will remain with the Contractor. The Administration assumes neither responsibility nor liability for the condition of the camera when returned.

CATEGORY 200
GRADING

SECTION 204 - EMBANKMENT AND SUBGRADE

204.01 DESCRIPTION.

227 **ADD:** The following.

The Contractor is advised that the proposed embankment areas for this project include areas where tie-in slopes are anticipated to be 2 percent. The Contractor shall insure that slopes in these areas are placed to provide positive drainage. Any areas that do not drain after completion of the fine grading shall be regraded at the Contractor's expense. No sod or seed and mulch shall be placed until the engineer is satisfied that positive drainage will be assured.

204.02 MATERIALS

204.02.01 Rock

227 **ADD:** The following.

Existing pavement, curb, gutter, ditch lining, sidewalk, etc, (either hot mix asphalt or portland cement concrete) excavated under this project may be used in embankment provided it is broken up into pieces no more than six inches in any direction, and provided the resulting embankment meets the requirements of this section. Specification 201.03.02 applies to the material listed in this paragraph.

CATEGORY 200
GRADING

SECTION 207 – REMOVAL OF EXISTING MASONRY

207.01 DESCRIPTION.

232 **ADD:**

SP 800 This work shall also include removal of existing drainage structures in their entirety as specified in the Contract Documents or as directed by the Engineer.

232 **207.03.04 Backfill.** Backfill for removal of existing drainage structures shall conform to all specifications of Select Borrow up to the pavement patch limits as specified in the Contract Documents.

207.04.04 MEASUREMENT AND PAYMENT.

233 **ADD:**

When specified in the contract documents, removal of existing drainage structures will be measured and paid for at the Contract unit price per each.

CATEGORY 300
DRAINAGE

300-01 BULKHEAD AND ABANDON EXISTING PIPE END

300-01.01 DESCRIPTION. This work shall consist of placing a brick bulkhead or other approved plug at the upstream end of a pipe and abandoning the pipe in place as specified in the Contract Documents or as directed by the Engineer. This work is for storm drain pipe only.

300-01.01 MATERIALS.

Brick	903.02
Mortar	903.06

300-01.03 CONSTRUCTION. This work shall be performed in conformance with Section 305. All pipes to be abandoned shall remain in place and be bulkheaded in a neat manner. Pipe ends shall be cleaned prior to the bulkheading process to ensure a proper bond between pipe and masonry. Upon inspection and approval by the Engineer, the upstream end of the pipe, 24-inch in diameter and larger, shall be plugged with a double course of brick, mortared in place, and those between 8 to 22-inch in diameter shall be plugged with a standard clay plug and mortared in place. The masonry bulkhead shall have courses laid level with full-mortared joints and face plumb. Brick shall be broken as necessary to maximize the amount of brick installed. The thickness of mortar joints shall not exceed 3/8-inch.

300-01.014 MEASUREMENT AND PAYMENT. This item will be measured and paid for at the Contract unit price per each. Payment will be full compensation for all labor, materials, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 300
DRAINAGE

300-02 SANDBAG DIKE

300-02 .01 DESCRIPTION. This work shall consist of constructing sandbag dike as specified in the Contract Documents or as directed by the Engineer. The sandbag dike shall be utilized for diverting drainage flows out of the work area and for anchoring the temporary diversion pipes.

300-02.02 MATERIALS. Sand bags shall be filled with material consisting of the mortar sand aggregate filler material firmly packed into a bag made of durable weather resistant fabric, with a weave tight enough to prohibit leakage of filler material and as approved by the Engineer. Each sand bag shall have a minimum length, width and thickness of 24", 12" and 6" respectively, and shall be of a weight not less than 75 pounds.

Sheeting shall consist of a polyethylene or other approved material which is impervious and resistant to puncture or tearing.

300-02.03 CONSTRUCTION. Placement and arrangement of the sandbag dike shall conform to location and detail as shown on the plans or as directed by the Engineer.

300-02.04 MEASUREMENT AND PAYMENT. Sandbag dike will be measured in a per each basis. The per each measurement, as provided above, shall be paid for at the contract unit price bid per each for "Sandbag Dike" accepted in place. The price and payment shall include full compensation for furnishing, and placing the sandbags and sheeting, removing all sand bag installations upon completion of the project, furnishing and handling, all labor, materials and incidentals necessary to complete the work.

CATEGORY 300
DRAINAGE

300-03 TEMPORARY DIVERSION PIPE

300-03 .01 DESCRIPTION. The work covered under this article shall consist of placing temporary diversion pipe.

300-03 .02 MATERIALS.

Temporary Diversion Pipe 905

Temporary Diversion Pipe shall be the size specified in the Contract Documents and conform to material specifications found in Section 905 – Pipe.

300-03 .03 CONSTRUCTION. The Contractor shall install the specified size of pipe to the length and slope shown in the Contract Documents. The Contractor shall provide positive drainage for all temporary diversion pipes.

300-03 .04 MEASUREMENT AND PAYMENT. Temporary diversion pipe shall be measured complete in place and paid for at the Contract unit price per linear foot of 18" HDPE FLEX PIPE and 24" HDPE FLEX PIPE as shown in the Contract Documents. The payment for this item will be full compensation for all hauling, storing, pipe installation, removal of temporary pipe on completion of work and for all material, labor, equipment, tools, and incidentals necessary to complete this work.

CATEGORY 300
DRAINAGE

300-04 STORMWATER MANAGEMENT FACILITY NO. 3

300-04.01 DESCRIPTION. This work shall consist of the above listed Stormwater Management Facility clearing, excavation, grading, stabilization and outfall structure construction as specified in the Contract Documents.

Site Preparation. This work shall consist of clearing and grubbing the designated area for pond excavation and structural work within the limits specified in the Contract Documents.

Pond Excavation. This work shall consist of the excavation and grading for the Stormwater Management Facilities to the lines and grades specified in the Contract Documents.

Weir Wall Structure. This work shall consist of constructing cast-in-place or precast structures with required appurtenances as specified in the Contract Documents or as directed by the Engineer.

Pipe Culverts. This work shall consist of placing pipe on firm bed to the specified line and grade. The pipe shall be the size, type and constructed as specified in the Contract Documents. Outfall protection shall be placed to the specified line, grades, and type as specified in the Contract Documents.

Pond Embankment. This work shall consist of constructing the embankment of suitable material placed, processed and compacted to the lines and grades specified in the Contract Documents.

Placing Salvaged Topsoil. This work shall consist of placing and spreading salvaged topsoil and stabilized as specified in the Contract Documents.

300-04.02 MATERIALS.

Pond Embankment	204.02
No. 2 Stone	300
Pipe Culverts	303
Miscellaneous Structures	305
Riprap	311

Placing Salvaged Topsoil	701.01
Turf Establishment	705
No. 57 Aggregate	901, Table 901A
Select Borrow	916.01.01
Common Borrow	916.01.04
Geotextile	921.09 Class SE

304-04.03 CONSTRUCTION.

Site Preparation. Refer to Section 101.03

Pond Excavation. Refer to Section 201.03

Pond Embankment. Refer to Section 204.03. The fill material shall be taken from borrowed areas approved by the Project Engineer. It shall be free of roots, stumps, wood, rubbish, stones greater than 6", and frozen or other objectionable materials.

Pipe Culverts. Refer to Section 303.03. Pipe shall have bell and spigot joints with water tight rubber gaskets. Bell and spigot pipe shall be placed with the bell end upstream. Joints shall be made in accordance with recommendations of the manufacturer of the material. After the joints are sealed for the entire line, the bedding shall be placed so that all spaces under the pipe are filled. Care shall be exercised to prevent any deviation from the original line and grade of the pipe. The first joint must be located within 4 feet from the riser.

Weir Wall Structure. Refer to Section 305.03.
Pre-cast structures shall be cast monolithic.

Placing Salvaged Topsoil. Refer to Section 701.03

Turf Establishment. Refer to Section 705.03

300-04.04 MEASUREMENT AND PAYMENT.

Site Preparation. Refer to Section 101.04

Pond Excavation. Refer to Section 201.04.

201.04

ADD: the following to the first paragraph after … rounded and transition slopes,:

dewatering measures, including hoses and pumps…

Pond Embankment. Refer to Section 204.04

Pipe Culverts. Refer to Section 303.04

Weir Wall Structure. Refer to Section 305.04

305.04

ADD: the following to the first paragraph after … backfill,:

orifice plates, trash racks, low flow and draw-down devices, including PVC piping and ¼" wire mesh…

Placing Salvaged Topsoil. Refer to Section 701.04

Turf Establishment. Refer to Section 705.04

CATEGORY 300
DRAINAGE

300-05 STORMWATER MANAGEMENT AS-BUILT CERTIFICATION

300-05.01 DESCRIPTION. An As-Built Certification conducted by a Professional Engineer or Professional Land Surveyor who is licensed in the State of Maryland shall be submitted by the Contractor to the Administration in order to certify that the constructed stormwater management facilities comply with the Contract Documents.

300-05.02 MATERIALS. Not Applicable.

300-05.03 CONSTRUCTION. Upon completion of the stormwater management facilities, as specified in the Contract Documents, the Contractor shall submit to the Authority a signed as-built certification and as-built plan certifying compliance with the Contract Documents for the completed stormwater management facilities. The submission of the as-built plan shall include a completed As-Built Checklist, a copy of the grading plans, along with any and all sheets associated with the stormwater management facilities (i.e. details, profiles, landscaping, structures, etc). The As-Built Certification shall be signed by a registered Professional Engineer or Professional Land Surveyor with experience in designing stormwater management facilities. The Professional Engineer or Professional Land Surveyor shall be an agent of the Contractor and shall make regular inspections and prepare documentation at specified stages of construction as listed in the as-built construction checklist provided on the plans. The as-built plan shall include all information necessary to compare the actual constructed stormwater management facilities to the Contract Documents. The As-Built Certified plans and the aforementioned attachments as well as an electronic version in Adobe Reader® format (pdf) shall be sent to the Construction Project Engineer and shall also be submitted to:

Mr. Douglas Novocin, P.E.
Environmental Manager - Engineering
Maryland Transportation Authority
300 Authority Drive
Baltimore, MD 21222

300-05.04 MEASUREMENT AND PAYMENT. Stormwater Management As-Built Certification shall be paid for at the contract lump sum bid price for "Stormwater Management As-Built Certification". Payment of such price will be full compensation for all labor, inspections, plan reviews and documentation which may include pictures, suggestions, final signed plans with as-built corrections marked as required to satisfactorily complete the work.

CATEGORY 300
DRAINAGE

300-06 STONE WINDOW

300-06.01 DESCRIPTION. The work covered under this article shall consist of constructing a stone window as specified by the Contract Documents.

300-06.02 MATERIALS.

Geotextile	921.09 Class SE
Riprap	311
No. 57 Aggregate	901, Table 901A

300-06.03 CONSTRUCTION.

Geotextile. Geotextile shall be placed in conformance with the Contract Documents. The machine direction of the geotextile shall be parallel to the longitudinal direction of the window. The geotextile shall be of sufficient width to completely enclose the window including any specified overlaps. The geotextile shall be placed tightly against the bottom of the window to eliminate voids beneath the geotextile. Wrinkles and folds in the geotextile shall be avoided, except when changing direction. A minimum 24 inch overlap at the geotextile joint ends or breaks shall be maintained. Geotextile joints and overlaps shall be pinned to securely hold the geotextile in place until placement of the gravel. All edges shall be pinned. Longitudinal joints and overlaps shall be pinned a minimum of 10 feet on center.

Class 0 Riprap. Class 0 Riprap shall be placed in conformance with the Contract Documents.

No. 57 Aggregate. No. 57 Aggregate shall be placed in conformance with the Contract Documents.

300-06.04 MEASUREMENT AND PAYMENT. The stone window will be measured and paid for at the Contract unit price per ton of Class 0 Riprap and No. 57 Aggregate. All excavation, backfill, geotextile, gravel, and all material, labor equipment, and tools necessary to complete the work are incidental to the cost of the Class 0 Riprap and No. 57 Aggregate.

CATEGORY 300
DRAINAGE

300-07 STABILIZED MAINTENANCE ACCESS ROAD

300-07.01 DESCRIPTION. This work shall consist of constructing stabilized maintenance access roads for the stormwater management facilities at the locations indicated on the plans including installation of a cell confinement system according to the Contract Documents and as directed by the Engineer.

300-07.02 MATERIALS.

Crusher Run Aggregate CR-6	901.01
Mulch Binder	904.03, 920.05.04
Furnished Topsoil	920.01.02
Fertilizer	920.04.01, 920.04.02
Mulch	920.05.03, 920.05.04
Miscellaneous	920.08
Geotextile Class ST	921.09

Cell Confinement Load Support System. This system shall be fabricated using strips of sheet polyethylene each having a length of 3.61 m (11.8 ft). Polyethylene strips shall be connected using full-depth, ultrasonic spot-welds aligned perpendicular to the longitudinal axis of the strip. Weld spacing shall be 356 mm ± 2.5 mm (14 in ± 0.10 in). The ultrasonic weld melt-pool width shall not exceed 25 mm (1.0 in). The sections shall have a "6" cell depth in inches, "10" and "18" expanded section width and length in number of cells. The cell dimensions shall have an expanded length ranging from 204 mm (8.02 in.) to 245 mm (9.65 in) and an expanded width ranging from 234 mm (9.20 in) to 281 mm (11.07 in). The cells shall have a minimum expanded section of 2.8 m wide x 3.7 m long (9.1 ft x 12.0 ft). The cell confinement system consists of an assembly of fully surface-textured H.D.P.E. sheet strips connected in series, using full-depth ultrasonic spot-welded seams, aligned perpendicular to the longitudinal axis of the strips. When expanded, the interconnected strips form the walls of a flexible, three-dimensional cellular confinement structure into which the specified infill materials can be placed.

The system includes cell confinements and stake anchors. Polyethylene used to make strips for cell confinement sections shall have a density of 0.935 - 0.965 g/cm^3 (58.4 - 60.2 lb/cu.ft.) tested per ASTM D1505. Polyethylene used to make strips for cell confinement sections shall have an Environmental Stress Crack Resistance (ESCR) of 3000 hour tested per ASTM D1693. Carbon black shall be used for ultra-violet light stabilization. Carbon black content shall be 1.5% - 2% by weight through the addition of a carrier with certified carbon black content. The carbon black shall be homogeneously distributed throughout the material. Strips used to make cell confinement sections shall have a sheet thickness, of 1.27 mm -5% +10% (50 mil -5% +10%) tested per ASTM D5199. Thickness shall be determined in the flat, before any surface texturing or other surface

disruption. Perforations shall be such that the peak friction angle between the surface of the perforated plastic and #40 silica sand at 100% relative density shall be no less than 85% of the peak friction angle of the silica sand in isolation when tested by the direct shear method per ASTM D 5321. The quantity of perforations shall remove 13.8% ± 2.1% of the cell wall area. Cell seam strength shall be uniform over the full depth of the cell. Short-term peel strength shall be tested per U.S. Army Corps of Engineers Technical Report GL-86-19, Appendix A. Minimum seam peel strengths shall be: 2000 N (450 lb) for the 203 mm (8.0 in) depth cell, 1420 N (320 lb) for the 152 mm (6.0 in) depth cell, 1000 N (225 lb) for the 102 mm (4.0 in) depth cell, 710 N (160 lb) for the 76 mm (3.0 in) depth cell. Seam hang-strength test shall be performed for a period of 7 days minimum in a temperature-controlled environment that undergoes change on a 1-hour cycle from room temperature to 54°C (130°F). Room temperature is defined in ASTM E41. Test samples shall be made by welding two 102 mm (4 in) wide polyethylene strips together. A test sample consisting of two carbon black stabilized strips shall support a 72.5 kg (160 lb) load for the test period. A test sample consisting of carbon black stabilized strip and a HALS stabilized strip shall support a 63.5 kg (140 lb) load for the test period.

300-07.03 CONSTRUCTION. Verify that site conditions are as indicated on the Construction Drawings. Verify that layout of the proposed work is in accordance with the Construction Drawings. Verify that all required materials delivered to the site comply with the Contract Specifications. The locations for stabilized maintenance access road for the stormwater management facilities are as shown on the plans.

Subgrade Preparation. Subgrade preparation shall conform to 211.03.02.

Geotextile Placement. Geotextile shall be placed on the prepared surface as per 211.03.03.

Cell Confinement Placement. The cell confinement shall be laid overtop of a geotextile that meets the specification for geotextile found elsewhere in this document and in areas indicated on the plans. The cell confinements shall be placed within three working days of geotextile placement.

The cell confinement sections shall be expanded into position at the grades and lines shown on the Construction Drawings. The orientation of expanded sections shall be as indicated on the Construction Drawings. Individual cell confinement sections can be held in their expanded positions with suitable "stretcher frames" or J-hook stakes driven inside selected outer cell walls prior to placing infill material. The stake diameter and length shall be suitable to hold the cell confinement sections in tension for the given foundation soil conditions. When properly expanded, the typical plan dimensions of individual cells should measure between 315 mm (12.39 in) long by 289 mm (11.39 in) wide and 260 mm (10.25 in) long by 350 mm (13.77 in) wide. The edges of adjacent sections of cell confinement shall be inter-leafed or butt-jointed according to which side-wall profiles abut. In all cases, the upper surfaces of adjoining cell confinement sections shall be flush at the joint. Inter-leaf side connections between expanded

cell confinement sections according to which sidewall profiles abut. Welded edge seams should be overlapped and aligned when stapling. Abut end connections between cell confinement sections. The longitudinal centerlines of abutting external cells should be aligned and stapled at the cell wall contact point. Adjoining sections shall be stapled together using a pneumatic stapler using 1/2-inch wire staples or other approved stapler and staples. Refer to the manufacturer's standard drawings for additional details regarding panel connections. If stretcher frames are not used, the cell confinement sections shall be anchored in position prior to placing infill material by using either temporary stakes or by hand placement of infill material into the corner cells. At catch basins, utilities, or other obstructions, the cell confinement shall be stretched into position and cut around the perimeter of the obstruction to allow the cell confinement sections to slip over the obstruction and placed flat on the prepared surface.

Infill Aggregate Placement. The cell confinement infill aggregate shall be well graded crushed stone or gravel with a maximum particle size of 37.5 mm (1 1/2 in) and no greater than 10% passing the #200 sieve. The coarse fraction of the base aggregate shall have a Los Angeles Abrasion test wear of no greater than 50%. The fines fraction (i.e. passing the #200 sieve) shall not be greater than two-thirds of the fraction passing the #40 sieve and the fraction passing the #40 sieve shall have a liquid limit no greater than 25% and a plasticity index not greater than 6%.

Overfill the cells with Aggregate Infill and level to a minimum 50 mm (2 in) above the top of the cell walls. A front-end loader may be used to place the infill provided that it only traffics above cell confinement sections that have been filled and covered with the minimum 50 mm (2 in) of additional material. The infill material shall be compacted to a minimum density of 95% Standard Proctor Dry Density or as specified by the Engineer. The surface shall be graded to the minimum specified height of compacted overfill material. This may be accomplished by back-blading with a straight edged loader bucket. A tolerance of plus or minus 12.5 mm (1/2 in) is acceptable. The specified aggregate wearing course material shall be placed and compacted to the lines and grades shown on the Construction Drawings. The surface aggregate shall be compacted to a minimum density of 95% SPDD.

Topsoil, Seed and Mulch. Placement of topsoil, seed and mulch shall conform to 705.03.

300-07.04 MEASUREMENT AND PAYMENT. Stabilized Maintenance Access Road will be measured and paid for at the Contract unit price bid per square yard. Payment will be full compensation for all transportation, excavation, labor, equipment, tools, materials and incidentals required to satisfactorily complete the work including subgrade preparation, geotextile fabric, seam stitching, fasteners, cell confinement system including fasteners and related items, aggregate backfill, topsoil, seed and mulch to complete the work.

CATEGORY 300
DRAINAGE

SECTION 305
MISCELLANEOUS STRUCTURES

305.01 DESCRIPTION.

246 **ADD:**

This work shall also consist of constructing the Weir Outfall Structure for Stormwater Management Facility No. 3 in accordance with the Contract Documents.

305.04 MEASUREMENT AND PAYMENT.

248 **ADD:**

305.04.08 Weir Outfall Structure for Stormwater Management Facility No. 3 shall be paid for at the Contract unit price per each. Payment will be in accordance with Section 305.04 and will include all material, labor, equipment, tools and incidentals necessary to complete the work as depicted in the Contract Documents.

CATEGORY 500
PAVING

SECTION 504 — HOT MIX ASPHALT PAVEMENT

504.04 MEASUREMENT AND PAYMENT.

478 **DELETE:** 504.04.01 Price Adjustment for Asphalt Binder in its entirety.

INSERT: The following.

504.04.01 Price Adjustment for Asphalt Binder. A Price Adjustment (PA) will be made to provide additional compensation to the Contractor or a credit to the Administration for the fluctuation in the cost of asphalt binder.

For adjustment purposes, the prevailing base index price will be the price specified for PG 64-22 Asphalt Binder currently posted at www.marylandroads.com (Business with SHA/Contracts, Bid, and Proposals) prior to bid opening. Cost differentials between PG 64-22 and a binder specified shall be included in the price bid per ton for Hot Mix Asphalt. A historical database will be maintained by the Administration

The PA will be made when the index price for the month of placement increases or decreases more than 5 percent of the prevailing base index price. Computations will be as follows:

$$\text{Percent Change} = ((Pp - Pb)/ Pb) \times 100$$

$$PA = T \times Q \times ((Pp - (D \times Pb))$$

Where:

PA = Price Adjustment for the current month
T = Design target asphalt content expressed as a decimal
Q = Quantity of Hot Mix Asphalt placed for the current month
Pp = Index price for PG 64-22 Asphalt Binder per ton for the month of placement
D = 1.05 for increases over 5 percent; 0.95 for decreases over 5 percent
Pb = Prevailing base index price for PG 64-22 Asphalt Binder per ton

PA resulting in increased payment to the contractor will be paid under the item Price Adjustment for Asphalt Binder. The item amount will be established by the Administration and shall not be revised by the Contractor. PA resulting in a decreased payment will be deducted from monies owed the Contractor.

01-06-09¶

CATEGORY 500
PAVING

SECTION 504 — HOT MIX ASPHALT PAVEMENT

504.04 MEASUREMENT AND PAYMENT.

479 **DELETE**: 504.04.02 Payment Adjustments for Pavement Density and Hot Mix Asphalt Mixture in its entirety.

INSERT: The following.

504.04.02 Payment Adjustments for Pavement Density and Hot Mix Asphalt Mixture. Payment adjustments for pavement density will be based on individual sublot core test data for a given lot and the lot average density as specified in this section and Table 504A. Payment reductions for density and for mixture will be made by adjusting the payment for Hot Mix Asphalt. Incentive payments will be made using the Contract items for HMA Density Incentive and HMA Mix Design Incentive. The item amounts will be established by the Administration and shall not be revised by the Contractor. Payment reductions for density will be waived for portions of the pavement where the Engineer determines that inadequate density is due to a poor foundation.

TABLE 504A		
Dense Graded HMA Mixes – Percent of Maximum Density		
Lot Average % Minimum	No Individual Sublot Below %*	Pay Factor
94.0	94.0	1.050
93.8	93.7	1.045
93.6	93.4	1.040
93.4	93.1	1.035
93.2	92.8	1.030
93.0	92.5	1.025
92.8	92.2	1.020
92.6	91.9	1.015
92.4	91.6	1.010
92.2	91.3	1.005
92.0	91.0	1.000
91.8	90.8	0.990
91.6	90.6	0.980
91.4	90.4	0.970
91.2	90.2	0.960
91.0	90.0	0.950
90.8	89.8	0.940
90.6	89.6	0.930
90.4	89.4	0.920
90.2	89.2	0.910
90.0	89.0	0.900
89.8	88.8	0.890
89.6	88.6	0.880
89.4	88.4	0.870
89.2	88.2	0.860
89.0	88.0	0.850
88.8	87.8	0.840
88.6	87.6	0.830
88.4	87.4	0.820
88.2	87.2	0.810
88.0	87.0	0.800
Less than 88.0	87.0	0.750 or rejected by Engineer

Note 1: When any test data is above 97.0, the lot may be rejected per the Engineer. When not rejected, the lot will receive a pay adjustment in accordance with the following:
(a) When the density lot average is above 97.5, the pay factor = 0.750
(b) When 3 sublot densities are above 97.0, the pay factor = 0.950
(c) When 4 or more sublot densities are above 97.5, the pay factor = 0.750

Note 2: Pay incentive or pay disincentive will not be paid for placements identified as wedge/level courses or thin lift courses.

*Note 3: When the Contractor's core specific gravity data does not compare with the Administration's core specific gravity data, only the Administration's single sublot values and lot average value will be used in acceptance decision.

*Note 4: The average sublot values and the lot average will be used in acceptance decision.

Acceptance of a mixture lot will be in conformance with Sections 904, 915, and MSMT 735. A composite pay factor (CPF) for asphalt content and gradation will be based on the total estimated percent of the lot that is within Specification limits as computed using the quality level analysis in conformance with MSMT 735.

Payment adjustments will be computed as follows:

Density Lot Payment Adjustment = (DF – 1) x (CP) x (TL)

Mix Design Lot Payment Adjustment = (MF – 1) x (CP) x (TL)

where:

DF = Density pay factor from Table 504A
MF = Mixture pay factor [0.55 + (0.5 x CMPWSL)]
Refer to MSMT 735 for CMPWSL.
CP = Contract unit price
TL = Applicable tonnage per lot

An in-place density lot containing material with a pay factor of less than 1.000 may be accepted at the reduced pay factor, provided the pay factor for density is at least 0.800 and there are no isolated defects.

A mixture lot containing material with a pay factor of less than 1.000 may be accepted at the reduced pay factor, provided the composite pay factor for asphalt content and grading is at least 0.750 and there are no isolated defects.

An in-place density lot containing nonconforming material that fails to obtain at least a 0.800 pay factor and a mixture lot containing nonconforming material that fails to obtain at least a 0.750 pay factor for asphalt content and gradation will be evaluated to determine acceptance. Any lot that is rejected shall be replaced.

When less than five Quality Control or Quality Assurance samples per in-place density lot have been obtained, the lot will not be evaluated for incentive payment.

When less than three mix samples have been obtained at the time of the acceptance sampling or at the time a lot is terminated, the Engineer will determine if the material in a shortened lot will be considered a part of the previous lot or whether it will be accepted based on the individual test data.

CATEGORY 500
PAVING

SECTION 522 — PORTLAND CEMENT CONCRETE PAVEMENT REPAIRS

522.02 MATERIALS.

509 **DELETE:** 522.02 MATERIALS in its entirety.

INSERT: The following:

522.02 MATERIALS. Refer to 520.02 except as follows:

Graded Aggregate for Base Course	901.01
Crusher Run Aggregate CR-6	901.01
Concrete Mix No. 9	902.10
Nonshrink Grout	902.11(c)
Epoxy Grout	902.11(d)
Epoxy Adhesive	921.04

522.02.01 Polyester Grout. A polyester grout may be used in lieu of epoxy grout, provided the grout conforms to 902.11(d). Identify cartridge type systems by batch or lot number.

522.02.02 Epoxy Adhesives. Refer to 921.04. Use water insensitive materials classified as Type IV, Grade 3, Class B and C.

522.02.03 Reinforcement. Section 908 for reinforcement, including load transfer assemblies, tie bars, deformed steel bars, and longitudinal tie devices, except all material shall be epoxy coated.

CATEGORY 500
PAVING

SECTION 550 — PAVEMENT MARKING PAINT

550.01 DESCRIPTION. Furnish and apply nontoxic lead free waterborne pavement marking paint to pavement surfaces as specified in the Contract Documents or as directed by the Engineer. These markings includes lines (striping), legends (letters and numbers) and symbols

550.02 MATERIALS. Paint is a nontoxic lead free waterborne pavement marking and is a non-durable material. All Paint Pavement Marking material shall be selected from the Qualified Products List

Nontoxic Lead Free Waterborne Pavement Marking Material	951.01

550.03 CONSTRUCTION.

550.03.01 Quality Control / Quality Assurance. Refer to Section 549

550.03.02 Application. The location, width, and type of marking shall be as specified in the Contract Documents or as directed by the Engineer.

(a) Temperature. The markings shall be applied when the paint, ambient and surface temperature, and relative humidity conform to the manufacturer's recommendations.

(b) Glass Beads. The Contractor shall apply the Maryland Blend gradation of glass beads uniformly across the surface of the stripe, at the rate of 7 to 9 lb/gal of paints.

(c) Thickness. The paint shall be applied at a wet film thickness of 18 ± 1 mils.

(d) Color. The color of the dry markings shall match Federal Standard 595 (38907 - yellow or 37925 - white). The Contractor shall make available the specified color chips for the Engineer's use to visually determine that the waterborne material matches the specified color.

(e) No-Track. The paint shall conform to 60 second no-track requirements. The no-track condition shall be determined by passing over the applied line at approximately 30 degrees with a standard passenger car or pickup truck. When viewed from a distance of 50 ft, the pavement surface shall show no evidence of the paint being picked up and redeposited on the pavement by the vehicle.

(f) Retroreflectance. The minimum retroreflectance shall be 150 millicandelas/lux/square meter for yellow and 250 millicandelas/lux/square meter for white as determined in conformance with 549.03.01

550.03.03 Application Equipment. The equipment used for application of the paint shall be approved by the Engineer prior to start of work, and shall be capable of applying waterborne traffic paint that has been approved by the Administration. The Contractor shall provide access to the paint application equipment for inspection by the Engineer.

The paint carriage on the left side of the paint truck shall have three paint and bead guns. The paint carriage on the right side of the paint truck shall have two paint and bead guns.

All 10 in. lines shall be applied using two paint and bead guns. Raising the paint carriage in order to paint these lines with one paint gun and bead gun is prohibited.

The footage counters used to measure pavement markings shall be calibrated, and a notarized certification shall be submitted to the Engineer as part of the Quality Control Plan.

Temperature gauges shall be calibrated every six months and a copy of the calibration certification shall be submitted to the Engineer as part of the Quality Control Plan.

The applicator shall apply the surface dressing beads to the wet paint marking by means of a pressurized bead dispenser or other mechanical conveying method not dependent upon gravity for uniform application. The bead dispenser shall be equipped with an automatic cutoff system that will stop the flow of the paint material whenever there is a disruption in the application of the beads so that all markings placed shall be covered with a uniform layer of surface dressing beads.

Application equipment shall be capable of applying the markings at multiple width settings ranging from 4 to 12 in.

The applicator shall provide a method for cleanly cutting off stripe ends and shall be capable of applying all longitudinal pavement markings.

The equipment shall be mobile and maneuverable to the extent that straight lines can be followed and all standard curves can be made in true arcs.

All parts of the equipment shall be thoroughly cleaned of foreign material or different colored material prior to the introduction of a new batch of material.

550.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for all pavement preparation, furnishing and placing of markings, testing, and for all material, labor, equipment, tools, and incidentals necessary to complete the work. Refer to 549.04.

Pavement Marking Paint will be measured and paid for at the Contract unit price for one or more of the following items:

(a) Pavement Marking Paint lines (striping) will be measured and paid for at the Contract unit price per linear foot for the color and width specified.

(b) Pavement Marking Paint Legends (letters and numbers) and Symbols will be measured and paid for at the Contract unit price per square foot. The square foot pay quantity for Legends (letters and numbers) and Symbols will be as specified in the Administrations Standard Details.

CATEGORY 500
PAVING

SECTION 553 — LEAD FREE REFLECTIVE THERMOPLASTIC PAVEMENT MARKINGS

553.01 DESCRIPTION. Prepare and apply lead free reflective thermoplastic pavement markings to roadway surfaces as specified in the Contract Documents or as directed by the Engineer.

553.02 MATERIALS.

Lead Free Reflective Thermoplastic Pavement Markings	951.02

553.03 CONSTRUCTION.

553.03.01 Quality Assurance/Quality Control. Refer to 549.03.01.

553.03.02 Application Equipment. An oil or air jacketed kettle shall be utilized for uniform melting and heating of the thermoplastic material. The kettle shall provide continuous mixing and agitation of the material. The kettle and the applicator shall be equipped with an automatic thermostatic device to provide positive temperature control.

The equipment shall be constructed so that all mixing and conveying parts, up to and including the application apparatus, maintains the material at the specified temperature. Conveying parts of the applicator between the reservoir and the application apparatus shall be constructed to prevent clogging and accumulation. The applicator shall be capable of containing a minimum of 600 lb of molten thermoplastic material.

The kettle and applicator shall be constructed and arranged to conform to the requirements of the National Board of Fire Underwriters (NBFU), the National Fire Protection Association (NFPA), and State and local authorities.

Temperature gauges shall be calibrated every six months and a copy of the calibration certification shall be submitted to the Engineer.

The applicator shall apply the surface dressing beads to the molten thermoplastic marking by means of a pressurized bead dispenser or other mechanical conveying method not dependent upon gravity for uniform application. The bead dispenser shall be equipped with an automatic cutoff system that will stop the flow of the thermoplastic material whenever there is a disruption in the application of the beads so that all markings placed shall be covered with a uniform layer of surface dressing beads.

Application equipment shall be capable of applying the markings at multiple width settings ranging from 4 to 12 in. as specified in the Contract Documents.

The applicator shall provide a method for cleanly cutting off stripe ends and shall be capable of applying all longitudinal pavement markings.

The equipment shall be mobile and maneuverable to the extent that straight lines can be followed and all standard curves can be made in true arcs.

All parts of the equipment shall be thoroughly cleaned of foreign material or different colored material prior to the introduction of a new batch of thermoplastic material.

553.03.03 Cleaning Pavement Surfaces. Refer to 549.03.02.

553.03.04 Application. The ambient and surface temperatures shall be at least 50 F and rising at the time of application.

Thermoplastic pavement markings shall be sprayed onto the pavement surface. Only the spray method of application shall be permitted. Gore areas, crosswalks, small intersections, roundabouts, and other areas which preclude the application of the markings with truck mounted equipment will be exempt from the spray application requirement.

Thermoplastic pavement markings shall conform to the following:

(a) Temperature. The molten material temperature shall be between 400 and 440 F unless otherwise recommended by the manufacturer, and approved by the Engineer.

(b) Primer. A primer shall be used if thermoplastic is applied to portland cement concrete. Any primer used shall be compatible with the thermoplastic material.

(c) Thickness. The pavement markings shall yield a solid thickness range of 80 to 95 mils above the roadway surface across the middle two-thirds of the line width when tested as specified in MSMT 729. Variation from this range will be used for the price adjustment specified in 553.04.01.

(d) Glass Beads. Glass beads shall be uniformly applied to the surface of the molten thermoplastic at the minimum rate of 7 to 9 lb/100 ft^2, as specified in MSMT 729.

(e) Color. The color of the dry markings shall match Federal Standard 595 (13538 - yellow or 17886 - white). The Contractor shall supply the specified color chips for the Engineer's use to visually determine that the thermoplastic material matches the specified color.

(f) Retroreflectance. Refer to 549.03.03(h). The millicandellas/lux/square meter values taken anytime within the first 30 days shall conform to the following:

RETROREFLECTANCE

COLOR	RETROREFLECTIVITY	CORRECTIVE ACTION
White	equal to or greater than 250	None
Yellow	equal to or greater than 150	
White	less than 250	Necessary corrective actions, including grinding if necessary, and re-tracing
Yellow	less than 150	

(g) Width. Refer to 549.03.03(e).

(h) Alignment. Refer to 549.03.03(f).

(i) Layout Markings. Refer to 549.03.03(i).

553.03.05 Quality Control Test Strip. Refer to 549.03.04.

553.03.06 Responsibility. Refer to Section 549.

553.03.07 Observation Period. Refer to Section 549.

553.04 MEASUREMENT AND PAYMENT. Refer to 549.04. The reflectometer will become the property of the Contractor at the completion of the project.

553.04.01 Price Adjustment for Film Thickness. The unit price for Lead Free Reflective Thermoplastic Pavement Markings will be per striped linear foot based on MSMT 729 calculations for thickness, and will be adjusted in conformance with the following:

MIL THICKNESS	PERCENT OF PAYMENT - UNIT PRICE
80 – 95 (a)(b)	100
75 – 79	90
70 – 74	88
65 – 69	82
60 – 64	72
Less than 60	Retrace to achieve a thickness of 80 to 95 mils. Retrace thickness shall be 30 mils min (b).

(a) The Engineer may require the Contractor to remove excess material thickness.
(b) Removal of excess material and retracing pavement markings shall be performed at no additional cost to the Administration.

CATEGORY 500 PAVING

SECTION 556 — PREFORMED
THERMOPLASTIC PAVEMENT MARKINGS

556.01 DESCRIPTION. This work shall consist of furnishing and installing heat applied preformed thermoplastic pavement marking symbols, legends, and lines as specified in the Contract Documents or as directed by the Engineer.

556.02 MATERIALS.

Preformed Thermoplastic is a durable pavement marking material. All Preformed Thermoplastic Pavement Marking material shall be selected from the Qualified Products List.

Heat Applied Permanent Preformed Thermoplastic Pavement Marking Material	951.06

556.03 CONSTRUCTION.

556.03.01 Quality Assurance/Quality Control. Refer to 549.

556.03.02 Application. The location, width, and type of marking, shall be as specified in the Contract Documents or as directed by the Engineer.

Applying pavement markings over longitudinal joints is prohibited; they shall preferably be offset 2 in. from them.

Thermoplastic Pavement Marking shall conform to the following:

(a) Temperature. The markings shall be applied when the thermoplastic, ambient, and surface temperature, and relative humidity conform to the manufacturer's recommendations.

(b) Color. The color of the dry markings shall match Federal Standard 595 (13538 - yellow or 17886 - white). The Contractor shall supply the specified color chips for the Engineer's use to visually determine that the thermoplastic material matches the specified color.

(c) Primer. When specified by the manufacturer, a primer shall be used if thermoplastic is applied to Portland cement concrete.

(d) Retroreflectance. The minimum retroreflectance shall be 150 millicandelas/lux/square meter for yellow and 250 millicandelas/lux/square meter for white as determined in conformance with 549.03.

556.03.05 Packaging. The material shall be handled for shipping, unloading and storage as recommended by the manufacturer. Each shipping package shall be marked with the following information:

(a) Manufacturer's name.

(b) Description of item.

(c) Date of manufacture.

(d) Contractor's name.

(e) Purchase order number.

(f) Lot number.

(g) Color.

556.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for all pavement preparation, furnishing and placing of markings, testing, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Preformed Thermoplastic Pavement Marking Legends (letters and numbers) and Symbols will be measured and paid for at the Contract unit price per square foot. The square foot pay quantity for Legends (letters and numbers) and Symbols will be as specified in the Administrations Standard Details

Preformed Thermoplastic Pavement Marking lines will be measured and paid for at the Contract unit price per linear foot for the color and width specified.

CATEGORY 500
PAVING

SECTION 557 – SNOWPLOWABLE RAISED PAVEMENT MARKERS

557.01 DESCRIPTION. Furnish and install new Snowplowable Raised Pavement Markers (SRPM) and replacement components as specified in the Contract Documents or as directed by the Engineer.

557.02 MATERIALS.

Castings	Qualified Products List / 951.05
Pavement Marker Reflector Lenses	Qualified Products List / 951.05
Epoxy	951.05

Snowplowable Raised Pavement Markers are durable materials.

557.03 CONSTRUCTION.

Casting. Recycled iron castings are prohibited.

Placement. Snowplowable Raised Pavement Markers shall be installed and located as specified in the Contract Documents and in conformance with the Maryland Manual of Uniform Traffic Control Devices (Md MUTCD).

General Installation Requirements.

(a) The Contractor shall install the SRPM no later than two weeks after the completion of the final surface or as directed by the Engineer.

(b) At the time of installation, the road surface and ambient temperature shall be as specified in the manufacturers' recommendations. Installing markers on wet pavement surfaces as determined in MSMT 729 is prohibited.

(c) At the time of installation, the Contractor shall have on the jobsite all the materials necessary to complete the installation.

(d) The quality control test strip containing a minimum of 10 groove cuts spaced as specified in the Contract Document shall be constructed to verify the accuracy and ability of the equipment and personnel. The contractor shall replace at no additional cost to the Administration any incorrect groove cuts and any incorrect casting placements within the test strip.

(e) At the time of installation, SRPM castings delivered with Pavement Marker Reflector Lens affixed should be free of dirt, dust, oil, grease, rust, moisture, or any foreign matter that will impair adhesion to the pavement. Any residual material that inhibits retroreflectivity of the reflector lens shall be removed without damage to the lens surface. It shall be the contractor's responsibility to clean each contaminated casting by sand blasting, wire brushing or other procedure approved by the Engineer to remove all foreign matter prior to installation. The use of chemicals to remove rust from the castings is prohibited.

(f) The contractor shall replace at no additional cost to the Administration any incorrect groove cut and any incorrect casting placement. An additional test strip may be required by the Engineer in the event of incorrect installations. Incorrect installations, as determined by the Engineer, shall be corrected and repaired by the contractor at no additional cost to the Administration.

Pavement Marker Reflector Lens. Reflector lenses for pavement markers shall be the same color as the adjacent pavement marking except the back side shall be as follows;

(a) One-Way Applications: The backside for One-Way Markers shall be red or blank as specified in the Contract Documents or as directed by the Engineer.

(b) Two-Way Applications: The backside for Two-Way Markers shall be the same color as the adjacent pavement marking.

The pavement marker reflector lens shall be imprinted with the model/batch number and the manufacturers' name.

Castings. The casting shall be imprinted with the model number and the manufacturer's name.

New Installation.

(a) The SRPM shall be installed in accordance with manufacturer's recommendations and D 4383. The installed height shall not exceed 0.25 in. above the road surface. The surface of the keel and web shall be free of scale, dirt, oil, grease or any other contaminant which may reduce its bond to the epoxy adhesive. All requirements of the manufacturer's installation instructions shall be met.

(b) The groove cut for the casting shall be the appropriate dimensions to allow 0.125 in. movement side to side of the casting. All leveling lugs on the casting must contact the pavement. The leading and trailing edges of the casting must lie below the pavement surface and the casting properly seated. All other requirements of the manufacturer's installation instructions shall be met.

(c) Lenses used shall be of a type specifically manufactured and approved for use as SRPM reflector lenses. Lenses that are manufactured exclusively for recessed pavement markers are not permitted as substitutes for SRPM reflector lenses.

Replacement.

(a) Casting Replacement. The re-use of damaged or removed castings is prohibited.

(b) Pavement Marker Reflector Lens Replacement. The Contractor shall remove and dispose of any damaged reflector lens and replace with a new lens. Previously installed undamaged castings which are missing a reflector lens shall have a new reflector lens installed. The replacement lenses shall be installed per manufacturer's written instructions.

(c) Casting Groove Cut Replacement and Accuracy. The re-use of existing groove cuts is prohibited; castings shall only be installed in new groove cuts. Previously used groove cuts shall be permanently patched in accordance with applicable sections of 504, 505 and 522 or

as directed by the Engineer. The location of the replacement groove cut shall be within 10 percent longitudinally in front (with the direction of traffic) and no lateral deviation exceeding 1½ in.

Casting Adhesive. The epoxy adhesive used to fasten the castings to the pavement surface shall conform to D 4383-05 Table X1.1.

Reflector Lens Adhesive in Casting. The adhesive used to fasten the reflector lens to the casting shall meet the manufacturers' recommendations.

Quality Assurance/Quality Control. Refer to Section 549.

Observation Period. The Contractor shall replace at no additional cost to the Administration, any SRPM or Pavement Marker Reflector Lenses found to be damaged, non-retroreflective or missing due to improper installation or manufacturing defects within 180 days after opening to traffic.

557.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for all pavement preparation, furnishing and placement of SRPM's, testing, removal, groove cutting, repair and all materials, labor, equipment, tools and all incidentals necessary to complete the work.

(a) Snowplowable Raised Pavement Markers will be paid for at the Contract unit price per each. Furnishing and installing SRPM includes the casting, reflector, adhesive and grooving.

(b) Removal of existing Castings, excluding any incorrect installation by the Contractor, and repair of Groove Cuts will be paid for at the Contract unit price per each.

(c) Replacement of Pavement Marker Reflector Lenses will be paid for at the Contract unit price per each.

CATEGORY 500
PAVING

SECTION 559 — PERMANENT PREFORMED PATTERNED REFLECTIVE PAVEMENT MARKINGS

559.01 DESCRIPTION. This work shall consist of furnishing and applying permanent preformed patterned reflective pavement (PPPRP) markings as specified in the Contract Documents or as directed by the Engineer.

559.02 MATERIALS.

Permanent Preformed Patterned Reflective Pavement Marking Materials	951.07

559.03 CONSTRUCTION.

559.03.01 General. PPPRP markings shall be applied in conformance with the manufacturer's recommendations or as directed by the Engineer.

On new hot mix asphalt projects, the PPPRP markings shall be inlaid into the hot surface of the top course of pavement. No top course paving shall be permitted unless the stripping crew and marking materials are at the project site.

When the Contract Documents specifies the use of PPPRP markings on concrete pavements or existing asphalt pavements, the Contractor shall use heat, solvent, or other type of adhesive primer in conformance with the manufacturer's recommendations.

Preformed legends and symbols shall conform to the applicable shape and sizes as specified in the MUTCD, and Contract Documents.

PPPRP markings shall conform to pavement contours and be resistant to deformation by traffic and damage from snow removal equipment. Surface preparation, use of solvents and primers and equipment used in the application of PPPRP markings shall conform with the manufacturer's recommendations and be approved by the Engineer. After PPPRP markings are applied, they shall be immediately ready for traffic.

559.03.02 Quality Assurance/Quality Control. Refer to 549.03.01.

559.03.03 Cleaning Pavement Surfaces. Refer to 549.03.02.

553.03.04 Application. Refer to 549.03.03 and the following:

(a) Manufacturer's Recommendations. The Contractor shall provide a copy of the manufacturer's recommendations to the Engineer, and shall follow them for the installation of the line markings.

(b) Adherence. Adherence of PPPRP markings shall be randomly checked by using a paint scraper or another approved tool, which shall be held nearly parallel with the highway surface, so there is no dislodging of the tape.

(c) Thickness. The finished thickness of the PPPRP markings shall have a minimum caliper of 0.060 in. at the thickest portion of the patterned cross section, and a minimum caliper of 0.020 in. at the thinnest portion of the cross section. Measurements shall be made from the top of finished pavement surface.

(d) Color. The color of the markings shall match Federal Standard 595 (33538 - yellow, 37886 – white, or 37038 - black). The Contractor shall supply the specified color chips for the Engineer's use to visually determine that the PPPRP markings match the specified color.

(e) Retroreflectance. Refer to 549.03.03(h) and the following:

MINIMUM RETROREFLECTANCE

COLOR	RETROREFLECTIVITY	CORRECTIVE ACTION
White	350 or higher	None
Yellow	250 or higher	
White	less than 350	Necessary corrective actions, removal, replacement
Yellow	less than 250	

(f) Width. Refer to 549.03.03(e).

(g) Alignment. Refer to 549.03.03(f).

(h) Layout Markings. Refer to 549.03.03(i).

559.03.05 Quality Control Test Strip. Refer to 549.03.04.

559.03.06 Responsibility. Refer to Section 549.

559.03.07 Observation Period. The Contractor shall be responsible for any defects in materials and workmanship of the PPPRP markings for a period of 180 days from the date the markings are applied and under traffic.

The Engineer will not assess time charges during the observation period provided all other work on the Contract is complete. At the end of the observation period, the Engineer will inspect the pavement marking for durability, color, reflectivity, and inform the Contractor of all pavement markings that have failed and require replacement. The pavement marking will be considered failed for any of the following conditions:

(a) More than five percent of the substrate is exposed in any 2000 ft section of longitudinal pavement marking line.

(b) Retroreflectance values have dropped below 300 mcd/L/m^2 for white or 220 mcd/L/m^2 for yellow.

(c) Marking is discolored on a visual comparison with the color chips.

The Contractor shall remove and replace all failed PPPRP markings within 30 days of receiving written notification from the Engineer at no additional cost to the Administration. Work shall be in conformance with the manufacturer's recommendation and as approved by the Engineer before the project is accepted. The replacement markings shall conform to the same requirements as the original markings. If the work is not completed in this period, the Engineer will resume time charges until this work is completed.

At the end of the observation period, the Engineer will accept the work and terminate the Contractor's responsibilities upon satisfactory inspection of the PPPRP markings.

559.04 MEASUREMENT AND PAYMENT. Measurement and payment for the pertinent Permanent Preformed Patterned Reflective Pavement Marking items will be as specified in 549.04. The reflectometer will become the property of the Contractor at the completion of the project.

CATEGORY 500
PAVING

SECTION 565 — REMOVAL OF EXISTING PAVEMENT MARKINGS

565.01 DESCRIPTION. Remove existing pavement markings (lines, letters, numbers, arrows, and symbols) during temporary or permanent traffic shifts, and repairing any roadway areas damaged during the removal process. This Specification does not apply to raised or recessed pavement markers. Temporary blackout tape shall be applied when existing pavement markings will require salvaging for reuse after completion of temporary traffic shifts necessary to perform work specified in the Contract Documents. Refer to 104.11.02.

565.02 MATERIALS. Not applicable.

565.03 CONSTRUCTION. The Contractor shall layout and apply all new pavement markings (temporary or permanent) as specified in Section 549 before any removal of existing pavement markings begin.

565.03.01 Quality Control/Quality Assurance. At least two weeks prior to the start of pavement markings removal, the Contractor shall submit a Quality Control Plan (QCP) to the Engineer for review. The QCP shall contain (as a minimum) the following information:

(a) How the Contractor proposes to perform the work while ensuring conformance with the Specifications.

(b) Proposed method of removal based on road conditions, type and number of equipment to be used, manpower expectations, and time frame to complete the work based on maintenance of traffic (MOT) restrictions.

(c) Location and quantity of markings to be removed.

(d) Protective shielding plan and containment system, particularly in the case of markings that may contain toxic materials.

The QCP shall also detail when, how, and what corrective actions will be taken for unsatisfactory construction practices and deviations from the Contract Documents. Any deviation from the QCP shall be cause for immediate suspension of work. Operations shall not resume without the Engineer's approval.

565.03.02 Quality Control Test Strip. Prior to the beginning of work, the Contractor shall demonstrate the removal method to the Engineer for approval. A minimum of 100 ft of existing pavement markings shall be removed as a test strip at a location determined by the Engineer. If the method does not work or shows signs of damaging the road surface, then another method shall be tried. Additional control strips will be required. The preferred method is that which least damages the roadway and completely removes the markings.

565.03.03 Methods of Removal. The following removal methods are based on the pavement condition and type of marking material:

(a) Manual. A scraper or putty knife shall be used to lift tape from the pavement surface. Open flame for tape removal is prohibited.

(b) High Pressure Water Blasting. A high pressure water blast shall be used to break the bond between the marking material and the pavement surface. The water blast may contain fine grit.

(c) Alternate Methods. Abrasive blasting or grinding methods shall be submitted for approval to the Office of Materials Technology prior to use.

565.03.04 Cleaning Pavement Surfaces. Immediately behind the removal operation, a vacuum equipped street sweeper capable of removing all loose material shall be used to remove all dust and debris generated by the removal process prior to returning the area to traffic. The Contractor shall prevent debris from draining into inlets and waterways, and all debris shall be collected and disposed of on an approved spoil area or landfill.

565.03.05 Alignment. Removal shall be performed in a straight and uniform manner, and shall follow the longitudinal alignment of the markings with a lateral deviation of no more than 1 in. in any 10 ft section. Affected area shall not exceed 1/2 in. on either side of the existing marking. The depth shall be uniform throughout, 1/8 in. or less, with no gouge areas in the pavement surface. If a second pass is necessary to completely remove the markings, the edges of the groove shall be feathered to a width of 1.25 in. on each side for every additional 1/8 in. of depth.

565.03.06 Corrective Action. Any pavement surface damaged beyond the requirements specified herein by the Contractor's operations shall be repaired or repaved as determined by the Engineer at no additional cost to the Administration.

565.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for the removal of the markings, pavement clean up, test strips, protective shielding, containment, disposal of marking material and pavement debris, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Removal of the existing pavement markings will be measured and paid for at the Contract unit price for one or more of the following items:

(a) Removal of Existing Pavement Marking Lines per linear foot, any width.

(b) Removal of Existing Pavement Marking Letters, Symbols, Arrows, and Numbers per square foot.

CATEGORY 700

700-01 HERBACEOUS EMERGENT PLANTS

700-01-01 PART 1 – GENERAL

1.1 WORK INCLUDED

A. The Contractor shall furnish all labor, materials, equipment, and services necessary for and incidental to furnishing and complete installation of herbaceous emergent plants, as shown on the drawings and as specified herein.

B. Work under this section shall include the following:

1. Furnishing and planting operations for herbaceous emergent wetland plants.

2. Contract coordination of drawings and specifications, submittals, and additional requirements.

3. Maintenance and guarantee for one year for all plants indicated on the Stormwater Management Facility Landscape Plan.

1.2 REFERENCES

A. The work under this section shall be in accordance with applicable portions of the Maryland Department of Transportation SHA Standard Specification for Construction and Materials, July 2008 as updated by subsequent Supplemental Specifications and Provisions except as specified herein.

1.3 QUALITY ASSURANCE

A. Herbaceous emergent or wetland plant nomenclature shall be in accordance with the most recent edition of Reed, P.B., Jr. National List of Plant Species that occur in Wetlands: Northeast (Region 1). U.S. Fish and Wildlife Service. Biol. Re. 88 (26.1)

B. For the stormwater management pond planting schedule, and in particular the constructed wetlands at the permanent pool perimeter, the contractor is advised to utilize a subcontractor specializing in aquatic landscaping.

C. The initial inspection of plant materials shall be per Reference Specification Section 920.07.03. Plants damaged in handling or transportation, or by improper storage shall be rejected by the Engineer.

1.4 SUBMITTALS

A. Source of supply for herbaceous emergent plant material and Type B Compost 2 weeks prior to digging. The Contractor shall obtain all stock from a nursery approved by the Engineer.

B. Product names and literature, and application rates for fertilizer, insecticide and herbicide.

C. Analysis of Type B compost to be in accordance with the Reference Specification.

D. Prior to the start of planting the herbaceous emergent wetland plants, the Contractor shall submit a proposed installation schedule to the Engineer for review. No wetland planting work shall be performed until the Engineer approves this schedule.

1.5 ENVIRONMENTAL CONDITIONS

A. Planting at any other time outside the designated planting season shall require the written approval of the Engineer.

B. Herbaceous emergent wetland stock shall only be planted from early April to mid-June in order to maximize the length of time the wetland plants have to build the root reserves needed to get through the winter.

1.6 HANDLING

A. Post-nursery care of wetland plants is very important in the interval between delivery of the plants and their installation. Plant handling and storage for herbaceous emergent wetland stock may include root systems being kept in water or in contact with a saturated mulch material. Stock shall be frequently watered and shaded while on site.

B. Floating-leaved and submerged aquatics must be kept continually wet and shall be transported in water. They shall not be stored more than 1 or 2 days.

700-01.02 PART 2 – PRODUCTS

2.1 MATERIALS

A. All materials scheduled below shall meet the requirements of the Reference Specification:

Material	Reference Specification Section
Water	920.09
Insecticide	920.09.03
Herbicide	920.09.03

B. Fertilizer for herbaceous emergent plants on the Stormwater Management Pond Planting Schedule shall be as follows:

1. Fertilizer shall be Agriform 20-10-5 two year release 10 gram planting tablets suitable for use under water if necessary.

C. Herbaceous emergent wetland plants shall be nursery grown, indigenous to the eastern region of the United States, and obtained from local aquatic nurseries.

D. Herbaceous emergent wetland plants, shown in the Stormwater Management Pond Planting Schedule which will be planted between the permanent pool elevation and a one foot pool depth, shall be wet – cultured plant material grown in a saturated soil condition for a minimum of 3 months during the growing season. The designed wet pool elevation of the pond will result in a regular 0-12 inch inundation for these plantings.

E. Herbaceous container grown stock root systems shall be well-developed and well distributed throughout the container such that roots visibly extend to the inside face of the container. If in leaf, the plants shall appear healthy with no leaf spots, leaf damage, leaf discoloration, leaf wilting or evidence of insects on the plant.

F. Herbaceous plugs shall have a solid soil/root mass with the soil in place. Roots shall appear clean and white in coloration. If growing, plants shall appear healthy with no leaf spots, leaf damage, leaf discoloration, leaf wilting or existence of insects on the plant. If dormant, new healthy shoots shall be apparent. Plugs containing shoots that are soft or mushy or otherwise appear rotten shall not be accepted.

G. Goose netting shall be polypropylene or nylon with an aperture size of approximately ¾" including required stakes, staples and ties, etc.

2.2 SUBSTITUTIONS

A. Substitutions: No substitutions shall be made without the permission of the Owner or Engineer. It is the contractor's responsibility to make every reasonable effort to find the specified plant material. If plant material is not available at time of planting, Contractor shall submit in writing evidence that the plants are unavailable. Suitable substitutions will be determined by Owner or Engineer.

B. If possible, herbaceous emergent wetland plants shall be ordered at least 3 months in advance of the planting date to ensure availability of the desired species.

700-01.03 PART 3 – EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. Planting and shall be in accordance with the Contract Drawings.

B. Planting season shall be as stated previously under "Environmental Conditions."

C. Herbaceous emergent wetland plant installation shall be conducted under the supervision of the Engineer.

D. Contractor shall take precautions to install netting an appropriate distance from the plants to prevent the rice cutgrass, duck potato and common three square plants from being eaten or uprooted by geese.

3.2 SUPPLEMENTAL PLANTING PROCEDURES

A. During planting operations, all areas shall be kept neat and all reasonable precautions shall be taken to avoid damage to installed plants and seeded areas. The Contractor shall be responsible for all damage to existing conditions. Damage shall be repaired or replaced to the satisfaction of the Owner.

B. Plant List: The Contractor shall furnish all plants in quantities and size necessary to complete the work as shown on the drawings. Where the drawings and plant list conflict as to quantity the graphic plant symbols shown on the plan shall determine the actual quantity.

C. All utilities shall be located in the field before any digging is begun. Coordinate with the General Contractor for location of any other underground utilities.

D. Plant Locations: All plants shall be located as shown on the drawings, to dimensions if shown, to scale if not dimensioned.

E. Fertilization:

1. Herbaceous emergent plants on the Stormwater Management Pond Planting Schedule shall receive 2 tablets into each quart size hole, and 1 tablet into each smaller hole.

F. Contractor shall monitor and control for pests and apply insecticide to plants before damage occurs. Apply all materials at manufacturers recommended rates. Use and dispose in accordance with EPA, State, and other Regulations.

G Stormwater Management Facility side slopes and top of embankment shall receive a four inch depth of topsoil. Topsoil shall be placed as noted on the stormwater landscape plan.

H. Sequence for preparing the Stormwater Management Facility wetland perimeter for planting:

1. The basin bottom shall be dewatered to at least one foot below the permanent pool elevation, or lower as directed by the Engineer. Drawing down of the pool elevation may be necessary to remove accumulated sediment, prepare the subgrade, place topsoil and install the wetland plants "in the dry" around the permanent pool perimeter, and install temporary goose netting.

2. As quickly as possible following planting the herbaceous emergents, the pond water surface shall be returned to the designed permanent pool water surface elevation.

3. The pool perimeter subgrade elevation to be planted shall be de-consolidated by disking, ripping, plowing, or tilling to a depth of 4 to 6 inches.

4. Finish grade shall comply with the grading plan and be within the grading tolerances specified. Finish grade of the topsoil surface between then permanent pool elevation and 1 foot depth of water shall be within 1 inch of the designed elevation to provide compliance with the grading plan and designed planting zones.

5. The pond perimeter shall be subdivided in separate planting zones based upon the permanent pool water surface elevation.

6. Plant zones shall be perimeter staked or flagged every 10 to 25 feet at the outset of the planting season to clearly delineate the zones for the Engineer's approval before planting begins.

I. Planting Procedures for plants listed on the Stormwater Management Facility Planting Schedule:

1. All plant materials and construction techniques shall be inspected and approved by the Engineer prior to installation. The Engineer shall be present during installation of the herbaceous emergent plants.

2. Remove the plant from the flat or container.

3. Dig a hole large enough (using a trowel or other appropriate equipment) to install the plant with the roots down, while allowing space to backfill around it.

4. Place the plant in the hole so the top of the plug or container's soil medium, or the plants root collar is flush or slightly higher than the finish grade.

5. Center the plant in the hole. Place the specified fertilizer tablets in the hole.

6. Backfill using the material from the hole. Firmly pack the material around the plant to remove voids, and to secure the plant in place in an erect position.

7. Even out the left over material to match the original grade. Do not form a saucer.

8. Water the plant thoroughly until the soil is saturated. Remove any tags or strings from the plant.

9. Goose netting shall be installed on both sides of the plantings to prevent geese from accessing the plants from the permanent pool side or the land side.

10. Immediately return the water surface to the permanent pool elevation.

3.3 MAINTENANCE FOR PLANTS SHOWN ON LANDSCAPE PLAN

A. The Contractor shall be responsible for care and maintenance of planting immediately upon installation, during the period prior to inspection and initial acceptance.

B. Inspection shall be made by the Engineer and the Contractor within two weeks of written notification from the Contractor.

C. This inspection can be on all work or partially completed work under the Contract.

D. Maintenance for the herbaceous emergent wetland plants at the perimeter of the Stormwater Management Pond includes replacement of any dislodged or eroded plantings, removal of any accumulated sediment from eroded areas, and maintenance of the permanent pool elevation and goose netting.

3.4 GUARANTEE

A. The Contractor will conduct a final inspection with the Owner or Engineer at the end of the one year period. It will be the Contractor's responsibility to notify the Owner or Engineer within 10 days of the anticipated meeting.

B. The Contractor shall achieve a minimum 85% survival rate for the herbaceous emergent plants shown on the Stormwater Management Facility Planting Schedule. Any of these plants considered dead by the Engineer shall be considered a dead plant. If in the Engineer's opinion more than 15% of the total quantity of these plants is dead, the Contractor shall replace the number of plants necessary to meet the 85% requirement. The replacement will be as determined by the Engineer and at no additional cost to the Owner.

C. Replacements will be made immediately when directed by the Engineer. There will be a one time replacement policy.

D. A replacement will be of the same size, type, and quality as the specified original, with no additional soil additives or fertilizer being necessary.

E. The Contractor will not be responsible for plant material that has been damaged by vandalism, fire, removal or other activities beyond his control.

F. Replacement plants are not guaranteed.

700-01.04 PART 4 - MEASUREMENT AND PAYMENT

A. Installation of herbaceous emergent plants will be measured and paid for at the Contract unit price per each item as specified in the Contract Documents. The payment will be full compensation for all plants, fertilizing, replacements, goose netting installation materials and for all labor, equipment, tools, and incidentals necessary to complete the work in a manner satisfactory to the Engineer. The goose netting shall be incidental to the unit price of the herbaceous emergent plants.

END OF SECTION

CATEGORY 800
TRAFFIC

800-01 SQUARE PERFORATED TUBULAR STEEL POSTS

800-01.01 DESCRIPTION. This work shall consist of furnishing and installing Square Perforated Tubular Steel Posts and Square Perforated Tubular Steel Anchor Bases for mounting traffic signs as specified in the contract documents, or as directed by the Engineer.

800-01.02 MATERIALS.

Steel Posts	A570 Grade 50
Galvanizing	A653 Designation G-90
Spray Galvanizing Compound	A780

Square Tubular Steel Posts and Square Tubular Steel Anchor bases shall be formed from 12 gauge steel. All sides of the tubes shall have 7/16 in. die punched circular holes or perforated knock-outs, at one in. centers along their entire length.

The Tubular Steel Posts shall be two in. square tubes 12 ft long.

Square Tubular Steel Anchor Bases shall be comprised of two telescoping tubes. The first shall be 2 1/4 in. square, three ft long, formed from 12 gauge steel and shall snugly fit over the sign post. The second section shall be a 2 1/2 in. square, 18 in. long, formed from 12 gauge steel, and shall snugly fit over the
2 1/4 in. section.

800-01.03 CONSTRUCTION. The Square Tubular Steel Anchor Base assembly shall be constructed by placing the 18 in. base section over the 3 ft base section so that they are flush at the top and the holes are aligned. The entire unit shall be driven into the ground so that one or two rows of holes in the Square Perforated Tubular Steel Base are exposed. The base shall be driven so that it remains plumb and to provide the final sign assembly with the correct orientation.

Finished length of the Tubular Steel Posts shall be determined by adding the total height of the signs to 8 Ft, 2 in. The sign post shall be cut to the correct length, and cold spray galvanizing shall be applied to the cut end. The signs shall be bolted to the top of the post, using tamper proof bolts or drive rivets. The Square Tubular Steel Posts shall be lowered 8 in. into the base, and the post secured to the base using two corner bolts designed for this purpose.

800-01.04 MEASUREMENT AND PAYMENT. Square Tubular Steel Posts will be measured and paid for at the contract unit price per each. The payment will be full compensation for the sign post, corner bolts, and painting as required, and for all materials, labor, equipment, tools, and incidentals necessary to complete the work.

Square Tubular Steel Anchor bases will be measured and paid for at the contract unit price per each. The payment will be full compensation for both tubes comprising the base section, all excavation, and for all materials, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 800
TRAFFIC

800-02 LED - TRAFFIC SIGNAL HEADS

800-02.01 DESCRIPTION. This work shall consist of furnishing and installing vehicle traffic control signal heads and pedestrian signal indications, self-contained wide angle LED type with mounting hardware as specified in the Contract Documents and in accordance with the latest ITE specifications for light emitting diode (LED) signals.

800-02.02 MATERIALS. LED signal heads, and all component parts shall meet the latest edition of the formally-adopted version of the specification titled "Vehicle Traffic Control Signal heads - Part 2: Light Emitting Diode (LED) Vehicle Traffic Signal Modules," published by the Institute for Transportation Engineers (ITE) 2006. The Contractor is required to provide laboratory certification for compliance with the latest ITE specifications.

(a) All signals shall be certified by the manufacturer to meet or exceed all requirements of that specification over their entire 5-year warranty period.

(b) The advertising date of this Contract shall be used to determine the date of the applicable standards.

(c) Serial numbers and model numbers, if available, shall be permanently identified on all removable components and hardware. The serial number and model number shall be etched, stamped, molded, or attached using metallic self-adhesive labels. The use of adhesive backed paper labels is not acceptable.

(d) LED traffic signal head modules shall be in accordance with the most recent guidelines listed below.

DESCRIPTION	ITE SPEC
8" RED BALL	ITE 6-27-05
8" YELLOW BALL	ITE 6-27-05
8" GREEN BALL	ITE 6-27-05
12" RED BALL	ITE 6-27-05
12" YELLOW BALL	ITE 6-27-05
12" GREEN BALL	ITE 6-27-05
12" RED ARROW	ITE 6-27-05
12" YELLOW ARROW	ITE 6-27-05
12" GREEN ARROW	ITE 6-27-05

800-02.03 CONSTRUCTION. LED signal head modules shall fit in standard, LED vehicle

traffic signal housings without modifications or the need for special tools, and shall be complete with a lens that is tinted for the appropriate color.

Design. LED traffic signal modules shall have:

(a) A printed circuit board inclusive of all of the LEDs and required circuit components.
(b) Minimum 39- inch wire leads, minimum # 20 AWG, 600 volt, 105 C, with strain relief and spade terminals. Screw-type terminals shall not be allowed.
(c) A rigid housing for protection in shipping, handling and installation:
(d) A one piece neoprene gasket shall be used to seal out water and contaminants.

Assembly Techniques.

(a) The LEDs within the modules shall be mounted and soldered to a printed circuit board.
(b) LED signal head modules shall be watertight when properly installed in traffic signal housings.
(c) LED signal head modules shall utilize the same mounting hardware used to secure a standard incandescent lens and gasket assembly, and shall only require a screwdriver or basic installation tools to complete the mounting.
(d) LED signal head module assemblies shall weigh less than 5 pounds.
(e) LED signal head modules may not protrude into the signal visor area more than two and three-quarters of an inch in depth.
(f) LED signal modules shall be marked 'TOP' or have an up arrow to designate the proper orientation of the signal module in the traffic signal housing.
(g) LED signal module housings shall utilize an integral metal layer in their design and construction.
(h) LED signal modules shall utilize the latest technology in thermal management.

Lenses. Lenses for ball type modules shall be made of ultraviolet stabilized polycarbonate, and incorporate facets that serve to enhance the optical efficiency of the LED traffic signal module. Individual *lens-lets* or external lens facets shall not be permitted.

(a) The ball type signals shall incorporate a diffuser-type lens system that serves to collimate the light emitted by the LEDs. The lens and diffuser system shall focus the collimated light, to meet ITE intensity and distribution standards.
(b) LED signals shall almost perfectly approximate the appearance of an incandescent traffic signal to the motorist.

(1) The face of the ball LED lamps shall appear to the motorist as uniform in illumination, and have a wide viewing angle that makes it suitable for installation on wide boulevards.

(2) The external lens surface for all vehicle signals shall be smooth, with no raised features, so as to minimize the collection of dirt, diesel smoke, and other particulate contaminates, and to facilitate periodic cleaning.
(3) The lens shall be keyed to the housing of the LED signal module to insure the proper orientation and to avoid possible rotation during any handling.
(4) External lenses shall be hard-coated in compliance with Caltrans specifications.
(5) For LED turn arrow signals, the LED arrow lens may be a replaceable part without the need to replace the complete LED arrow.

Optical. The light intensity, chromaticity, and distribution from Red and Green LED traffic signal modules shall meet all photometric values stated in the most recent, formally-adopted version of the specification titled "Vehicle Traffic Control Signal heads – Part 2: Light Emitting Diode (LED) Vehicle Traffic Signal Modules," published by the Institute for Transportation Engineers (ITE). Yellow LED traffic signal modules shall meet the chromaticity requirements of the most recently-adopted ITE specification, with a minimum intensity of 1,500 candelas.

(a) Red and Green LED signals shall be certified by the manufacturer to meet or exceed all requirements of that specification over their entire 5-year warranty period.
(b) The light output from Yellow LED signals shall be the peak instantaneous intensity, measured at instant-on and at the highest intensity point.

Design.

(a) The LEDs shall be connected in series-parallel strings.

(1) No more than 1% of the total luminosity of the entire signal module may be lost in the event of a single string failure.
(2) The failure of a single LED shall cause loss of light from only that LED.
(3) No loss of light output from the complete module assembly shall occur as a result of a single LED failure.

(b) The control circuitry shall prevent the current flow through the LEDs in the off state to avoid any false indication as may be perceived by the human eye, during daylight and evening hours.

(1) The LED traffic signal module shall be operationally compatible with NEMA TS - 1 and NEMA TS - 2 conflict monitoring parameters.
(2) The intensity of the LED signal module shall not vary by more than 10% over the allowable voltage range as specified in the electrical section below.

Electrical.

(a) The Power factor shall be 0.90 or greater, at nominal rated voltage, at 25°C, after 60 minutes of operation.

(b) Total harmonic distortion (THD) shall be less than 20% at rated voltage, at 25°C.

(c) All LED traffic signal modules shall be in compliance with FCC noise regulations and must meet the FCC Title 47, SubPart B Section 15 regulation.

(d) The LED junction technology used in all signal modules shall not exhibit degradation of more than 30% of the modules' initial light intensity following accelerated life testing (operating at 85 degrees C and 85% humidity, for 1000 hours). Under no circumstances shall AlGaAs technology be acceptable.

(e) The LED signal modules shall be connected directly to line voltage, 120 Volts AC nominal, and shall be able to operate over the voltage range of 80 VAC to 135 VAC.

(f) Red and Green LED traffic signal modules shall consume no more than a nominal 15 watts for either the 8" or 12" signal. Yellow signal modules shall consume no more than 24 watts.

(g) Transient voltage suppression rated at 1500 watts for 1 millisecond and fusing with a maximum rating of 2 amps shall be provided to minimize the effect and repair cost of an extreme over voltage situation or other failure mode.

(h) Low Voltage Turn OFF: There shall be no visible illumination from the LED signal module when the applied voltage is less than 50 VAC.

(i) Turn-ON and Turn-OFF Time: A module shall reach 90% of full illumination (turn-ON) within 75 msec of the application of the nominal operating voltage. The signal shall cease emitting visible illumination (turn-OFF) within 75 msec of the removal of the nominal operating voltage.

Compatibility Testing: The LED module manufacturer shall certify that their modules meet the Load Switch and Signal Conflict Monitor Compatibility testing requirements found in the most recent, formally-adopted version of the specification titled "Vehicle Traffic Control Signal heads –

Part 2: Light Emitting Diode (LED) Vehicle Traffic Signal Modules," published by the Institute for Transportation Engineers (ITE), 2006.

Electronic Failure Protection. To assure compatibility with NEMA TS1/TS2 controllers for both conflict monitoring and Red Fail, all signal colors (Red, Yellow, and Green) once energized, must turn off prior to 50VAC, and if the signal fails it shall present a high impedance on the input side of the signal.

Warranty. Manufacturers shall provide a written with the following minimum provisions:

(a) Modules shall be replaced, repaired or purchase value refunded if the module fails to function as intended due to workmanship or material defects within the first 60 months from the date of delivery.

(b) Modules which exhibit luminous intensities less than the minimum specified values within the first 60 months of the date of delivery shall be replaced, repaired or purchase value refunded.

Miscellaneous.

(a) The manufacturers part number, date code, and electrical characteristics of the LED signal module shall be visible on the rear of the assembly.

(b) The LED traffic signal manufacturer shall be ISO 9000 series certified

800-02.04 MEASUREMENT AND PAYMENT. Aluminum, Polycarbonate Vehicle Traffic Control Signal Heads and Pedestrian Signal Indications will be measured and paid for at the Contract unit price per each section of signal type and size as specified in the contract Documents. The payment will be full compensation for furnishing and installing the LED signal head, modules, assembly, mounting hardware, equipment specified, all cables, labor, and incidentals necessary to complete this work.

Aluminum and Polycarbonate LED Signal heads furnished and installed will be measured and paid for at the Contract unit price per each section of signal head type and size as specified in the Contract Documents. The signal heads will have the LED module already fitted into the housing assembly. The payment will be full compensation for all components necessary for the type of light source (LED), mounting hardware, assembly, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Self-contained LED signal head modules will be measured and paid for at the contract unit price each. The payment will be full compensation for the LED module, hardware, assembly, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 800
TRAFFIC

800-03 MAST ARMS AND MAST ARM POLES - SINGLE, TWIN AND TRIPLE

800-03.01 DESCRIPTION. This work shall consist of furnishing and installing galvanized traffic signal mast arms and mast arm poles at locations specified in the Contract Document or as directed by the Engineer.

800-03.02 MATERIALS. Design shall meet the 1994 edition of AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals except as noted. All welding shall conform to American Welding Society (AWS) Structural Welding Code D1.1 - Steel, Tubular Structures.

Each mast arm(s) and mast arm pole structure furnished shall consist of a design from a steel pole shaft with a steel base plate and flange plate, steel mast arm shaft(s) with steel flange plate(s), four flange bolts per mast arm, four anchor bolts and miscellaneous hardware.

(a) The mast arms and mast arm poles shall be manufactured from steel tubing conforming to A 595 Grade A or equal. Each mast arm and mast arm pole shall be fabricated of one length and shall have one longitudinal weld, parallel to the long axis of the mast arm or mast arm pole, with no transverse welds. The longitudinal weld shall be finished to form a smooth outside surface and the wall of the mast arms and mast arm poles shall be of uniform thickness including the welded area. The mast arms and mast arm poles shall be round or multi-sided (8 sides or more) in cross section and be uniformly tapered from butt to tip with a 1 in. reduction in diameter for each 7 ft in length (0.14 in./ ft). Mast arms shall be of two piece design for all mast arms 50 ft and 60 ft in length. Mast arms shall be of three piece design for all mast arms 70 ft in length. Any combination of two piece of 50 ft and 60 ft arms of the same butt diameter shall fit together and any combination of two or three piece of 60 ft and 70 ft mast arms in sequence shall fit together. The bolted splice for two or three piece mast arms shall be as specified in the Contract Document.

(1) 50 ft mast arms shall have a butt section 30 ft in length.

(2) 60 ft and 70 ft mast arms shall have a butt section of 35 ft in length.

(3) 38 ft single piece mast arms shall be 9 in. outside diameter at the flange plate and shall be made of 7 gauge (0.179 in.) thickness steel.

(4) 50 ft two piece mast arm butt sections shall be 10 in. outside diameter at the flange plate and shall be made of 3 gauge (0.250 in.) thickness steel.

(5) 60 ft two piece and 70 ft three piece mast arm butt sections shall be 12.5 in. outside diameter at the flange plate and shall be made of 3 gauge (0. 250 in.) thickness steel.

(6) All extension sections of two and three piece mast arms shall be made of 7 gauge (0.179 in.) thickness steel.

(7) Single 27 ft mast arm pole designed with a 38 ft mast arm length shall be 12 in. outside diameter at the base plate and shall be made of 7 gauge (0.179 in.) thickness steel.

(8) Single 27 ft mast arm pole designed with a 50 ft mast arm length shall be 13 in. outside diameter at the base plate and shall be made of 3 gauge (0.250 in.) thickness steel.

(9) Single 27 ft mast arm pole designed with 60 ft or 70 ft mast arm lengths shall be 15 in. outside diameter at the base plate and shall be made of zero gauge (0.312 in.) thickness steel.

(10) Twin 27 ft mast arm poles designed with 50 ft mast arm lengths shall be 13 in. outside diameter at the base plate base and shall be made of 3 gauge (0.250 in.) thickness steel.

(11) Twin 27 ft mast arm poles designed with mast arm lengths for one mast arm of 50 ft and the remaining mast arm of 60 ft or 70 ft shall be 15 in. outside diameter at the base plate and shall be made of zero gauge (0.312 in.) thickness steel.

(12) Triple 27 ft mast arm pole designed with mast arm lengths for one mast arm of 38 ft, second mast arm of 60 or 70 ft and the third mast arm of 50 ft shall have 15 in. outside diameter at the base plate and shall be made of zero gauge (0.312 in.) thickness steel.

(b) The material for mast arm pole base plate shall conform to A 709, Grade 36 and shall be of sufficient size and strength. The base plate shall be secured to the lower end of the mast arm pole by two continuous electric arc welds. The base plate shall telescope the mast arm pole with one weld on the inside of the base plate at the end of the mast arm pole shaft. The remaining weld shall be located on the outside of the base plate, around the circumference of the mast arm pole. The weld connection shall develop the full strength of the adjacent mast arm pole shaft to resist bending action. All base plates shall be fabricated with the holes for anchor bolts to the size and location dimensions as shown on the appropriate detail.

(c) All mast arms and mast arm poles shall be furnished with flange plate(s) as noted in the

details. These attachments, including the bolts, shall be connected in such a manner as to develop the minimum guaranteed yield and ultimate tensile strength for the mast arm and mast arm pole. This assembly shall be capable of transferring the maximum moment being carried by the mast arm without distortion or rotation of the mast arm or the attachment. Flange plate(s) shall be connected by the use of 4 bolts. The size of the plates and bolts shall be as shown in the details. Four (1-1/2 in. O.D.) rubber grommets shall be furnished for each mast arm to accommodate signal heads wiring access.

(d) The mast arm flange plate shall be secured to the lower end of the mast arm pole by two continuous electric arc welds. The mast arm flange plate shall telescope the mast arm with one weld located on the inside of the flange plate at the end of the mast arm. The remaining weld shall be located on the outside surface of the flange plate around the circumference of the mast arm pole. The weld connections shall develop the full strength of the adjacent mast arm to resist bending action.

(e) Mast arm flange plates and mast arm pole flange plates surfaces shall be plane to within 1/16 in. and shall be free of any buildup of galvanizing (drips, runs, etc.) which would prevent intimate contact between the connecting surfaces.

(f) Access hole frames shall be welded into the mast arm pole as detailed in MD 818.11. A galvanized steel cover, conforming to A 709, Grade 36 shall cover the access hole frame. The access hole cover's top shall be secured to the access hole frame by a hinge fabricated from 0.063 in. stainless steel using a 0.120 in. diameter stainless steel hinge pin. The hinge shall be secured to the access hole frame by 2 (1/4 in. - 20 UNC) hex head stainless steel bolts. The hinge shall be secured to the access hole cover by 2 (1/4 in. - 20 UNC) hex head stainless steel bolts and lock nuts. A slotted opening shall be provided at the bottom of the access hole cover to allow for attachment of a furnished (1/4 in. - 20 UNC) hex head stainless steel bolt into the access hole frame face.

(g) A 3/8 in. diameter X 1 in. stud copper servit post for two #6 AWG stranded wire shall be furnished into the bottom of the access hole frame.

(h) Mast arm poles shall be provided with entrance ways for cable as noted on the appropriate detail. These holes shall be factory drilled and a straight tapped coupling, conforming to Underwriters Laboratory's UL-6 Specification, for 3 in. rigid conduits, shall be installed for each hole. A nipple with a unitized hexagonal fitting and integral inside radius on one end shall then be installed and fully seated on the interior side of the coupling. Location and installation of the coupling shall be as shown in the details.

(i) "J" hooks shall be installed as follows, located 1 ft above the highest mast arm T dimension.

(1) A single "J" hook shall be welded inside the pole for single mast arm poles.

(2) Two "J" hooks shall be welded inside the pole for twin mast arm poles and triple mast arm poles.

(j) All mast arms, mast arm poles, access hole frames and hardware, except materials manufactured from stainless steel or cast aluminum, shall be hot dipped galvanized. The galvanized coating shall conform to the thickness, adherence and quality requirements of A 123 or A 153 for hardware. Threaded components shall be chased and cleaned after galvanizing. All internally threaded components shall be tapped the minimum amount required to permit assembly on the coated externally threaded fastener. Internally threaded components shall be provided with an lubricant which shall be clean and dry to the touch.

(k) Each mast arm pole shall be furnished with four removable ornamental anchor bolt covers made of cast aluminum. Bolt holes for attaching the bolt covers to the base plate shall be drilled at the location obtained by following the diagonal line of the base plate until it intersects the bolt circle diameter, then proceeding tangentially from the bolt circle diameter a distance equal to the Anchor Bolt Center to Bolt Slot Center Distance as provided in the MD 818.14. Attachment to the base shall be made using hex head stainless steel bolts (1/4 in.- 20 UNC).

(l) Each mast arm extension section and mast arm pole shall be furnished with a removable domed cap, fabricated from cast aluminum, circumferentially attached to the outside of the pole shaft or mast arm end with 3 hex head stainless steel bolts (1/4 in.- 20 UNC). All mast arm caps shall have inside diameter one (1) inch larger than the outside diameter of mast arm end.

(m) Each mast arm and mast arm pole shall have an identification plate mechanically attached, oriented such that the identification plate may be read from a ground observation position.

(1) Single piece mast arms and the butt section of two and three piece mast arms shall have the identification plate attached 6 in. above the flange plate.

(2) Each extension section of two and three piece mast arms shall have the identification plate attached 6 in. from the larger diameter end.

(3) Poles shall have the identification plate attached 6 in. above the bottom flange plate.

(n) Recessed hub type, galvanized malleable iron plugs shall be inserted flush into all mast arm pole couplings.

Anchor Bolts.

(a) Each mast arm pole anchor bolt shall be made of steel in accordance with F1554, Grade 55 S1.

(b) Anchor bolt threads shall be of cut thread design with a minimum 9 in. of threads at the top and bottom.

(c) The template and anchor plates shall be as shown the contract documents.

(d) The diameter of the anchor bolt shall be stamped into the top of the threaded end of each anchor bolt.

(e) Each anchor bolt shall be provided with two anchor bolt nuts and two flat washers.

(1) Anchor bolt nuts shall conform to A 194 grade 2 or 2H or A 563 D or DH.

(2) All nuts shall be tapped oversize the minimum amount required to permit assembly on the coated externally threaded fastener.

(3) Washers shall conform to F436.

(f) All nuts, washers and the top 12 in. of all anchor bolts shall be hot dipped or mechanically galvanized. The galvanized coating shall conform to the thickness, adherence and quality requirements of A 123 or A 153 for hardware.

All high strength bolts (of a given length), nuts (of a given size) and washers (of a given diameter) shall be from the same manufacturing lot per each requisition of materials. The use of foreign made fasteners is prohibited!

Alternate Design. Alternate mast arm and mast arm pole designs will be considered provided the following qualifications are observed:

(a) Alternate mast arm designs may use sectional construction provided each section has a minimum length of 30 ft except for the outer most section.

(b) Overlap between sections shall be minimum 18 in.

(c) Bolt circle diameters shall be as specified in the Contract Document.

(d) Alternate post designs may be straight (not tapered) sections and shall have a base diameter equal to, or no greater than 1 in. more than, those values shown on the typicals.

(e) All alternate design shall be structurally equivalent to the original design and as approved by the Engineer.

800-03.03 CONSTRUCTION Refer to 818.03

800-03.04 MEASUREMENT AND PAYMENT. Furnish and install poles for mast arm(s) and mast arm(s) will be measured and paid for at the contract unit price per each type of pole and mast arm(s) size as specified in the Contract Document. The payment will be full compensation for furnishing & installing all materials including labor, equipment, materials, tools and incidentals necessary to complete the work.

Anchor bolts will be measured and paid for as specified in section 801.

Tag Details

Single Mast Arm Pole

Mfg: [1] Contract. #: [2]
Pole Height: [3]
Arm Sizes: [4]
Anchor Bolts: [5] Bolt Circle: [8]
Flange Bolts: [7]

One Piece Mast Arm

Mfg: [1] Contract #: [2]
Arm Length: [6]
Flange Bolts: [7]

Two or three Piece Mast Arm - Butt Section

Mfg: [1] Contract #: [2]
Butt For Arms: [4]
Flange Bolts: [7]
Connection Bolt: [9]

**Two or three Piece Mast Arm –
Extension Section**

Mfg:	[1]	Contract #:	[2]
Extension Arm:	[6]		
Connection Bolt:	[9]		

**Twin Mast Arm Pole
(Identical Size Flange Plates)**

Mfg:	[1]	Contract #:	[2]
Pole Height:	[3]		
Arm Sizes:	[4]		
Anchor Bolts:	[5]	Bolt Circle:	[8]
Flange Bolts:	[7]		

Twin Mast Arm Pole
(Different Size Flange Plates)

Mfg: [1]	Contract #: [2]
Pole Height: [3]	
Left Arm Sizes: [4]	
Right Arm Sizes: [4]	
Anchor Bolts: [5]	Bolt Circle: [8]
Left Arm Flange Bolts: [7]	
Right Arm Flange Bolts: [7]	
Pole Type [10]	

Triple Mast Arm Pole

(Different Size Flange Plates)

Mfg: [1]	Contract #: [2]
Pole Height: [3]	
Left Arm Sizes: [4]	
Center Arm Sizes: [4]	
Right Arm Sizes: [4]	
Anchor Bolts: [5]	Bolt Circle: [8]
Left Arm Flange Bolts: [7]	
Center Arm Flange Bolts: [7]	
Right Arm Flange Bolts: [7]	

Tag Reference

[1] Name of the manufacturer of the mast arm or mast arm pole.

[2] Administration Contract Number of the mast arm or mast arm pole.

[3] 27 ft height.

[4] Mast Arm Size and Orientation[1]

Pole Gauge Size	Indicate
7 GA	38'
3 GA	50'
0 GA	60' or 70'

[5] Anchor Bolts

Pole Gauge Size	Indicate
7 GA	1-½" x 54" & 2 Washers
3 GA	1-¾" x 66" & 2 washers
0 GA	2" x 72" & 2 washers

[6] Mast Arm Length

Constructed Extension for arm length	Indicate
50'	50'
60'	60'-70'
70'	70'

[1]For twin mast arm poles with identical size flange plates, indicate **L & R** preceding the 50' mast arm size; for twin mast arm poles with different size flange plates, indicate either 50' or 60'-70' mast arm sizes in the corresponding Left Arm Size or Right Arm Size as oriented by the line bisecting the acute angle formed by the two mast arm pole flange plates. For triple mast arm poles with different size flange plates, indicate either 50', 60'-70' or 38' mast arm sizes in the corresponding Left Arm Size, Center Arm Size or Right Arm Size as oriented by the centerline of the mast arm pole center flange plate.

[7] Flange Bolt Size[2]

Pole Gauge Size	Indicate
7 GA	1-¼" x 4" & washer
3 GA	1-½" x 5" & washer
0 GA	1-¼" x 6-½" & 2 flat washers & lock washer

[8] Bolt Circle

Pole Gauge Size	Indicate
7 GA	16" Dia.
3 GA	18" Dia.
0 GA	22" Dia.

[9] Connection Bolt Size

Two or three Piece Arm Size	Indicate[3]
50'	5/8" x Var.
60'	5/8" x Var.
70'	5/8" x Var.

[10] Standard or Alternate Twin.

[2]For twin mast arm poles with identical size flange plates, indicate **L & R** preceding the 1-½" x 5" & washer Flange Bolt Size; for twin mast arm poles with different size flange plates, indicate either 1-½" x 5" & washer or 1-¼" x 6-½" & 2 flat washers & lock washer flange bolt sizes in the corresponding Left Flange Bolt Size or Right Flange Bolt Size as oriented by the line bisecting the acute angle formed by the two mast arm pole flange plates. For triple mast arm poles with different size flange plates, indicate either 1-½" x 5" & washer, 1-¼" x 6-½" & 2 flat washers & lock washer or 1-¼" x 4" & washer flange bolt sizes in the corresponding Left Flange Bolt Size, Center Flange Bolt Size or Right Flange Bolt size as oriented by the centerline of the mast arm pole center flange plate.

[3]Length to be determined by the successful bidder.

CATEGORY 800
TRAFFIC

800-04 NON-INVASIVE, MAGNETO-INDUCTIVE MICROLOOP DETECTOR

800-04.01 DESCRIPTION. This work shall consist of furnishing and installing a non-invasive, magneto-inductive microloop vehicle detection sensors/probes. The sensors/probes shall be installed as a set or assembly of three (3) per traveled lane.

800-04.02 MATERIALS. All materials and equipment furnished and installed shall be new corrosion resistant, and approved by the Engineer. Manufacturer's certifications or certified copies of reports of tests shall be furnished as directed by the Engineer.

800-04.03 CONSTRUCTION.

(a) Vehicle data collection requirements.

(1) Each non-invasive sensor shall have an inductance change that will allow an appropriately designed, matched inductive loop vehicle detector to detect all licensable vehicles that contain ferromagnetic material. The sensor will detect these vehicles when they are within a travel distance less than one half the height of the ferromagnetic material of the vehicle.

(2) The non-invasive vehicle sensing assemblies shall consist of three sensors connected in series to a common lead in wire.

(3) Each non-invasive, magneto-inductive vehicle sensing assembly shall be connected to an appropriately designed, matched inductive loop vehicle detector.

(4) Traffic data collection or traffic flow parameter measurements across diverse roadway geometry shall be optimized by installing, triple non-invasive sensor assemblies.

(b) Electrical and magnetic requirements

(1) The non-invasive sensor shall transduce changes in the ambient magnetic field to changes in its inductance. An increase in the ambient magnetic field shall result in a decrease in the inductance of the non-invasive sensor, and the inductance change of the non-invasive sensor shall be directly proportional to the changes in the earth's magnetic field.

(2) The nominal magnitude of the vertical magnetic field over which the non-invasive sensor shall function to specified requirements shall be 200 millioerstads to 800 millioerstads. The non-invasive sensor shall detect reliably and consistently changes in the ambient magnetic field of seven (7) millioerstad or greater when the earth's magnetic field is ≥200 millioersted (H_{DC}=200 mOe) and the peak-to-peak amplitude of the applied inductive

current is 40 $mAmp_{p-p}$ (I_{AC} = 40 $mAmp_{p-p}$). This requirement defines the sensitivity to be ≥ 2 nanohenries/millioerstad at H_{DC}=200 mOe and I_{AC} = 40 $mAmp_{p-p}$.

(3) The sensor/probe inductance shall be between 50 μH to 80 μH. The nominal operating frequency of the probe shall be between 20 kHz and 60 kHz. The non-invasive sensor shall operate with drive currents of 2.5 $mAmp_{p-p}$ to 175 $mAmp_{p-p}$. The specified electrical and operating requirements shall be maintained over temperatures ranging from –29.9 F to 162.5 F

(c) Sensor physical requirements. The non-invasive sensor shall have a maximum outer diameter of 0.8125 in. and a maximum height of 2.25 in. and shall be suitably sealed for use in 100 percent humidity environments within a conduit. Equipment shall be included to secure the probes in the conduit, ensure proper orientation during installation, and maintain proper orientation through life of the device. The sensors shall have pull chords to facilitate installation and removal from the conduit. The probes shall be designed to be easily assembled on-site without the use of special tools and equipment. The sensors shall be serviceable from adjacent handholes. Installation of sensors shall not disturb roadway surface.

(d) Conduit installation requirements.

(1) For detection locations that shall require new conduit installation, the conduit shall be a 3 in.conduit consisting of schedule 80 PVC with an inner diameter of 2.9 in. and an outer diameter of 3.5 in. The conduit shall be installed at a nominal centerline depth of 20 in. from the road surface following the roadway crownline. The depth of the conduit centerline from the road surface shall be maintained between 18 and 22 in. over its entire length. The centerline of the conduit shall not deviate horizontally more than required by the application, however, any deviation in conduit alignment shall be less than 0.25 in. per foot. At least one end of the conduit shall terminate at a standard size handhole with a nominal 24 inch diameter and extend three in into the handhole, and the conduit shall have a grade to permit drainage.

(2) The non-invasive probes shall function in 3 in. conduits that have been previously installed at greater than the optimum operational depth stated above. Non-invasive probe installation and alignment for non-optimum pavement depths shall be performed as directed by the Engineer or described in the contract plans.

(e) Probe lead-in cable. The cable leading from each probe set or assembly to the controller shall be included with the probes.

(f) Requirement of verification of proper installation

(1) The contractor shall provide a log of the boring depth measured every 2 ft in boring distance.

(2) The contractor shall verify that the non-invasive sensor set or assembly and lead-in cable installation meets requirements by measuring the inductance of the non-invasive sensor assembly with a properly designed, matched vehicle detector. The installer shall verify that the installation meets requirements by measuring the DC resistance of the non-invasive sensor assembly with a properly calibrated ohm meter. The installer shall measure the change in inductance of the installed non-invasive sensor assembly using a properly designed, matched vehicle detector when a standard, midsize vehicle is driven directly over the sensor.

The contractor shall provide a log of the measured inductance, DC resistance and the change in inductance for each installed non-invasive sensor assembly.

(3) The inductance shall be the sum of probe inductance, inductance of lead-in cable (16.5 μH per 100 ft) and home-run cable (23 μH per 100 ft) and shall be within ±20 per cent of the calculated inductance. The measured DC resistance shall be the sum of 1.5 ohms per probe, 3.0 ohms per 100 ft of lead-in wire and 2.0 ohms per 100 ft of home-run cable and shall be within ±20% of the calculated DC resistance. The measured change in inductance for a standard midsize vehicle shall be in the range from 120 nH to 1200 nH.

800-04.04 MEASUREMENT OF PAYMENT. Non-invasive Magneto Inductive Vehicle Detectors shall be measured and paid for at the contract unit price per each in the cable length specified. The payment will be full compensation for furnishing and installing one probe set, lead-in cable from the probe set to the field cabinet, probe carrier system, pull rope and all other incidentals. The payment shall be full compensation for all materials, labor, equipment and all other incidentals necessary to complete this work.

Conduit will be measured and paid for as specified in section 805.

CATEGORY 800
TRAFFIC

800-05 VIDEO DETECTION EQUIPMENT

800-05.01 DESCRIPTION. This work shall consist of furnishing and installing video detection equipment in accordance with this special provision and as shown on the plans or as directed by the Engineer. Video detection equipment shall detect by processing video images and providing detection input for NEMA TS-1 and NEMA TS-2 traffic signal controllers.

800-05.02 MATERIALS.

a) Video Image Processor (VIP)

1) The VIP shall be modular by design and housed in either a self-contained stand-alone unit or fit directly into NEMA TS1 & TS2 type racks as well as Type 170/179 input files. The VIP shall be interchangeable between a shelf or rack mount installation without replacing or modifying existing the VIP units.

2) The system shall control from 1 to 6 VIP boards allowing for 1 to 12 image sensors

3) The system shall be designed to operate reliably in the adverse environment of roadside cabinets and shall meet or exceed all NEMA TS1 and TS2, as well as Type 170/179 environmental specifications.

4) Ambient operating temperature shall be from –35 to +75 degrees Centigrade at 0 to 95% relative humidity non-condensing.

5) The system shall be powered by 12-40 VDC and draw less than 2 amperes.

6) The system shall utilize cabinet 24 VDC for rack mount installations or external 24 VDC for stand-alone shelf installations.

7) Surge ratings shall be set forth in the NEMA TS1 and TS2 specifications.

8) Serial communications shall be through an RS232 serial port. This port can be used for communications to a modem or laptop to upload/download detector configurations, count data and software upgrades. RS485 on the rear edge connector shall facilitate communications to other VIP boards.

9) Each VIP board shall have 4 opto-isolated open collector outputs. Twenty (20) additional outputs shall be available via the expansion port. The VIP shall have 20 presence detection zones and 4 data detection zones per camera. Data zones shall collect and store vehicle counts, volume, speed, gap time, headway, occupancy, and classification. Data shall be time-stamped (6713 intervals) and stored onboard (non-volatile memory) in intervals from 1-60 minutes.

10) Data alarms are generated for: queue, inverse direction, speed drop, no video, and errors.

11) Must be able to provide single or double loop emulation.

12) Presence hold time must have parameters that range from 10 to 600 seconds.

13) Each VIP board shall allow for 20 digital inputs via the I/O Expansion port.

14) Each VIP board shall have error detection. An output contact will open if the video signal is bad or the VIP board is not functioning properly. A user defined quality level will automatically put the VIP into a recall state in cases of severe degraded visibility (i.e., fog, blizzard, etc.). Normal detection resumes when visibility improves above the user defined quality level.

15) Operator selectable recall shall be available via the VIP front panel. Holding the recall switch on for 5 seconds shall activate this function.

16) A video select button on the VIP front panel will switch between camera images of the VIP.

17) The VIP board shall have 2 video inputs (RS-170 NTSC or CCIR composite video) and two video outputs (one on the front panel and one on the edge connector). The video inputs shall be though the VIP board's edge connector.

18) The VIP board shall have a reset button on the front panel to reset video detectors to "learn" the roadway image. During "relearn", selectable recall can be enabled or disabled for immediate operation. Learning time of video detectors shall be less than 5 minutes.

19) External surge suppression, independent of the VIP board shall separate the VIP from the image sensor.

20) The VIP board shall have separate light emitting diodes (LEDs) that indicate:

i) POWER: Red to verify power supply.

ii) I/O COMM: Red to indicate communications to expansion boards.

iii) VIDEO 1 & 2: Red to verify the presence of video input 75 Ohm.

iv) TX & RX: Red to indicate communications via the serial port.

v) OUT1- OUT4: Green if the corresponding detection group is active.

21) The VIP board shall also have 2 separate buttons for VIDEO SELECT:

i) RECALL: Manually places call on detectors.

ii) RESET: Manually reset detectors to "learn" new background.

22) The video detection system shall be capable of being programmed locally with a handheld keypad. Keypad and monitor must be separate units. A PC mouse will not be allowed. The monitor is to have a 9 inch, black and white screen.

23) The VIP board shall have a video out female RCA style connector, DB9 female Service port and DB9 I/O Expansion port.

24) The VIP Expansion board shall have 8 dip switches that define inputs and outputs used (range: 1-12 or 13-24). The VIP Expansion board shall also have separate LEDs that indicate:

i) POWER: Red to verify power supply.

ii) COMM: Red to indicate communications to VIP board.

iii) I/O1- I/O4: Green if the corresponding detection group is active.

25) Event Log Database: The VIP module shall have an onboard database capable of time stamping and storing 500 events. The Event Log Database can be viewed or downloaded to a selected spread sheet. Erasure of the Event Log Database shall not alter programmed configurations. As a minimum, the VIP shall log and time stamp the following events:

i) Firmware upgrade

ii) Loss of video signal.

iii) Resumption o f video signal.

iv) Configuration change.

v) Bad video quality.

vi) Loss of power to VIP module.

vii) Resumption of power to VIP module.

viii) Speed alarm.

ix) Inverse direction.

x) Recall activated.

26) Each VIP board shall be capable of processing two (2) separate video signals (two (2) separate cameras) per VIP board. The video signal shall be analyzed in real time (30 times per second).

27) The system shall be expandable up to 12 cameras that may be connected to different VIP units and programmed independently.

28) The system shall be capable of displaying detectors on the video image with associated outputs. Outputs/Inputs status will be indicated on the screen. Parameters will also include the ability to view raw video without any verbiage and/or detectors for surveillance purposes.

29) Each VIP board will detect within the view of the connected camera the presence of vehicles in user defined zones. Detectors available shall be presence, count, queue, delay, extension, or pulse mode of either arrival or departure of vehicles. Delay and extension shall be defined between 0.1 – 99.9 seconds and pulse mode between 0 – 200msin 33ms increments if NTSC is used. Each VIP board shall also detect and collect traffic data of passing vehicles in user-defined zones within the view of the connected camera.

30) Collected traffic data by direction shall include:

i) Volume (absolute numbers) per length class and per lane.

ii) Average speed (km/h or mph) per length class and per lane.

iii) Average gap time (1/10 sec) per length class and per lane.

iv) Average headway (m or feet) per lane.

v) Occupancy (%) per lane

vi) Concentration (vehicles/km or mile) per lane.

vii) Average length (m or feet) per lane.

viii) Confidence level (0-10) per lane.

31) The VIP board shall be programmed without the use of a supervisor computer. A standard CCTV monitor and handheld keypad plugged into the VIP serial port will facilitate detector programming. The handheld keypad shall include the following keys and respective functionalities:

Keys	Functionality
Enter Key	• To enter a menu, a submenu or an item within a submenu.
	• To select a value for a parameter and exit the topic.
Escape Key	• To exit the menu or submenu.
	• To exit the main menu and save the settings in the current
	configuration.
Arrow Keys	• To scroll through a menu.
	• To scroll through the values of a parameter.
	• To select a submenu.
	• To make a presence zone direction sensitive.
F1 Next Key	• To proceed to the next detection zone.
F2 Prev Key	• To move to the previous detection zone.
F3 Add Key	• To add a detection zone.
F4 Del Key	• To delete a detection zone.
Dir Key	• To make a data zone direction sensitive.
Help Key	• To display help text for an item.
Output Number Key	• To assign an output number to a detection zone.
Operate Key*	• To put the board in operation mode.
Edit Key	• To change settings while starting from default values for all parameters.
Modify Key*	• To change settings while starting from the last saved settings for all parameters.

* The functionality of this key is only for the video system communications modules

32) The VIP board shall store up to 8 detector configurations (4 per video input). It shall be possible to switch between detector configurations manually, automatically by time of day or remote input.

33) Via the serial port, detector configurations can be uploaded to a laptop and stored on disk.

34) Detectors may be linked to 24 outputs and 20 inputs using Boolean Logic features: AND, OR, NOT. It will be possible to generate conditional outputs based upon inputs from a controller.

35) It shall be possible to make a detector directional sensitive. Options will include an omni-directional detector or a detector that only senses movement: from right to left, left to right, up to down or down to up as you look at the monitor.

36) All detectors and parameters can be changed without interrupting detection. For example: when one detector is modified, all existing detectors continue to operate, including the one that is being modified. When the new position is confirmed, the new detector will enter a learning phase. Once the new detector is in function, it will take over the job of the old one. In this way, the detector is always fully operational with no interruption on any detector, even during modification. Learning phases for new detectors shall not exceed 10 seconds.

37) Four data detection zones per camera on a two camera VIP board may be used for collection of vehicle count, speed, classification, occupancy, density, headway, and gap time. These detectors will detect and store traffic data at user-defined intervals of 1, 2, 3, 5, 6, 10, 15, 30 & 60 minutes. It shall be possible for each VIP board to store up to 6713 intervals of data in non-volatile memory.

38) Six detectors per camera may be used as queue detectors. Using on screen calibration, queue detectors will detect queue delays and display the queue length in feet or meters. A queue may also generate an output alarm from the VIP board.

39) Associated software shall be used with a PC to download count data and export to a spreadsheet. The software shall also be used to upload/download detector configurations, traffic data, technical events and update software versions of the VIP board.

40) All software upgrades to associated software and VIP board software shall be provided at no cost to the City for the expected life of the VIP board.

41) The VIP board shall have an internal clock with daylight saving time system, which can be enabled or disabled.

42) The VIP board shall provide overlaid tool tips for each individual menu- and submenu-items.

43) The VIP board shall have an optional password implementation. Different user-levels shall be available each having different rights.

44) All equipment must be capable of having a minimum of 10 users that can be defined for each user-level.

45) The VIP board shall be able to delay or extend a detector zone output in combination with an input from the controller.

46) The VIP board shall detect wrong-way drivers and shall provide an alarm/event via communication board and/or output.

47) The VIP board shall provide an alarm and/or output when the user selected queue detection threshold of occupancy is exceeded for more than a user selected time threshold.

48) The VIP board shall distinguish five classes of detected vehicles based upon user selectable vehicle length thresholds.

49) The VIP shall be able to emulate loop emulation with user selectable loop dimensions.

50) The VIP shall have a Detection Hold Time function. The timing parameters shall be 10 – 600 seconds.

51) The VIP board shall provide advanced settings to optimize detection to avoid cross-lane traffic occlusion. Directional detectors shall be able to be programmed for Low, Medium or High depending on the severity of the occlusion.

52) The VIP shall be programmable for Wrong Way Suppression Delay. The timing parameters shall be 1 – 30 seconds.

53) The VIP board shall utilize advanced shadow rejection algorithms. It shall be possible to place detection zones over lane markings without affecting the shadow rejection accuracy from adjacent vehicle (moving) shadows.

54) The VIP board shall utilize an advanced Tree Shadow Suppression algorithm to suppress false detection of moving shadows (non-vehicular, i.e. trees) within a detection zone. It shall be possible to enable or disable this feature.

55) The VIP board shall provide integrated image quality diagnostics eliminating the need for users to manually place quality detection zones on the image. Advanced diagnostic information shall display both the quality of the video images (Qim) as well as the quality of detection (Qdet). The Qim and Qdet together will be averaged to provide an overall quality (Q). Each quality diagnostic (Qim, Qdet & Q) will be based on a 1 (poor quality) to 10 (excellent quality) scale.

56) The VIP board shall provide the capability to enter a "recall" state if the quality threshold falls inside a user-defined range. The range shall be defined by the Quality Level (1-10) and a timeout range of 1 to 99 minutes. For example, if the quality drops to level 5 for 2 minutes, the VIP shall enter a "recall" mode. Once the quality rises above level 5 for 2 minutes, the VIP resumes normal operation. The VIP shall also provide a contact closure output during this condition.

b) **Video System Communications Module**

1) The Communication board shall be modular by design and housed in either a self-contained stand-alone unit or fit directly into NEMA TS1 & TS2 type racks as well as Type 170/2070 input files.

2) The Communication board shall control from 1 to 6 VIP boards allowing for 1 to 12 image sensors.

3) The system shall be designed to operate reliably in the adverse environment of roadside cabinets and shall meet or exceed all NEMA TS1 and TS2, as well as Type 170/2070 environmental specifications.

4) Ambient operating temperature shall be from –34 to +74 degrees Centigrade at 0 to 95% relative humidity non-condensing.

5) The system shall be powered by 12-40 VDC and draw less than 2 amperes.

6) Serial and Ethernet (TCP/IP) communications shall be through respectively an RS232 serial port (F DB9 connector) and Ethernet port (RJ-45 connection). These ports can be used for communications to a laptop or modem to upload/download detector configurations, traffic data, technical events, send software upgrades and do remote setup of detectors. RS485 on the rear edge connector shall facilitate communications to VIP boards.

7) Surge ratings shall be set forth in the NEMA TS1 and TS2 specifications.

8) The Communication board shall have separate light emitting diodes (LEDs) that indicate:

   i) POWER: Red LED to verify power supply.

   ii) LAN: Red LED to indicate data activity over Ethernet communication.

   iii) VIDEO OUT: Female RCA style connector.

   iv) RESET: Manual reset to re-initialize communications.

   v) SERVICE: DB9 female Service port for setup of communication board and also used for serial/dial-up communication.

9) The Video System Communication board shall control from 1 to 6 VIP boards allowing for 1 to 12 image sensors.

10) The Video System Communication board shall provide a serial or Ethernet interface and communication to provide traffic data and allow remote configuration from the Traffic Operations Center.

11) The LAN port shall meet IEEE 802.3 with a RJ-45 connector and meet the following specification: Data rates for Ethernet via LAN port: 10Mbit/s, TCP/IP based protocol.

12) The serial communications port shall meet EIA-232-E and meet the following specifications:

    i) Dial-up data rates for RS232 via Serial port: maximum 57600 bps

    ii) Direct data rates for RS232 via Serial port: maximum 115200 bps

    iii) Mode of operation: asynchronous, serial, 8 bit word, 1 stop bit, duplex or half-duplex

    iv) Parity: none

    v) Handshake: RTS - CTS, DCD

    vi) Configuration: DTE

13) The communication shall support all functions of the video detection system.

14) All data transmissions shall be protected by CRC (cyclic redundancy checking) or an equivalent error detection method.

15) The communication board shall be programmed without the use of a supervisor computer. A standard CCTV monitor and keypad plugged into the communication serial port will facilitate board programming.

16) The communication shall support streaming video over Ethernet and serial communication.

17) Streaming video frame rate:

    i) Over Ethernet: 10 frames/second

    ii) Over serial communication: guarantee of 1 frame every 2 seconds.

18) Password protected remote setup (configuration upload/download, setup of detectors and detector parameters, setup of communication board parameters, firmware updates for Communication and VIP module) and monitoring of every connected VIP module shall

be possible.

19) Dialup shall be possible through PSTN modems.

20) The Communication board shall log data and events provided by the VIP module(s) and transmit data and events to the HOST computer.

21) RS485 communication to every VIP module shall be established via the Edge connector.

22) The Communication board shall able to store on board pre-post video sequences of alarm triggered upon traffic user defined events. When connected to a HOST computer, the JPEG video sequences shall automatically be downloaded to the HOST computer.

23) The Communication board shall be able to accept PAL or NTSC video format.

24) A (via Ethernet) connection with a standard Internet browser shall be possible to communicate with the Communication board for remote set-up, monitoring and real-time data of the VIP modules.

25) Password protection shall be provided on the Communication board for remote operations.

c) **Image Sensor Camera**

1) The unit shall be a high resolution, 1/3" image format CCD camera, designed for professional video surveillance systems. Incorporating the latest in CCD technology, the video camera shall provide detailed video without lag, image retention, or geometric distortion. System must also be capable of working with either a color or black and camera.

2) Temperature range -20 to + 55 degrees C

3) Humidity 0% to 95% relative, non-condensing

4) Dimensions 47mm X 47mm X 83mm

5) Weight 7.1oz.

6) Camera mounting slots 1/4-20, top and bottom

7) Connectors BNC for video out

8) Lens mount CS Power-in / pressure screw Lens / 6-pin miniature "DIN" style

9) Finish Off-white semi-gloss polyurethane

10) Construction All metal housing

11) Rated input voltage 24 VAC, 60 Hertz

12) Voltage range 21 to 30 VAC

13) Nominal power 4 Watts

14) Imager Interline transfer CCD 1/3" format

15) Imager spectral response

i) 100% @ 550nm

ii) 30% @ 400nm and 800nm

16) Sync system EIA RS-170

17) Active picture elements 768 H X 494 V

18) Horizontal resolution 580 TVL

19) Sensitivity (2856 K)

20) Illumination (see table below)

Illumination		**Usable Picture**	**Full Video**
Scene Illumination	fc	0.01	0.048
	lx	0.12	0.48
Imager Illumination	fc	0.0024	0.01
	lx	0.0024	0.10

* F 1.2 lens @ 89% highlight

21) Signal to noise ratio: 48 dB minimum, 58 dB typical

22) AGC: 21 dB, (max)

23) Electronic Shutter: 1/60 to 1/600000 sec. (EIA)

24) Aperture Correction: Horizontal and vertical symmetrical

25) Video out: 1.0 volts peak-to-peak +/- 0.1 volt @ 75 Ohms

26) Programmable Controls Video level, shutter, AGC, BLC, Auto Black

d) Image Sensor-Lens

1) The camera lens shall be a motorized vari-focal 6.5-65mm with auto iris.

2) Image format: 1/3 inch

3) Focal length: 10X zoom (6.5-65mm)

4) Iris range: f 1.4 – Approx. 360 (With ND Spot Filter)

5) Focus range: 9.85mm (in air)

6) Back focus distance: 10.05mm (0.4in.) in air

7) Weight: 285g.

8) Lens mount: CS

9) Iris control: 4 pin DC control

10) Focus control: Motorized

11) Zoom: Motorized

e) **Image Sensor-Housing**

1) The environmental housing shall be an aluminum enclosure designed for outdoor CCD camera installations.

2) Temperature range -40 to +50 degrees C

3) Dimensions 449mm x 97mm x 112mm

4) Weight1.4kg

5) Housing mounting Three 1/4-20 tapped holes

6) Camera mounting Removable cradle assembly

7) Cable entry Three liquid-tight fittings that will accept cable diameters of:

   i) One fitting - 2 to 7 mm

   ii) Two fittings - 3 to 10 mm

8) Finish: Off-white semi-gloss polyurethane

9) Construction: Extruded aluminum housing, Aluminum rear-end cap, Aluminum front cap with glass face plate, and Aluminum cradle. A sunshield shall be included

10) Window: 3 mm thick glass that includes a Thermostatically controlled window Heater/defogger strip

11) Rated input voltage: 115 VAC 60 Hertz

12) Voltage range: 108 VAC to 132 VAC

13) Output voltage: 24 VAC 60 Hertz

14) Nominal power: 30 Watts

15) Enclosure protection: Waterproof and dust-tight in a NEMA-4, IP65, enclosure Type 3

f) **Surge Protection**

1) A video surge suppressor(s) shall be available for installation inside the traffic signal controller cabinet. The suppressor shall provide coaxial cable connection points to an EDCO CX06-BNCY or approved equal transient suppresser for each image sensor.

2) Peak Surge Current (8 x 20 us) 20KA

3) Technology Hybrid, Solid State

4) Attenuation 0.1db @ 10Mhz

5) Response Time <1 nanosecond

6) Protection Line to Ground

7) Shield to Ground (isolated shield modules)

8) Clamp Voltage 6 volts

9) Connectors BNC

10) Impedance 75 Ohms

11) Temperature -40 to +85 degrees C

12) Humidity 0-95% non-condensing

13) Dimensions 4.5" x 1.5" x 1.25"

14) UL Listed UL 497B

g) Image Sensor-Mounting Brackets

1) Mast arm installations shall be mounted at a sufficient height to prevent occlusion from cross traffic between the stop bar and the mast arm on which the camera is installed. A 74" maximum length of internally reinforced, aluminum tube shall be attached to the mast arm bracket for camera mounting above the mast arm. Camera shall be mounted to the top of the tube with the camera manufacturers recommended bracket. Camera bracket shall provide adjustments for both vertical and horizontal positioning for the camera. Camera attachments shall be designed to securely fasten the camera to prevent the extension tube from falling into the path of vehicles and/or becoming loose. Mounting bracket must fasten to the Mast arm using a 64" or 82" aircraft cable. Miscellaneous hardware shall be stainless steel or galvanized steel. The cameras and associated pole/arm attachment unit shall be designed to withstand a wind load of 90 MPH with a 30-second gust factor.

2) Luminaire arm installations shall be installed on the luminaire arm, with the camera/video manufacturers recommended brackets. Camera luminaire brackets shall provide adjustments for both vertical and horizontal positioning of the camera. Camera attachments shall be designed to securely fasten the camera to the luminaire arm. Mounting bracket shall be made of aluminum. Miscellaneous hardware shall be stainless steel or galvanized steel. The cameras and associated pole/arm attachment unit shall be designed to withstand a wind load of 90 MPH with a 30-second gust factor.

h) Image Sensor-Cable (Coaxial & Power)

1) Coaxial & Power cable (Siamese) shall be installed in conduits or overhead as indicated in the plans. Coaxial cable shall be suitable for exterior use and in direct sunlight. Power cable will have a minimum of five (5) conductors.

2) A junction box on the camera bracket arm shall provide access to video and power cable terminations. No soldering shall be required in the field. Coaxial cable will terminate with a "barrel" style BNC connector and power shall be terminated via a small terminal strip or via "wire nuts."

3) Coaxial cable will be terminated in the surge suppressor before being connected to the VIP boards.

4) Power cable will be terminated into a fuse panel provided by the manufacturer and connected to 120 VAC in the controller cabinet.

5) Description of cable: Composite, 6 Conductors 2 elements: 18awg 5 conductors 7/26 bare copper, .016" polyethylene, 20awg 1 conductor, solid bare copper, 056" foam polyethylene jacket black, overall .030" PVC jacket black.

i) **Video Monitor**

A monochrome monitor for viewing the video output from the video processor unit shall be provided in the controller cabinet irregardless of the programming method utilized by the equipment. Monitor shall have a minimum diagonal measurement of 9". Monitor resolution shall exceed the required camera resolution. Monitor shall be provided with connector and cable for connection to the video processor unit. Monitor shall be provided with front panel mounted controls for contrast, brightness, vertical hold, horizontal hold and power on/off. Monitor shall be provided with 125 VAC power cord. Monitor shall fit on the shelf within the control cabinet without interference to control equipment.

III. Installation & Training

a) The product supplier of the video detection system shall supervise the installation and the testing of the video equipment. A factory certified representative from the manufacturer shall be on-site during installation. The factory representative shall install, make fully operational, and test the system as indicated on the intersection drawings and this specification.

b) Two days training shall be provided to personnel of the contracting agency in the operation, setup, and maintenance of the video detection system. Instruction and materials shall be produced for a maximum of 10 persons and shall be conducted at a location selected by the contracting agency. The contracting agency shall be responsible for travel, room and board expenses for its own personnel.

IV. Warranty

a) The video detection system shall be warranted against manufacturing defects in materials and workmanship for a period of two years from date of installation. The video detection supplier shall provide all documentation necessary to maintain and operate the VIP system.

b) Life expectancy of the video cameras and VIP boards shall be a minimum of five (5) years.

800-05.03 MEASUREMENT AND PAYMENT.

4-Video Detection Camera Intersection will be measured in units of each for the type specified and will be paid for at the contract unit price per each. This price shall include:

- Two 2-position VIP Cards
- Four Camera Assembly Packages
- Four Camera Mounting Assemblies, Mast Arm, Side of Pole, or Luminaire Arm as per the plans
- One Camera Interface Panel, 4-Camera, NEMA

- One 10-Pos Rack wired for ViewCom/E Expansion
- One Power Supply for 10-Pos Rack
- Ten BNC connectors
- One Programming Keypad
- One 9" Monitor
- One CT Zoom Lens Controller
- Software
- Transient protection
- Hardware
- Warranty
- Technical Support

3-Video Detection Camera Intersection will be measured in units of each for the type specified and will be paid for at the contract unit price per each. This price shall include:

- Two 2-position VIP Cards
- Three Camera Assembly Packages
- Three Camera Mounting Assemblies, Mast Arm, Side of Pole, or Luminaire Arm as per the plans
- One Camera Interface Panel, 3-Camera, NEMA
- One 10-Pos Rack wired for ViewCom/E Expansion
- One Power Supply for 10-Pos Rack
- Eight BNC connectors
- One Programming Keypad
- One 9" Monitor
- Software
- Transient protection
- Hardware
- Warranty
- Technical Support

2-Video Detection Camera Intersection will be measured in units of each for the type specified and will be paid for at the contract unit price per each. This price shall include:

- One 2-position VIP Cards
- Two Camera Assembly Packages
- Two Camera Mounting Assemblies, Mast Arm, Side of Pole, or Luminaire Arm as per the plans
- One Camera Interface Panel, 2-Camera, NEMA
- One 10-Pos Rack wired for ViewCom/E Expansion
- One Power Supply for 10-Pos Rack
- Six BNC connectors
- One Programming Keypad
- One 9" Monitor

- Software
- Transient protection
- Hardware
- Warranty
- Technical Support

Video Detection Camera Cable will be measured in units of linear feet and paid for at the contract unit price per linear foot. This price shall include the Siamese (coaxial and power) cable.

Video Detection Camera Y Cable - This item of work is not used in this contract.

CATEGORY 800
TRAFFIC

800-06 CATALOG CUTS AND WORKING DRAWINGS

800-06.01 DESCRIPTION. This work shall consist of the Contractor preparing and transmitting submittals to demonstrate the performance of the work will be in accordance with the Contract Documents. Submittal schedules, catalog cuts, shop drawings, installation methods, manufacturer's certifications, photometric data and working drawings shall be furnished on all Contractor furnished items for highway signing, sign lighting, highway lighting and traffic signals. Stakeouts of the sign locations shall be submitted for all sign structure locations as specified in the Contract Documents

800-06.02 MATERIALS. Not Applicable.

800-06.03 CONSTRUCTION.

Submittal Requirements. Submittals shall be scheduled and coordinated with the Contractor's construction schedule. A complete submittal schedule and list of required submittals shall be submitted with the first submittal, but no later than three days after the pre-construction conference. The schedule for submission of submittals shall be arranged so that related equipment items are submitted concurrently.

The Engineer may require changes to the submittal schedule to permit concurrent review of related equipment. Shop drawings for closely related items such as a sign and its support structures shall be submitted together.

Submittal Documents. Contractor's drawings shall be neat in appearance, legible and explicit to enable proper review to ensure Contract compliance. They shall be complete and detailed to show fabrication, assembly and installation details, wiring and control diagrams, catalog data, pamphlets, descriptive literature, and performance and test data. They shall be accompanied by calculations or other sufficient information to provide a comprehensive description of the structure, machine or system provided and its intended manner of use. If the Contractor's drawings deviate from the Contract Documents, the Contractor shall so advise the Engineer in writing with the submittal and state the reason therefore.

No portion of the work requiring a Contractor's drawing shall be started nor shall any materials be fabricated, delivered to the site, or installed prior to the approval or qualified approval of such item. Fabrication performed, materials purchased or on-site construction accomplished which does not conform to approved Contractor's drawings shall be at the Contractor's risk. The Administration will not be liable for any expense or delay due to corrections or remedies required to accomplish conformity.

Shop drawings shall show types, sizes, accessories, layouts including plans, elevations and sectional views, component, assembly and installation details, and all other information required to illustrate how applicable portions of the Contract requirements will be fabricated and installed. In case of fixed mechanical and electrical equipment, layout drawings drawn to scale, shall be submitted to show required clearances for operation, maintenance and replacement of parts. Manufacturer's certified performance curves, catalog cuts, pamphlets, descriptive literature, installation and application recommendations, shall be provided and indicate conformance to the Contract Documents. Certifications shall be originals. Certification shall also be sent to the Office of Materials and Technology (OMT) as required in the Contract Documents.

Manufacturer's catalog, product and equipment data shall be certified and shall include materials type, performance characteristics, voltage, phase, capacity, and similar data along with wiring diagrams when applicable. Indicate catalog, model and serial numbers representing specified equipment. Provide complete component information to verify all specified required items. Installation recommendations and instructions shall provide written Manufacturer's detail step by step preparation and installation of the materials, and products including recommended tolerances and space for maintenance and operation.

Catalog cuts for sign luminaires shall have photometric data attached for each sign to be illuminated. Photometric printouts shall include the sign number, the illumination on a one foot square grid covering the entire sign face, the average illumination, the maximum to minimum uniformity ratio, and a working drawing for the sign face attached.

Catalog cuts for roadway luminaires shall have photometric data attached as specified in the Contract Documents.

The Contractor shall submit working drawings as required for changes, substitutions, contractor design items, and Contractor designed methods of construction. Requirements for working drawings will be listed in appropriate Specification Sections and in Special Provisions. Drawings shall be accompanied by calculations or other information to completely explain the structure, machine or system described and its intended use. Review and approval of such drawings by the Engineer shall not relieve the Contractor from his responsibility with regard to the fulfillment of the terms of the Contract.

Working drawings and calculations as submitted shall be sealed, dated and signed by a Professional Engineer registered in the State of Maryland.

The review and approval of Contractor's drawings by the Administration shall not relieve the Contractor from his responsibility with regard to the fulfillment of the terms of the Contract. The Contractor shall be responsible for the verification and accuracy of all dimensions and insuring that all Contractor furnished items are compatible, and conform to all design and performance criteria.

All risks of error and omission are assumed by the Contractor and the Engineer will have no responsibility therefore.

Submittal Process. Each Contractor's drawing submitted by the Contractor shall have affixed to it the following Certification Statement, signed by the Contractor:

"By this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and pertinent data and I have checked and coordinated each item with other applicable approved drawings and Contract requirements."

With the first submittal, submit a Contractor's submittal schedule, listing by Specification Section number, all submittals required and approximate date submittal will be forwarded.

Each submittal having catalog descriptions, shop drawings, working drawings, photometric data, manufacturer's certifications, method of construction and manufacturer's installation recommendations shall be submitted for approval to:

For Traffic Signals and Baltimore City Lighting:

Department of Transportation
Construction Management Section
417 E. Fayette Street
Baltimore, MD 21202

For Maryland Department of Transportation Lighting, Traffic Signing and Sign Lighting:

ATTN: Mr. Doug Novicin
Maryland Transportation Authority
Engineering Division
300 Authority Drive
Baltimore, MD 21222

Each submittal shall have a transmittal page that indicates the Contractor's and Subcontractor's address and phone numbers. Submittals containing multiple items need the identification only on the exterior of each package. For original submittals, and each subsequent resubmittal that may be required, 9 copies will be submitted. A separate copy shall be forwarded to the Engineer.

All submittals for approval shall have the following identification data, as applicable, contained thereon or permanently adhered thereto.

(a) Drawing title, drawing number, revision number, and date of drawing and revision.
(b) Applicable Contract Drawing Numbers and Specification Section and Paragraph Numbers.

The first page of every catalog description, working drawing and material certification shall be stamped in red with the following. All pertinent Contract Document information shall be filled in the spaces provided.

MARYLAND DEPARTMENT OF TRANSPORTATION
SUBMITTAL PACKAGE #_____ DATED CONTRACT # _____ LOCATION PROJECT DESC. ITEM # _____ THIS ITEM CONTAINS_____ PAGES ITEM DESCRIPTION
☐ ACCEPTED ☐ ACCEPTED AS NOTED ☐ REJECTED - REVISE & RESUBMIT
REVIEWERS NAME DATE

The Contractor shall indicate the submittal package by sequential numbering and date of submittal. Catalog, product data or brochure submittals containing various products, sizes and materials shall be underscored or highlighted to indicate the salient features required to meet the specifications. Likewise, items not applicable to the Contract shall be marked "not applicable" or crossed out.

If one or more of the items in a submittal are not approved, resubmittal of only the unapproved items is required, highlighted to show the particular item being resubmitted. Resubmittals shall bear original submittal number and be lettered sequentially.

Three copies of all Contractor's drawings will be returned to the Contractor.

Each submittal shall be in accordance with the Contractor's submission schedule. Allow thirty days for checking and appropriate action by the Engineer.

Contractor's submittals will be returned, marked with one of the following classifications:

ACCEPTED: no corrections, no marks

ACCEPTED AS NOTED: a few minor corrections. Item shall be installed in accordance with the corrected drawings.

REJECTED - REVISE & RESUBMIT: requires corrections or is otherwise not in accordance with the Contract Documents. No items shall be fabricated. Correct and resubmit drawings as per original submission. Allow thirty days for checking and appropriate action by the Engineer.

800-06.04 MEASUREMENT AND PAYMENT. Catalog cuts, manufacturer's certifications, photometric data and working drawings will not be measured but the cost will be incidental to the pertinent items specified in the Contract Documents.

CATEGORY 800
TRAFFIC

800-07 NAZTEC MODEL 980 TS2 TYPE 1 CONTROLLER AND CABINET

800-07.01 DESCRIPTION. This work shall consist of furnishing and installing a City of Baltimore NAZTEC Model 980 TS2 Type 1 controller with the latest software revision, cabinet and foundation as specified in the Contract Documents. This will be a sole source item. No alternates will be accepted. Naztec's contact information is as follows:

Naztec, Inc.	Telephone:	281-240-7233
820 Park Two Drive	FAX:	281-240-7238
Sugar Land, TX 77478	Email:	naztec@naztec.com

800-07.02 MATERIALS.

Base Mounted NEMA Controller Cabinet Foundation Base

Base mounted cabinets shall be mounted on concrete foundations conforming to Section 801 and as specified in the Contract Documents. Conduit shall be furnished and installed as specified in Section 805. Conduit shall be as per Sections 902.10, 921.07.01, 921.07.03, and 950.11. Anchor Bolts, and Hardware, shall be as per the contract documents, and as approved by the CITY OF BALTIMORE.

GPS Time Reference Receiver and Supporting Equipment: The GPS Time Reference Receiver shall include a Naztec OEM Model 16-HVS that is readily compatible with the City of Baltimore Naztec Series 980 signal Controller and latest software revision. This equipment shall include a GPS Antenna, 16-foot Cat 5 cable, cable connectors, and controller interface adapters for a complete and operational installation. Installation of the GPS Antenna shall be either on top of the cabinet or mounted on the signal pole, as directed by the Engineer. This item shall be furnished as a turn-key system.

Eight-Phase Fully-Actuated Signal Controller: Contractor shall furnish and install an eight-phase Naztec Model 980-BALTMR TS 2 Type 1 signal controller and latest firmware release, all harnesses required for a fully operational controller in a NEMA TS 2 Baltimore base or pole mounted cabinet.

Type "A" Pole Mounted Controller Cabinet: Contractor shall furnish and install a non-vented eight-phase Naztec Model NEMA TS 2 Baltimore Type A pole mounted cabinet (INT-70008-TS2CBM8) with all harnesses required for a fully operational cabinet. Cabinet shall be populated with four two-channel detector amplifiers, video interface equipment, all output devices, communication terminal blocks, Bus Interface Units (BUIs), power supplies, communication surge arrestors, NEMA TS2 EDI MMU Model 16LE SmartMonitor and monitor harness. Each Type A sheet aluminum cabinet shall be in full compliance with the TS2 specifications and shall include all necessary pole-mounting accessories. All cabinet material

shall be 5052-H32 tampered aluminum. Each cabinet shall be provided with a Technician Service Panel switches for Flash/Normal, Stop Time/Run/Normal and Controller Power ON/OFF; Door Open Alarm Input; Local Flash Alarm Input; Ped Call Test switches for Phases 2, 4, 6 and 8, power supply, removable 3/8-inch Allen Wrench Lock in lieu of the door handle, three-point door latching mechanism and one 18-inch interior flexible arm goose neck lighting fixture and 25 watt incandescent lamps. The lamp shall be wired to either a 15-Amp ON/OFF toggle switch mounted to a door activated switch mounted near the top of the door. The lighting arm shall be mounted to the door and when swung open shall light the upper portion of the cabinet. The CONTRACTOR shall furnish and install suppression devices for each output file, power supply, controller unit, communications, and controller unit. Communication suppressors shall be supplied only for system controllers and shall be EDCO PC 642C-060 or approved equal. Power Supply suppressers shall be EDCO ACP 340 or approved equal. Catalog cut sheets of the cabinet are required for approval by the CITY OF BALTIMORE prior to final fabrication.

Type B Pole Mounted Controller Cabinet: Contractor shall furnish and install a non-vented eight-phase Naztec Model NEMA TS 2 Baltimore Type B pole mounted cabinet (INT-70008-TS2CBM12) with all harnesses required for a fully operational cabinet. Cabinet shall be populated with four two-channel detector amplifiers, video interface equipment, all output devices, communication terminal blocks, Bus Interface Units (BUIs), power supplies, communication surge arrestors, NEMA TS2 EDI MMU Model 16LE SmartMonitor and monitor harness. Each Type B sheet aluminum cabinet shall be in full compliance with the TS2 specifications and shall include all necessary pole-mounting accessories. All cabinet material shall be 5052-H32 tampered aluminum. Each cabinet shall be provided with a Technician Service Panel switches for Flash/Normal, Stop Time/Run/Normal and Controller Power ON/OFF; Door Open Alarm Input; Local Flash Alarm Input; Ped Call Test switches for Phases 2, 4, 6 and 8, power supply, removable 3/8-inch Allen Wrench Lock in lieu of the door handle, three-point door latching mechanism and one 18-inch interior flexible arm goose neck lighting fixture and 25 watt incandescent lamps. The lamp shall be wired to either a 15-Amp ON/OFF toggle switch mounted to a door activated switch mounted near the top of the door. The lighting arm shall be mounted to the door and when swung open shall light the upper portion of the cabinet. The CONTRACTOR shall furnish and install suppression devices for each output file, power supply, controller unit, communications, and controller unit. Communication suppressors shall be supplied only for system controllers and shall be EDCO PC 642C-060 or approved equal. Power Supply suppressers shall be EDCO ACP 340 or approved equal. Catalog cut sheets of the cabinet are required for approval by the CITY OF BALTIMORE prior to final fabrication.

Type C Base Mounted Controller Cabinet: Contractor shall furnish and install a non-vented eight-phase Naztec Model NEMA TS 2 Baltimore Type C cabinet (INT-70006-TS2CBM) with all harnesses required for a fully operational cabinet. Cabinet shall be populated with four two-channel detector amplifiers, video interface equipment, all output devices, communication terminal blocks, Bus Interface Units (BUIs), power supplies, communication surge arrestors, NEMA TS2 EDI MMU Model 16LE SmartMonitor and monitor harness. Each

Type C sheet aluminum cabinet shall be a NEMA TS2, size 6 modified and shall be in full compliance with the TS2 specifications and shall include all necessary base-mounting accessories including anchor bolts and adapter bases, if required. All cabinet material shall be 5052-H32 tampered aluminum. Each cabinet shall be provided with a Technician Service Panel switches for Flash/Normal, Stop Time/Run/Normal and Controller Power ON/OFF; Door Open Alarm Input; Local Flash Alarm Input; Ped Call Test switches for Phases 2, 4, 6 and 8, power supply, removable 3/8-inch Allen Wrench Lock in lieu of the door handle, three-point door latching mechanism and one 18-inch interior flexible arm goose neck lighting fixture and 25 watts incandescent lamps. The lamp shall be wired to either a 15-Amp ON/OFF toggle switch mounted to a door activated switch mounted near the top of the door. The lighting arm shall be mounted to the door and when swung open shall light the upper portion of the cabinet. The CONTRACTOR shall furnish and install suppression devices for output file, power supply and controller unit. Communication suppressors shall be supplied only for system controllers and shall be EDCO PC642C-060 or approved equal. Power Supply suppressers shall be EDCO ACP 340 or approved equal. Catalog cut sheets of the cabinet are required for approval by the CITYOF BALTIMORE prior to final fabrication.

800-07.04 MEASUREMENT AND PAYMENT.

Type A Pole Mounted Controller Cabinet with Eight-Phase Fully-Actuated Signal Controller:
Payment for this item shall be on a per each basis. Payment shall be full compensation for all equipment, materials, software, installation, TS 2 Type 1 signal controller, pole-mounted cabinet, input devices specified, output devices specified, communication terminal blocks and communication surge arrestors, BIUs and power supplies, MMU Model 16LE SmartMonitor and harness, shop drawings, catalog cuts, and all equipment, materials, and any other work necessary to complete the work to the satisfaction of the Engineer. The unit bid price for this item shall include flashers, relays, load switches, two detector input isolation cards, BIUs, harnesses, SDLC cables, surge and transient protection devices, cabinet power supply, programming signal timing plans, adapter cables, cabinet mounting kits and shipping and handling, on-site testing, controller test plan and submittal materials. Further, this item shall also include programming the controller unit with the prescribed phasing and timing information, detector assignment set-up, coordination, time base control functions, and timing information (phasing and timing information to be identical to that of the existing controller), and any fees for permits required for the work under this item.

Type B Pole Mounted Controller Cabinet with Eight-Phase Fully-Actuated Signal Controller:
Payment for this item shall be on a per each basis. Payment shall be full compensation for all equipment, materials, software, installation, TS 2 Type 1 signal controller, pole-mounted cabinet, input devices specified, output devices specified, communication terminal blocks and communication surge arrestors, BIUs and power supplies, MMU Model 16LE SmartMonitor and harness, shop drawings, catalog cuts, and all equipment, materials, and any other work necessary to complete the work to the satisfaction of the Engineer. The unit bid price for this item shall

include flashers, relays, load switches, two detector input isolation cards, BIUs, harnesses, SDLC cables, surge and transient protection devices, cabinet power supply, programming signal timing plans, adapter cables, cabinet mounting kits and shipping and handling, on-site testing, controller test plan and submittal materials. Further, this item shall also include programming the controller unit with the prescribed phasing and timing information, detector assignment set-up, coordination, time base control functions, and timing information (phasing and timing information to be identical to that of the existing controller), and any fees for permits required for the work under this item.

Type C Base Mounted Controller Cabinet with Eight-Phase Fully-Actuated Signal Controller:

Payment for this item shall be on a per each basis. Payment shall be full compensation for all equipment, materials, software, installation, TS 2 Type 1 signal controller, base-mounted cabinet, foundation, ground rods, input devices specified, output devices specified, communication terminal blocks and communication surge arrestors, BIUs and power supplies, MMU Model 16LE SmartMonitor and harness, shop drawings, catalog cuts, and all equipment, materials, and any other work necessary to complete the work to the satisfaction of the Engineer. The unit price shall include flashers, relays, load switches, two detector input isolation cards, BIUs, harnesses, SDLC cables, surge and transient protection devices, cabinet power supply, programming signal timing plans, adapter cables, cabinet mounting kits and shipping and handling. Further, this item shall also include programming the controller unit with the prescribed phasing and timing information, detector assignment set-up, coordination, time base control functions, and timing information (phasing and timing information to be identical to that of the existing controller) any fees for permits required for the work under this item, and all wiring of existing amplifier cabinets with new cabinet equipment.

GPS Time Reference Receiver and Supporting Equipment

The GPS system shall be will be measured and paid at the Contract unit price per each and shall include all material, labor, tools and equipment to provide an operational GPS time reference system compatible with the Naztec controller and include all harnesses, mounting brackets, connectors and extension cables.

CATEGORY 800
TRAFFIC

800-08 TRAFFIC HAND BOX

800-08.01 DESCRIPTION. This section specifies the installation of hand boxes for traffic control devices. Existing ducts entering/exiting hand boxes to be removed shall be abandoned/bulkheaded or extended through as shown on the Contract Plans.

800-08.02 MATERIALS.

A. Hand boxes; including Base Slab, Ground Rod, Cylindrical Box, and Frame and Cover: Standard Baltimore City items of construction, as per Std. Detail BC 804.01 and as referenced thereon.

B. Duct, Encasing Concrete, and Pull-Lines: As per Section titled "Type (See" Schedule of Prices") Duct Section".

C. Backfill: Borrow Excavation Type III Material.

D. Hand Box Cover Removal Key: Standard stock item of frame and cover caster, provide minimum of five (5) Operating Keys, deliver to Engineer Room 612 Benton Bldg. and obtain receipt therefor.

E. Ground Rods – Section 804.

800-08.03 CONSTRUCTION. Each hand box shall be installed complete, with a poured concrete base and ground rod. When a hand box is to be installed on an existing duct system, the Contractor shall rod the assigned duct to the nearest hand box or manhole. Should the assigned duct prove to be obstructed, another duct is to be rodded until a clear duct is found. The Contractor shall install an approved pull rope in the diverted duct from the nearest manhole or hand box to the new hand box. All ducts are to be plugged immediately after construction with approved plugs. In the event a duct must be diverted each way into the hand box, each leg of the diversion shall be rodded to the nearest manhole or hand box and a pull rope installed in each leg of the run.

A. Excavate for and place base slab to proper grade; install cylindrical box section, mortaring box to base. Cement mortar seal all "overbreak" openings in base and box that have been formed for duct entrance/exit.

B. Set frame and cover to finished project grade, utilize cement mortar during setting operations.

C. Perform backfilling/compacting operations when directed by the Engineer.

D. Where a new hand box is to be connected to an existing duct bank, the Engineer will, unless shown on the Contract Plans, determine the exact duct to be connected to.

E. Existing hand boxes to be removed under this Contract shall have their frames and covers removed and stockpiled at the project site for removal by Baltimore City personnel; ensure no damage to frames and covers. Ducts entering/exiting these hand boxes shall have their open ends closed-off with a minimum 8" thick concrete or brick masonry bulkhead or have ducts extended through as shown on the Contract Plans. "Unoccupied" duct extensions through hand boxes shall be performed utilizing full-round duct and specialty items; "occupied" duct extensions through hand boxes shall be performed BY OTHERS utilizing Contractor-furnished split duct and specialty items.

F. Install hand box covers "DTT CONDUIT" as per Contract Plans.

G. Completed hand box installation shall be as per Std. BC 804.01.

800-08.04 MEASUREMENT AND PAYMENT. Item "Traffic Hand Box" will be meausred and paid for at the Contract unit price per each. The payment will be full compensation for all hand boxes installed complete and accepted by the Engineer. Compensation will be for installed hand box, cover, backfill, poured concrete base, ground rod and all labor, materials, equipment, tools and incidentals necessary to complete the work. All labor to and materials required to divert a duct into the hand box, including rodding as necessary and installing pull rope, duct plugs, all bases, boxes, frames, covers, duct penetration as required, operation keys, mortaring removal and disposal of material shall be considered incidental to the cost of the hand box. No additional compensation will be made if the duct is diverted each way into the hand box. No payment will be made until the hand box is inspected and accepted as complete.

CATEGORY 800
TRAFFIC

800-09 REMOVAL, SALVAGE, DISPOSAL, PICK-UP AND DELIVERY OF TRAFFIC SIGNAL AND LIGHTING EQUIPMENT

800-09.01 DESCRIPTION. This work shall consist of removing, salvage, disposal, pick-up and or delivery of existing and proposed equipment: concrete, steel sub-base, foundation bases, structures, lighting fixtures, hardware, equipment and material which is no longer in use as part of a signal or street lighting system installation or modification.

800-09.02 MATERIALS. Not applicable.

800-09.03 CONSTRUCTION. The Contractor shall remove, salvage, disposal, pick-up and delivery of material and equipment as specified in the Contract Documents or designated by the Engineer. The Contractor shall tag all salvaged materials with the location and contract number. All salvaged materials shall be delivered in the same condition, as they existed in the field to Department of Transportation facilities between the hours of 9:00 am and 3:00 pm any City workday. The Contractor shall contact each facility 48 hours in advance to arrange pick-up and deliveries. The Contractor shall unload all material and place it in the area(s) designated at each facility listed below or as noted in the Contract Documents.

Traffic Signal Poles, Street Lighting Poles, Handbox frame and cover, Lighting Fixtures, Controller and or Cabinets, Signs, Signal Heads and Hardware:

The Contractor shall contact the Engineer one week prior to material removal to mark poles for disposal. The Contractor shall remove poles that have not been marked for disposal, vehicular and pedestrian signal heads, signs, mast arms, lighting poles and fixtures, and other related material and associated hardware and deliver to the appropriate facility list below:

The Contractor shall remove traffic signal pole and or cabinet bases to a depth twelve (12) inches below sub-grade, cut off anchor bolts, reinforcing steel, or remaining pole, dispose of all material, backfill voids with graded aggregate, compact the material, and patch the hole to match surrounding conditions and deliver to Department of Transportation facility located at:

3202 Southern Avenue
Baltimore, Maryland 21215
Phone # 443-984-1110

The Contractor shall remove electronic signal control and detection equipment, cabinets, and related hardware and deliver to the Department of Transportation facility at:

1620 Rappolla Street
Baltimore, Maryland 21224
Phone # 410-396-9065

The Contractor shall remove light pole bases to a depth twelve (12) inches below sub-grade, cut off anchor bolts, reinforcing steel, or remaining pole, dispose of all material, backfill voids with graded aggregate, compact the material, and patch the hole to match surrounding conditions.

The delivery of existing lighting poles, fixtures and related hardware will be made to the Department of Transportation facility Gay Street Yard at:

1801 Southern Avenue
Baltimore, Maryland 21206
Phone # 410-396-9012

The Contractor shall remove handboxes, backfill the voids with graded aggregate, compact the material and reconstruct the sidewalk to the nearest tooled/expansion joint, or restore the area to surrounding conditions. The Contractor shall deliver hand boxes to the Department of Transportation facility located at:

1400 Leadenhall Street
Baltimore, Maryland 21230
Phone No. (410)396-1515

The Contractor shall remove and dispose of any other material including span wire, banner arms, plates, covers, cable rings, cable, bands, clips and items not specifically designated by the Engineer for salvage.

800-09.04 MEASUREMENT AND PAYMENT Item "Removal, Salvage, Disposal and Delivery of Street Lighting Equipment" will be measurement and paid for at the Contract unit price per lump sum basis. The payment will be full compensation for all materials, labor, equipment, tools, transportation, delivery and unloading of materials, and for any incidentals necessary to complete the work. Any loss in value of salvaged materials due to damage or misplacement by the Contractor will be deducted from the Contractor's payment. A list of all removed and salvaged equipment shall be provided to the engineer.

Graded aggregate shall be paid for by the variable depth sub base crusher run (CR-6) bid item.

Lump sum payment will also include removal, salvage, disposal, pick-up, transportation and delivery, and unloading of all existing, proposed and temporary materials, structures, and equipment.

CATEGORY 800
SIGNAL STRUCTURES

800-10 FURNISH AND INSTALL BALTIMORE CITY SIGNAL STRUCTURES

800-10.01 DESCRIPTION. This work shall consist of furnishing and installing signal structures consisting of poles, post and pedestal shafts with anchor bases welded to the lower ends, complete with handholes as needed, handhole covers, pole caps, base covers, mast arm flanges and mast arms as needed, simplex fittings as needed, simplex fitting covers and all grommets, high strength bolts and miscellaneous hardware associated with proper installation.

Signal structures are defined as follows:

Steel Strain Poles
Joint-Use Type Steel Strain Poles
Multi-purpose Mast Arm Poles
Galvanized Steel Mast Arm Poles
Inner Harbor Type Steel Mast Arm
Inner Harbor Type (Joint Use) Mast Arm Poles
Steel Pedestal Poles

800-10.02 MATERIALS.

Pole Shaft	A 595
Post Shaft	A 53, A 595
Pedestal Shaft	A 53, A 595
Anchor Base	A 36
Mast – Arm Flange Plates	A 36
Mast – Arm	A 595
Bolts	A 325
Hardware	Type 304 SS
Galvanizing	A 153
Foundation	801
Grounding	804

1. **Pole Shafts.** Round pole shafts shall be fabricated from minimum 3 gauge sheet steel conforming to A 595 and shall have a minimum guaranteed yield strength of 55,000 p.s.i. Round pole shafts shall be uniformly tapered starting at the base and decreasing in diameter at a rate of not more than .14 inches per foot of length.

   Square pole shafts shall be fabricated from minimum 7 gauge sheet steel conforming to A 595 and shall have a minimum guaranteed yield strength of 55,000 p.s.i. Square pole shafts shall be uniformly tapered starting at the base and decreasing in diameter at a rate of 0.11 inches per foot of length.

2. **Anchor Base.** The base shall be made of steel plate conforming to ASTM A-36 of the proper strength to support the pole and its specified load. The center of the base shall have an opening of such diameter as to provide a slip fit for the shaft. The base shall be double welded, inside at the bottom and outside at the top. All welds shall meet the requirements of the AWS Structural Welding Code.

3. **Handhole(s).** The shaft shall have reinforced opening(s) for handholes complete with cover plate(s) and stainless steel Type 304 fasteners as specified in the Contract Documents.

4. **Ground Wire Connection.** A method to connect a ground wire by means of a ½" bolt shall be provided at the handhole, 3/8" bolt for pedestals.

   No ground connection required for push button posts.

5. **Pole Cap.** The top of the shaft shall be equipped with removable cast zinc or aluminum pole cape held securely in place by three stainless steel fasteners for round poles, four fasteners for square poles.

6. **Simplex Fittings.** Simplex fittings for joint use poles shall be provided as specified in the B.C. Standards and Contract Documents. A removable galvanized steel or aluminum cover plate shall be provided for each unused fitting.

7. **Base Cover.** The base cover shall be a two-piece cast aluminum or fabricated steel from, which is used to protect the anchor bolts and nuts. The manufacturer shall specify the method of fastening the base cover to minimize removal and theft. The cover shall provide for positive drainage of the base and allow venting of the pole. The finish shall be identical to the pole finish. Base covers shall be provided for Inner Harbor Type Mast arm Poles only.

8. **Mast Arms.** Mast arms shall be round or square, tapered steel with a uniform taper of 0.10 in. per foot. All mast arms shall be welded to form one continuous piece. Mast arms shall be connected to the support pole at the height necessary to provide sixteen-foot clearance under signals and three-foot high overhead signs. All mast arms shall include one clamp-type signal hanger and one wire outlet grommet for every eleven feet, or fraction thereof, of length. Mast arms shall have a removable cap at the tip. Guy rods or truss type arms will not be permitted.

   Mast arms materials and fabrication shall conform to A 595, Grade A, with the exception that the shaft shall be round or square and tapered.

   A flange plate is to be welded to the butt end to provide a rigid connection to the upright pole. Flange plate dimensions and bolt patterns shall be uniform for all mast arm lengths. A braided nylon line having a minimal tensile strength of four

hundred pounds shall be installed in all mast arms from each signal location to the hand hole.

9. **Welding.** Pole Post and Pedestal Shafts, and Mast Arms shall not have more than one longitudinal weld per section which shall be ground or cold rolled smooth to a uniform finish and thickness. Butt welds will not be permitted within a continuous single section. All welds and transverse joints shall fully develop the ultimate strength of the pole.

   All welds shall meet the requirements of the AWS Structural Welding Code.

10. **Galvanized Finish.** Each structure shall be thoroughly cleaned inside and out, then hot dip galvanized to a minimum zinc thickness of 0.003 in. in accordance with A-123.

11. **Bronze Finish.** Pre-Treatment – Each structure shall be thoroughly cleaned inside and out, then hot dip galvanized to minimum zinc thickness of 0.003 in. in accordance with A-123. All surfaces shall then be roughened by light sand blasting using a Fine Abrasive.

    Prime Coat – Thoroughly clean the surface using TNEMEC Type SSPCSPI Solvent, or equivalent. Then apply Series 66 Hi-Build Epoxoline Paint, or equivalent. One (1) Coat of Primer shall be applied, minimum thickness 4 mils. Primer color shall be approximately the same color as the topcoat.

    Top Coat – Apply TNEMEC Series 71 Endura-Shielded, or equivalent Paint to a Dry Film Thickness of 1.5 to 2.0 mils. Color shall match the color of Baltimore Inner Harbor Project 1 (DURANODIC 312 BRONZE) or equivalent.

    Protective Coating – A biodegradable protective covering shall be wrapped around bronze finish poles to prevent damage to the finish from occurring during shipment.

12. **Design Loads For Mast Arm and Multi-Purpose Poles.** All poles and mast arms shall be designed in accordance with the Contract Documents, AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, for a 90 MPH wind zone.

    For joint use poles assume two street lighting luminaries per pole, aligned with the longest signal mast arm for either category of pole.

13. **Marking.** All poles and individual mast arms shall be permanently marked or labeled for identification. Poles designated for mounting single mast arms up to 24 ft. shall be labeled

    "LIGHT DUTY" on aluminum plate riveted to the plate shaft. Poles designed for longer arms shall be labeled "HEAVY DUTY". Mast arm length shall be similarly labeled on the side of the mast arm.

14. **Design Calculations.** The manufacturer shall submit complete structural design calculations of all components including the loads applied to the foundation at the base plate level, i.e. axial load, overturning moment and torsional moments. The professional seal of a registered structural engineer shall be on all structural design calculations and shop drawings.

800-10.03 CONSTRUCTION. The signal structure shall be installed on a concrete foundation conforming to the Contract Documents.

Any finish on the signal structures and mounting hardware damaged during transportation and erection shall be repaired to match the original finish by and at the Contractor's expense and approved by the Engineer.

800-10.04 MEASUREMENT AND PAYMENT. Furnishing and installing of structures will be measured and paid for at the Contract unit price per each for the type of structure erected in place. The payment will be full compensation for the transportation and installation of all steel poles, weather heads and duct seal, conduit, elbows, strapping, clips, brackets, mounting hardware, mast arms, twin mast arms, strain poles, pedestal poles, push button posts, breakaway base support systems, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 800
TRAFFIC

800-11 PVC CONDUIT

1-2 IN. PVC CONDUIT, SCH. 40 –CONCRETE ENCASED-TRENCHED
1-3 IN. PVC CONDUIT, SCH. 40 –CONCRETE ENCASED-TRENCHED
2-3 IN. PVC CONDUIT, SCH. 40 –CONCRETE ENCASED-TRENCHED
1-4 IN. PVC CONDUIT, SCH. 40 –CONCRETE ENCASED-TRENCHED
2-4 IN. PVC CONDUIT, SCH. 40 –CONCRETE ENCASED-TRENCHED
1-2 IN. PVC CONDUIT, SCH. 40 –CONCRETE ENCASED-SLOTTED
1-3 IN. PVC CONDUIT, SCH. 40 –CONCRETE ENCASED-SLOTTED
1-4 IN. PVC CONDUIT, SCH. 40 –CONCRETE ENCASED-SLOTTED

800-11.01 DESCRIPTION.

This specifications cover the furnishing and installation of all the conduits, fittings pull and junction boxes, conduit expansion joints and incidental parts, necessary to provide for future lighting or operation of structures, The type, size and location of conduits, fittings and boxes will be as indicated on the Plans. The following pertains to work within the City of Baltimore only.

800-11.02 MATERIALS.

Refer to Section 805.02 - Electrical Conduit and Fittings.

800-11.03 CONSTRUCTION.

1. **General**.
   - The size of each conduit shall be such that the sum of the areas of the cross-sections of all conductors, including insulation and protective coverings, shall be not greater than thirty percent (30%) of the inside area of conduit except that no conduit encased in concrete or installed underground shall be less than two inches (2") inside diameter and no conduit small that three quarter inches (3/4") inside diameter shall be used except for fixture hangers.
   - All conduit sizes and conduit layouts shall be approved by the Engineer before installation and the Contractor shall submit data on the lay-out for the exact makeup, overall diameters and cross-sectional areas of the actual conductors he intends to use and the sum of the areas of the conductors in each conduit. All conduits used on a project shall be the product of one manufacturer.
   - Bends shall be of long sweep, free from kinks and of such easy curvature as to permit the drawing in of conductors without injury. The radius of curvature of inner edge of bends shall not be less than ten (10) times the inside diameter of the conduit except as may be otherwise noted on the Plans or in the Special Provisions. Conduits shall not be flattened or distorted. The total angle of all bends between any two (2) boxes, or fittings, shall not exceed two (2) quarter bends.
   - Exposed conduit runs shall be parallel to or at right angles to walls, slabs, girders, etc., and in locations giving greatest accessibility for painting and least accumulation of dirt. All exposed conduit runs shall be attached to steel masonry, concrete or timber by galvanized malleable iron or galvanized steel straps, clamps, or hangers of an approved type, held at not

less than two (2) points by galvanized steel bolts or lag screws. The runs shall be supporting members, Conduits mounted o structural steel members shall be securely clamped to prevent rattling and wear.

- All ends of conduits installed during construction, or for future use shall be closed against the introduction of foreign material by the use of standard pipe or brush caps. All conduits shall be installed so that they will drain and necessary holes for this purpose shall be made as directed.
- All conduits risers in railing post shall, unless otherwise shown on the Plans, terminate one inch (1") below the top surface of the post. The risers shall be accurately placed so that they may be located for future use.
- All conduits installed underground shall have a Mix No. 2 Concrete envelope providing cover as indicated by the dimensions shown on the Standard Plates for Standard Duct Sections.
- All traffic bearing ductwork shall be encased in Mix No. 2 Concrete. Concrete encasement shall be a minimum of 3" in all directions from the ductwork, as per Standard No. BC-824.01, and extend 3 feet from the curb unless otherwise noted in the plans.
- Excavation for installation and encasement shall be carefully done, sidewalks trimmed to line and the bottom of trench graded so that the envelope will be uniform and there will be no pockets or low points in the conduit run. All backfill, regardless of class shall be carefully tamped to conform to the requirements of Section 204, unless otherwise specified. Care shall be taken that the concrete envelope, or conduit, are not injured.
- In areas where a concrete footway currently exists, the Contractor shall remove the existing footway as required and excavate a trench of the width and depth as shown on the Standard Plates, or as directed by the Engineer. After the conduit is installed, the Contractor shall install CR-6 to the existing grade to provide a temporary and or permanent concrete footway.
- All conduits, boxes, etc., to be encased in concrete must be accurately placed and rigidly held in position so that no variation form line or grade occurs when concrete is placed.
- Conduits, fittings and boxes shall be stored under cover and above ground.
- Upon completion of the conduit installation, the system shall be cleared by a pull through mandrel type device inserted in the presence of the Engineer before any conductors are installed. Immediately prior to the installation of conductors in any run, the conduits comprising that run shall again be checked. Any and all obstructions shall be removed to the approval of the Engineer.
- The Contractor shall install and leave in place NO. 10 iron wire in all conduit runs installed for future use.
- The Contractor shall furnish work drawings. Work drawings shall be twenty-two inches by thirty-six inches (22"x36") and shall be furnished in duplicate for Engineer's preliminary examination. After work drawings have been accepted by the Engineer, and revisions made the Contractor shall furnish additional copies as may be requested.

2. **Metallic Conduits, Fittings and Boxes.**

- Conduit runs shall be made with as few couplings as standard lengths will permit. Screw couplings shall be used. All cuts shall be made with a hacksaw and reamed clear of fins or burrs with a reamer.
- Conduit shall have threaded ends coated with red or white lead and of sufficient length so that they will butt squarely and tightly in the coupling. Long running threads will not be permitted. Conduits shall be installed so as to be continuous and watertight between boxes and/or equipment.
- Where conduits cross expansion joints in the structure, or where otherwise specified, they shall be provided with expansion fittings of an approved type. The electrical continuity of the conduit runs across the expansion fittings shall be assured by approved fittings and bare No. 8 copper wire.
- Pull boxes shall be used wherever necessary to facilitate the installation of the conductors, conduits entering into cast iron pull boxes or enclosures shall be threaded into hubs on same. Conduits entering into sheet steel boxes or enclosures shall be secured with two (2) lock nuts and the projecting ends shall be equipped with an approved insulating bushing.
- All surfaces of conduits, boxes, fittings, etc., in contact with concrete encasement shall be painted one (1) coat using RTCB-5 Tar. All surfaces of conduits, boxes, fittings supp0orts, etc. exposed to view as well as the interior surfaces of boxes shall be painted as specified in the Special Provisions. All galvanized surfaces shall be prepared in accordance with Paragraph 9 (i) of Section 35.09-3 before the application of any paint.

3. **Asbestos-Cement Conduits, Fittings and Boxes.**

- Conduits shall be cut with a saw and all ends shall be accurately tapered or otherwise finished depending on type of conduit and coupling specified. Tools recommended for this work by the conduit manufacturer shall be used and finished ends shall be equal to those supplied by the manufacturer. All ends shall be smoothed of burrs or fins. Standard bends shall be used wherever possible and special bends shall preferably have a radius not less than that of standard bends. All special conduits shall be accurately dimensioned and manufactured.
- All joints shall be sealed with a waterproof joint sealing compound recommended by the conduit manufacture and approved by the City. All joints thus treated shall be waterproof.
- Expansion couplings shall be of a type designed and manufactured by the conduit manufacturer. They shall be sized to fit the conduit run in which they are to be used and of a length as indicated on the Plans. Expansion couplings shall be placed not more than fifty feet (50') apart where an exposed conduit run between boxes or terminals is equal to or more on all exposed runs less than on hundred feet (100') between boxes or terminals. Expansion couplings on conduit runs encased in concrete shall be 0placed as indicated on the Plans.
- Exposed conduit shall be supported by approved hangers at not more than ten foot (10') centers. Hangers shall be of a type, which permits movement of conduit independent of movement of the structure. Expansion couplings shall be rigidly secured to the structure.

4. **Fiber Conduit and Fittings.**
   - Conduit shall be cut with a saw and all ends shall be accurately tapered or otherwise finished depending on type of coupling specified. Tools recommended for this work by the conduit manufacturer shall be used and finished ends shall be equal to those supplied by the manufacturer. All ends shall be smoothed of burrs and fins. Standard bends shall be used wherever possible and special bends shall preferably have a radius not less than that of standard bends. All special conduits shall be accurately dimensioned and manufactured. All joints shall be sealed with waterproof joint sealing compound recommended by the conduit manufacturer and approved by the City. All joints thus treated shall be waterproof.
   - An expansion joint shall consist of a break in the conduit run with a space between ends of conduit as indicated on the Plans. A conduit sleeve not less than eighteen inches (18") long, unless otherwise indicated shall cover the break. The sleeve shall be rigidly anchored to the structure.

5. **Polyvinyl Chloride (PVC) Conduit and Fittings.**
   - Conduit shall be cut with a saw and all ends shall be accurately tapered or otherwise finished depending on type of coupling specified. Tools recommended for this work by the conduit manufacturer shall be used and finished ends shall be equal to those supplied by the Manufacturer. All ends shall be smoothed of burrs and fins. Standard bends shall be used wherever possible and special bends shall preferably have a radius not lee than that of standard bends. All special conduits shall be accurately dimensioned and manufactured. All joints shall be sealed with waterproof joint sealing compound recommended by the conduit manufacturer and approved by the City. All joint thus treated shall be waterproof.
   - An expansion joint shall consist of a break in the conduit run with a space between ends of conduit as indicated on the Plans.
   - A conduit sleeve not less than eighteen inches (18") long unless otherwise indicated shall cover the break. The sleeve shall be rigidly anchored to the structure.
   - All underground ductwork shall have magnetically detectable plastic warning tape installed 12" above the duct for the entire length of the duct. The color of the warning tape shall be red for electric ductwork. Provide tape in rolls, 3 inches minimum width with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification shall be "CAUTION BURIED ELECTRIC LINE BELOW" or similar. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material. Bury tape with printed side up. Three-foot (3') clearances are recommended between lighting conduits and meter vaults.

2. Inspection and Testing:

- A braided nylon line, having a minimum tensile strength of four hundred pounds (400 lbs), shall be installed in each duct.
- Each duct shall be tested in the presence of the Engineer. A test device made from ridged material not more than one-half inch (1/2") smaller than the bore of the duct, and a minimum of two feet (2') long, shall be passed through each duct. The device shall be so constructed as to prevent its use through bends whose radius is less than twenty feet (20'). Any duct

through which the device cannot be passed shall be repaired by the Contractor to the satisfaction of the Engineer with no additional compensation from the City.

- All manholes shall be inspected for proper duct entries, terminators, bell ends, pulling in irons, concrete seal around duct, caps or lugs, pull lines and grout seals between the frame and chimney.
    a. The duct line sizing device is to be used as a "go" gauge for new PVC duct and will be used on the basis of a receipt signed by the Contractor.
    b. Use of the device must be observed by the Engineer. Arrangements are to be made at least three (3) days in advance.
    c. Prior to testing, the Contractor shall assure that the bore of all the ducts are clean and clear of fins, burrs or sharp edges and dry.
    d. The Contractor shall supply labor and equipment necessary to gauge the new duct.
    e. If the device meets any resistance within the run of duct, the operation shall stop and the device recovered as its starting point.
    f. Any duct which has resistance to the passing of the device will not be accepted.
    g. Final acceptance of the conduit system will not be made until completion of all the Work in the Contract including completion of cable Work and viability and continuity of cable service acceptance in the specified duct system.

800-11.04 MEASUREMENT AND PAYMENT

This work will be paid for at the contract unit price bid per linear foot for which price and payment shall be full compensation for all trench excavation, conduit, concrete encasement, core drilling into manholes walls, waterproof epoxy, rodding, pavement patching, replacement with matching roadway materials, fittings, pull wires, duct plugs, caps, terminators, junction boxes, warning tape, backfill, seeding, CR-6, and all labor, materials, equipment, and tools necessary to complete the work. Payment will also include hauling and disposing of all excavated materials and furnishing, transporting and placing of RC-6 or CR-6 stone backfill.

CATEGORY 8
TRAFFIC

800-12 RED LIGHT CAMERA FORCE ACCOUNT WORK BY BALTIMORE CITY

800-12.01 DESCRIPTION. This work shall consist of using the Baltimore City Department of Transportation (BCDOT) contractor to restore the red light camera back in service.

The Contractor is directed to protect and maintain service to the existing traffic poles, signal equipment and traffic signal control cables during roadway and utility construction. The Contractor will be responsible to reinstall these facilities if damaged at his/her own expense. The Contractor will be required to reinstall any traffic loop detectors that are affected by roadway, resurfacing, and sidewalk or utility construction. The loop detector items and the Contractor's cost to reinstall the loop detectors and fully restore those loop detectors in service are to be included in the project.

The Contractor is required to contact Mr. Raj Sharma at 410-396-6892 and Mr. Glenn Michael at 410-396-9065, two weeks prior to construction and changes in signal operation. Contact Mr. Mike Harrington (410)-396-6892 for traffic signal timing related operation.

The existing red light camera equipment is located on southbound Hawkins Point Road at Fort Armistead Road. The Contractor is required to contract Mr. Matt Hoppwood or Mr. Johnny Fogg of ACS at 410-347-4770 ext.10/11/12 for work involving the existing red light camera four weeks prior to start of construction.

The estimated allowance of $2,000.00 for restoring the red light camera back in service by the ACS inc., Vendors is included in the project.

800-12.02 MEASUREMENT AND PAYMENT. Traffic signal force account work by Baltimore City will be measured and paid for using force account records of the City.

This is a direct reimbursement and the Contractor is not allowed to any mark up.

CATEGORY 8
TRAFFIC

800-13 TRAFFIC SIGNAL FORCE ACCOUNT WORK BY BALTIMORE CITY

800-13.01 DESCRIPTION. This work shall consist of using Baltimore City Department of Transportation (BCDOT) forces and others as deemed necessary by BCDOT for inspection of traffic signal work performed by the contractor. An allowance of $12,000.00 is included in the project.

800-13.02 MEASUREMENT AND PAYMENT. Traffic signal force account work by Baltimore City will be measured and paid for using force account records of the City. This is a direct reimbursement and no mark up is allowed for the Contractor.

CATEGORY 8
TRAFFIC

800-14 UTILITY CONNECTION FORCE ACCOUNT WORK BY BGE

800-14.01 DESCRIPTION. This work shall consist of reimbursing BGE for their costs related to connecting the utilities from base back to power source. An allowance of $10,000.00 is included in the project.

800-14.02 MEASUREMENT AND PAYMENT. Utility connections work will be paid for as direct reimbursements per invoices by BGE. It is possible that BGE may have to be paid in advance to start and complete the work. It will be the responsibility of the Contractor to pay BGE in advance and then be paid by the Authority in the following monthly estimate.

This is a direct reimbursement and no mark up is allowed for the Contractor.

CATEGORY 800
TRAFFIC

SECTION 804 - GROUNDING

804.04 MEASUREMENT AND PAYMENT

DELETE: 804.04 in its entirety.

ADD: The following:

Ground Rods will not be measured, but will be incidental to the pertinent item into which they are installed. Bare copper wire for bonding and grounding shall be incidental to the grounding system.

CATEGORY 800
TRAFFIC

SECTION 805 – ELECTRICAL CONDUIT AND FITTINGS

805.01 DESCRIPTION

ADD: The following paragraph

805.01 This section covers the work involving underground conduits carrying power lines and fiber optic communication lines as shown on the Contract Documents.

805.02 CONSTRUCTION

ADD: The following at the end of Section **805.03.09 Encased Conduit (Slotted or Trenched).**
Conduits containing fiber optic communication cables shall have a minimum cover of 24 inches in all trenches except as needed to transition to junction boxes or cabinets. Fiber optic conduits shall be placed so that a distance of two (2) inches or more exists between the outside of the conduit and virgin undisturbed earth. All fiber optic conduits shall be encased in concrete as detailed in the Plans. If other conduits run parallel to the fiber optic conduit, the conduits shall share a single trench as long as practical as detailed in the Plans or as directed by the Engineer.

ADD: The following at the end of Section **805.03.10 Conduit Installation under Existing Paved Areas (Bored).**
Conduits installed under existing roadways via directional boring shall be High Density Polyethylene (HDPE) SDR 11 conduit. Conduits shall be installed at least 36" in depth. Conduits shall be installed perpendicular to the traveled sections of roadway.

The conduit shall pass completely under paved and unpaved shoulder and at least 4 feet beyond the edge of pavement and completely into the manhole or junction box as indicated on the Plans.

ADD: The following sections:

805.03.11 Guardrail. Conduits shall be placed so as to avoid damage to the conduit installations. The Contractor shall be responsible for coordinating the work so as to avoid such damage to both existing and proposed conduit systems. Conduit damage caused by the Contractors actions, as determined by the Engineer, shall be repaired at no additional expense to the Contract.

805.03.12 Pull Cord. Pull cord shall be placed in all conduit runs (whether occupied or spare) for future use.

805.03.13 Conduit Type. All outdoor trenched conduits, unless otherwise noted, shall be PVC. All bored conduits under pavement structures shall be HDPE. All above ground or exposed conduits shall be rigid galvanized steel.

805.03.14 Bend Radius. All conduits shall have a bend radius greater than the minimum bend radius of the cables to be placed inside the conduit.

805.03.15 Conduit Ends. The Contractor shall seal all conduit ends with an approved compression fitting.

805.04 MEASUREMENT AND PAYMENT

REMOVE: "excavation, backfill, conduit encasing concrete" from the first paragraph.

ADD: The following after paragraph 805.04.03:

805.04.04 Electrical and fiber optic conduits and fittings installed in trenches shall be paid for per linear foot per conduit complete and in place. The costs of the trench excavation and backfill shall be paid separately (see Section 809 of these Special Provisions).

CATEGORY 800
TRAFFIC

SECTION 806-LUMINAIRES AND LAMPS

DELETE: The title "806.03 CONSTRUCTION." only.

INSERT: The following.

806.03 CONSTRUCTION. All luminaires that have an access door facing downward, and have the door supporting the weight of all or part of the ballast, shall have a safety cable installed. The safety cable shall be capable of supporting the full weight of the door and ballast, and shall restrict the amount the door may swing open to 90 degrees. The cable shall be attached to the door by spring clips that can be removed without the use of tools, to allow the door to be easily removed.

ADD: The following after 806.03.04 Installation.

806.03.05 Luminaire Photometric Data and Calculations. Photometric data on roadway luminaires shall be submitted with the catalog cut for the luminaire. This data shall include:

(a) Photometric Data. A photometric file for the luminaire selected, in standard I.E.S.N.A. format, on a 3.5 in. IBM compatible diskette or CD. If more then one file is available on the diskette or CD, the name of the file shall be clearly indicated on the catalog cut. Only one diskette or CD shall be submitted with the catalog cuts.

(b) Photometric Calculations. Contractor shall submit printouts of computer lighting calculations for the lighted areas indicated in the Contract Documents. If no areas are indicated the Contractor shall select a typical section of the project for each type of luminaire. A maintenance factor of 0.64 will be assumed for the calculations.

Calculations for the roadway luminaires shall show predicted horizontal footcandle values and veiling luminance ratios for the lighted areas indicated in the Contract Documents. The calculations shall include a Summary Table showing the Average Footcandles, the Minimum Footcandle, the Maximum Footcandle and Uniformity Ratio (Average/Minimum).

For purpose of calculations the lighted areas indicated in the Contract Documents may be divided into separate Ramps for the areas served by the Cobra Head luminaires.

If the Contractor desires to change luminaire models during the course of the Contract, or the manufacturer changes specifications for the luminaire during the Contract, photometric calculations, and CD's, shall be submitted for each change.

All roadway luminaires shall conform to the following criteria:

(a) Fixed Aim Luminaires. Fixed aim luminaires, such as cobra-head, luminaires, shall have an I.E.S.N.A. full cutoff, Type 3 distribution pattern. The intensity shall be zero candela at or above an angle of 90 degrees above nadir and the candela per 1000 lamp lumens does not numerically exceed 100 at or above a vertical angle of 80 degrees above nadir. This applies to all lateral angles around the luminaire.

Testing Submittal and approval of photometric data and calculations shall not absolve the Contractor of the photometric testing required by Section 820, or the Contractor's responsibility to correct or replace lighting where field measurements do not conform to Administration requirements.

CATEGORY 800
TRAFFIC

SECTION 807 – ELECTRICAL SERVICE EQUIPMENT

807.03 CONSTRUCTION

ADD: The following.

807.03.08 Construction Stake Out And Coordination

(a) The Contractor shall coordinate this work with the work of other trades to avoid conflicts. Electrical cables and equipment damaged by the execution of work of other trades shall be completely removed and replaced at no additional cost to the Authority.

(b) The Contractor shall keep an up-to-date set of as-built red lined drawings on the job site. All work shall be incorporated into as-built sets within 7 calendar days of completion of the work Submit as-built drawings upon completion of the work. The Contractor shall note the exact location of trenches at 100-foot intervals on the as-built drawings by station and offset from the roadway. The Contractor shall show only the work that is part of the final project on as-built drawings. The Engineer or his representative may inspect the status of as-built drawings at any time and payment for completed work may be withheld where said work is not reflected in the as-built as required above.

807.03.09 Meters. Meters shall be installed at all locations where local utility company electrical service is provided. Meter installation and materials MUST be in accordance with the local utility company standards and requirements. Use Metered Service Pedestal as indicated where shown on plans. Use standard utility company provided meter and mount as shown on plans in all other locations.

a) At no time shall conduits enter the top of a meter assembly.
b) Use only pre-cut conduit knockouts for connections to meter assemblies.
c) The meter assembly must be protected from the environment before installation of the metering device by the utility company.

807.03.10 Cabinet Electrical Service. Cabinets receiving electrical service in excess of 120 volts shall be equipped with step-down transformers and a circuit breaker on the primary side of the transformer. These transformers shall provide power at both 240 volts and 120 volts.

Mount the transformer and breaker as shown in the Plans. Working space around the step down transformer shall be maintained which is adequate for the use of hand tools to access terminal connections and mounting lugs.

Breakers shall be heavy duty, quick make/quick-break type with terminals suitable for copper conductors and equipped with an insulated groundable neutral.

Step-down transformers shall be totally enclosed and dry type, designed for indoor/ outdoor applications, suitable for wall mounting. The insulation material shall be Class H which will not permit a temperature rise of 115°C, or greater, above the 40°C ambient, when tested in accordance with ANSI and NEMA standards. The core and coil assemblies of transformers for up to 25 KVA single phase, and 15 KVA three phase, shall be epoxy encapsulated. The transformers shall be designed and tested in accordance with applicable requirements of NEMA-ST20, NEMA-TR27 and UL-506 transformer standards, and shall be UL listed. The transformer enclosures shall meet NEMA-3R requirements and shall be degreased, primed, and finished with two coats of outdoor enamel paint in conformance with the manufacturer's standards.

807.03.11 Base mounted metered service pedestal. Base mounted metered service pedestals shall consist of a base-mounted aluminum pedestal containing a main circuit breaker for service disconnect, branch circuit breakers, and integral meter socket. All conduit stub-outs shall extend a 6 inches beyond the edge of the foundation and shall be arranged as shown in the contract documents. The base mounted metered service pedestal shall be designed for pad mounting using 18-inch long anchor bolts. The pedestal shall measure 16 inches wide, 17 inches deep, and 48 inches tall. The pedestal shall meet nema 3R. Provisions shall be provided to padlock the customer service side door closed to protect the circuit breakers, and to install a utility company seal to secure the meter. The meter shall be protected by a hinged hood. Branch circuit breaker types and sizes shall be as shown on the drawings. One duplex outlet shall be installed in the service pedestal, and wired to the GFI breaker. Base mounted metered service pedestals shall be UL listed "Suitable for Service Equipment," and shall be acceptable to the local utility companies for use as a service connection.

807.04 METHOD OF MEASUREMENT AND PAYMENT

ADD: The following:

807.04.11 Cabinet electrical service shall be paid per each complete and in place, by the size (KVA rating). This price shall include furnishing, installing and testing the transformer, primary side surge protection and circuit breaker, labeling, cables, mounting hardware and wiring connections.

807.04.12 Base Mounted Metered Service Pedestal. Base Mounted Metered Service Pedestal will be measured and paid for at the Contract unit price per each. The payment will be full compensation for all enclosures, panel boards, circuit breakers, internal wiring, wiring devices, meter sockets, meter, shunts, cover plates, wiring and all materials, labor, equipment, tools, concrete, and incidentals necessary to complete the work. Concrete foundation for the Base Mounted Metered Service Pedestal shall be incidental to the Base Mounted Metered Service Pedestal.

CATEGORY 800
TRAFFIC

SECTION 809 – TRENCHING AND BACKFILL

809.03 CONSTRUCTION

CHANGE: Text which reads: '"CAUTION: SHA ELECTRICAL LINE BURIED BELOW," repeated…' to '…read "BURIED ELECTRICAL LINE", "BURIED COMM LINE " or other approved message, repeated…'

ADD: the following paragraphs before the "Cable Treatment" paragraph:

"Miss Utility". Where trenching and backfilling for the placement of conduits, splice boxes, handholes and handboxes is required, the contractor must contact "Miss Utility". "Miss Utility" shall be notified 48 hours in advance of any work under the contract. The Contractor shall test pit all marked locations for exact position of cables, conduits, and other underground utilities.

The Contractor is hereby advised that Miss Utility will not locate the MdTA nor the SHA facilities. The Contractor shall notify the Engineer 48 hours prior to any work under the contract to have the MdTA and the SHA mark their facilities. The Contractor shall test pit all marked locations for exact position of cables, conduits, and other underground utilities.

No excavation work shall occur until Miss Utility, the MdTA, and the SHA have marked the existing facilities and the Contractor has test pitted the locations.

The Contractor shall maintain the utility markings throughout the construction period as necessary.

Depth. Unless otherwise specified on the contract drawings, trenches shall be excavated to a depth such that all conduits, wires, and duct cable in trench is at a finished elevation at least 24" below the final grade. Where trenches are placed on slopes, cover shall be measured from the outside conduit to the nearest top of grade. This measurement will generally be perpendicular to the slope of the grade.

Where proper trench depth cannot be obtained, and improper depth presents a hazard to the cables or conduit, the Engineer may require concrete cover in shallow trench, on slopes, or where other conditions indicate the need.

Width. Unless otherwise specified on the contract drawings, trenches shall be excavated to a width such that all conduits, wires, and duct cables in the trench are placed with at least 2" of backfilled material between the outside edge of the conduits, wires, and duct cables and undisturbed earth.

Stake Out. The Contractor shall stake out trenches prior to trenching and obtain approval from the Engineer prior to installation. Generally, keep trenches at least 3' behind guardrail and curb, and out of drainage ditches, gutters, culverts, etc. Run trenches in as straight a line as possible and parallel to the nearest roadway. Where no guardrail currently exists, conduit shall be at least 3' behind the location where guardrail might be placed if it were installed.

Guardrail. The Contractor shall be responsible for coordinating the work so as to avoid such damage to both existing and proposed conduit systems. Conduit damage caused by the Contractors actions, as determined by the Engineer, shall be repaired at no additional expense to the Contract.

Curb and Gutter. Where curb or gutter work is to be done in close proximity to electrical work, perform the work in the order and fashion necessary to minimize the risk of damaging either of the two types of works.

Unsuitable Materials in Trench. Remove any objects or projections into the trench which may damage the conduit. These objects may include rocks, debris, glass, old cables, concrete, etc.. Alternatively, provide a galvanized rigid steel sleeve with grommets where projections into the trench cannot be removed.

The Contractor may choose to use directional boring for installation of conduit at the discretion of the Contractor and without additional charge to the authority.

CATEGORY 800
TRAFFIC

SECTION 810 – ELECTRICAL CABLE, WIRE, AND CONNECTORS

810.01 DESCRIPTION

DELETE: The following text from the paragraph: "micro-loop probe sets."

810.02 MATERIALS

DELETE: "Micro-Loop Probe"

ADD: the following

Splice kits for repair of underground direct buried cables:

Splice kits shall consist of a mechanical single conductor connector with four lugs (two for each end of cable), arranged in-line. The kit shall also consist of two heat shrink sleeves. The first sleeve shall be slightly smaller than the outer sleeve. An adhesive shall be applied to the inner portion of the heat shrink sleeves. Kits and components shall be UL Listed for direct burial.

Splice kits for aerial cable:

Aerial cable splicing shall be performed using copper H or T compression taps. The taps shall be made of high conductivity extruded copper manufactured as per ASTM designations and shall be tin-plated. Contractor shall install flame retardant, snap on type insulation covers on the splices. The insulation covers shall be made of flame retardant, high impact polypropylene with a voltage rating of 600V and temperature rating of 90^0C. The taps and insulation covers shall be UL listed for this application. Contractor shall refer to contract documents for cable sizes and shall select the appropriate taps and insulation covers for the splices based on the cable sizes. Contractor shall obtain Engineer's approval on the selected taps and insulation covers prior to installation.

ADD: Cable Duct End Seals shall consist of a one-piece heat shrinkable device designed to provide a waterproof seal around the cable duct and each individual cable. The Cable Duct End Seal shall have separate entranceways for each cable, and shall hold the cables apart when applied.

810.03 CONSTRUCTION

INSERT: The following just prior to paragraph 810.03.01

All wire intended for systems of 60VAC to 600VAC shall be color-coded and #12AWG minimum. Wire size #10 AWG and smaller shall have permanently colored insulation. Wire size #8 AWG and larger may have permanently colored insulation or have colored tape applied in all hand boxes, pull boxes, junction boxes, light standards, and signs. The colored tape shall measure at least 6 inches along the length of the wire and shall wrap completely around the wire. The colored tape shall be applied to clean dry wires. Wire colors shall be as indicated in the following table:

Voltage	Phase A	Phase B	Phase C	Neutral	Ground
60 to 240	Black	Red	Blue	White	Green
277 to 600	Yellow	Brown	Orange	Gray	Green

Aerial cable shall be installed at locations as shown in the drawing and in accordance with the design details, manufacturer's recommendations and applicable codes (including NEC and NESC).

Contractor shall properly ground the messenger cable of the aerial cable as per code and manufacturer's recommendations.

Contractor shall abide by the installation practices provided by the manufacturer while installing the cable. Contractor shall refer to the sag calculation charts and tables to calculate the nominal values of sag and tension on the cable prior to installation. Contractor shall ensure that the allowable sag and tension limits for the cable are not exceeded. In accordance with the manufacturer's recommendations maximum sag on the cable shall be no more than 1% of the total length of the cable. Contractor shall use appropriate devices to ensure the tensioning requirements are met while tensioning the cable.

810.03.03 Preassembled Cable Duct

DELETE: The second paragraph beginning "After backfilling..." in it's entirety.

INSERT: The following.

After backfilling the contractor shall demonstrate that the conductors move freely within the duct by pulling the conductors out a minimum of length of 2 ft. Pulling Tension shall conform to 810.03.02. The cable shall be then pulled to it's original position, and the Cable Duct End Seals installed. After installation of the Cable Duct End Seals, but prior to installing connector kits or splices, the electrical circuit testing shall be performed as specified in 820.03.02 (b) and the results recorded. The contractor shall record the length of cable, locations of both ends of the cable duct, and the insulation resistance on a form acceptable to the Engineer, and forward the form to the Engineer.

DELETE: Paragraph 810.03.09 in its entirety.

INSERT: The following.

810.03.10 Splice kits for repair of underground direct buried cables

These kits shall be used where underground duct cable, or direct buried cable is damaged. Ends of each cable shall be inserted under two of the lugs and fastened into place. Two heat shrink sleeves shall be applied over the mechanical connector. The first sleeve shall be slightly smaller than the outer sleeve, but shall completely cover the mechanical connector and overlap the still-insulated portion of the attached cables by at least ½ inch. An adhesive shall be applied to the inner portion of the heat shrink sleeves. Each sleeve shall be centered over the mechanical connector and heat-shrunk into place. Follow manufacturer instructions for underground splice kits.

810.03.11 Splice kits for aerial cable

These kits shall be used to splice aerial cable or where aerial cable is damaged. Contractor shall strip the cables to be spliced, with the strip length not exceeding manufacturer's recommendations and follow manufacturer's instructions in splicing the cables. Contractor shall install insulation covers on the splices as per manufacturers recommendations. Splices for multiple phases shall be offset (longitudinally) to prevent shorting between phases. At locations requiring tapping into individual phases of a multiconductor cable, the Contractor shall provide proper insulation between the individual splices in accordance with the manufacturer's recommendations for the aerial cable and splice kits.

810.04 MEASUREMENTS AND PAYMENT

ADD: 810.04.01 Preassembled Cable Duct that has not had the required electrical tests performed and reported to the engineer will not be measured or paid for.

ADD:
810.04.03 Cable Duct End Seals shall be measured and paid for at the contract unit price per each.

CATEGORY 800
TRAFFIC

SECTION 811 – ELECTRICAL HAND HOLES, MANHOLES, HANDBOXES, PULLBOXES, AND SPLICE BOXES

DESCRIPTION

DELETE: The entire text of Paragraph 811.01.

INSERT: The following.
This work shall consist of furnishing and installing electrical hand holes, electrical and communication manholes, and communication junction boxes as specified in the Contract Documents or as directed by the Engineer.

CONSTRUCTION

DELETE: Paragraph 811.03.02 in its entirety

INSERT: The following.

811.03.02 Junction Boxes

(a) Communication junction boxes shall be in conformance with the plan details and the applicable MdSHA standard drawings.

(b) Junction boxes shall not be placed in ditches.

(c) Junction boxes for fiber optic cables shall be spaced at a maximum of 1000 feet apart. Where conduit bends will increase pulling tension beyond acceptable limits, as determined by the Engineer, additional junction boxes shall be installed to allow an intermediate pull-point.

(d) A minimum of 20 feet of fiber optic cable shall be coiled in each junction box.

MEASUREMENT AND PAYMENT

DELETE: Paragraph 811.04 in its entirety

ADD: the following:

Electrical Hand Holes, Electrical and Communication Manholes, and Communication Junction Boxes will be measured and paid for at the Contract unit price per each unless otherwise specified in the Contract Documents. The payment will be full compensation for all excavation, aggregate drain, concrete, bolts, bricks, pipes, backfill, sealer, frames and covers, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 800
TRAFFIC

SECTION 820 – GENERAL ELECTRICAL WORK AND TESTING

820.01 DESCRIPTION

ADD: The following.

(a) This work includes contacting, coordinating and cooperating with BG&E for the changes and additions to the electrical service.

(b) The Plans show only diagrammatic locations of cables, conduits, and other underground utilities and are for information only.

(c) The Contractor shall provide working drawings, shop drawings, and catalog cuts, etc., which show final details of the installation.

820.01.01 Codes and Standards. All work shall be performed in accordance with the codes and standards listed below. In addition, materials and construction methods shall meet the minimum requirements and recommendations of the listed codes, standards, and organizations. Unless otherwise stated, the latest edition, revision, or supplement, as of the date of advertisement, of the specified codes shall be used.

- ANSI - American National Standards Institute
- ASTM - American Society for Testing and Materials
- IEEE - Institute of Electrical and Electronic Engineers
- NEC - National Electrical Code (NFPA70)
- NEMA - National Electrical Manufacturers Association
- NESC - National Electrical Safety Code
- NFPA - National Fire Protection Association
- UL - Underwriters' Laboratories
- TIA - Telecommunications Industry Association

All materials supplied by the Contractor shall be new and UL listed, where such listing is possible. Submit catalog cuts for all materials in accordance with the Contract Documents.

The MdTA Chief Electrical Inspector or his appointed representative will inspect the entire installation. The Contractor shall contact the Electrical Inspector at least 48 hours before needed inspections. All trenches shall be inspected before backfilling. All equipment shall be inspected at rough in.
Unless clearly specified otherwise, all voltages indicated are AC (alternating current), shall be at 60 Hz, and stated as RMS values.

820.01.02 Quality Assurance and Quality Control. The contractor must provide qualified labor to perform installation. Where licenses or certifications are available or required by local jurisdictions, state jurisdictions, or federal jurisdictions for certain skilled trades, such as electrical, mechanical, plumbing, welding, etc., the skilled trade workers shall have current versions of the appropriate license or certification prior to working the associated specialty.

Electrical work shall be supervised by an electrician licensed in the state of Maryland. Any time electrical work is performed, the Contractor shall provide a full time electrician for on site supervision. Electrical work shall be defined as any item of work specified in this section of the special provisions.

The contractor shall inspect all materials furnished or installed under this contract and shall bring any damage, failure, or other problem to the attention of the project inspector prior to incorporation into the work.

CONSTRUCTION

820.03.01 General

ADD: The following:
Installation, splicing, terminating, and testing of fiber optic cable shall be performed by a trained and qualified fiber optic cable technician. Copies of certifications and experience shall be submitted to the Engineer prior to commencement of work.

ADD: The following just prior to paragraph 820.04.

820.03.04 Testing Fiber Optic Cables

Tests shall be performed to verify that each fiber is connected to the proper equipment, and that it is continuous with no breaks, or damaged sections. All strands shall meet current EIA/TIA-568 specifications. Dark fibers and excessive attenuation due to breaks, bends, bad splices, defective connectors and bad installation practices will not be accepted and shall be corrected with no additional compensation. For fiber optic testing standards, see EIA-455-171 (FOTP-171), EIA 526-14.

(a) All cables shall have ST connectors installed prior to testing. All testing, for purposes of acceptance of the system, shall be conducted on fully installed and assembled fiber optic cables.

(b) Upon completion of testing, replace or repair any failed cable(s) with a new fiber or cable, and test the new cable to demonstrate acceptability.

(c) Insertion loss testing shall be performed.

(d) Tests shall be measured in dB.

(e) These tests shall use 1300 and 1550 nm for single mode fiber and the results shall be documented on paper and stored on a computer CD and shall be turned over to the electrical inspector after testing is complete. Attachment 820-A to this Section shows a sample fiber optic test report.

(f) An Optical Time Domain Reflectometer (OTDR) approved by the Engineer shall be used to conduct testing. The OTDR shall be calibrated to sheath (jacket) length, not optical length, by adjusting the unit's index of refraction. Properly trained technicians shall conduct tests.

(g) All OTDR traces shall maximize both the vertical and horizontal scales to the greatest extent possible and still fit the entire trace on the screen.

(h) A cable segment shall be deemed a failure if the total loss exceeds the calculated loss for that length of cable as indicated in Attachment 820-A. A cable segment shall fail if any individual splice loss is greater than 0.3dB, or if any mated connector pair loss is greater than 1.0dB, or if there is any point loss (over less than 1' of cable) of more than 1.0dB.

(i) After the circuit test, a functional test shall be performed. This test shall consist of allowing the system to operate as normal for 30 consecutive days. Any failures shall be repaired by the Contractor at his own expense, and the test restarted.

(j) The cables shall be retested after repair. If, after repair of the cable segment, the test results do not meet specified requirements, the Contractor shall replace the cable at no additional cost to the Authority.

820.03.05 All switches and breakers shall be operational and the operation of the devices they control verified. That is, the Contractor shall test switches and breakers to assure that the device (or devices) specified is (are) controlled and no other device (or devices) is (are) controlled.

820.03.06 All GFI protected outlets shall be tested with a suitable tester. The tester shall be a device that plugs into the outlet and indicates proper wiring of the outlet. A switch on the tester shall be utilized to introduce a ground fault that trips the GFI.

ATTACHMENT 820-A
SAMPLE FIBER OPTIC CABLE TEST REPORT

(To be filled out after installation is complete)

Job Name: FIBER SPURS **Job ID: MA-247-000-006**	**Fiber Cable:**
Location (A):	**Location (B):**

ANSI/EIA/TIA 568A: Cable Loss Factor (CLF); 1km=3280.83 feet

3.75 db/km **(0.00114 db/ft)** @ 850 nm for 62.5/125 μm MM

0.50 db/km **(0.00045 db/ft)** @ 1300 nm for 62.5/125 μm MM

0.50 db/km **(0.00015 db/ft)** @ 1310 nm and 1550 nm for OSP SM

1.0 db/km **(0.00030 db/ft)** @ 1310 nm and 1550 nm for ISP SM

0.5 Connector Loss (CL) = 0.75 db per pair of connectors

Splice Loss (SL) = 0.3 db each

To calculate ACCEPTABLE LOSS (db): Multiply cable length x (CLF) + (CL) + (SL) = DB margin:_____

Cable Length	Strand No.	A to B	B to A	Fiber ID
Feet	1			Blue
1300 NM MM	2			Orange
dB	3			Green
	4			Brown
	5			Slate
	6			White
	7			Red
	8			Black
	9			Yellow
	10			Violet
	11			Rose
	12			Aqua

Cable Length	Strand No.	A to B	B to A	Fiber ID
Feet	1			Blue
1550 NM MM	2			Orange
dB	3			Green
	4			Brown
	5			Slate
	6			White
	7			Red
	8			Black
	9			Yellow
	10			Violet
	11			Rose
	12			Aqua

Technician: _____ **Date:** _____

CATEGORY 800
TRAFFIC

SECTION 834 – RACEWAY AND BOXES

834.01 GENERAL

834.01.01 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

834.01.02 SUMMARY

This Section includes raceways, wireways, fittings, boxes, enclosures, and cabinets for electrical wiring.

834.01.03 DEFINITIONS

EMT: Electrical metallic tubing.

FMC: Flexible metal conduit.

LFMC: Liquidtight flexible metal conduit.

834.01.04 SUBMITTALS

Product Data: For surface raceways, wireways and fittings, enclosures, and cabinets.

Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.

a) Custom enclosures and cabinets.

Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

a) Structural members in the paths of conduit groups with common supports.

b) HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

Source quality-control test reports.

834.01.05 QUALITY ASSURANCE

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

Comply with NFPA 70.

834.02 PRODUCTS

834.02.01 MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

834.02.01.01 METAL CONDUIT AND TUBING

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a) AFC Cable Systems, Inc.
b) Alflex Inc.
c) Allied Tube & Conduit; a Tyco International Ltd. Co.
d) Anamet Electrical, Inc.; Anaconda Metal Hose.
e) Electri-Flex Co.
f) Manhattan/CDT/Cole-Flex.
g) Maverick Tube Corporation.
h) O-Z Gedney; a unit of General Signal.
i) Wheatland Tube Company.
j) MdTA approved equivalent.

834.02.01.02 GALVANIZED RIGID STEEL CONDUIT: COMPLY WITH ANSI C80.1.

834.02.01.03 EMT AND FITTINGS: COMPLY WITH ANSI C80.3.

a) Fittings: Compression type.

834.02.01.04 FMC: ZINC-COATED STEEL.

834.02.01.05 LFMC: FLEXIBLE STEEL CONDUIT WITH PVC JACKET.

a) Fittings: NEMA FB 1; compatible with conduit and tubing materials.

834.02.02 METAL WIREWAYS

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a) Cooper B-Line, Inc.
b) Hoffman.
c) Square D; Schneider Electric.
d) MdTA Approved equivalent.

Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 12, unless otherwise indicated.

Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

Wireway Covers: Screw-cover type.

Finish: Manufacturer's standard enamel finish.

834.02.03 BOXES, ENCLOSURES, AND CABINETS

834.02.03.01 MANUFACTURERS

a) Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
b) EGS/Appleton Electric.
c) Erickson Electrical Equipment Company.
d) Hoffman.
e) Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
f) O-Z/Gedney; a unit of General Signal.
g) RACO; a Hubbell Company.
h) Robroy Industries, Inc.; Enclosure Division.
i) Scott Fetzer Co.; Adalet Division.
j) Spring City Electrical Manufacturing Company.
k) Thomas & Betts Corporation.
l) Walker Systems, Inc.; Wiremold Company (The).
m) Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
n) MdTA approved equivalent.

Sheet Metal Outlet and Device Boxes: NEMA OS 1.

Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

Hinged-Cover Enclosures: NEMA 250, Type 12, with continuous-hinge cover with flush latch, unless otherwise indicated.

a) Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel finish.

Cabinets:

a) Aluminum
b) Hinged door in front cover with flush latch and three point concealed hinge.
c) Key latch to match panelboards.
d) Metal barriers to separate wiring of different systems and voltage.

834.03 EXECUTION

834.03.01 RACEWAY APPLICATION

Outdoors: Apply raceway products as specified below, unless otherwise indicated:

a) Exposed Conduit: Galvanized rigid steel conduit.
b) Boxes and Enclosures, Aboveground: Aluminum.

Comply with the following indoor applications, unless otherwise indicated:

a) Exposed, Not Subject to Physical Damage: EMT.
b) Exposed, Not Subject to Severe Physical Damage: EMT.
c) Exposed and Subject to Severe Physical Damage: Galvanized rigid steel conduit.
d) Boxes and Enclosures: NEMA 250, Type 12.

Minimum Raceway Size: 3/4-inch trade size.

Raceway Fittings: Compatible with raceways and suitable for use and location.

a) Galvanized Rigid Steel Conduit: Use threaded galvanized rigid steel conduit fittings, unless otherwise indicated.

834.03.02 INSTALLATION

Complete raceway installation before starting conductor installation.

Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.

Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.

a) Run parallel or banked raceways together on common supports.

b) Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

Join raceways with fittings designed and approved for that purpose and make joints tight.

a) Insulating bushings that exceed code requirements.

b) Use insulating bushings to protect conductors.

Tighten setscrews of threadless fittings with suitable tools.

Terminations:

a) Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.

b) Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.

Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

a) Where otherwise required by NFPA 70.

Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers.

834.03.03 PROTECTION

Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

a) Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

834.03.04 CLEANING

After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

834.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all raceways, wireways, fittings, boxes, enclosures and cabinets for electrical wiring and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

834.04.01 Raceways will be measured and paid for at the contract unit price per linear foot for the type and sizes specified in the contract documents.

834.04.02 Wireways, fittings, boxes, enclosures, and cabinets will be measured and paid for at the contract unit price per each type.

CATEGORY 800
TRAFFIC

SECTION 836 – LIGHTING CONTROL DEVICES

836.01 GENERAL

836.01.01 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

836.01.02 SUMMARY

This Section includes the following lighting control devices:

a) Outdoor photoelectric switches.
b) Lighting contactors.

Related Sections include the following:

a) Specification Section "Wiring Devices" for wall-switches and door switches.

836.01.03 SUBMITTALS

Product Data: For each type of product indicated.

Shop Drawings: Show installation details for light-level sensors.

a) Interconnection diagrams showing field-installed wiring.

Field quality-control test reports.

Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

836.01.04 QUALITY ASSURANCE

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

836.02 PRODUCTS

836.02.01 OUTDOOR PHOTOELECTRIC SWITCHES:

Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

a) Area Lighting Research, Inc.; Tyco Electronics.
b) Grasslin Controls Corporation; a GE Industrial Systems Company.
c) Intermatic, Inc.
d) Lithonia Lighting; Acuity Lighting Group, Inc.
e) Novitas, Inc.
f) Paragon Electric Co.; Invensys Climate Controls.
g) Square D; Schneider Electric.
h) TORK.
i) Touch-Plate, Inc.
j) Watt Stopper (The).
k) MdTA approved equivalent.

Description: Solid state, with DPST dry contacts rated for 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.

a) Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range.
b) Time Delay: 15-second minimum, to prevent false operation.
c) Surge Protection: Metal-oxide varistor, complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.
d) Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

836.02.02 LIGHTING CONTACTORS

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a) Allen-Bradley/Rockwell Automation.
b) ASCO Power Technologies, LP; a division of Emerson Electric Co.
c) Eaton Electrical Inc.; Cutler-Hammer Products.
d) GE Industrial Systems; Total Lighting Control.
e) Grasslin Controls Corporation; a GE Industrial Systems Company.
f) Hubbell Lighting.

g) Lithonia Lighting; Acuity Lighting Group, Inc.
h) MicroLite Lighting Control Systems.
i) Square D; Schneider Electric.
j) TORK.
k) Touch-Plate, Inc.
l) Watt Stopper (The).
m) MdTA approved equivalent.

Description: Electrically operated and electrically held, combination type with circuit breaker, complying with NEMA ICS 2 and UL 508.

a) Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
b) Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
c) Enclosure: Comply with NEMA 250.
d) Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

836.03 EXECUTION

836.03.01 SENSOR INSTALLATION

Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

836.03.02 CONTACTOR INSTALLATION

Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

836.03.03 WIRING INSTALLATION

Coordinate this Article with Drawings.

Wiring Method: Comply with Specification Sections 810 and 950.06. Minimum conduit size shall be 3/4 inch.

Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

836.03.04 IDENTIFICATION

Identify components and power and control wiring according to Specification Section "Electrical Identification."

a) Identify controlled circuits in lighting contactors.
b) Identify circuits or luminaries controlled by photoelectric sensors at each sensor.

Label contactors with a unique designation.

836.03.05 FIELD QUALITY CONTROL

Perform the following field tests and inspections and prepare test reports:

a) After installing sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.

b) Operational Test: Verify operation of each lighting control device, and adjust time delays.

Lighting control devices that fail tests and inspections are defective work.

836.03.06 ADJUSTING

Outdoor Photoelectric Switch Adjustments: When requested within 1 month of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit operating conditions. Provide up to two visits to Project during dawn and dusk hours for this purpose.

836.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all outdoor photoelectric switches and lighting contactors and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

836.04.01 **OUTDOOR PHOTOELECTRIC SWITCHES AND LIGHTING CONTACTORS WILL BE MEASURED AND PAID FOR AT THE CONTRACT UNIT PRICE**

CATEGORY 800
TRAFFIC

SECTION 837 – PANELBOARDS AND CIRCUIT BREAKERS

837.01 GENERAL

837.01.01 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

837.01.02 SUMMARY

This Section includes the following:

a) Distribution panelboards.
b) Lighting and appliance branch-circuit panelboards.
c) Fusible switches.
d) Molded-case circuit breakers.
e) Loadcenters

837.01.03 DEFINITIONS

EMI: Electromagnetic interference.

GFCI: Ground-fault circuit interrupter.

RFI: Radio-frequency interference.

RMS: Root mean square.

SPDT: Single pole, double throw.

837.01.04 SUBMITTALS

Panelboards shall be fully enclosed with front trim hinged to back box and door within door containing key latch, copper bus, full size ground and neutral buses located on both sides of panel interior and shall be fully rated for short circuit current indicated on respective panel schedule. Each panel shall have label identifying panel name, associated BGE meter number, voltage, phase, wire, ampacity and short circuit rating located on front cover. Each panel shall have spare circuit breakers and spaces indicated.

Contractor shall submit shop drawings for the following electrical products for Engineer approval prior to ordering material:

1. Enclosed Circuit Breakers
2. Panelboards
3. Branch Circuit Breakers
4. Fused and Non-Fused Disconnect Switches
5. Fuses
6. Dry Type Transformers
7. Control Power Transformers
8. HOA Selector Switches
9. Enclosed Contactors
10. Terminal Blocks
11. Control Distribution Cabinet Enclosure
12. Safety Barriers, Cabinet Hardware and Options

Shop Drawings shall include the following specific information:

1. Manufacture product information
2. Manufacturer installation, operation and maintenance information
3. Circuit breaker time current curves. This applies to all Panelboards and Load Centers.
4. Panelboard layouts produced by manufacturer representative specific for each panel to be provided
5. Control Distribution Cabinet layout dimensional drawings indicating all equipment inside cabinet
6. Control Distribution Cabinet outline drawings with overall dimension, weights, lifting locations and conduit openings.

Shop Drawing submittals shall indicate all options and specific components indicated with arrows and/or circles. General manufacturer data not specific to the shop drawing submittal shall be clearly indicated through use of cross out that it is not part of submittal. Incomplete submittals shall be returned without review. Submittals shall be stamped by Contractor as complying with the project drawings and specifications.

Product Data: For each type of panelboard, overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

Shop Drawings: For each panelboard and related equipment.

Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a) Enclosure types and details for types other than NEMA 250, Type 1.

b) Bus configuration, current, and voltage ratings.
c) Short-circuit current rating of panelboards and overcurrent protective devices.
d) UL listing for full rating of installed devices.
e) Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

Field quality-control test reports including the following:
a) Test procedures used.
b) Test results that comply with requirements.
c) Results of failed tests and corrective action taken to achieve test results that comply with requirements.

Panelboard Schedules: For installation in panelboards.

837.01.05 QUALITY ASSURANCE

Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

a) Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7.

Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.

Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

Comply with NEMA PB 1.

Comply with NFPA 70.

837.01.06 PROJECT CONDITIONS

Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated.

a) Ambient Temperature: Not exceeding 104 deg F.
b) Altitude: Not exceeding 6600 feet.

Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

a) Notify Owner no fewer than two days in advance of proposed interruption of electrical service.
b) Do not proceed with interruption of electrical service without Owner's written permission.

837.01.07 EXTRA MATERIALS

Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

a) Keys: Six spares for each type of panelboard cabinet lock.

837.02 PRODUCTS

837.02.01 MANUFACTURERS

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:

a) Eaton Corporation; Cutler-Hammer Products.
b) General Electric Co.; Electrical Distribution & Protection Div.
c) Siemens Energy & Automation, Inc.
d) Square D.
e) MdTA approved equivalent.

837.02.02 MANUFACTURED UNITS

Enclosures: Surface-mounted cabinets. NEMA PB 1, Type 12.

a) Rated for environmental conditions at installed location.
b) Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
c) Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
d) Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.

Phase and Ground Buses:

a) Material: Hard-drawn copper.
b) Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.

Conductor Connectors: Suitable for use with conductor material.

a) Main and Neutral Lugs: Compression type.
b) Ground Lugs and Bus Configured Terminators: Compression type.

Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.

Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

837.02.03 PANELBOARD SHORT-CIRCUIT RATING

Coordinate with Drawings.

UL label indicating full rating with integral or remote upstream overcurrent protective devices.

Include size and type of upstream device allowable, branch devices allowable, and UL full short-circuit rating.

a) Fully rated to interrupt symmetrical short-circuit current available at terminals.

837.02.04 DISTRIBUTION PANELBOARDS

Coordinate this Article with Drawings.

Doors: Secured with vault-type latch with tumbler lock; keyed alike. Omit for fused-switch panelboards.

Main Overcurrent Protective Devices: Circuit breaker.

Branch Overcurrent Protective Devices:

a) For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

837.02.05 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

837.02.06 LOAD CENTERS

Overcurrent Protective Devices: Bolt-on, full-module circuit breaker.

Conductor Connectors: Mechanical type for main, neutral, and ground lugs and buses.

837.02.07 OVERCURRENT PROTECTIVE DEVICES

Molded-Case Circuit Breaker: UL 489, with interrupting capacity to meet available fault currents.

a) Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

b) Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
   1) Instantaneous trip.
   2) Long- and short-time pickup levels.
   3) Long- and short-time time adjustments.
   4) Ground-fault pickup level, time delay, and I^2t response.

Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.

a) Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
b) Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage time delay.

Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

837.02.08 ACCESSORY COMPONENTS AND FEATURES

Furnish accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

a) Fungus Proofing: Permanent fungicidal treatment for panelboard interior, including overcurrent protective devices and other components.

837.03 EXECUTION

837.03.01 INSTALLATION

Install panelboards and accessories according to NEMA PB 1.1.

Mount plumb and rigid without distortion of box.

Install overcurrent protective devices.
a) Set field-adjustable switches and circuit-breaker trip ranges.

Install filler plates in unused spaces.

Arrange conductors in gutters into groups and bundle and wrap with wire ties.

837.03.02 IDENTIFICATION

Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Specification Section "Electrical Identification."

Create a directory to indicate installed circuit loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

837.03.03 CONNECTIONS

Ground equipment according to Specification Section "Grounding and Bonding."

Connect wiring according to Specification Section "Conductors and Cables."

837.03.04 FIELD QUALITY CONTROL

Prepare for acceptance tests as follows:

a) Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.

b) Test continuity of each circuit.

Perform the following field tests and inspections and prepare test reports:

a) Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
b) Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

837.03.05 CLEANING

On completion of installation, clean and inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

837.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all panelboards and circuit breakers and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

837.04.01 Panelboards and circuit breakers will be measured and paid for at the contract unit price per each type specified in the contract documents.

CATEGORY 800
TRAFFIC

SECTION 838 – WIRING DEVICES

838.01.01 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

838.01.02 SUMMARY

This Section includes the following:

a) Receptacles and associated device plates.
b) Wall switches.
c) Door switches.
d) Hand off Auto switches.
e) Heater controls.

838.01.03 DEFINITIONS

EMI: Electromagnetic interference.

GFCI: Ground-fault circuit interrupter.

UTP: Unshielded twisted pair.

838.01.04 SUBMITTALS

Product Data: For each type of product indicated.

838.01.05 QUALITY ASSURANCE

Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer.

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

Comply with NFPA 70.

838.02 PRODUCTS

838.02.01 MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Wiring Devices:

a) Bryant Electric, Inc./Hubbell Subsidiary.
b) Eagle Electric Manufacturing Co., Inc.
c) Hubbell Incorporated; Wiring Device-Kellems.
d) Leviton Mfg. Company Inc.
e) Pass & Seymour/Legrand; Wiring Devices Div.
f) Intermatic, Inc.
g) Square D
h) MdTA approved equivalent.

838.02.02 STRAIGHT BLADE RECEPTACLES

Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

838.02.03 WALL SWITCHES

Wall Switches, 120/277 V, 20 A: Comply with NEMA WD 1 and UL 20.

838.02.04 DOOR SWITCHES

Door Switches, 120/277 V, 20 A: Comply with NEMA WD 1 and UL 20.

838.02.05 HAND OFF AUTO SWITCHES

HOA Switches, 120/277 V, 20 A: Comply with NEMA WD 1 and UL 20.

838.02.06 PHOTOSWITCH:

Photo switch for outdoor use, 20-amperes, 277 volts AC. Photo switch contacts shall be DPDT and be energized when light level is below setpoint. Photo switch shall include indicating light to be lit when output is energized

838.02.07 WALL PLATES

Single type to match corresponding wiring devices.

Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

838.03 EXECUTION

838.03.01 INSTALLATION

Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

Coordination with Other Trades:

a) Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
b) Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
c) Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
d) Install wiring devices after all wall preparation, including painting, is complete.

Conductors:

a) Do not strip insulation from conductors until just before they are spliced or terminated on devices.
b) Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
c) The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
d) Existing Conductors:
    1) Cut back and pigtail, or replace all damaged conductors.
    2) Straighten conductors that remain and remove corrosion and foreign matter.
    3) Pigtailing existing conductors is permitted provided the outlet box is large enough.

Device Installation:

a) Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
b) Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
c) Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
d) Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
e) Use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
f) Use a torque screwdriver when a torque is recommended or required by the manufacturer.
g) When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
h) Tighten unused terminal screws on the device.
i) When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

Receptacle Orientation:

a) Install ground pin of vertically mounted receptacles up.

Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

838.03.02 IDENTIFICATION

Comply with Specification Section "Electrical Identification."

a) Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with red-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

838.03.03 CONNECTIONS

Ground equipment according to Specification Section "Grounding and Bonding."

Connect wiring according to Specification Section "Conductors and Cables."

Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

838.03.04 FIELD QUALITY CONTROL

Perform the following field tests and inspections and prepare test reports:

a) After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.
b) Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

Remove malfunctioning units, replace with new units, and retest as specified above.

838.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for receptacles, switches and heater controls and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

838.04.01 Receptacles, switches, and heater controls will be measured and paid for at the contract unit price per each type.

SECTION 875-UTILITIES STATEMENT

DESCRIPTION. The Contractor's attention is called to the requirements of Sections GP-5.05, GP-7.13 and GP-7.17.

MATERIALS. Not Applicable.

CONSTRUCTION.

(a) Attention of the Contractor is directed to the possible presence of water, sewer, gas mains, electrical wires, conduit, communications cables (both overhead and underground), poles and house service connections in the street or highway in which the construction project is to be performed. The Contractor shall exercise special care and extreme caution to protect and avoid damage to utility company facilities as described in the preceding sentence. The Contractor shall take into consideration the adjustments and installations by public utilities in areas within the limits of this Contract. Existing utilities have been generally located and shown on the Plans as they are believed to exist; however, the Administration assumes no responsibility for the accuracy of these locations.

Prior to ordering any storm drain materials, the Contractor shall locate and test pit any underground facilities that appear to be in conflict in order to determine if conflicts exist. In the event that conflicts may be possible, this information shall immediately be forwarded to the State's representative for review and resolution.

(b) The Contractor shall locate all existing utilities and be responsible for their safety. Should any existing utilities be damaged or destroyed due to the operations of the Contractor, the damaged or destroyed components shall be immediately replaced or repaired as necessary to restore the utility to a satisfactory operating condition. These repairs or replacements shall be at no additional expense to the Administration or the owner of the utility.

(c) The existing utilities requiring relocation or adjustment shall be relocated or adjusted by the agency responsible for their maintenance or by the owner of the utility unless otherwise indicated in the Contract Documents. The Contractor shall inform the respective utility companies at least five days prior to working in any area. In addition, the Contractor shall give sufficient notice to the specific utilities of the Contractor's overall plan for construction. The utility companies will establish the lead-time necessary to meet the applicable utility work schedule and coordinate with the Contractor's work operations based upon the Contractor's overall plan.

(d) Any submittal by the Contractor to vary the sequence of work and/or perform concurrent work in multiple phased differing from the recommended maintenance of traffic phasing, must be accompanied by an updated schedule or CPM reflecting all utility relocation's and adjustments. The Contractor shall be responsible, upon gaining approval, for coordinating utility relocations and adjustments with the affected utility owners, MdTA project manager. All requirements and lead times as stated in the Utility Statement and Special Provisions will remain in effect unless written approval for the utility company and the District Utility Engineer is received by the Contractor prior to the commencing any requested work.

(e) The following known utility companies may have existing facilities or may have adjustments/installations within the limits of this Contract:

Baltimore Gas Electric Company-Electric

Mr. RJ Marshall
410-597-7835

Mr. Matthew McMichael
410-597-7062

BGE-Electric has aerial and underground facilities within the limits of this project. No conflicts are anticipated for this project, however, the Contractor(s) shall exercise caution when working in their vicinity. It will be the responsibility of the Contractor to contact Mr. Woody Wilson at 410-291-4866, to obtain replacement manhole frames and covers. Mr. Wilson will need two weeks advance notice to adjust the larger manhole frames and covers and/or to replace any defective frames and covers.

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Baltimore Gas & Electric Company-Gas

Mr. Douglas Walter
410-291-5122

BGE-Gas has underground facilities within the limits of this project. No conflicts are anticipated, however, the Contractor(s) shall exercise caution when working in their vicinity. It will be the responsibility of the Contractor to contact Mr. Woody Wilson at 410-291-4866, to obtain replacement manhole frames and covers. Mr. Wilson will need two weeks advance notice to adjust the larger manhole frames and covers and/or to replace any defective frames and covers.

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Baltimore Gas & Electric Company-Outdoor Street Lighting Mr. Nick Costa
410-291-3615

BGE- Outdoor Street Lighting has facilities within the limits of this project. No conflicts are anticipated, however, the Contractor(s) shall exercise caution when working in their vicinity.

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Verizon Mr. Stephen Oconnor
410-393-6377

Verizon has aerial and underground facilities within the limits of this project. No conflicts are anticipated for this project, however, the Contractor(s) shall exercise caution when working in their vicinity. The Contractor(s) are not to open and/or enter into any of Verizon's manholes. It will be the responsibility of the Contractor to contact Mr. Tony Maiorana at 410-393-6144, prior to paving to allow Verizon to adjust any of their manholes.

Attention of the Contractor is directed to Verizon's need to relocate its overhead facilities along Quarantine Road crossing MD 695 in advance of the upcoming MdTA contract. This relocation work may be required to be performed during the construction phase of this project. If required, Verizon will establish the lead-time necessary to meet the applicable utility work schedule and coordinate with the Contractor's work operations based upon the Contractor's overall plan.

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Baltimore City Department of Public Works Mr. Michael Schultz
410-396-3500

Baltimore City has water and sewer facilities within the limits of this project. No conflicts are anticipated, however, the Contractor(s) shall exercise caution when working in their vicinity.

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Baltimore City Department of Transportation-Traffic/Conduit Mr. Richard Baker
410-396-6870

BCDOT Traffic/Conduit Section facilities within the limits of this project. Conflicts are anticipated, however, the Contractor(s) shall exercise caution when working in their vicinity.

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Baltimore City Department of Transportation-Street Lighting — Mr. William Colbert 410-396-6870

BCDOT Street Lighting facilities within the limits of this project. Conflicts are anticipated, however, the Contractor(s) shall exercise caution when working in their vicinity.

Comcast Cablevision of Baltimore City — Mr. James Moore 410-649-4900 Ext. 4841

Comcast has indicated they have no facilities within the limits of this project.

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NOTE: THE CONTRACTOR SHALL MAKE ALL ADJUSTMENTS TO SURFACE UTILITY FRAME AND COVERS, WATER VALVES, AND WATER METERS. THE COST OF THESE ADJUSTMENTS SHALL BE INCIDENTAL TO THE PRICE BID FOR BITUMINOUS CONCRETE SURFACE AS PER SECTION 504.04 OF THE SPECIFICATIONS OR THE VARIOUS SIDEWALK, DRIVEWAY AND CURB/GUTTER WORK UNLESS THE ADJUSTMENT IS TWELVE INCHES OR MORE, IN THESE CASES THE ADJUSTMENT SHALL BE PAID FOR UNDER THE PERTINENT LINE ITEM. ALL ADJUSTMENTS SHALL BE DONE ACCORDING TO THE PERTINENT UTILITY OWNERS SPECIFICATIONS. THE CONTRACTOR SHALL CONTACT THE PERTINENT UTILITY OWNERS PRIOR TO ADJUSTMENT OF ANY FACILITY. CONTRACTOR WILL REQUEST UTILITY TO ACCEPT IN WRITING ALL ADJUSTMENTS UPON COMPLETION OF WORK AND ARRANGE A FIELD MEETING BETWEEN THE UTILITY, THE CONTRACTOR AND THE MdTA PROJECT STAFF.

(f) When it is necessary to use steel plates at any point during construction, the following minimum requirements shall be met:

1) **Steel plates are to be no less than 1-inch thick.**
2) **Steel plates are to cover access pit(s) with a 1-foot overlap onto existing pavement on all four sides of access pit(s).**
3) **When only three sides overlap existing roadway, the fourth side shall be supported by a 12"X 12"I beam or timber.**
4) **In cases where plates are used to cover extremely large excavations, it will be necessary to install an immediate support system to prevent deflection.**
5) **Steel plates must be pinned to prevent movement.**
6) **Steel plates must be ramped with cold patch or hot mix asphalt at end of each work shift.**
7) **It will be necessary to recess any steel plates that are placed in the roadway during the winter months.**

8) **In cases where two or more are placed together, they shall be welded together by placing at least three welds, 12 inches (centered on each plate) in length on each abutting plate. One weld is placed no more than one foot from each edge and one is placed in the center of the plates.**

(g) All notifications to the above utility companies and **"MISS UTILITY"**, 1-800-257-7777, shall be given 48 hours (two full working days) in advance of working in the area of the specific affected utility. The notification to **"MISS UTILITY"** is required whenever any excavating or similar work is to be performed.

(h) If an adjustment is required to facilities, it is necessary that the existing facilities remain in service until the new construction is complete and placed in service. Also, when adjustments are required, establishment of lead times are necessary to meet the applicable utility schedule and coordination with the Contractor's work operation.

MEASUREMENT AND PAYMENT. Working around or protecting existing aerial and underground utilities, regardless of ownership (State or Public); removal of temporary materials from the adjusted utilities prior to placement of the proposed hot mix asphalt; cooperation with the owners of the utilities and with other Contractors will not be measured for payment and the cost will be incidental to the items specified in the Contract Documents.

CATEGORY 800
TRAFFIC

SECTION 898 – BALTIMORE CITY CONCRETE FOUNDATIONS FOR TRAFFIC AND LIGHTING STRUCTURES (VARIOUS TYPES)

898.01 DESCRIPTION

Construct concrete foundations for installing Baltimore City traffic signal poles pedestal pole, joint-use signal pole and lighting pole bases.

898.02 MATERIALS

A. Concrete: Concrete for foundations shall be Mix No. 2.

B. Steel Reinforcement: Steel reinforcement shall be ASTM A 65, Grade 60.

C. Non-Shrink Leveling Grout: Minimum Compressive Strength = 5,000 psi.

D. Epoxy Grout: Hilti-HY 150 Max Adhesive Anchoring System, or Equal. Minimum Tensile Strength = 18, 000 psi.

E. Anchor Bolts for Traffic Signal Poles and Pedestal Poles: Anchor bolts shall be fabricated from high strength steel conforming to ASTM A-449 having minimum yield strength of 105,000 P.S.I. The anchor bolts shall be fully galvanized using the hot dip method in accordance with ASTM A-153. The top nine inches of each bolt shall be threaded. There shall be four (4) anchor bolts provided for each pole. Each bolt shall be provided with two (2) hex nuts conforming to ASTM A-194, Grade 2H and (2) flat washers conforming to ASTM F-436. Both nuts and washers shall be hot dip galvanized. After galvanizing, the nuts shall fit onto the threaded end of the anchor bolts hand tight. Each anchor bolt shall be furnished with plated steel nuts and plated flat washer conforming to ASTM F-436.

F. Ground Rods Section 804.

898.03 CONSTRUCTION METHOD

The Contractor shall perform all excavation to neat lines for the levels and dimensions specified in the Contract Documents. All excavation work will be inspected and approved by the Engineer before proceeding with construction. Approved material selected from the excavation shall be used for backfill.

Excavation for foundation installation shall be by hand method; or mechanical method, if specified in the Contract Documents. All foundations shall be Test Pit using non-destructive methods to ensure clearance from obstructions and utilities.

In fill areas, the fill shall be completed prior to construction of the bases. The base excavation may be augured provided the top six inches (6") of the base is blocked square.
Galvanized parts that have been cut or chipped to bare metal shall be repaired as specified in A.S.T.M. specification.

The Contractor shall furnish and install stainless or galvanized steel nuts and washers, if poles are to be installed as an item of work; otherwise, the nuts and washers furnished by the Contractor shall be delivered to the Engineer.

It is intended that all concrete for foundations are poured against existing undisturbed earth. However, where the existing ground will not retain its shape during or after excavation, or if the excavation should show any tendency to cave in before placing the foundation, the Contractor shall provide a sleeve or form to retain the earth and receive the concrete. Sleeve material shall be composed of sheet steel formed to the required shape. The sleeve shall be carefully driven to the required depth. As the concrete is placed, the sleeve shall be carefully withdrawn so that the wet concrete will flow into intimate contract with the sides of the excavation. All concrete for foundations shall be placed in a continuous operation. When the sleeve is entirely withdrawn, provide above grade forms and templates to complete the foundation.

Concrete shall not be placed in the foundation by dumping from the top. If there is no groundwater present in the excavation, the method of placing the concrete shall be approved by the Engineer. If there is groundwater in the foundation, the concrete shall be placed by tremie or other method approved by the Engineer. The concrete in a foundation shall be vibrated.

Bases for signal and lighting structures shall be installed to the grade of adjacent footway or as indicated in the Contract Documents.

Poured concrete foundations shall be allowed to cure for at least 72 hours prior to installing the poles.

Concrete shall be mixed, placed and tested as specified in the contract documents. Footings including reinforcement and bolt circle data shall be as specified in the Contract Documents or in conformance with approved working drawings. Anchor bolts shall be plumb. Suitable templates for setting anchor bolts shall be supplied by the Contractor and shall be accurately placed and left in place until the concrete has attained its initial set. Two of the bolts shall be on a line parallel to the roadway unless otherwise indicated in the Contract Documents.

Tops of foundations shall be screened to a dense smooth finish. Exposed surfaces shall be cured by use of a liquid membrane curing compound. The top 6" of base shall be boxed square.

Elbow(s) of the type(s) and size(s) specified shall be placed in each foundation.

898.04 MEASUREMENT AND PAYMENT

Measurement of this item will be on a per each basis and quantity to be paid for will be the actual number of signal, pedestal, lighting and/or joint-use pole bases of various sizes actual installed and accepted. This work will be paid for at the Contract Unit price bid per each for the specific Signal, Pedestal, Lighting and/or Joint Use Pole bases indicated in the Proposal, which price and payment shall constitute full compensation for all materials, including ground rods, labor, tools, equipment, hauling, cement concrete, formwork, finishing, anchor bolts, stainless steel nuts and washers, protective sleeves and nuts, galvanizing, compaction, re-compaction, disposal of unsuitable material, and incidentals necessary to complete the work.

CATEGORY 800
TRAFFIC

SECTION 899 BALTIMORE CITY LIGHTING HAND BOXES

899.01 DESCRIPTION. This work shall consist of furnishing and installing Baltimore City Lighting Hand Boxes as specified in the contract documents, or as directed by the Engineer.

899.02 MATERIALS. The Baltimore City Lighting Hand Box shall be a precast polymer concrete hand box consisting of a fiber glass reinforced polymer concrete box and cover. Dissimilar materials for the box and cover will not be accepted. The hand box shall be a nominal 13" X 24" X 18" with an open bottom. The hand box shall have 2 hex nuts. Hand Box shall be Quazite Style PG or approved equal.

The hand box and cover shall be rated at a design load of 22,500 lbs. and comply with ANSI / SCTE 77.

The cover shall provide a water tight seal on the hand box and be secured with two pentagonal bolts. Each cover shall bear the logo "STREET LIGHTING" clearly stamped on the cover. All covers are to be skid resistant, with a minimum coefficient of friction of 0.50 in accordance with ASTM C 1028.

899.03 CONSTRUCTION. All hand boxes are to be installed on 6" of pea gravel compacted. The gravel bed shall extend past the limits of the hand box by four inches in every direction. The hand box shall be set to the finished grade.

Backfill any voids with suitable material from the excavation of by using select backfill compacted to 92% proctor.

This polymer hand box does not require a ground rod.

899.04 MEASUREMENT AND PAYMENT. Polymer concrete hand boxes shall be made on a per each basis for each hand box installed and accepted by the Engineer. The bid price shall be full compensation for all excavation, pea gravel, hand box and cover, backfill and all labor and incidentals necessary to provide a complete hand box in place and acceptable to the Engineer.

CATEGORY 900
MATERIALS

665 **DELETE:** SECTION 902 — PORTLAND CEMENT CONCRETE AND RELATED PRODUCTS in its entirety.

INSERT: The following.

SECTION 902 — PORTLAND CEMENT CONCRETE AND RELATED PRODUCTS

902.01 STORAGE. Storage of materials shall conform to the Contract Documents and as directed by the Engineer.

902.02 CERTIFICATION OF PORTLAND CEMENT AND BLENDED HYDRAULIC CEMENT. The manufacturer shall furnish certification as specified in TC-1.02. The certification shall also include:

(a) The mill shall report its quality control procedures, and submit a new report whenever there is a procedural change.

(b) The mill's control laboratory shall be inspected by the Cement and Concrete Reference Laboratory of the National Institute of Standards and Technology on their regularly scheduled visits. The Engineer shall be provided with copies of the reports of these inspections along with an account of the action taken to correct cited deficiencies.

(c) Records of data accumulated by the quality control procedures shall be produced upon request.

(d) A certified document shall accompany each shipment stating that the contents conform to all applicable requirements. Additionally, the document shall show the producer's name, mill location, carrier number, date loaded, weight contained in carrier, silo number, consignee, destination, Contract number, and type of cement. The signature and title of the signer shall be shown on the document.

(e) The mill shall, upon request, supply certified chemical and physical test values that can be associated with any sample representing cement drawn from a particular silo on a given date.

(f) Acceptance of cement by certification will be terminated if test results differ from mill results by more than the precision limits given in the test method. The acceptance procedure will then revert to storage testing and approval prior to shipment.

902.03 HYDRAULIC CEMENT.

902.03.01 Portland Cement. M 85, with the fineness and the time of setting determined using T 153 and T 131, respectively.

902.03.02 Ground Iron Blast Furnace Slag. M 302, Grade 100 or 120. The Contractor may request to substitute a maximum of 50 percent of the weight of cement with ground iron blast furnace slag. When ground iron blast furnace slag is used, the minimum cement factor and water/cement ratio will be determined on the basis of the combined weight of the portland cement and ground iron blast furnace slag. When ground iron blast furnace slag is used to control alkali silica reactivity, see Table 902 B for percentage.

902.04 BLENDED HYDRAULIC CEMENT. M 240, Type I (PM) or a Type IP containing 15 to 25 percent pozzolan by weight of cement. Maximum loss on ignition is 3.0 percent. Do not use ground iron blast furnace slag for blending. The requirement for a manufacturer's written statement of the chemical composition is waived.

902.05 MASONRY CEMENT. C 91, except the water retention and staining tests are waived.

902.06 CONCRETE ADMIXTURES. Do not use concrete admixtures that contribute more than 200 ppm of chlorides based on the cement content when tested per MSMT 610. Use only prequalified admixtures.

Do not use pozzolan and Type I (PM) or Type IP cement in the same mix. Since the strength gains are delayed with these materials, a longer period of time may be required for curing and form removal.

902.06.01 Air Entraining Admixtures. M 154.

902.06.02 Chemical Admixtures. M 194, Type A, D, or nonchloride C.

902.06.03 High Range Water Reducing Admixtures. M 194, except that it shall be a liquid, the water content shall be a maximum of 85 percent of that of the control, and the durability factor shall be a minimum of 90. Use Type F for early strength, which shall produce a minimum compressive strength in 12 hours of 180 percent of that of the control. Use Type G when early strength is not specified. The manufacturer shall furnish certification as specified in TC-1.02. The certification shall include curves indicating the fluid ounces of admixture per 100 lb of cement as related to water reduction and strength gain for 12 hours when used with a minimum cement factor of 700 lb.

902.06.04 Pozzolans. The use of pozzolans may be requested to control alkali silica reactivity or for other reasons. When a pozzolan is used, determine the minimum cement factor and water/cement ratio on the basis of the combined weight cement and pozzolan. See Table 902 B for percentage of fly ash, and microsilica.

(a) Fly Ash. M 295, pozzolan Class C or F, except that the maximum permissible moisture content shall be 1.0 percent, and when used in concrete Mix Nos. 3 and 6 the maximum loss on ignition 3.0 percent.

(b) Microsilica. C 1240, except that the oversize requirement is waived.

902.06.05 Corrosion Inhibitors. Corrosion inhibitors shall be calcium nitrite based and contain a minimum of 30 percent active ingredients by mass. The gallonage of corrosion inhibitor used in the concrete mixture shall be included as water when determining the water/cementitious materials ratio.

902.07 PORTLAND CEMENT CONCRETE CURING MATERIALS. Use burlap cloth, sheet materials, liquid membrane forming compounds, or cotton mats.

902.07.01 Burlap. M 182, Class 1, 2, or 3.

902.07.02 Sheet Materials. M 171 with the following exceptions:

(a) White Opaque Burlap Polyethylene Sheeting. Tensile strength and elongation requirements are waived. Use sheeting having a finished product weight of not less than 10 oz/yd^2.

(b) White Opaque Polyethylene Backed Nonwoven Fabric. 902.07.02(a), with the thickness requirement waived. Use material having a finished product weight of not less than 5 oz/yd^2.

(c) White Opaque Polyethylene Film. Tensile strength and elongation requirements are waived.

902.07.03 Liquid Membrane. M 148. Field control testing of the white pigmented curing compounds is on the basis of weight per gallon. The samples shall not deviate more than ± 0.3 lb/gal from the original source sample.

902.07.04 Cotton Mats. Cotton mats consist of a filling material of cotton bats or bats covered with unsized cloth and tufted or stitched to maintain the shape and stability of the unit under job conditions of handling.

Use coverings of either cotton cloth, burlap or jute having the following properties:

(a) Cotton cloth covering shall weigh not less than 6.0 oz/yd^2 and have an average of not less than 32 threads/in. of warp and not less than 28 threads/in. of filling. Use raw cotton, cotton comber waste, cotton card strip waste, or combinations thereof as the raw material used in the manufacture of the cotton cloth.

(b) Burlap or jute covering for cotton mats shall weigh not less than 6.4 oz/yd^2 and shall have not less than of 8 threads/in. of warp and not less than 8 threads/in. of filling. Use the grade known commercially as "firsts" and they shall be free from avoidable imperfections in manufacture and from defects or blemishes affecting the serviceability.

Use a cotton bat, or bats made of raw cotton, cotton waste, cotton linters, or combinations thereof, as the filling material for the mats. Mats shall weigh not less than 12 oz/yd^2.

902.08 FORM RELEASE COMPOUNDS. Use form release compounds that effectively prevent the bond of the concrete to the forms. Form release compounds shall not cause discoloration of the concrete or adversely affect the quality or rate of hardening at the interface of the forms.

The flash point of the form release compound shall not be less than 100 F when tested per T 73.

902.09 PARAFFIN WAX. Use clear paraffin wax for use as a bond breaker for concrete. The flash point shall not be less than 380 F when tested under D 92.

902.10 PORTLAND CEMENT CONCRETE. Section 915 and as specified herein.

902.10.01 Proportioning. Prior to the start of construction, submit to the AME the source and proportions of materials to be used for each concrete mix. The mixture shall meet 902.10.03.

The concrete, with the exception of water and chemical admixtures, shall be proportioned by weight. Water and chemical admixtures may be proportioned by volume or weight. The mix shall be uniform and workable.

902.10.02 Materials.

Coarse Aggregate	901.01
Fine Aggregate	901.01
Cement	902.03 and 902.04
Concrete Admixtures	902.06
Synthetic Fibers	902.15
Water	921.01

902.10.03 Portland Cement Concrete Mixtures.

The concrete mixes shall conform to the following:

TABLE 902 A

PORTLAND CEMENT CONCRETE MIXTURES									
MIX NO.	28 DAY SPECIFIED COMPRESSIVE STRENGTH psi	STANDARD DEVIATION psi	CRITICAL VALUE psi	MIN CEMENT FACTOR lb/yd³	COARSE AGGREGATE SIZE M 43 / M 195	MAX WATER/ CEMENT RATIO by wt	SLUMP RANGE in.	TOTAL AIR CONTENT %	CONCRETE TEMPERATURE F
1	2500	375	2430	455	57, 67	0.55	2 — 5	5 — 8	70 ± 20
2	3000	450	3010	530	57, 67	0.50	2 — 5	5 — 8	70 ± 20
3	3500	525	3600	580	57, 67	0.50	2 — 5	5 — 8	70 ± 20
4	3500	525	3600	615	57, 67	0.55	4 — 8	N/A	70 ± 20
5	3500	525	3600	580	7	0.50	2 — 5	5 — 8	70 ± 20
6	4500	675	4770	615	57, 67	0.45	2 — 5	5 — 8	65 ± 15
7	4200	630	4420	580	57	0.50	1½ — 3	5 — 8	70 ± 20
8	4000	600	4180	750	7	0.42	2 — 5	5 — 8	65 ± 15
9	3000 (a)	N/A	N/A	800	57, 67	0.45	4 — 8	5 — 8	70 ± 20
10	4500	675	4770	700	¾" – No. 4	0.45	2 — 5	6 — 9	65 ± 15
11	4200	630	4420	—	57, 67	0.45	2 — 5	5 — 8	65 ± 15
12	4200	630	4420	—	¾" – No. 4	0.45	2 — 5	6 — 9	65 ± 15

Note 1: When concrete is exposed to water exceeding 15,000 ppm sodium chloride content, Type II cement shall be used. In lieu ofType II cement, a Type I cement may be used in combined form with an amount of up to 50 percent replacement with ground iron blast furnace slag, or an amount of up to 25 percent replacement with Class F fly ash. The Contractor shall submit to the Engineer the proposed mix proportions and satisfactory test results per C 1012 showing a sulfate resistance expansion not exceeding 0.10 percent at 180 days

Note 2: The temperature of Mix No. 6 when used for other than superstructure work as defined in TC-1.02 shall be 70 ± 20 F.

Note 3: Type A or D admixture shall be added to bridge, box culvert, and retaining wall concrete.

Note 4: Nonchloride Type C admixtures may be used when approved by the Engineer.

Note 5: Other Slump Requirements:
When a high range water reducing admixture Type F or Type G is specified, the slump shall be 4 to 8 in.
When synthetic fibers are specified, the slump shall be 5 in. maximum.
When concrete is to be placed by the slip form method, the slump shall be 2-1/2 in. maximum.
When the absorption of the coarse aggregate is greater than 10 percent, the slump shall be 3 in. maximum.

Note 6: Mix 9 shall contain a Type F high range water reducing admixture.

Note 7: Mix 10 and 12 shall be proportioned as specified in 211.2 of the ACI's Recommended Practices for Selection Proportions for. Structural Lightweight Concrete. The maximum average Density of Cured Concrete shall be 118 lb/ft³. Control testing for Density of Cured Concrete shall be two companion cylinders for each 100 yd³, or fraction thereof, as specified in M 195.

Note 8: Mix 11 and 12 shall also conform to all requirements as specified in Table 902 C.

(a) Acceptance will be based on a minimum compressive strength of 3000 psi in 24 hours. Design approval will be given based on trial batch obtaining a minimum compressive strength of 2500 psi in 12 hours. Testing shall conform to 902.10.08 except that cylinders shall remain in the molds until tests are conducted.

Coarse and fine aggregate having an expansion up to 0.10 percent when tested for alkali silica reactivity (ASR) MSMT 212 may be used without restriction. Aggregates having an expansion greater than 0.10 but less than 0.35 percent are considered reactive and may only be used when one of the options in table 902 B are employed. Those having an expansion of 0.35 percent and greater are prohibited.

TABLE 902 B

OPTION	ALKALI CONTENT OF CEMENT % max	REPLACE CEMENT WITH		SPECIFICATION
		MATERIAL	% BY WEIGHT	
1	1.50	Class F Fly Ash	15 – 25	M 295
2	1.50	Ground Iron Blast Furnace Slag	25 – 50	M 302 Grade 100 or 120
3	1.50	Microsilica	5 – 7	C 1240
4	—	Blended Cement (a)	100	M 240
5	0.60 (b)	Low Alkali Cement	100	M 85

(a) Pozzolan content of 15 – 25 percent by weight of cement
(b) For mix 9 used for Portland cement concrete pavement repairs; the maximum allowable percentage of alkalies in Portland cement shall be 0.70.

When reactive aggregate is used, designate which option will be used to control the formation of the ASR gel. If an option other than option 5 in Table 902 B above is chosen, conduct tests per MSMT 212 using the reactive aggregate and the proposed cementitious material. The expansion test results shall not be greater than 0.10 percent. When more than one reactive aggregate is used in a concrete mix, each shall be tested individually and the maximum amount of pozzolan required to reduce the expansion of all the aggregates to 0.10 percent or less shall be used. Submit the aggregate source, test results, and the percent and type of replacement cement to the Engineer. The Engineer may withhold source approval pending verification testing.

TABLE 902 C

MIX PHYSICAL PROPERTIES		
TEST PROPERTY	**TEST METHOD**	**SPECIFICATION LIMITS**
Minimum Cementitious Materials Factor, lb/yd^3	—	580
Maximum Content of Portland Cement, lb/yd^3	—	550
Water/Cementitious Materials Ratio by Wt.	—	0.45
Corrosion Inhibitor, gal/yd^3	902.06.05	2.0
Synthetic Fibers, lb/yd^3	902.15	1.5
Permeability of Field Concrete, moving average of three tests, coulombs max	T 277. Modified	2500
Permeability of Field Concrete, individual test, coulombs max	T 277 Modified	3000
Shrinkage at 28 days, microstrains	C 157	400

Note 1: Only Type I or II Portland cement shall be used.

Note 2: Mixes shall contain ground iron blast furnace slag, fly ash or microsilica.

Note 3: The water to cement ratio shall be based upon the total water to cementitious materials ratio. The gallonage of the corrosion inhibitor shall be included in the water/cementitious materials ratio.

Note 4: The permeability test value of field concrete shall be the average of two test specimens representing production concrete. Test specimens shall be molded on the project site in 4 x 8 in. molds conforming to M 205. Test specimens shall be handled under same conditions as compressive strength test specimens in conformance with C 31 for the first seven days. When seven days old, they shall be cured in a 100 F water bath for the remainder of the 28 day curing. The 28 day rapid chloride permeability of the specimens will be determined in conformance with T 277. Test for the geometry of test specimens will be waived.

Note 5: Shrinkage tests will be performed on trial mixes only.

Note 6: High range water reducing admixture may be used except the water reducing requirements will be waived.

Note 7: A sealer conforming to 902.12 shall be used on the finished surface.

902.10.04 Trial Batch. A trial batch shall be prepared to certify that each mix meets 902.10.05 and 902.10.06. Approval will be given when the test results meets the minimum required average strength.

Make arrangements with the AME at least two weeks in advance, to have an authorized representative present during the batching and testing. Each trial batch shall consist of at least 3 yd^3 of concrete. Supply all equipment, and labor required to produce the trial batches and conduct the required tests at no additional cost to the Administration.

The AME may waive the requirement for a trial batch when past performance records show that the required average strength requirement has been met.

902.10.05 Design Required Average Strength.

Specified compressive strength, f_c', psi	Required average compressive strength, f_{cr}', psi
$f_c' \leq 5000$	Use the larger value computed from Eq. (A-1) and (A-2) $f_{cr}' = f_c' + 1.34s$ (A-1) $f_{cr}' = f_c' + 2.33s - 500$ (A-2)
Over 5000	Use the larger value computed from Eq. (A-1) and (A-3) $f_{cr}' = f_c' + 1.34s$ (A-1) $f_{cr}' = 0.90 f_c' + 2.33s$ (A-3)

where:

f_c' = the 28 day specified compressive strength.
s = the standard deviation as specified in 902.10.06.

A test is defined as the average strength of two companion cylinders.

902.10.06 Standard Deviation.

(a) When past performance records are available, a standard deviation will be established from documented performance records of the producer consisting of a minimum of 15 consecutive 28 day compressive strength tests obtained within the last 12 months.

The standard deviation will be established as the product of the calculated standard deviation and multiplier.

NUMBER OF TESTS	MULTIPLIER FOR STANDARD DEVIATION
15	1.16
20	1.08
25	1.03
30 or more	1.00

Interpolate for intermediate number of tests.

(b) When past performance records are not available, the required average strength shall meet to the following:

Specified compressive strength, f_c', psi	Required average compressive strength, f_{cr}', psi
$f_c' < 3000$	$f_{cr}' = f_c' + 1000$
$3000 \leq f_c' \leq 5000$	$f_{cr}' = f_c' + 1200$
$f_c' > 5000$	$f_{cr}' = 1.10 f_c' + 700$

902.10.07 Standard of Control. The average of all sets of three consecutive strength tests shall equal or exceed the critical value as specified in 902.10.03 which shall be computed using the following formula:

Critical Value = $fc^{'}$ + (1.14 X S) – 500

Failure to conform to this criteria shall be cause for immediate investigation and remedial action up to and including suspension of production. A design standard deviation equal to 15 percent of the specified strength shall be used for calculation until a minimum of 15 test results are obtained.

The actual average strength and standard deviation shall be computed upon the availability of 28 day strength data comprising a minimum of 15 tests. Should this determination indicate an excessive margin of safety, the concrete mix may be modified to produce lower average strength as approved by the Engineer. If these calculations indicate a coefficient of variation greater than 15, the quality of the concrete and testing will be evaluated.

902.10.08 Testing. Sampling per T 141. Testing as follows:

TEST	METHOD	MINIMUM TEST FREQUENCY	RESPONSIBILITY
Temperature (e)	T 309	1 per 50 yd^3 (or fraction thereof)	Project Engineer
Slump (a)(e)	T 119	1 per 50 yd^3 (or fraction thereof)	Project Engineer
Air Content (a)(e)	T 152 T 196	1 per 50 yd^3 (or fraction thereof)	Project Engineer
Compression (b)(c)(d)	T 23	1 per 50 yd^3 (or fraction thereof)	Project Engineer
Compression (b)(c)(d) Mix No. 7 Only	T 23	3 per Day	Project Engineer

(a) A second test will be made when the first slump or air content test fails. Acceptance or rejection will be based on the results of the second test.
(b) Compressive strength tests are defined as the average of two companion cylinders.
(c) The Contractor shall be responsible for the making of all early break cylinders and furnishing the molds, stripping, curing/delivery of all cylinders, including 28 day cylinders, to the testing laboratory.
(d) The Project Engineer will be responsible for making, numbering and signing the 28 day cylinders.
(e) When constructing plain and reinforced concrete pavements, the testing frequency for slump, air content, and temperature shall be 1 per 100 yd^3 or fraction thereof.

902.10.09 Acceptance. Concrete will be acceptable if both of the following requirements are met:

(a) The average of all sets of three consecutive strength tests equal or exceed the specified design strength.

(b) No individual strength test (average of two companion cylinders) falls below the specified design strength by more than 500 psi.

902.10.10 Price Adjustment. A price adjustment will be based on the Contract unit price per cubic yard of concrete. If the unit is a lump sum item, the price per cubic yard for the concrete will be determined by dividing the cubic yards into the Contract lump sum price.

(a) Test Results More Than 500 psi Below the Specified Design Strength. Failing strength tests will be considered individually with a price adjustment being applied on the percentage basis as shown below.

(Price per yd^3) X (quantity of yd^3 represented by the failing concrete strength) X (percent of failure).

Example:

$400.00 per yd^3 X 50 yd^3 X [1-(3600/ 4500 psi)] = $4,000.00

No payment will be allowed when the test results fall below 50 percent of the specified design strength for structural concrete or 40 percent for incidental concrete.

The Engineer will determine when the strength of the concrete represented by the failing tests is sufficient to remain in place or whether it must be removed and replaced with Specification concrete.

(a) Test Results 500 psi or Less than the Specified Design Strength. Strength failures 500 psi or less than the specified design strength will be averaged with the next two consecutive tests. If those two tests include a failure greater than 500 psi, those tests will be evaluated as in 902.10.10(a) and replaced with the next consecutive test. If the resulting average falls below the specified design strength, a price adjustment will be applied as specified in the table below. Any failure will only be included in one grouping.

STRENGTH BELOW THE SPECIFIED (avg of 3 tests) DESIGN LEVEL, psi	**ADJUSTMENT FACTOR**
MIX NO. 1 THRU MIX NO. 7	
1 – 100	0.005
101 – 200	0.01
201 – 300	0.02
301 – 400	0.04
401 – 500	0.08

Adjustment price equals (price per yd^3) X (quantity of yd^3 represented by the failing cylinders) X (the adjustment factor).

Example:

$400.00 per yd^3 X 50 yd^3 X 0.01 = $200.00

902.11 MORTAR FOR GROUT. Mortar used for grouting anchor bolts, pipe, handrail posts, and miscellaneous items shall be composed in accordance with one of the following:

(a) One part Portland cement or blended hydraulic cement and one part mortar sand by dry loose volume.

(b) Prepared bag mixes consisting of Portland cement or blended hydraulic cement and mortar sand. The prepared mixes shall produce a mortar meeting the strength requirements specified in the Contract Documents.

(c) Use nonshrink grout when specified. The grout shall have a minimum compressive strength of 5000 psi in seven days when tested as specified per T 106, except that the cube molds shall remain intact with a top firmly attached throughout the curing period. The nonshrink grout shall have a minimum expansion of 0.0 percent after seven days when tested as specified per T 160.

(d) Epoxy grout shall consist of sand and epoxy mixed by volume in per the manufacturer's recommendations. The grout shall be capable of developing a minimum compressive strength of 6500 psi in 72 hours when tested per MSMT 501. Sand for epoxy grout as specified in 901.01.

(e) An epoxy or polyester anchoring system may be used when approved by the Engineer in accordance with the manufacturer's recommendations. Strength values shall be as specified in the Contract Documents.

902.12 LINSEED OIL. Shall consist of a 50-50 mixture (by volume) of boiled linseed oil meeting Federal Specification TT-L-190 and kerosene per D 3699.

902.13 LATEX MODIFIED CONCRETE. Portland cement concrete containing prequalified Laboratory approved styrene butadiene latex emulsion is defined as Latex Modified Concrete (LMC).

Latex emulsion shall have a minimum of 90 percent of the nonvolatiles as styrene butadiene polymers. The latex emulsion as specified in Table 902.13 A. The material shall be stored in suitable containers and be protected from freezing and exposure to temperatures in excess of 85 F.

LMC shall be proportioned using volumetric mixing and designed as follows:

LATEX MODIFIED CONCRETE	
MATERIAL	**SPECIFICATION LIMITS**
Portland Cement, CWT/yd^3, min	6.6
Latex Emulsion/Cement Ratio	0.31 – 0.34
Water/Cement Ratio, max	0.22
Entrained Air, %	6.0 ± 3
Slump, in.	5 ± 1

The physical properties of LMC shall conform to Table 902.13 B. The Contractor shall furnish the necessary 3 X 6 in. molds per M 205 to be used for the fabrication of compressive strength cylinders.

Control and Acceptance Sampling.

(a) Submit a two qt minimum sample, of the styrene butadiene latex emulsion to the AME daily for each lot of material used in a day's production.

(b) A batch for LMC is defined as the capacity of the equipment being used on the project. Slump and air samples will be taken and tested before the placement of a batch is permitted. The slump shall be measured four to five minutes after discharge from the mixer. The test material shall be deposited off the deck and not be disturbed during this

waiting period. One additional sample for slump and air will be taken randomly during the placement of each batch. For seven day compressive strength, two tests each per batch are required. A test is defined as consisting of two companion cylinders. The samples for these tests will be taken at random while the placement is in progress.

TABLE 902.13 A

REQUIREMENTS FOR CHEMICAL PROPERTIES OF LATEX EMULSION MATERIALS

PROPERTY	SPECIFICATIONS		QUALITY ASSURANCE TESTS	
	LIMITS	TOLERANCE	PREQUALIFICATION TESTS	CONTROL AND ACCEPTANCE
Color	White	—	X	X
pH	9.0 – 11.0	—	X	X
Weight, lb/gal	8.40 – 8.47	—	X	X
Solids Content, %	46 – 53	—	X	X
*Butadiene Content, % of polymer	30 – 40	—	—	—
Viscosity @ 10 rpm-cps	Match Original	± 20	X	X
*Surface Tension, dynes/cm max	50	—	—	—
*Mean Particle Size, polymer – Å	1400 – 2500	—	—	—
Coagulum, % max	0.10	—	X	X
*Freeze-Thaw Stability, coagulum, % max	0.10	—	X	X
Infrared Spectra of Latex Film	Match Original	—	X	X
Infrared of Alcohol, Soluble Portion of Latex	Match Original	—	X	X
Shelf Life, min	1 yr	—	X	—

Note 1: Quality assurance tests shall be conducted as specified in MSMT 612 except those denoted by an * shall be conducted as specified in FHWA RD – 78-35.

Note 2: The original or prequalification sample shall be accompanied by the producer's certification on all of the tests and properties noted above and as specified in TC-1.02. The certification shall contain actual test values of the product and the infrared spectrograph.

Note 3: A separate certification is required for each lot of material. The certification shall note the date of manufacture, lot size, and whether or not the material is identical to the formulation of the original sample.

TABLE 902.13 B

LATEX MODIFIED CONCRETE PHYSICAL PROPERTIES			
TEST PROPERTY	**TEST VALUES**	**QUALITY ASSURANCE TESTS**	
		PREQUALIFIED TESTS	**CONTROL AND ACCEPTANCE**
7 Day Compressive Strength, psi min	3000	X	X
28 Day Compressive Strength, psi min	3500	X	—
42 Day Compressive Strength, psi min	3500	X	—
7 Day Flexural Strength, psi min	550	X	—
28 Day Flexural Strength, psi min	650	X	—
42 Day Shear Bond Strength, psi min	2000	X	—
Durability Factor, 300 cycles, % min	85	X	—
Chloride Permeability, Ppm max	510	X	—
Scaling Resistance, 50 cycles, max	3	X	—

Note 1: Quality assurance tests shall be conducted as specified in MSMT 721.

Note 2: Seven Day Compressive Strength Test will be used for Control & Acceptance of the material. The minimum specified design strength is 3000 psi at seven days. The mix design approval and acceptance will be based on a coefficient of variation of 10 percent with a probability of 1 in 10 tests falling below the specified strength. Only test values 80% or greater than the specified strength will be accepted

902.14 RAPID HARDENING CEMENTITIOUS MATERIALS FOR CONCRETE PAVEMENT REPAIRS. Materials shall be a dry, packaged cementitious mortar having less than 5 percent by weight of aggregate retained on the 3/8 in. sieve and meet the following requirements:

Classification.

Class I — For use at ambient temperatures below 50 F.
Class II — For use at ambient temperatures of 50 to 90 F.
Class III — For use at ambient temperatures above 90 F.

Chemical Requirements. C 928 except that no organic compounds such as epoxy resins or polyesters as the principal binder.

Physical Requirements. Meet the following when tested per MSMT 725:

COMPRESSIVE STRENGTH, psi min				
CLASSIFICATION	**< 2 hr**	**2-6 hr**	**6 hr**	**28 days**
Type I — Slow	—	—	2000	4500
Type II — Rapid	—	2000	—	4500
Type III — Very Rapid	2500	—	—	4500

TEST RESULTS	
TEST PROPERTY	**LIMITS**
Bond Strength, 7 days, psi min	2000
Length Change, increase after 28 days in water, based on length at 3 hr, % max	+ 0.15
Length Change, decrease after 28 days, % max	- 0.15
Freeze Thaw, loss after 25 cycles in 10% $CaCl_2$ solution, % max	8
Initial Setting Time, minutes min	10

Marking. All packages delivered to the project shall be marked with the following information:

(a) Date material was packaged.

(b) Approximate setting time.

(c) Recommended dosage of water or liquid component.

(d) Mixing instructions.

(e) Class or temperature range.

Certification. The manufacturer shall furnish certification as specified in TC-1.02 showing the actual test results for each class and type of material submitted to the Laboratory.

902.15 SYNTHETIC FIBERS. When synthetic fibers are specified in the Contract Documents, the fibers shall be 1/2 to 1-1/2 in. long and conform to C 1116, Type III. The manufacturer shall furnish certification as specified in TC-1.02. The quantity of fibers used and their point of introduction into the mix shall conform to the fiber manufacturer's recommendations.

CATEGORY 900
MATERIALS

SECTION 950.06-ELECTRICAL CABLE AND WIRE

714 **950.06.03 Cable Duct.**

DELETE: Delete 950.06.03 in its entirety.

INSERT: The following.

950.06.03 Cable Duct. Cable duct shall consist of cables preinstalled in either a polyvinyl chloride (PVC) or polyethylene (PE) plastic duct conforming to NEMA TC7 and the NEC. PVC duct shall conform to D3485. PE duct shall be designed for use as electrical conduit, and shall be manufactured from high density PE resin conforming to D3350, Type III, Grade PE33, Class C, Category 5. Duct dimensions and wall thickness shall conform to NEMA TC2 and D2447 Schedule 40. Minimum nominal diameter of the duct shall be 1-1/2 in. Cable shall be type XHHW, rated for 600 volts.

CATEGORY 950
TRAFFIC MATERIALS

SECTION 950.15 TRAFFIC SIGNAL HEADS

725 **DELETE** the table and section titled Hardware in its entirety

INSERT The following:

SP 800 TEM	DESCRIPTION	A	SP 801	SP 80	SP 803
1	SP 804 Aluminum Alloy - Casting	A 319	A 380	A 713	6063 T6
2	Yield Strength, ksi	18	23	25	25
3	Tensile Strength, ksi	27	47	35	30
4	Brinell Hardness	70	80	75	73
5	Elongation (% in 2 in.)	1.5	4	3	12
6	Stainless Steel	A 316	-	-	-
7	Galvanized Steel	A 157	A 153	G 60	-
8	Steel-Flat Sheet	16 gauge	-	-	-
9	Coating	*	Anodized Finish	-	-
10	Brass	CZ120	-	-	-

* The signal head housing shall be yellow in conformance with Federal Standards 595, Color Chip No. 13538. The signal head door and visor shall be optical flat (dull) black Federal Standards 595, Color Chip No. 37038. Aluminum signal heads shall be painted using fusion bonded polyester coating method.

Hardware.

(a) Hub plate shall conform to A, 1 thru 5 and 9B.

(b) Span wire hanger clamp shall conform to C, 1 thru 5.

(c) Balance adjuster body shall conform to 10A.

(d) Balance adjuster eyebolt and hardware shall conform to 6A, 7A, and 7B.

(e) 2-way lower arm shall conform to 7C and 8A.

(f) 2-way tri-stud arm shall conform to A, 1 thru 5.

(g) Span wire entrance fitting shall conform to C, 1 thru 5.

(h) Mast arm mount signal bracket (1-way, 2-way, and 5-section) shall conform to 1A and 1D.

(i) Side pole upper and lower arm assembly shall conform to 1B thru 5B or 1D thru 5D.

The maximum allowable play or space between the sides of the eyebolt and span wire clamp shall be 0.062 in.

728 **ADD** under **Electrical**

(f) Terminal blocks screws shall be of the captive type secured by fasteners on the reverse side of the terminal block. Terminal block screws shall be a # 10 size.

(g) Male spade terminal ends shall be furnished for each position on the terminal block angled at 45 degrees and perpendicular to the terminal block face.

CATEGORY 900
MATERIALS

SECTION 951 — PAVEMENT MARKING MATERIALS

951.01 NONTOXIC LEAD FREE WATERBORNE PAVEMENT MARKINGS

All nontoxic lead free waterborne pavement marking materials shall be ready-mixed, pigmented binder, emulsified in water, and capable of anchoring reflective beads that are applied separately.

The pavement marking material shall not contain any hazardous material listed in the Environmental Protection Agency Code of Federal Regulations (CFR) 40, Section 261.24, Table 1.

951.01.01 Waterborne Physical Requirements. The nontoxic lead free waterborne pavement marking material shall conform to the manufacturer's formulations as initially approved for use by the Administration and shall be controlled from batch to batch. All paint shall be evaluated in conformance to the requirements listed below.

Production batch samples will be subject to random tests, such as but not limited to, X-ray spectroscopy, infrared spectroscopy, ultraviolet spectral analysis, and atomic absorption spectroscopy.

The combined total of lead, cadmium, mercury, and hexavalent chromium shall not exceed 100 ppm, when tested by X-ray fluorescence spectroscopy, or other method capable of detection at this level.

For each production batch, the Contractor shall provide the Administration with the manufacturer's certified analysis conforming to TC-1.02 of the Standard Specifications.

(a) Viscosity. The viscosity shall be 85 ± 10 KU when tested in conformance with D 562.

(b) Pigment For Yellow Pavement Marking Material. The colorants used to attain the color of the yellow product shall be one or more of the following, along with titanium dioxide: Pigment Yellow 65, Pigment Yellow 75, and opaque Pigment Yellow 74.

(c) Color and Appearance. Color and appearance shall be evaluated using the following: CIE 1976 L*a*b*, illuminant D 65, and standard observer angle 1931 CIE 2 degrees. The geometry shall be 45/0 or 0/45, or d/8, excluding specular gloss. Measurements shall be taken from samples applied to an opacity chart, e.g., Leneta Form 2A, at a wet film thickness of 15 mils ± 1 mil. The applied sample shall have been allowed to dry for at least 12 hours before measurements are taken. The evaluation shall be as follows:

(1) Production: The color of the dry paint film of the production sample shall match the L*a*b* values provided, under the specified conditions. For white material the values are: L* = 94.80, a* = -2.35, b* = 3.20. For yellow material the values are: L* = 80.70, a* = 19.40, b* = 88.65. The colors shall match when compared instrumentally.

(2) **Control**. The maximum permissible variation from the specified L*a*b* values shall be 2.0 ΔE_{cmc}. The measurements shall be taken from a sample applied over the black portion of an opacity chart.

The Administration will approve or disapprove any batch based on a laboratory visual evaluation for blemishes and irregularities in the test specimen (i.e. cracks, flaking, surface depressions, pooling, etc.) that would interfere with the measurement of color and appearance on the opacity chart. The Administration will make the final decision.

(3) **Reflectance**. The reflectance, without beads, and using CIE XYZ Yxy, shall be a minimum Y of 80 percent for white production batches; and a minimum of 50 percent for yellow production batches with a maximum of 60 percent. The measurement shall be taken from a sample applied over the black portion of an opacity chart.

(4) **Color Difference over Black and White.**. For any production batch the measured color difference between readings taken over the black portion of the opacity chart from those taken over the white portion shall be a maximum value of 1.0 ΔE_{cmc} for white products and 1.3 ΔE_{cmc} for yellow products.

(5) **Yellowness Index**. The yellowness index of the white material, when determined according to E 313, Using Equation 1 and the coefficients for CIE D 65 illumination, 1931 from Table 1 in that standard, shall not exceed 8.0.

(d) **Flexibility**. The pigmented binder shall not display cracking or flaking when subjected to the flexibility test of Federal Test Method TT-P 1952D, with the exception that the panels shall be 35 to 31 gauge (0.0078 to 0.0112 in.) tin plate approximately 3 x 6 in. The tin plates shall be lightly buffed with steel wool and thoroughly cleaned with solvent and dried before being used for the test.

(e) **Weight per Gallon**. The weight per gallon for a production batch, when determined according to D 1475, shall be within ± 0.3 lb/gal of the value obtained by The National Transportation Product Evaluation Program (NTPEP), and reported on a NTPEP deck designated "north". When the Administration waives the NTPEP requirements, another target value will be stipulated.

951.01.03 Glass Bead Physical Requirements. Each lot of glass beads shall be sampled in conformance with the Administration's Frequency Guide and shall be submitted to the Administration's Office of Materials and Technology for testing and approval prior to use.

Glass beads shall be colorless, clean, transparent, and free of milkiness and excessive air bubbles.

Reflective glass beads shall conform to M 247, except that the gradation shall conform to the following:

PERCENT PASSING			
SIEVE SIZE	**Standard Beads**	**Large Beads**	**Maryland Blend**
12 (1.70 mm)	—	100	100
14 (1.40 mm)	—	95 – 100	98 – 100
16 (1.18 mm)	—	80 – 95	88 – 97
18 (1.00 mm)	—	10 – 40	48 – 70
20 (0.85 mm)	100	0 – 5	28 – 50
30 (0.60 mm)	75 – 95	—	—
50 (0.30 mm)	15 – 35	—	5 – 25
80 (0.18 mm)	—	—	0 – 5
100 (0.15 mm)	0 – 5	—	—

Moisture resistance and flotation test are not required.

(a) Refractive Index. The refractive index shall be 1.50 minimum, when tested in conformance with MSMT 211.

(b) Roundness. Glass beads shall be smooth, spherical in shape, free of sharp angular scars, scratches, or pits, and shall contain a minimum of 60 percent silica. Beads shall have a minimum average roundness of 75 percent when tested in conformance with D 1155.

951.01.04 Qualification. Pavement marking material manufacturers desiring to have their material formulations approved under this Special Provision shall have their formulations evaluated on a NTPEP North Test Deck unless waived by the Administration. Only NTPEP evaluated formulations will be considered candidates for selection, unless the requirement is waived.

951.01.05 Field testing. Materials conforming to this specification shall be field evaluated for performance on a NTPEP North Test Deck. Materials performing satisfactorily throughout the test period will be placed on the Administration's Qualified Products List. All marking materials supplied under the Contract Documents shall be identical in composition to the materials submitted for initial NTPEP testing. The Office of Materials and Technology will determine conformity with these requirements.

951.01.06 Material Acceptance. Only Administration approved and stamped materials conforming to these Specifications shall be used.

Prior to the shipment of any pavement marking material batch, the manufacturer shall provide access for the Administration's representative to collect samples of the material from each production batch. The samples shall be sent to the Administration laboratory for QA testing. Each sample shall be accompanied by a certified analysis conforming to TC 1.02, showing compliance with the physical and chemical requirements of this Specification, and a statement certifying that any marking material supplied under the Contract Documents is identical in composition to the material submitted for initial NTPEP testing. The Administration will determine conformity with these requirements. Administration authorization shall be required before a batch or a portion of a batch is shipped.

Paints shall be compatible with cleaning solvents used in equipment cleaning.

Nontoxic waterborne pavement markings shall not skin, curdle, settle or be unusable or difficult to apply within 12 months of the date of manufacture. The supplier, at the Administration's request, shall replace containers of marking material exhibiting an unacceptable level of settling, skinning, or curdling, as determined by the Administration. Marking material from a production batch shall not be used beyond 12 months after the date of manufacture.

951.01.07 Certification. The manufacturer shall explicitly certify in writing that any marking material supplied under the Contract Documents conforms to the formulation identified by the same product code or name placed on the NTPEP test deck from which it was approved. The same code or name as used in the published report from that test deck must identify the product. Failure to certify will be considered grounds for product batch rejection.

The manufacturer shall, in accordance with TC-1.02, explicitly certify, in writing, of any paint batch supplied under the Contract Documents that it complies with all applicable specifications. Failure to so certify will be considered grounds for product batch rejection. Certification for yellow nontoxic lead free waterborne pavement markings shall include, for the purpose of showing compliance with this specification, the name or the type of colorant used to achieve the yellow color. The Administration will keep the paint composition and chemical analysis information confidential.

The Certification shall also, contain the following:

(a) Manufacturer's name.

(b) Place (address) of manufacture.

(c) Color of material.

(d) Date of manufacture (month-day-year).

(e) Lot or batch identification.

(f) Size of lot/batch.

(g) The recommended paint temperature at the spray gun.

(h) Material Safety Data Sheets for all materials submitted for testing and application.

The Contractor shall furnish a copy of this certification to the Administration's representative before applying the paint batch it represents.

951.01.08 Production Facility.

(a) The producer shall have a facility, presently in operation, capable of producing the traffic paint in the quantity and quality required by the Administration. This facility will be subject to the Administration's approval.

(b) The producer shall have a laboratory, subject to the Administration's approval, that is capable of performing the required tests.

CATEGORY 900
MATERIALS

SECTION 951 — PAVEMENT MARKING MATERIALS

951.02 LEAD FREE REFLECTIVE THERMOPLASTIC PAVEMENT MARKINGS. All materials composing the reflective thermoplastic material shall be lead free. Reflective thermoplastic material shall be homogeneously composed of pigment, filler, resins and glass beads and shall conform to the following.

951.02.01 Reflective Thermoplastic Components.

(a) Composition.

COMPONENT	TEST METHOD	COLOR	
		WHITE	YELLOW
Binder, % min	Certified	18.0	18.0
Premixed Reflective Beads, % min	MSMT 614	30.0	30.0
Titanium Dioxide, % min	X-Ray Fluorescence	10.0	N/A
Calcium Carbonate Inert fillers, % max	D 34	42.0	*
Yellow Pigment, %	—	N/A	*

* Amount of yellow pigment, calcium carbonate and filler shall be at the option of the manufacturer, provided all other requirements are in conformance.

Restrictions. The combined total of lead, cadmium, mercury and hexavalent chromium shall not exceed 100 ppm when tested by X-Ray Fluorescence, ICP, or comparable method capable of this level of detection. Diarylide type pigments shall only be used when the manufacturer or pavement marking material application temperature does not exceed 392 F.

(b) Binders. The binder shall be alkyd consisting of maleic modified glycerolester of resin and other plasticisers.

(c) Titanium Dioxide. The titanium dioxide shall be rutile type.

951.02.02 Reflective Thermoplastic.

(a) Physical Properties.

TEST PROPERTY	TEST METHOD	SPECIFICATION LIMITS
Bond Strength, psi min.	MSMT 614	180
Softening Point, F		215 ± 15
Low Temperature Stress Resistance	T 250	No Cracks

(b) Specific Gravity. The specific gravity of the white and yellow pavement marking material shall be 1.7 to 2.2 when tested in conformance with D 153, Method A at 77 F.

(c) Color. After heating for 4 ± 0.5 hours at 425 ± 3 F, the thermoplastic shall be as specified in E 1347 and the following:

(1) Production. The color of the cured thermoplastic material film of the production sample shall match the Federal Standard 595 Color chips specified when compared by instrumental measurement.

(2) Control. Control color matching determinations will be made using a Pacific Scientific Color Machine, and an observation angle of 2°, and the CIE Chromaticity Coordinate Color Matching System under light source Illuminate C, with the following tolerances permitted between the standard chip and the cured thermoplastic film sample:

	WHITE Color No. 17886		YELLOW Color No. 13538	
	X	Y	X	Y
Standard Chip	0.310	0.330	0.480	0.450
Delta Tolerance	± 0.020	± 0.020	± 0.030	± 0.030

(3) Reflectance.

COLOR	TEST METHOD	DAYLIGHT REFLECTANCE at Degree	PERCENT MIN
White	Fed Std 595 No. 17886	45 - 0	80
Yellow	Fed Std 595 No. 13538	45 - 0	50

(d) Yellowing Index. The yellowing index of the white material shall not exceed 8 prior to QUV and 15 after QUV when tested in accordance with E 313.

951.02.03 Glass Beads Physical Requirements. The glass beads shall conform to M 247 and the following:

GRADATION SIEVE SIZE	PERCENT PASSING
	STANDARD BEADS
0.85 mm (No. 20)	100
0.60 mm (No. 30)	75 - 95
0.30 mm (No. 50)	15 - 35
0.15 mm (No. 100)	0 - 5

Glass beads shall be colorless, clean, transparent, and free of milkiness, excessive air bubbles, and essentially free of sharp angular scarring or scratching. The beads shall be spherical in shape and shall contain a minimum of 60 percent silica. Roundness shall be 75 percent minimum when tested as specified in D 1155, Procedure A.

Glass beads shall have a 1.50 minimum refractive index when tested in conformance with MSMT 211.

Glass beads shall not absorb moisture in storage and shall remain free of clusters or lumps.

951.02.04 Field Testing. Materials conforming to this specification shall be field evaluated at the National Transportation Product Evaluation Program (NTPEP) Northeast test deck for performance. Materials performing satisfactorily throughout the test period will be placed on the Administration's Prequalified Materials List. All marking materials supplied during the Contract shall be identical in composition to the materials submitted for initial testing. Conformity with these requirements will be determined by the Office of Materials and Technology (OMT).

951.02.05 Sampling for Preapproval. Sources supplying thermoplastic material and glass beads shall be submitted by the Contractor to the Engineer for approval in conformance with the Contract Documents.

Each lot of thermoplastic material will be sampled at the source and tested by the Administration over two construction seasons. If 95 percent of the lots tested conform to Specifications, source samples will no longer be required and the manufacturer may ship directly to the project. All shipments shall be accompanied by a manufacturer's certification in conformance with TC-1.02 and shall include the following:

(a) Manufacturer's name.

(b) Place of manufacture.

(c) Material color.

(d) Date of manufacture (month-year).

(e) Lot identification.

(f) Size/quantity of lot represented.

Random samples will be taken on the project in conformance with the MSMT Sample Frequency Guide and tested for conformance with these specifications. Nonconformance may result in the suspension from the certification program until conformance is reestablished. To reestablish conformance, the manufacturer shall achieve a 95 percent approval level from samples taken at the manufacturer's facility and tested by the Administration prior to shipment to Administration projects.

Each lot of glass beads shall be sampled in conformance with the MSMT Sample Frequency Guide and shall be submitted to the OMT for testing and approval prior to use.

Sampling will be by batch or lot which is defined as a maximum of 44 000 lbs of material.

951.02.06 Certification. The Contractor shall furnish notarized certification as specified in TC-1.02. The manufacturer shall certify that any reflective thermoplastic materials supplied during the Contract conforms to the identical formulation as the samples submitted for evaluation on the NTPEP Northeast test deck, and identify the formulas by referring to the code used on the deck. Reflective thermoplastic materials which fail to conform will be rejected.

The manufacturer shall also provide the following:

(a) Material Safety Data Sheets for all materials submitted for testing and use.

(b) A facility, presently in operation, capable of producing the reflective thermoplastic materials in the quantity and quality required by the Administration.

(c) A laboratory subject to the Administration's approval which is capable of performing the required tests.

CATEGORY 900
MATERIALS

SECTION 951 — PAVEMENT MARKING MATERIALS

951.04 REMOVABLE PAVEMENT MARKING TAPE. Removable pavement marking tape shall remain in place on the pavement surface without being displaced by traffic, or affected by weather conditions. The material shall be capable of being removed without the use of heat, solvents, grinding, or sand blasting and shall not leave an objectionable residue.

The material shall be of good appearance and free from cracks. Edges shall be true, straight and unbroken. Line marking material shall be in rolls having no more than three splices per 150 ft of length. All marking materials shall be packaged in conformance with accepted commercial standards and shall have a minimum shelf life of one year.

Performance Requirements. When applied in conformance with the manufacturer's recommendations, the material shall provide a neat, durable marking that will not flow or distort due to temperature if the pavement surface or underlying markings remain stable. The material shall be weather resistant and, through normal traffic wear, shall show no lifting or shrinkage that will significantly impair the intended usage of the tape throughout its useful life, and shall show no significant tearing while in place, or other signs of poor adhesion. The material shall be capable of easy removal without tearing into small pieces.

951.04.01 White and Yellow. Removable preformed pavement marking materials shall conform to the requirements of the MdMUTCD and the following:

(a) Composition. The marking material shall consist of a mixture of polymeric materials, pigment, and glass beads distributed uniformly throughout the surface.

(b) Color. The color of the marking materials shall match Federal Test Standard No. 595 for the following color numbers:

White - 37925
Yellow - 38907

(c) Glass Beads. Glass beads shall conform to the General Requirements of M 247 and have a minimum refractive index of 1.90 when tested as specified in MSMT 211.

(d) Frictional Resistance. The British Pendulum Number shall be a minimum of 50 when tested as specified in E 303.

(e) Certification. Samples submitted to the Office of Materials Technology (OMT) for testing shall be accompanied by the manufacturer's certified analysis in conformance with TC-1.02.

Any material supplied for a Contract shall be identical in composition to the material originally submitted for testing. Conformity will be determined by OMT.

(f) Field Testing. Line marking materials conforming to the Contract Documents will be field tested by The National Transportation Product Evaluation Program (NTPEP) and over 180 day period as specified in MSMT 723 for conformance with the following:

(1) Ease of Application - satisfactory.

(2) Removability - a minimum rating of 2.

(3) Residue Remaining at Time of Removal (day and night) - minimum rating of 2.

(4) Durability, Appearance, and Night Visibility - minimum weighted rating of 4.

(5) Loss or Movement - minimum rating of 2.

Upon satisfactory completion of the field testing, the marking materials will be placed on OMT's Qualified Products List. The material shall conform to all criteria for a minimum period of 120 days to be considered satisfactory.

951.04.02 Black. Removable preformed pavement marking materials shall conform to the requirements of the Md MUTCD and the following:

(a) Composition. The non-reflective blackout tape shall not contain metallic foil and shall consist of a mixture of high quality polymeric materials, pigments, and inorganic fillers distributed throughout its cross-sectional area, with a matte black non-reflective surface. The film shall be pre-coated with a pressure sensitive adhesive. A nonmetallic medium shall be incorporated to facilitate removal.

For patterned materials, a minimum of 20 percent of the total surface area shall be raised and coated with nonskid particles. The channels between the raised areas shall be substantially free of particles.

(b) Color. The color of the blackout material shall match Federal Test Standard No. 595 for the following color numbers:

Black - 37038 (or as approved by the Engineer)

(c) Frictional Resistance. The British Pendulum Number shall be a minimum of 50 when tested as specified in E 303.

(d) Certification. Samples submitted to OMT for testing shall be accompanied by the manufacturer's certified analysis in conformance with TC-1.02.

Any material supplied for a Contract shall be identical in composition to the material originally submitted for testing. Conformity will be determined by OMT.

(e) Field Testing. Line marking materials conforming to the Contract Documents will be field tested by The National Transportation Product Evaluation Program (NTPEP) and over a 180 day period as specified in MSMT 723 for conformance with the following:

(1) Ease of Application - satisfactory.

(2) Removability - a minimum rating of 2. The manufacturer shall show that the blackout tape can be manually removed after its intended use, intact or in large pieces, at temperatures above 40 F without the use of heat, solvents, grinding, or sand or water blasting. The blackout tape shall remove cleanly from existing markings that are adequately adhered to the pavement surface.

(3) Residue Remaining at Time of Removal (day and night) - minimum rating of 2.

(4) Durability, Adhesion, Appearance, and Night Visibility - minimum weighted rating of 4. The manufacturer shall demonstrate that the properly applied blackout tape adheres to the roadway and existing stable roadway markings under climatic and traffic conditions normally encountered in the construction work zone.

(5) Loss or Movement - minimum rating of 2.

Upon satisfactory completion of the field testing, the marking materials will be placed on OMT's Qualified Products List. The material shall conform to all criteria for a minimum period of 180 days to be considered satisfactory.

951.04.03 Packaging. Preformed pavement markings shipping package shall conform to the manufacturer's shipping requirements to prevent damage during delivery and unloading of all shipments. The shipping package shall be marked with the following information placed on each container:

(a) Description of item.

(b) Date of manufacture.

(c) Successful Bidder's Name.

(d) Purchase Order Number.

(e) Lot Number.

(f) Color.

(g) Installation instructions.

CATEGORY 900
MATERIALS

SECTION 951 — PAVEMENT MARKING MATERIALS

951.05 SNOWPLOWABLE RAISED PAVEMENT MARKERS (SPRPM) AND RECESSED PAVEMENT MARKERS (RPM).

Pavement Marker Reflector Lenses. Pavement marker reflector lenses shall conform to the requirements of D 4383 and shall be comprised of materials with adequate chemical, water and UV resistance for the intended use. The reflector lens shall contain one or two prismatic reflective faces to reflect incident light from opposite directions. The reflector lens shall be in the shape of a shallow frustum of a pyramid. The bottom of the reflector lens shall be equipped with an elastomeric pad to permit its attachment to the surface of the casting using the manufacturer's recommended adhesive. The lens faces shall provide extremely hard and durable abrasion resistant surfaces.

Pavement marker reflector lenses shall be 4.00 x 2.00 x 0.46 in. The slope of the reflecting surface shall be 30 degrees and the area of each reflecting surface shall be 1.7in.^{2}. The outer surface of the shell shall be smooth except in identification areas.

The pavement marker reflector lens shall be imprinted with the model number and the manufacturer's name.

SPRPM Casting. Both ends of the casting shall be shaped to deflect a snow plow blade. The bottom of the casting shall incorporate two parallel keels and an arcuately shaped web designed to fit into a grooved surface. Casting dimensions shall be a minimum of 9.25 x 5.86 x 1.69 in. and shall not exceed 10.5 x 7.25 x 1.69 in. The installed height shall not exceed 0.25 in. above the road surface.

The casting shall be nodular iron conforming to A 536, Grade 80-55-06, hardened to 51 to 55 R_C. The surface of the keel and web shall be free of scale, dirt, oil, grease or any other contaminant, which may reduce its bond to the epoxy adhesive.

The casting shall be imprinted with the model number and the manufacturer's name.

Recessed Pavement Marker Adhesive. The adhesive used to fasten the pavement marker lens to the pavement surface shall conform to D 4383-05 Table X1.4.2.3 M 237 Type II. Rapid Set Type adhesives shall not be used.

Casting Adhesive. The epoxy adhesive used to fasten the castings to the pavement surface shall conform to D 4383-05 Table X1.1.

Reflector Lens Adhesive in Casting. The adhesive used to fasten the reflector lens to the casting shall conform to the manufacturers' recommendations.

951.05.01 Field Testing. Materials conforming to SPRPM Specification shall be field evaluated at the National Transportation Product Evaluation Program (NTPEP) Northeast test deck for performance. Materials conforming to recessed pavement marker specification shall be field evaluated at any (NTPEP) test deck for performance. Materials performing satisfactorily throughout the test period will be placed on the Administrations Prequalified Materials List. All marking materials supplied during the Contract shall be identical in composition to the materials submitted for initial testing. Random sampling will be performed on projects sites. Conformity with these requirements will be determined by the Office of Materials Technology (OMT).

951.05.02 Facility Sampling. Random testing of samples will be performed by the Administration as Quality Assurance and certification verification. Materials will be periodically sampled at the manufacturer's facility by the Administration. Each sample shall be accompanied by a certification showing compliance with the physical requirements of this Specification. Materials supplied during the Contract shall be identical in composition to the materials submitted for initial testing. Conformity with these requirements will be determined by OMT.

Sources supplying materials shall be submitted by the Contractor to the Engineer for approval in conformance with the Contract Documents.

The material manufacturer shall reimburse the Administration for the cost of sampling and shipment of the samples when sampled by the Administration.

Material Shipment. The components shall be shipped in containers sealed by the manufacturer. The label on each container shall include the following information:

(a) Manufacturer's Name.

(b) Place of Manufacture.

(c) Color of Material and Component Type.

(d) Date of Manufacture (month-year).

(e) Batch and Lot Identification Number.

(f) Size/quantity of lot represented.

951.05.03 Certification. The Contractor shall furnish notarized certification as specified in TC-1.02.

The manufacturer shall certify that any SPRPM materials supplied during the Contract conforms to the identical composition of the samples submitted for evaluation on the NTPEP Northeast Test Deck, and identify the SPRPM materials by referring to the code used on the deck. PRPM materials which fail to conform will be rejected.

The manufacturer shall certify that any recessed pavement marker materials supplied during the Contract conforms to the identical composition of the samples submitted for evaluation on any NTPEP Test Deck, and identify the recessed pavement marker materials by referring to the code used on the deck. Recessed pavement marker materials which fail to conform will be rejected.

The manufacturer shall also provide the following:

(a) Material Safety Data Sheets for all materials submitted for testing and use.

(b) A facility, in operation, capable of producing the materials in the quantity and quality required by the Administration.

(c) A laboratory capable of performing the required tests. This laboratory will be subject to the Administration's approval.

CATEGORY 900
MATERIALS

SECTION 951 — PAVEMENT MARKING MATERIALS

951.06 HEAT APPLIED PERMANENT PREFORMED THERMOPLASTIC PAVEMENT MARKING MATERIAL. The material shall be highly durable retroreflective polymeric materials designed for use as transverse lines, numbers, legends, symbols and arrow markings subjected to high traffic volumes and severe wear conditions such as shear action from crossover or encroachment.

The applied material shall adhere to hot mix asphalt (HMA), open-grade friction courses (OGFC), stone matrix asphalt (SMA), portland cement concrete (PCC), and any existing pavement markings when applied using normal heat from a propane fueled heat gun in conformance with manufacturer's recommendations.

The applied material shall be capable of conforming to pavement contours, breaks and faults, shall not be affected by weather conditions, and shall remain in place on pavement surfaces without being displaced by traffic.

The material shall have a minimum shelf life of one year.

The material shall conform to the requirements of the MUTCD and the following:

(a) Composition. The material shall consist of polymeric materials, pigments, binders and glass beads distributed throughout the entire cross-sectional area. The thermoplastic material shall conform to M 249 with the exception of the relevant differences for the material being supplied in the preformed state.

Restrictions. The combined total of lead, cadmium, mercury and hexavalent chromium shall not exceed 100 ppm when tested by X-ray diffraction, ICP, or comparable method capable of this level of detection. Nonleachable lead based pigments will not be permitted. Diarylide type pigments shall only be used when the manufacture or pavement marking material application temperature does not exceed 392 F.

(b) Color. Preformed markings shall consist of film with pigments selected and blended to match Federal Standard 595 color chip Nos. 17886 and 13538 for white and yellow respectively.

(c) Frictional Resistance. The surface of the applied material shall provide a minimum average skid resistance value of 50 BPN when tested in conformance with E 303.

(d) Patchability. The material shall be capable of use for patching worn areas of the same type in conformance with manufacturer's recommendations.

(e) Thickness. The minimum thickness, without adhesive, shall be 120 mils.

(f) Adhesion. The material shall retain a minimum of 65 percent adhesive bond after 100 cycles of freeze-thaw when tested in conformance with C 666, Method B.

(g) Beads.

(1) Index of Refraction. All beads shall meet the general requirements of M 247, Type I, and shall have a minimum index of refraction of 1.50 when tested using the liquid oil immersion method specified in MSMT 211.

(2) Acid Resistance. A maximum of 15 percent of the beads shall show a formation of a distinct opaque white layer on the entire surface after exposure to a 1 percent solution (by weight) of sulfuric acid in conformance with MSMT 211.

Field Testing. Materials conforming to this Specification shall be field tested at AASHTO regional test facilities, such as National Transportation Product Evaluation Program (NTPEP), for performance.

Materials performing satisfactorily throughout the test period, including exhibiting a minimum retained reflectance of 100 mcd/m^2/lux at the completion of the testing, will be placed on the Prequalified Materials List maintained by the Office of Materials and Technology.

Certification. Any marking material supplied during the Contract shall be identical in composition to the material submitted for initial testing. Samples submitted for testing shall be accompanied by the manufacturer's certified analysis in conformance with TC-1.02.

CATEGORY 900
MATERIALS

SECTION 951 — PAVEMENT MARKING MATERIALS

951.07 PERMANENT PREFORMED PATTERNED REFLECTIVE PAVEMENT (PPPRP) MARKING MATERIAL. The material shall be capable of adhering to hot mix asphalt and portland cement concrete surfaces, and to any existing pavement markings in accordance with manufacturer's recommendations by a pre-coated pressure sensitive adhesive. A primer shall be used to precondition the surface if recommended by the manufacturer. The markings shall be capable of being inlaid in new hot mix asphalt surfaces during the paving operation.

The material shall be highly durable and retroreflective and shall be fabricated of a polymeric material designed for longitudinal and legend/symbol markings subjected to high traffic volumes and severe wear conditions, such as shear action from crossover or encroachment on typical longitudinal configurations, and where high levels of reflectivity are required to ensure the safety of the motoring public.

The material shall be of good appearance and free from cracks. Edges shall be true, straight and unbroken. Line marking material shall be in rolls having no more than three splices per 150 ft of length. All marking materials shall be packaged in conformance with accepted commercial standards and shall have a minimum shelf life of one year.

The material shall remain in place on the pavement surface without being displaced by traffic, and shall not be affected by weather conditions.

951.07.01 Permanent Preformed Patterned Reflective Pavement Marking Material Components.

Composition. The material shall consist of a mixture of polymeric materials, pigments and reflective spheres distributed throughout the base cross-sectional area and reflective spheres bonded to the topcoat surface to provide immediate and continuing retroreflection.

Restrictions. The combined total of lead, cadmium, mercury and hexavalent chromium shall not exceed 100 ppm. Diarylide based pigments and non-leachable lead pigmentation are not acceptable. The presence of these compounds shall be tested for compliance to the specification by X-ray diffraction, ICP, or another comparable method, capable of this level of detection.

951.07.02 Permanent Preformed Patterned Reflective Pavement Marking Material Physical Requirements.

(a) Reflectance. The manufacturer shall certify that the white and yellow materials shall have the minimum initial retroreflectance values of 350 mcd/L/m^2 for white and 250 mcd/L/m^2 for yellow markings in any 528 ft section. Reflectance shall be measured using a reflectometer with CEN 30-meter geometry (88.76 degree entrance angle and 1.05 degree observation angle).

(b) Color. The color of preformed markings shall essentially match the 37886, 33538 or 37038 color chips for white, yellow or black respectively as shown in Federal Standard 595A.

(c) Frictional Resistance. The surface of the retroreflective pliant polymer shall provide a minimum initial average skid resistance value of 45 BPN when tested according to ASTM E 303.

951.07.03 Field Testing. Materials conforming to this specification shall be field evaluated at the National Transportation Product Evaluation Program (NTPEP) Northeast test deck for performance. Materials performing satisfactorily throughout the test period will be placed on the Administration's Prequalified Materials List. All marking materials supplied during the Contract shall be identical in composition to the materials submitted for initial testing. Conformity with these requirements will be determined by the Office of Materials and Technology.

951.07.04 Prequalification. Samples shall be taken by Administration for testing. The manufacturer shall submit any data from AASHTO NTPEP Northeast Test Deck which support material performance. Materials conforming to this Specification will be placed on the Administration's Prequalified List of Patterned Tapes.

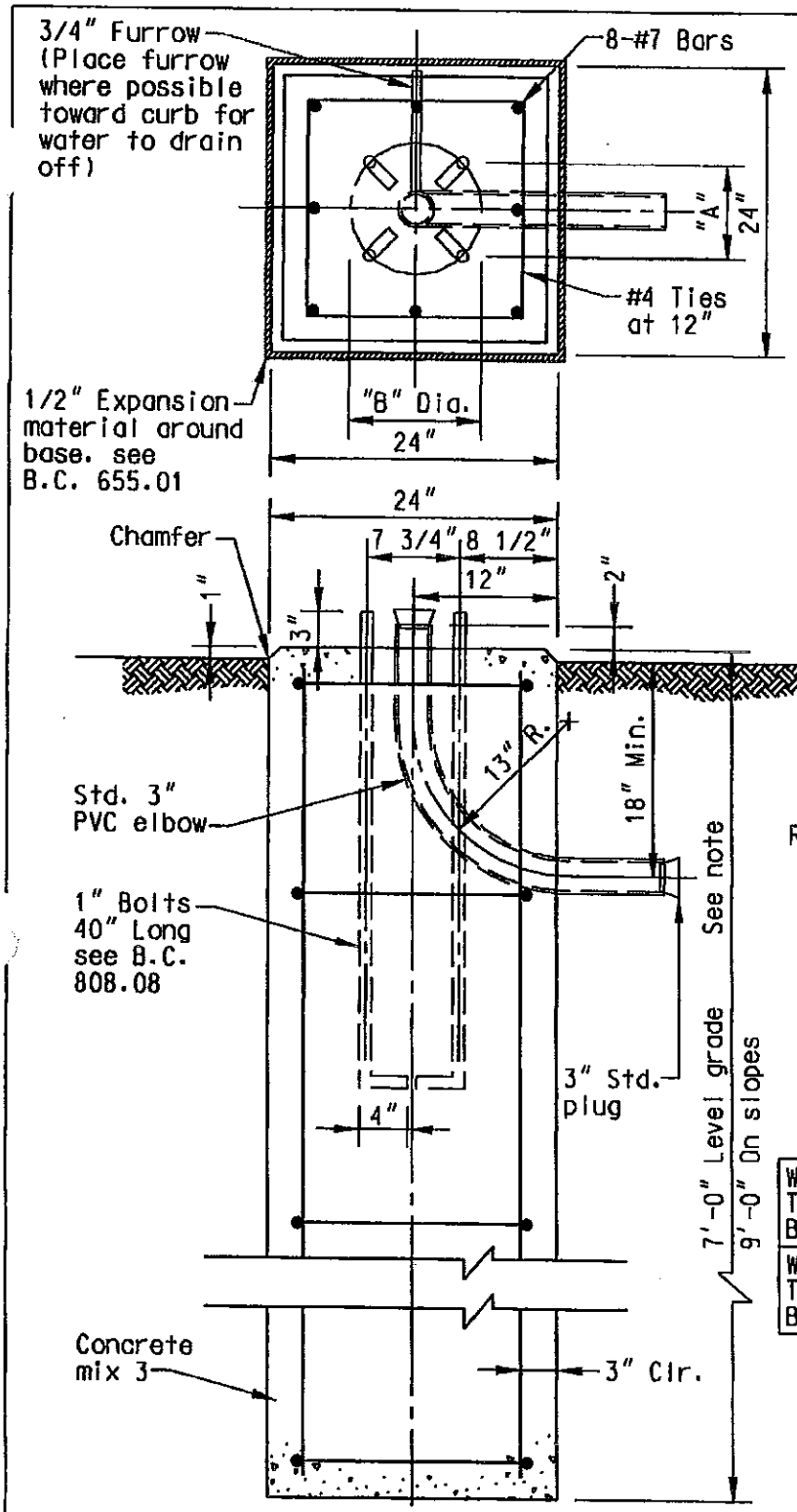
951.07.05 Certification. The Contractor shall furnish notarized certification as specified in TC-1.02. The manufacturer shall certify that any reflective thermoplastic materials supplied during the Contract conforms to the identical formulation as the samples submitted for evaluation on the NTPEP Northeast test deck, and identify the formulas by referring to the code used on the deck. Reflective thermoplastic materials which fail to conform will be rejected.

The manufacturer shall also provide the following:

(a) Material Safety Data Sheets for all materials submitted for testing and use.

(b) A facility, presently in operation, capable of producing the reflective thermoplastic materials in the quantity and quality required by the Administration.

(c) A laboratory subject to the Administration's approval which is capable of performing the required tests.



Note: 7' Base for mast arms up to 15'

9' Base for mast arms 15' and larger

Reinforcing: 7' Base must have 8-#7 bars (one at each corner) and 8-#4 ties at 12" O/C.

9' Base must have 8-#7 bars (one at each corner) and 10-#4 ties at 12" O/C.

	"A" Bolt Space	"B" Bolt Cir. Dia.
Without Transformer Base	7 3/4"	11"
With Transformer Base	10 5/8"	15"

POLES TO BE 6' BACK FROM FACE OF CURB UNLESS OTHERWISE NOTED.

CITY OF BALTIMORE
DEPARTMENT OF PUBLIC WORKS

APPROVED: _____

STANDARD NO. 801.02

ISSUED	2-8-71	
REVISED	5-10-77	
	11-10-82	
	3-18-83	

10-7-86

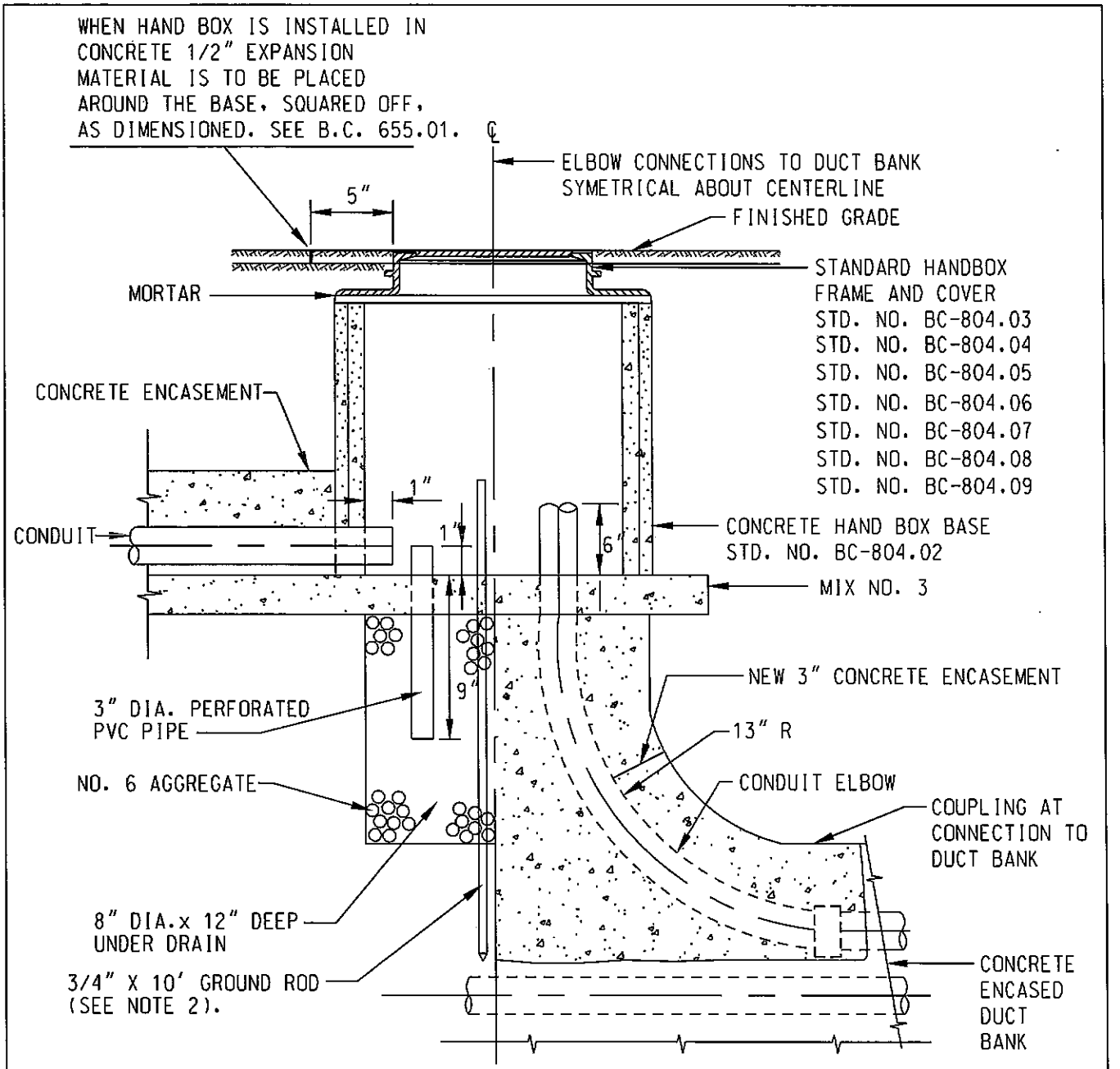
FHWA WASHINGTON OFFICE
8-17-71
7-28-77

ROADWAY PEDESTAL BASE FOR LIGHT POLES-SQUARE

CATEGORY CODE: 80111 THRU 80115

SCALE: NONE

SHEET 1 OF 1



NOTES:

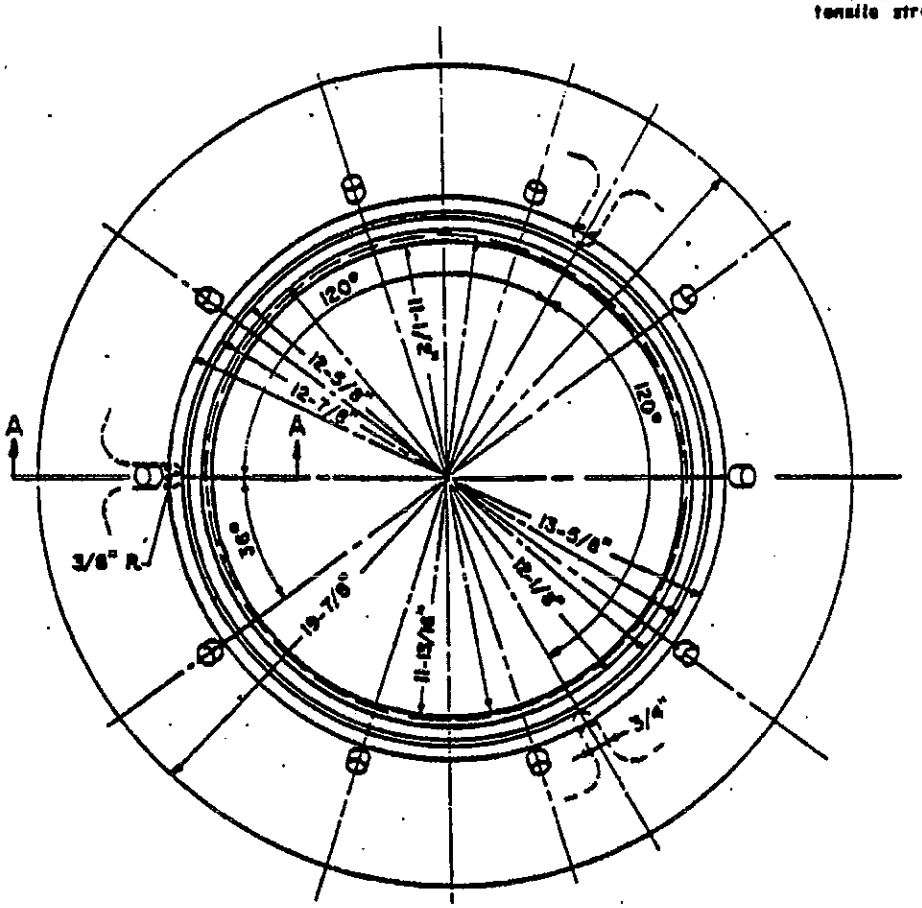
1. WHERE THE INGRESS & EGRESS OF THE CONDUIT IS FROM THE SIDES OF THE HAND BOX, THE DIAMETER OF THE UNDER DRAIN SHALL BE ENLARGED TO 10" AND SHALL BE CENTERED UNDER THE HANDBOX.

2. 3/4"x 10' GROUND ROD INSTALLED WHERE INDICATED ON THE PLANS AND CONFORMING TO THE NATIONAL ELECTRICAL CODE.

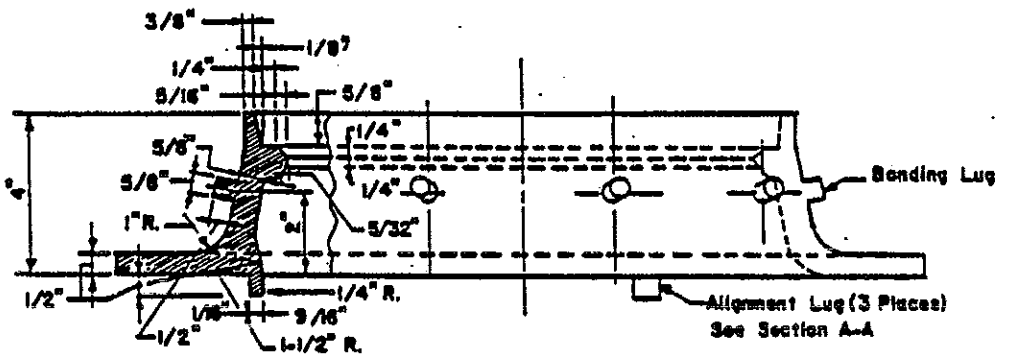
CAD FILE: DTL-015.dwg

CITY OF BALTIMORE DEPARTMENT OF PUBLIC WORKS				FHWA WASHINGTON OFFICE	HANDBOX - CONDUIT TYPICAL INSTALLATION	
APPROVED: _____	ISSUED				CATEGORY CODE:	
	REVISED	8-5-93				
STANDARD NO. 804.01					SCALE: NONE	SHEET 1 OF 1

NOTE: Material shall be cast iron, 21,000 psi. tensile strength.



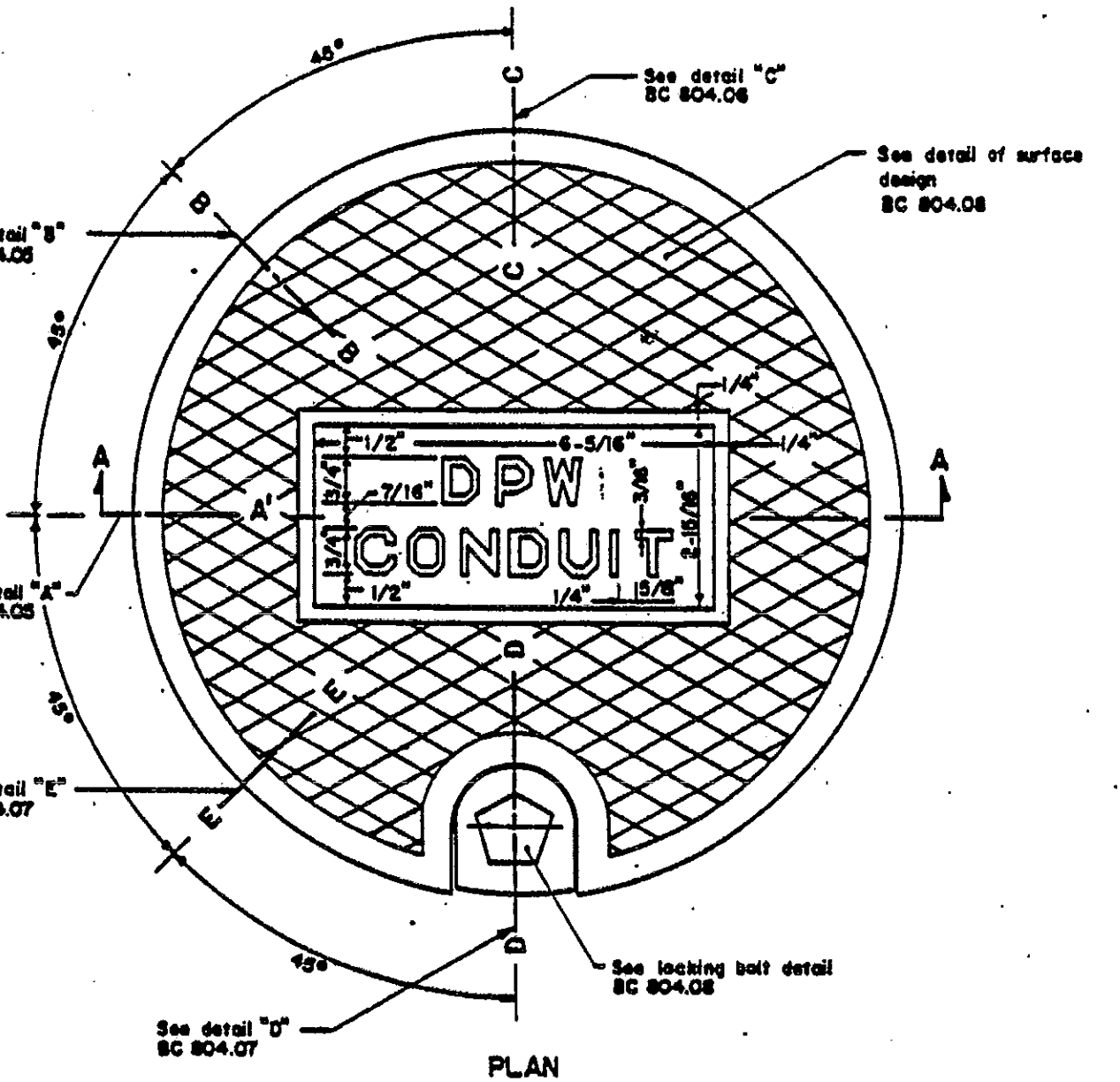
PLAN



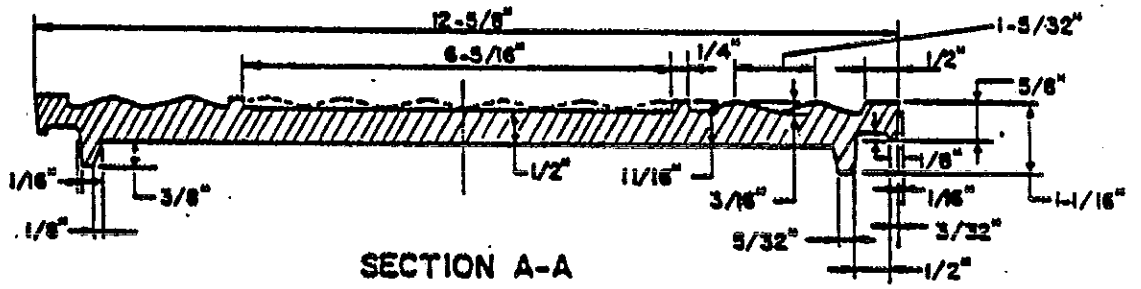
A-A ELEVATION & SECTION

NOTE:
Average Weight of Frame - 57.75 lbs

CITY OF BALTIMORE DEPARTMENT OF PUBLIC WORKS			BUREAU OF PUBLIC ROADS MARYLAND DIVISION / WASHINGTON OFFICE		HANDBOX - CONDUIT STD. FRAME
APPROVED: C. Edward Rieter HEAD, BUREAU OF ENGINEERING	ISSUED	5-1-70		10-20-70	CATEGORY CODE 80407 & 80408
	REVISED	9-10-70			
STANDARD NO. BC 804.03					SCALE: NONE / SHEET 1 OF 1



PLAN

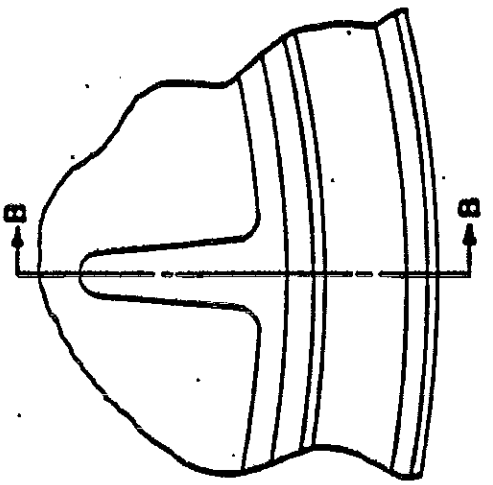


SECTION A-A

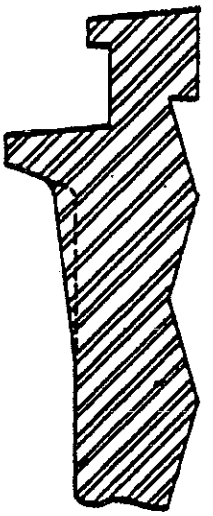
NOTE:
Handbox cover material shall be cast steel,

21,000 psi tensile strength. Weight = 21 lbs.

CITY OF BALTIMORE DEPARTMENT OF PUBLIC WORKS			FHWA WASHINGTON OFFICE	HANDBOX - CONDUIT STD. COVER
APPROVED: C. Edward Rinehart HEAD, BUREAU OF ENGINEERING	ISSUED	5-1-76		CATEGORY CODE 80408
STANDARD NO. BC 804 .04	REVISED			SCALE: NONE / SHEET 1 OF 1

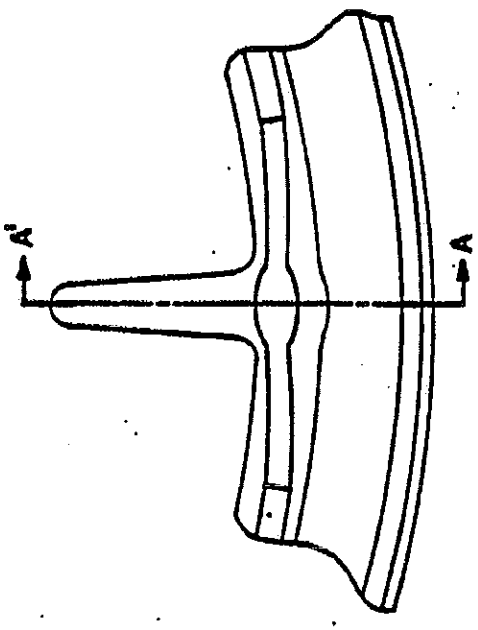


PLAN-BOTTOM VIEW

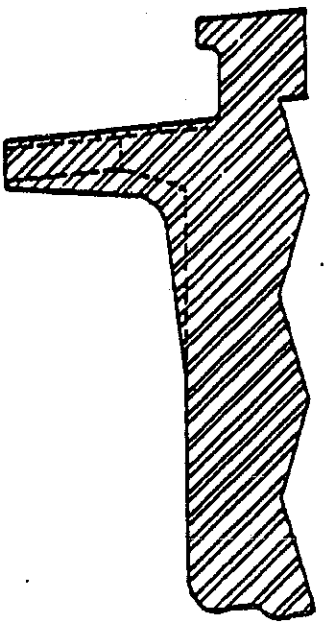


SECTION B-B

DETAIL "B"



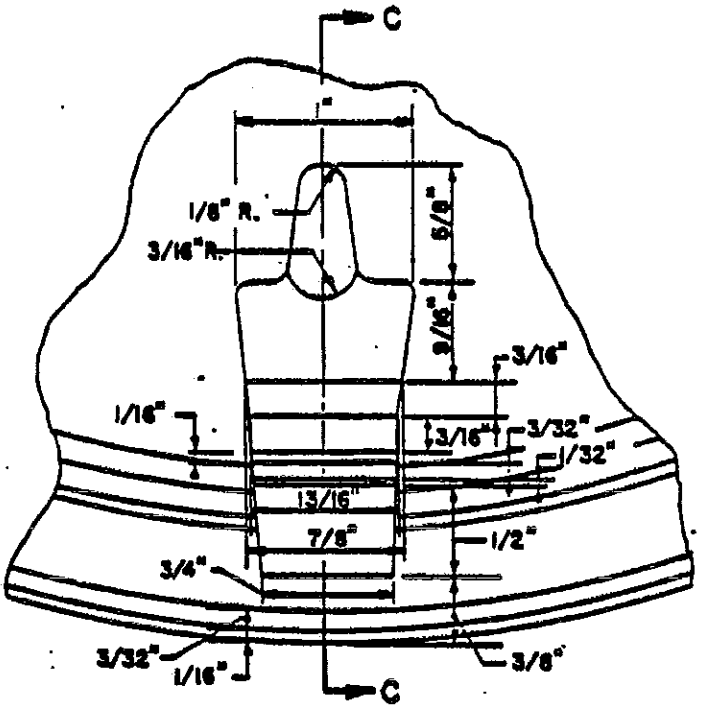
PLAN-BOTTOM VIEW



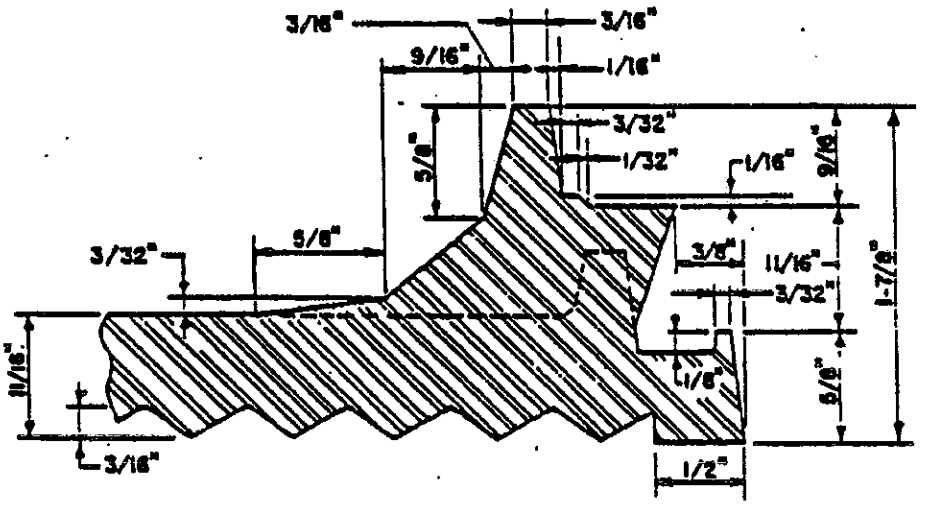
SECTION A-A'

DETAIL "A"

CITY OF BALTIMORE DEPARTMENT OF PUBLIC WORKS			BUREAU OF PUBLIC ROADS		HANDBOX - CONDUIT STD COVER - DETAILS 'A' & 'B'.
			MARYLAND DIVISION	WASHINGTON OFFICE	
APPROVED C. Edward Rinehart HEAD, BUREAU OF ENGINEERING	ISSUED	5-1-70			
	REVISED	8-10-70			CATEGORY CODE 80407 & 80408
STANDARD NO. BC 804 .05					SCALE: FULL SIZE — SHEET 1 OF 1



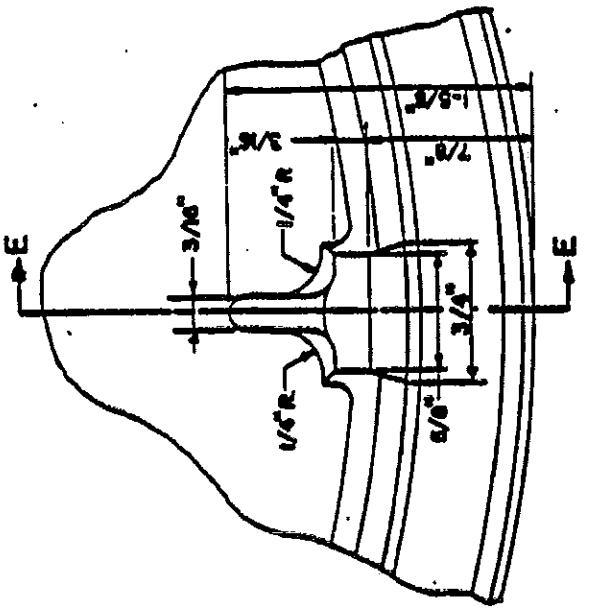
PLAN-BOTTOM VIEW



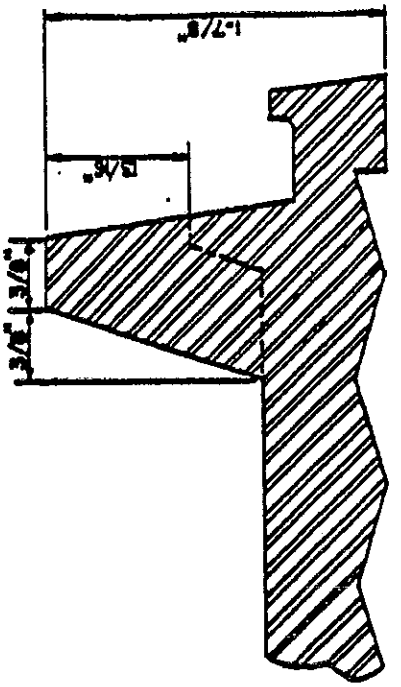
SECTION C-C

DETAIL 'C'

CITY OF BALTIMORE DEPARTMENT OF PUBLIC WORKS			BUREAU OF PUBLIC ROADS		HANDBOX - CONCRETE STD COVER - DETAIL 'C'	
			MARYLAND DIVISION	WASHINGTON OFFICE		
APPROVED: C. Edward Rinehart HEAD, BUREAU OF ENGINEERING	ISSUED	5-1-70		1-1-70	CATEGORY CODE	80407 & 80408
	REVISED	8-10-70				
STANDARD NO. BC 804 .06					SCALE: FULL SIZE	SHEET 1 OF ___

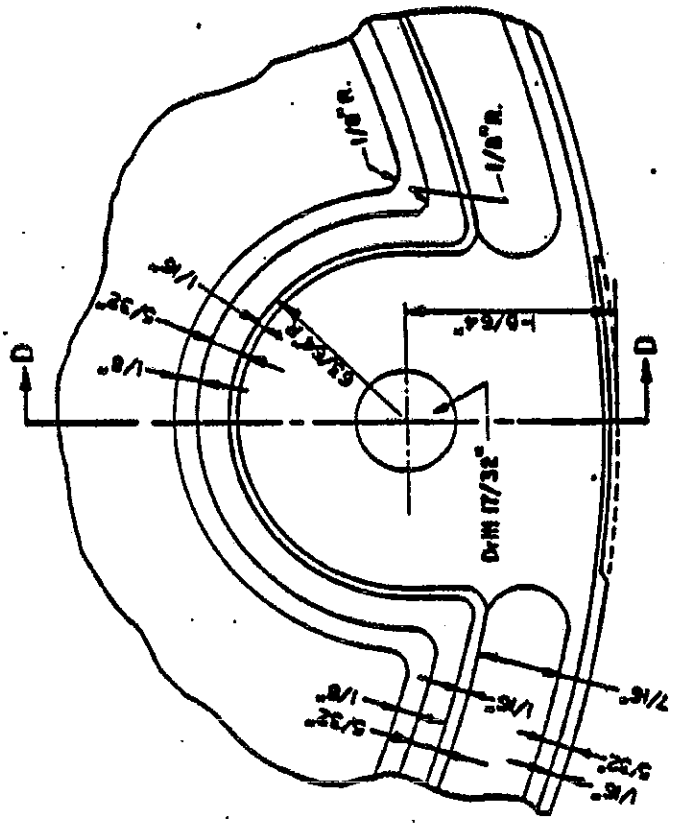


PLAN-BOTTOM VIEW

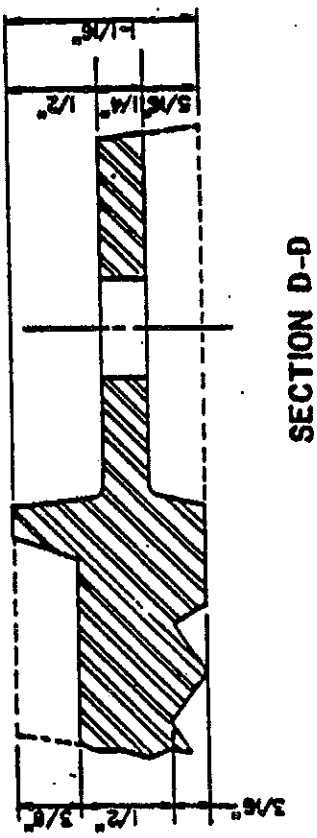


SECTION E-E

DETAIL 'E'



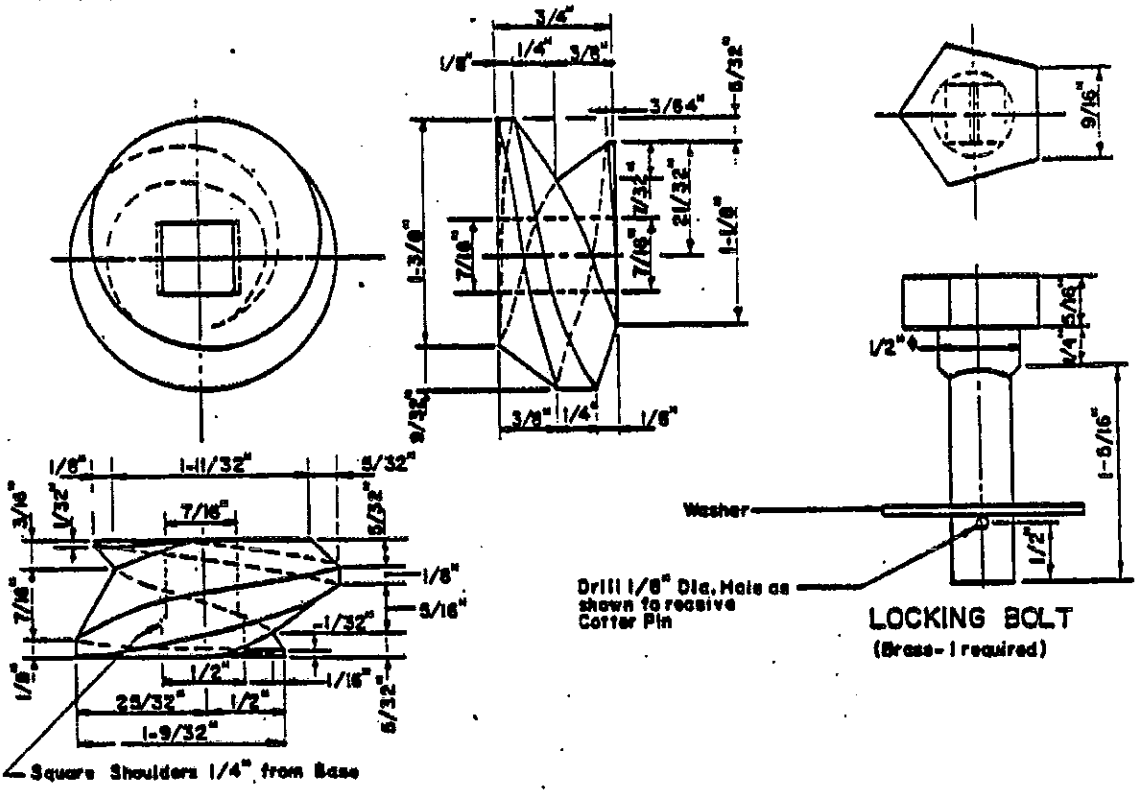
PLAN-BOTTOM VIEW



SECTION D-D

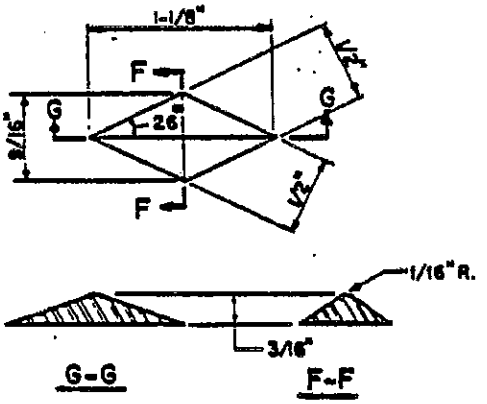
DETAIL 'D'

CITY OF BALTIMORE DEPARTMENT OF PUBLIC WORKS			BUREAU OF PUBLIC ROADS MARYLAND DIVISION / WASHINGTON OFFICE		HANDBOX - CONDUIT STD. COVER - DETAILS 'D' & 'E'
APPROVED: C. Edward Walter HEAD, BUREAU OF ENGINEERING	ISSUED	3-1-70			CATEGORY CODE 80407 & 80408
	REVISED	8-10-70			
STANDARD NO. 9C 804-07					SCALE: FULL SIZE / SHEET 1 OF 1

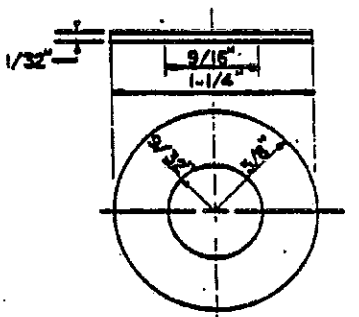


LOCKING BOLT
(Brass - 1 required)

LOCK WORM
(Cast Iron - 1 Required)

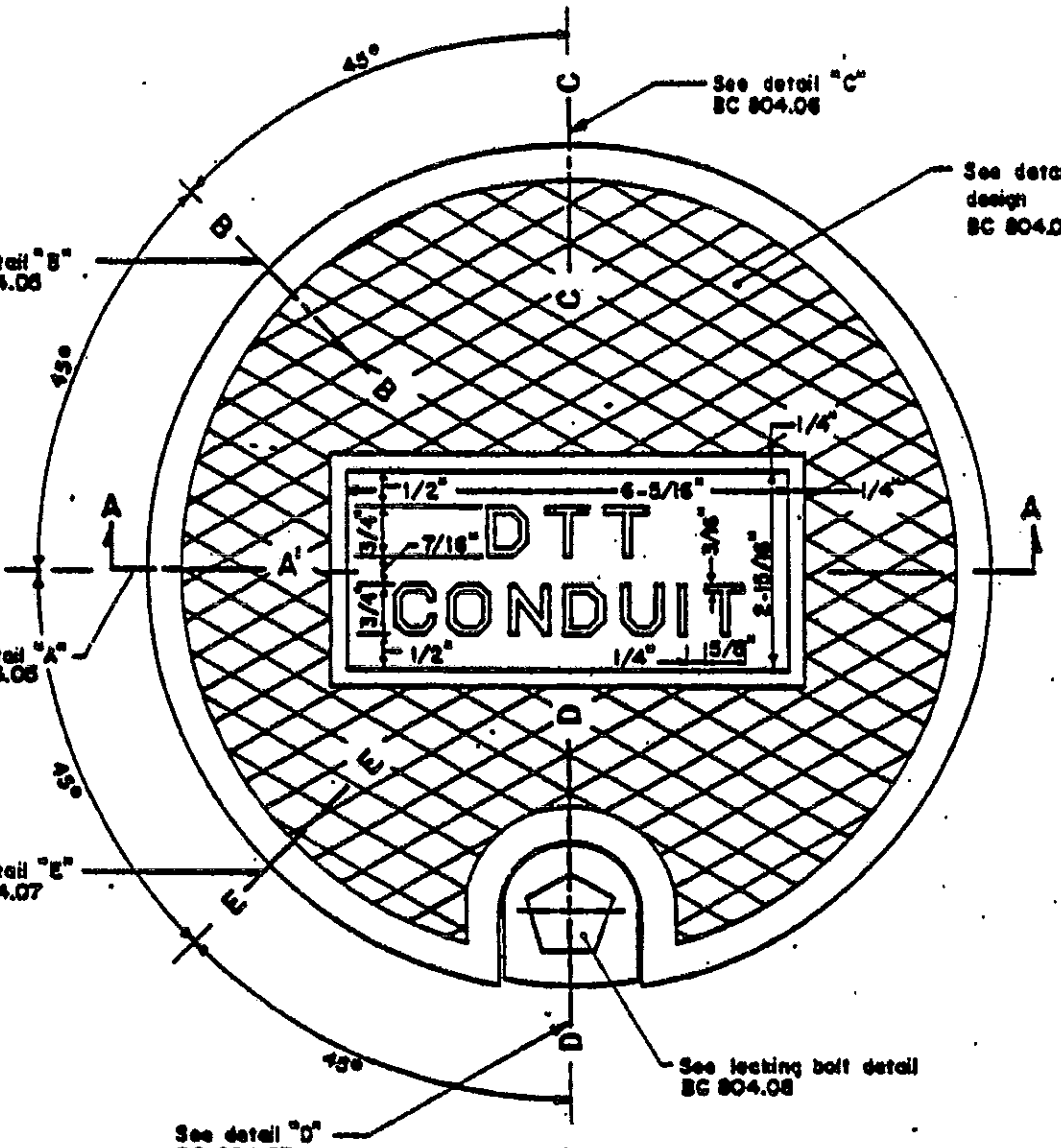


SURFACE DESIGN DETAIL

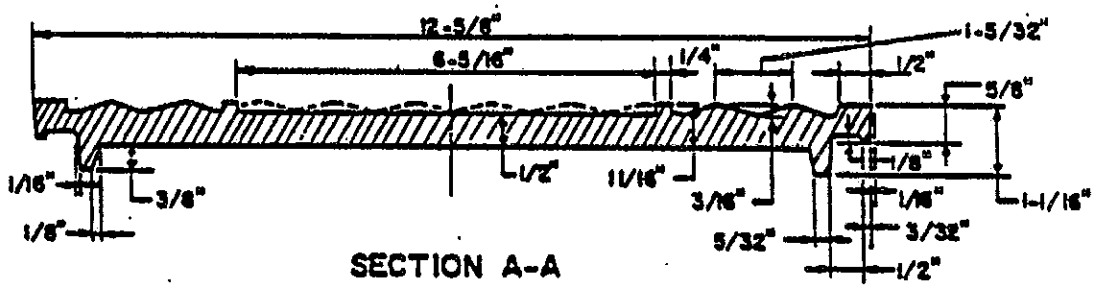


WASHER
(Bronze - 2 required)

CITY OF BALTIMORE DEPARTMENT OF PUBLIC WORKS			BUREAU OF PUBLIC ROADS MARYLAND DIVISION	WASHINGTON OFFICE	HANDBOX - CONDUIT STD. COVER-LOCKING BOLT & SURFACE DESIGN DETAILS
APPROVED: C. Edward Slatt HEAD, BUREAU OF ENGINEERING	ISSUED	5-1-70			CATEGORY CODE 80407 & 80408
	REVISED	6-10-70			
STANDARD NO. BC 804 .08					SCALE: FULL SCALE SHEET 1 OF 1



PLAN

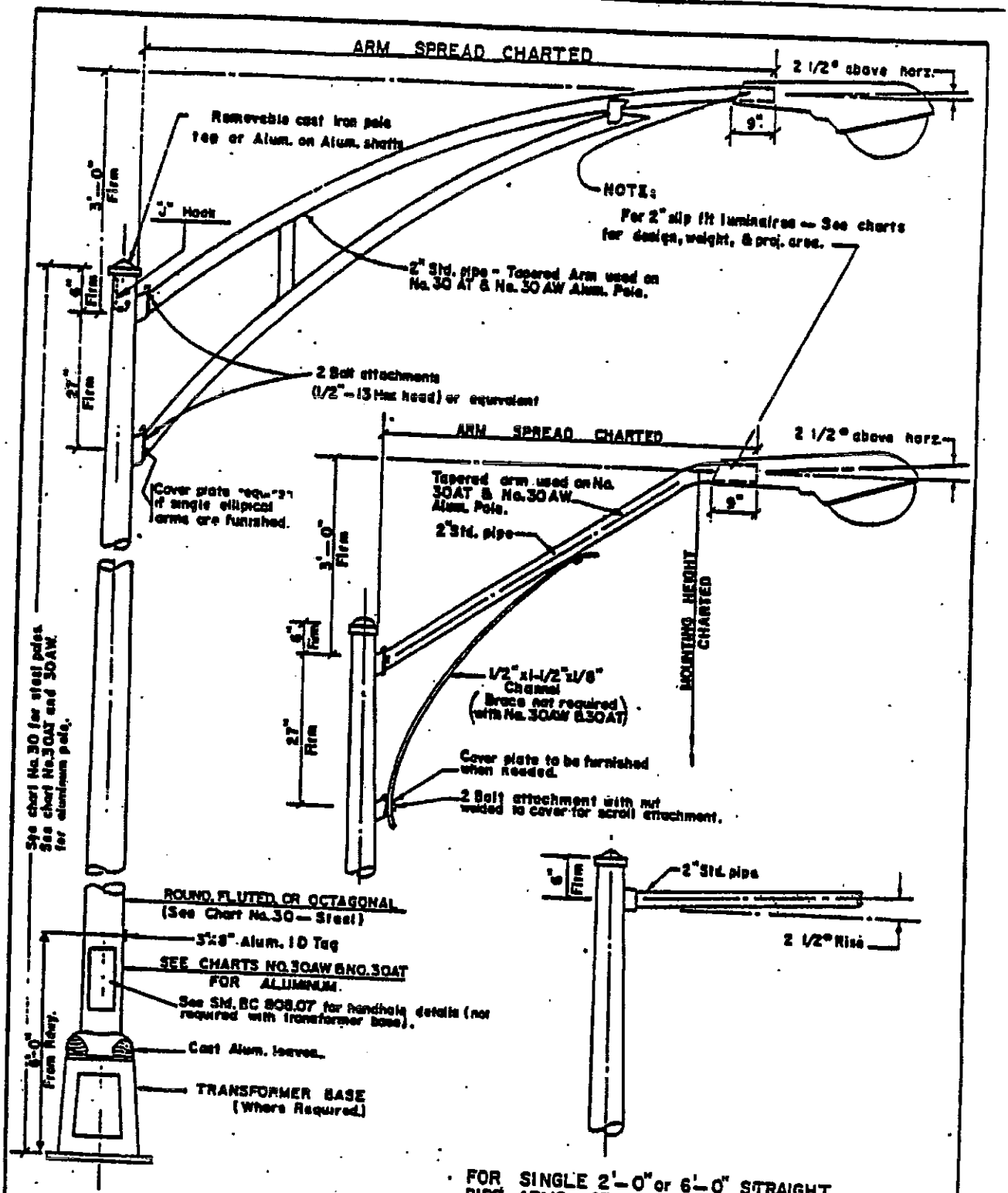


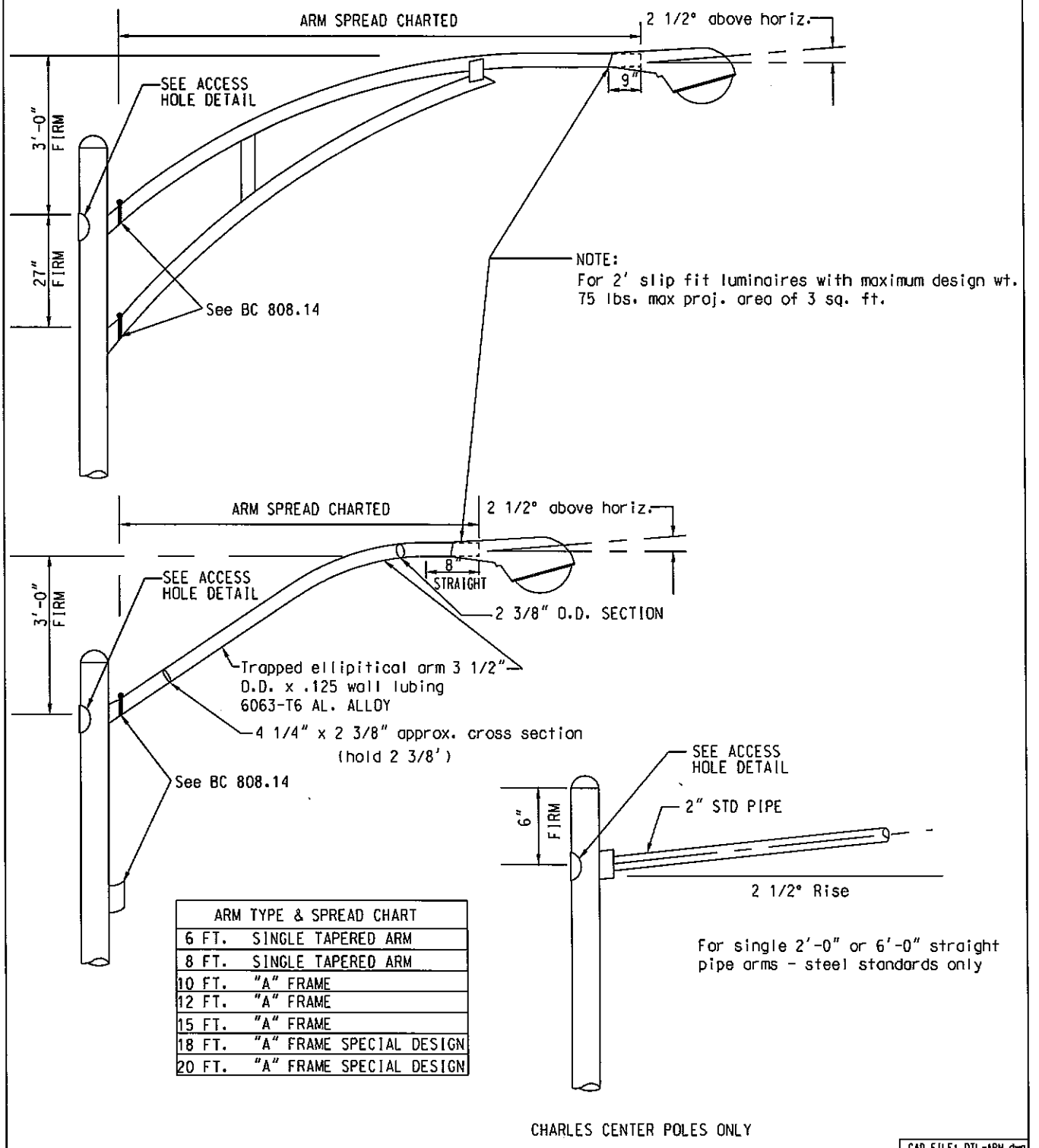
SECTION A-A

NOTE:
Handbox cover material shall be cast steel,

21,000 psi tensile strength. Weight = 21 lbs.

CITY OF BALTIMORE DEPARTMENT OF PUBLIC WORKS			FHWA WASHINGTON OFFICE	STANDARD HANDBOX COVER – DTT
APPROVED: HEAD, BUREAU OF ENGINEERING	ISSUED	5-6-70		CATEGORY CODE 80407
STANDARD NO. BC 804.09	REVISED			SCALE: NONE / SHEET 1 OF 1


ARM SPREAD CHARTED
2 1/2° above horz.
9"
Removable cast iron pole top or Alum. on Alum. shafts
"J" Hook
3'-0" Firm
6" Firm
27" Firm
NOTE:
For 2" slip fit luminaires — See charts for design, weight, & proj. area.
2" Std. pipe - Tapered Arm used on No. 30 AT & No. 30 AW Alum. Pole.
2 Bolt attachments (1/2"-13 Hex head) or equivalent
Cover plate "eq." if single elliptical arms are furnished.
ARM SPREAD CHARTED
2 1/2° above horz.
Tapered arm used on No. 30AT & No. 30AW Alum. Pole.
2" Std. pipe
9"
MOUNTING HEIGHT CHARTED
3'-0" Firm
6" Firm
27" Firm
1/2" x 1-1/2" x 1/8" Channel (Brace not required with No. 30AW & 30AT)
Cover plate to be furnished when needed.
2 Bolt attachment with nut welded to cover for scroll attachment.
See chart No. 30 for steel poles. See chart No. 30AT and 30AW for aluminum pole.
ROUND, FLUTED, OR OCTAGONAL (See Chart No. 30 — Steel)
3"x8" Alum. I.D Tag
SEE CHARTS NO. 30AW & NO. 30AT FOR ALUMINUM.
See Std. BC 808.07 for handhole details (not required with transformer base).
8'-0" From Key.
Cast Alum. leaves.
TRANSFORMER BASE (Where Required)
6" Firm
2" Std. pipe
2 1/2° Rise
FOR SINGLE 2'-0" or 6'-0" STRAIGHT PIPE ARMS — STEEL STANDARDS ONLY.
See Specifications & Special Provisions for Materials & Finish.
CITY OF BALTIMORE
DEPARTMENT OF PUBLIC WORKS
APPROVED: HEAD, BUREAU OF ENGINEERING
ISSUED 3-6-71
REVISED 12-9-71
REVISED 4-26-72
STANDARD NO. BC 808.02
FHWA WASHINGTON OFFICE 8/18/71
7/19/73
TYPICAL LIGHT STANDARDS 30 FT. POLES
CATEGORY CODE 80812 Thru 81418
SCALE: NONE
SHEET 1 OF 1



ARM TYPE & SPREAD CHART	
6 FT.	SINGLE TAPERED ARM
8 FT.	SINGLE TAPERED ARM
10 FT.	"A" FRAME
12 FT.	"A" FRAME
15 FT.	"A" FRAME
18 FT.	"A" FRAME SPECIAL DESIGN
20 FT.	"A" FRAME SPECIAL DESIGN

CHARLES CENTER POLES ONLY

CAD FILE: DTL-ARM.dwg

CITY OF BALTIMORE
DEPARTMENT OF PUBLIC WORKS

FHWA
WASHINGTON OFFICE

TYPICAL POLE ARMS
FOR 25', 28' & 30' POLES

APPROVED: _____

ISSUED
REVISED 8-5-93
REVISED 8-16-93

CATEGORY CODE:

STANDARD NO. 808.04

SCALE: NONE

SHEET 1 OF 1

...\Specs\DGN\dtl-arm.dgn 2/10/2009 2:47:02 PM

CHART
No. 30 AW

ALUMINUM WITHOUT TRANSFORMER BASE

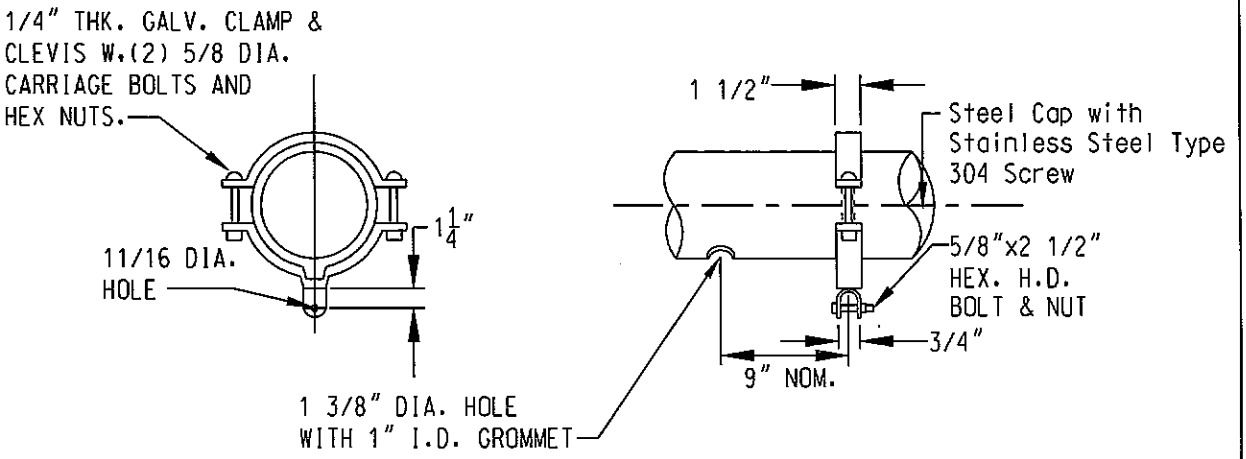
BRACKET - ARM TYPE & SPREAD	SHAFT SIZE & WALL THICKNESS	LUMINAIRE MOUNTING HEIGHT	LUMINAIRE MAX. WT. & PROJECTED AREA	
6 FT. SINGLE TAPERED ARM	8.0"x 4.5"x 27'-6" 0.188"	30'— NOM.	71 LBS.	3.2 SQ. FT.
8 FT. SINGLE TAPERED ARM	8.0"x 4.5"x 27'-6" 0.188"	"	52 LBS.	"
10 FT. "A" FRAME	8.0"x 4.5"x 27'-6" 0.188"	"	75 LBS.	"
12 FT. "A" FRAME	8.0"x 6.0"x 27'-6" 0.188"	"	75 LBS.	"
15 FT. "A" FRAME	8.0" 6.0" 27'-6" 0.188"	"	62 LBS.	2.2 SQ. FT.
18 FT. "A" FRAME	SPECIAL DESIGN			
20 FT. "A" FRAME				

CHART
No. 30 AT

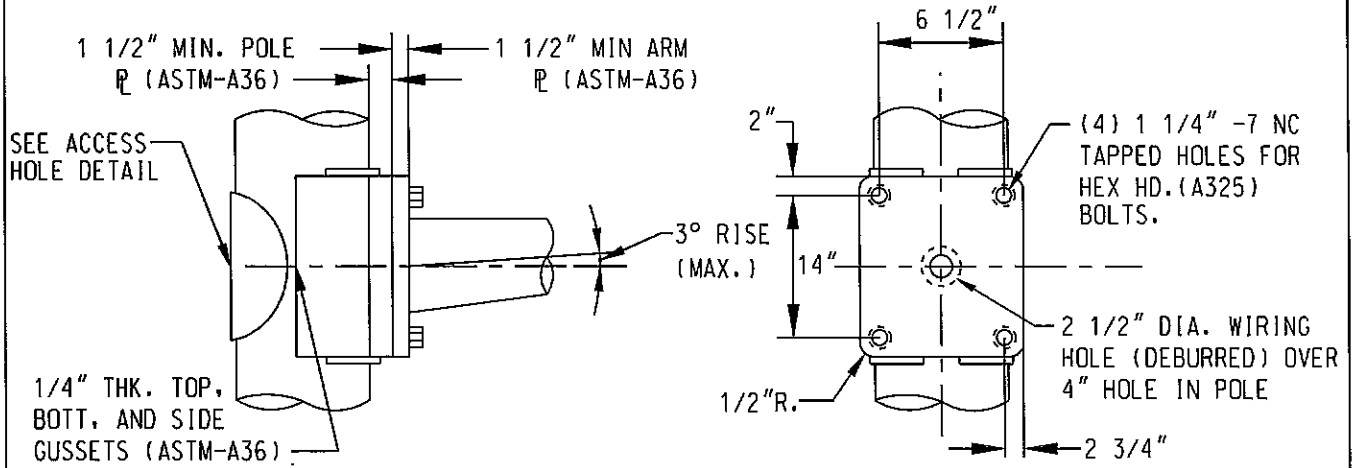
ALUMINUM WITH TRANSFORMER BASE

BRACKET - ARM TYPE & SPREAD	SHAFT SIZE & WALL THICKNESS	LUMINAIRE MOUNTING HEIGHT	LUMINAIRE MAX. WT. & PROJECTED AREA	
6 FT. SINGLE TAPERED ARM	8.0"x 4.5"x 25'-10" 0.188"	30'— NOM.	71 LBS.	3.2 SQ. FT.
8 FT. SINGLE TAPERED ARM	8.0"x 4.5"x 25'-10" 0.188"	30' — NOM.	52 LBS.	"
10 FT. "A" FRAME	8.0"x 4.5"x 25'-10" 0.188"	30'— NOM.	75 LBS.	"
12 FT. "A" FRAME	8.0"x 6"x 25'-10" 0.188"	30'— NOM.	75 LBS.	"
15 FT. "A" FRAME	8.0"x 6"x 25'-10" 0.188"	30'— NOM.	62 LBS.	2.2 SQ.FT.
18 FT. "A" FRAME	SPECIAL DESIGN			
20 FT. "A" FRAME				

CITY OF BALTIMORE DEPARTMENT OF PUBLIC WORKS			FHWA WASHINGTON OFFICE	TYPICAL LIGHT STANDARDS ALUMINUM POLE DIMENSIONS
APPROVED: C. Edward Dyer HEAD, BUREAU OF ENGINEERING	ISSUED	2-8-71	5/18/72	CATEGORY CODE 80812 Thru 81418
	REVISED	12-6-71	7/19/73	
STANDARD NO. BC 805.04		4-25-72		SCALE: NONE SHEET 1 OF 1



SIGNAL HANGER DETAIL "B"/ ASTRO BRACKETS AND PIPE FITTINGS ON POLE AND MASTARM TYP. @ EACH SIGNAL LOCATION



SIGNAL ARM ATTACHMENT DETAIL

CAD FILE: DTL-021A.dwg

CITY OF BALTIMORE DEPARTMENT OF PUBLIC WORKS				FHWA WASHINGTON OFFICE	ROUND STEEL MAST ARM POLES: GALVANIZED OR BRONZED
APPROVED: _____	ISSUED				CATEGORY CODE:
	REVISED	3-13-98			
STANDARD NO. BC 808.05					SCALE: NONE / SHEET 2 OF 3

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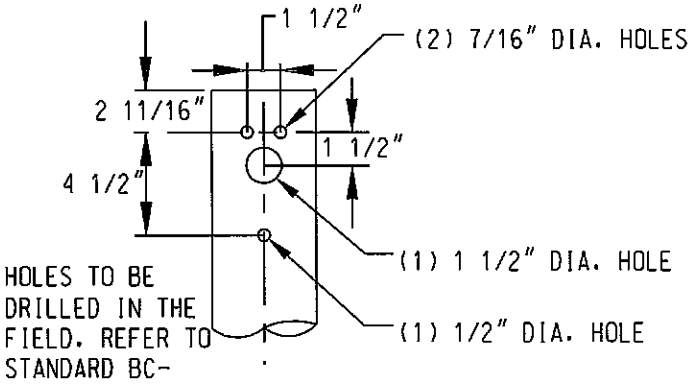
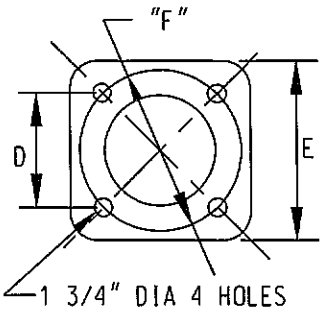
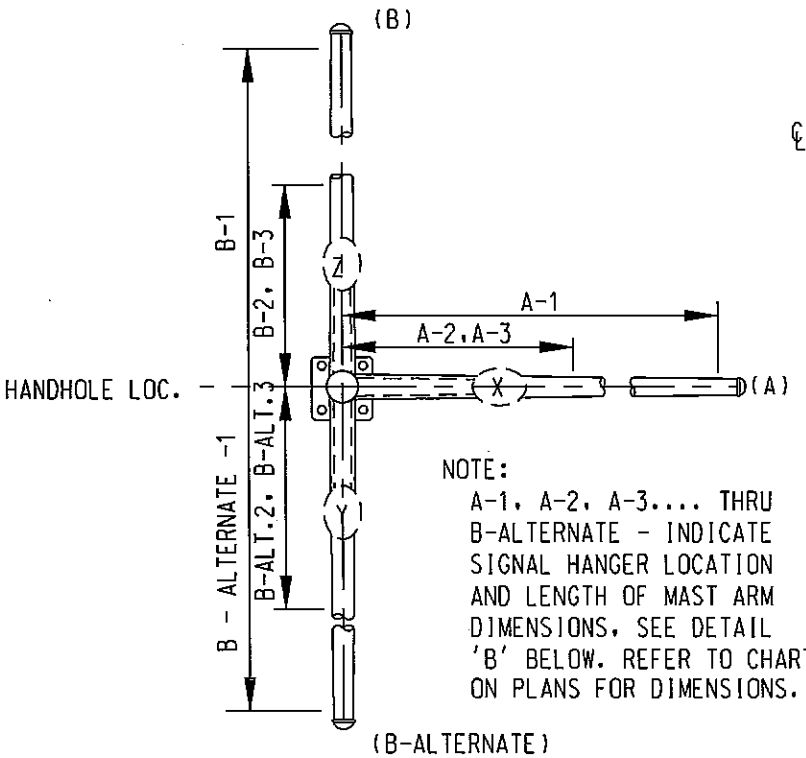


SQUARE LUMINAIRE ARM ATTACHMENT DETAIL

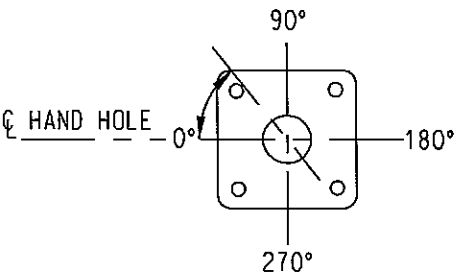


BASE PLATE DETAIL



NOTE:
A-1, A-2, A-3.... THRU B-ALTERNATE - INDICATE SIGNAL HANGER LOCATION AND LENGTH OF MAST ARM DIMENSIONS. SEE DETAIL 'B' BELOW. REFER TO CHART ON PLANS FOR DIMENSIONS.

MAST ARM DETAIL

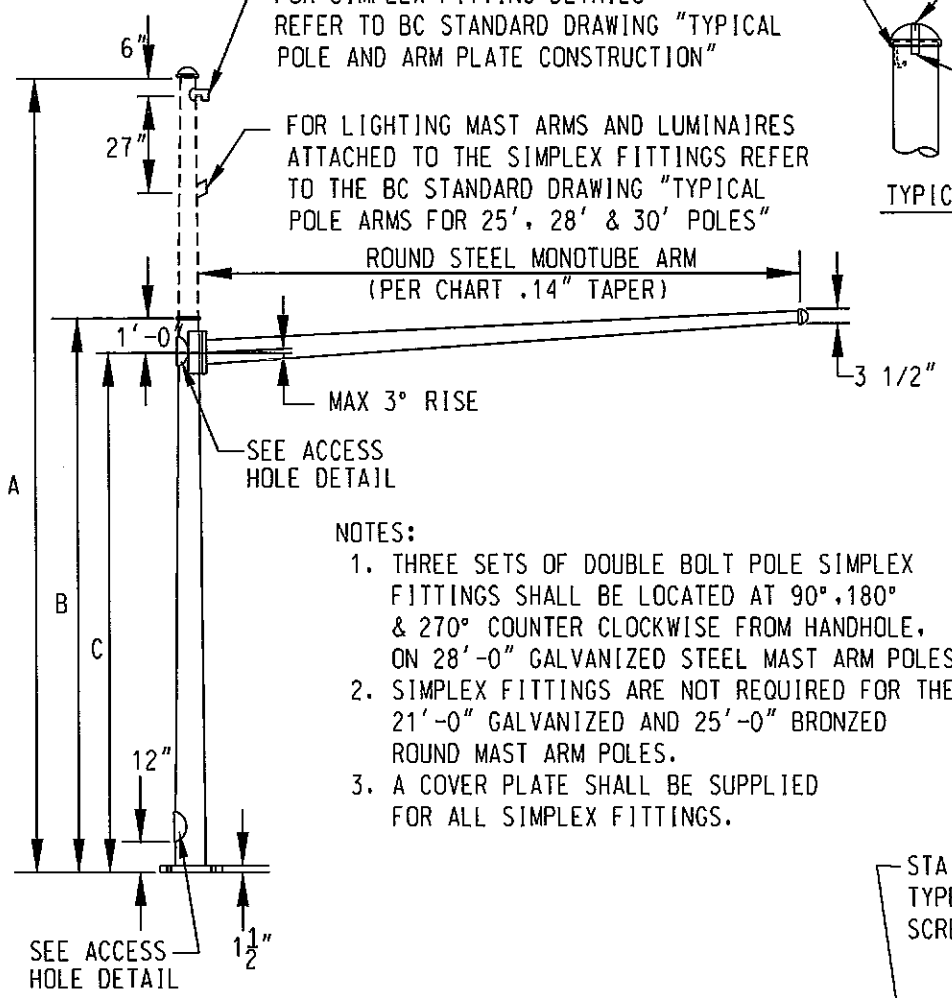


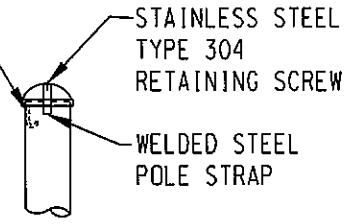
ARM LOC DETAIL (TYP.)

ALL ANGLES MEASURED CLOCKWISE FROM HAND HOLE LOC (@ 0°)

CAD FILE: DTL-021B.dwg

CITY OF BALTIMORE DEPARTMENT OF PUBLIC WORKS				FHWA WASHINGTON OFFICE	ROUND STEEL MAST ARM POLES: GALVANIZED OR BRONZED	
APPROVED: _____	ISSUED				CATEGORY CODE:	
	REVISED	8-5-93				
		8-16-93				
STANDARD NO. BC 808.05					SCALE: NONE	SHEET 3 OF 3

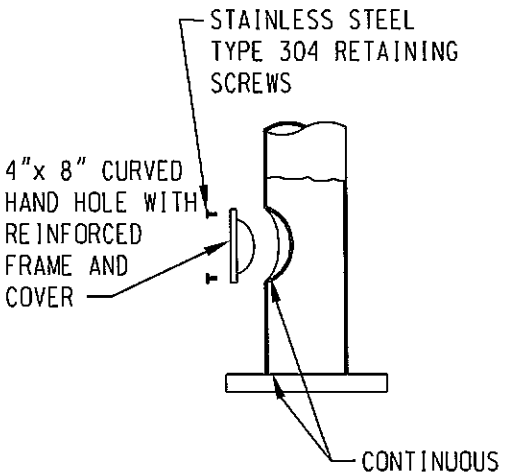




TYPICAL CAP DETAIL

NOTES:

1. THREE SETS OF DOUBLE BOLT POLE SIMPLEX FITTINGS SHALL BE LOCATED AT 90°,180° & 270° COUNTER CLOCKWISE FROM HANDHOLE, ON 28'-0" GALVANIZED STEEL MAST ARM POLES.
2. SIMPLEX FITTINGS ARE NOT REQUIRED FOR THE 21'-0" GALVANIZED AND 25'-0" BRONZED ROUND MAST ARM POLES.
3. A COVER PLATE SHALL BE SUPPLIED FOR ALL SIMPLEX FITTINGS.



ACCESS HOLE DETAIL

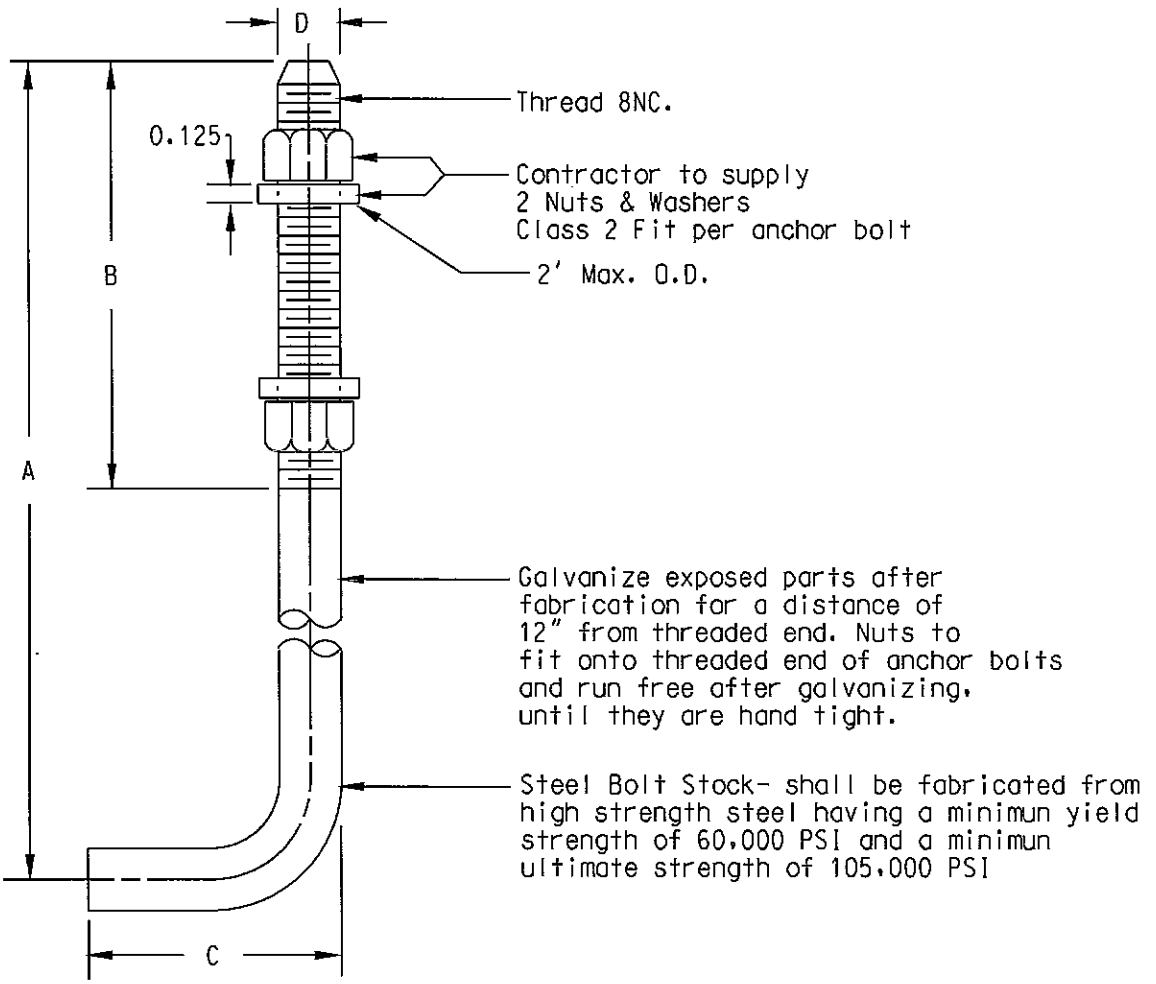
ROUND STEEL MAST ARM POLES

DIMENSION SCHEDULE			
	(21 FEET) GALVANIZED	(28 FEET) GALVANIZED	(25 FEET) BRONZED
A	NA	28'-0"	25'-0"
B	21'-0"	21'-0"	20'-0"
C	20'-0"	20'-0"	19'-0"
D *	14 1/8"	14 1/8"	10 5/8"
E *	17 1/2"	17 1/2"	15 5/8"
F *	20"	20"	15"

* See Sheet 3 of 3

CAD FILE: DTL-021.dwg

CITY OF BALTIMORE DEPARTMENT OF PUBLIC WORKS				FHWA WASHINGTON OFFICE	ROUND STEEL MAST ARM POLES: GALVANIZED OR BRONZED
APPROVED: _____	ISSUED				CATEGORY CODE:
	REVISED	3-13-98			
STANDARD NO.					SCALE: NONE SHEET 1 OF 3



Anchor nuts, bolts, and washers shall be hot-dipped galvanized in accordance with ASTM A153. Nuts and washers shall meet the Physical and Chemical Requirements of ASTM A 307.

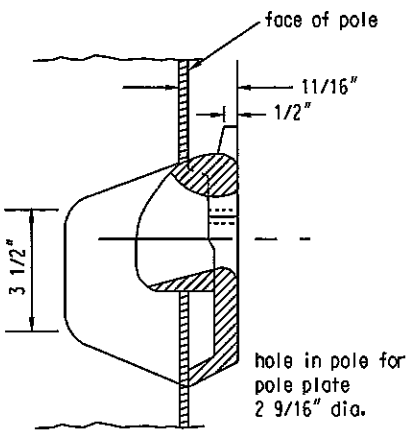
DIMENSION SCHEDULE

	STRAIN POLE MAST ARM POLE	INNER HARBOR TYPE LIGHT POLE	STANDARD LIGHT POLE	PEDESTRIAN POLE PUSH BUTTON POLE	BASE MOUNTED CONTROL CABINET
A	60"	48"	40"	24"	16"
B	9"	6"	6"	6"	3"
C	6"	4"	4"	5"	3"
D	* 1 1/2"	1 1/4"	1"	1"	3/4"

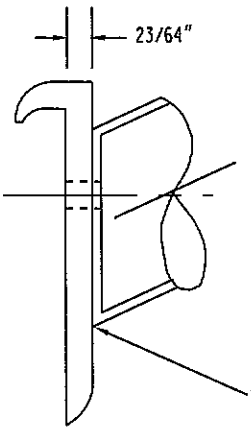
* Anchor bolts for 32' strain Pole shall be 1 3/4" in diameter.

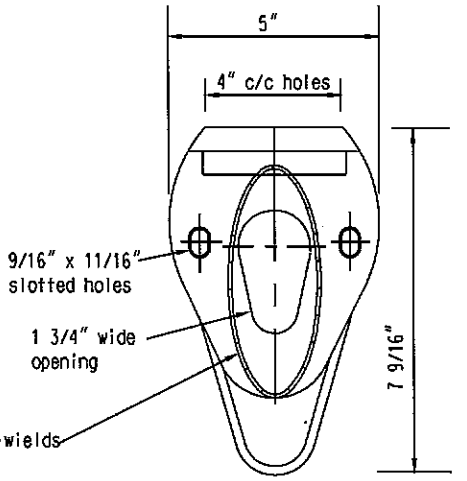
CAD FILE: DTL-001.dwg

CITY OF BALTIMORE DEPARTMENT OF PUBLIC WORKS				FHWA WASHINGTON OFFICE	STANDARD ANCHOR BOLTS
APPROVED: _____	ISSUED				CATEGORY CODE:
	REVISED	8-5-93			
		10-20-93			
STANDARD NO. 808.08					SCALE: NONE / SHEET 1 OF 1

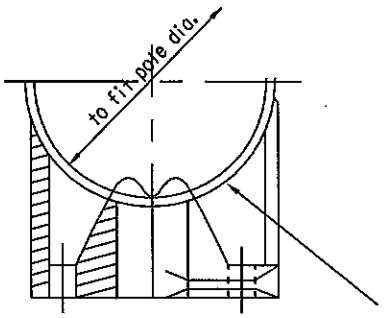


SECTION THRU POLE PLATE

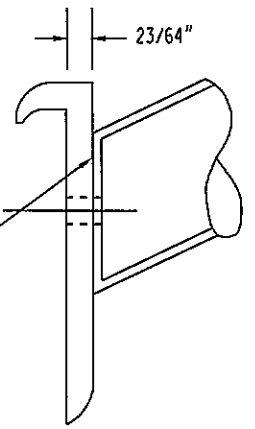


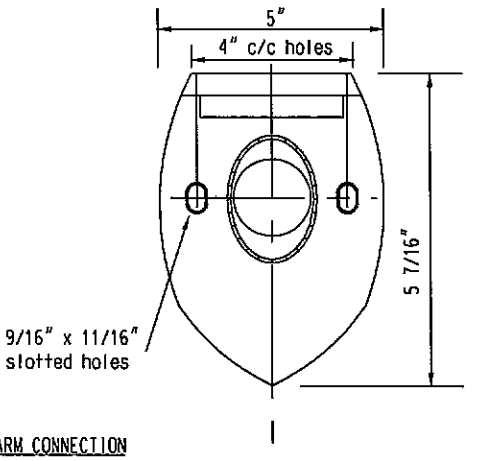


TAPERED ARM CONNECTION

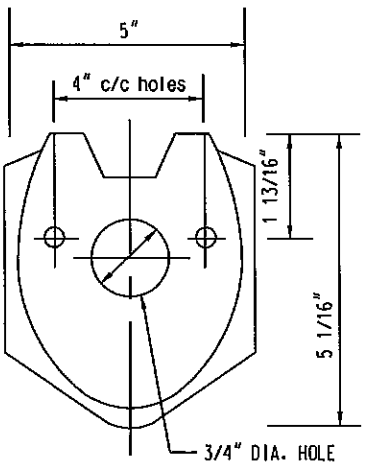


TOP VIEW OF POLE PLATE

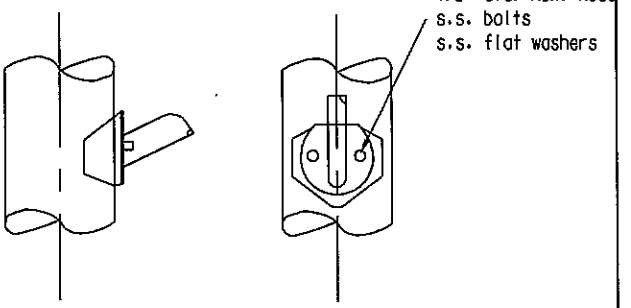




PIPE ARM CONNECTION



FRONT VIEW OF POLE PLATE

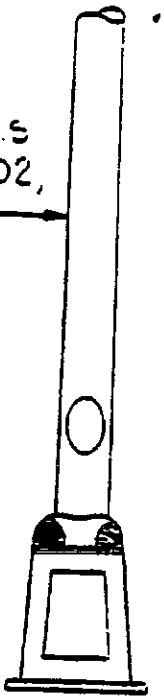


ASSEMBLED VIEW

CAD FILE: DTL-alum.dwg

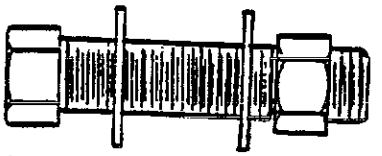
CITY OF BALTIMORE DEPARTMENT OF PUBLIC WORKS				FHWA WASHINGTON OFFICE	TYPICAL POLE AND ARM PLATE CONSTRUCTION
APPROVED: _____	ISSUED			4-24-78	
	REVISED	4-12-78		7-5-76	CATEGORY CODE:
		6-14-78			
STANDARD NO. 808.14		7-27-82			SCALE: NONE / SHEET 1 OF 1

For Pole Details
See BC 808.02,
Sheet 2 of 2.



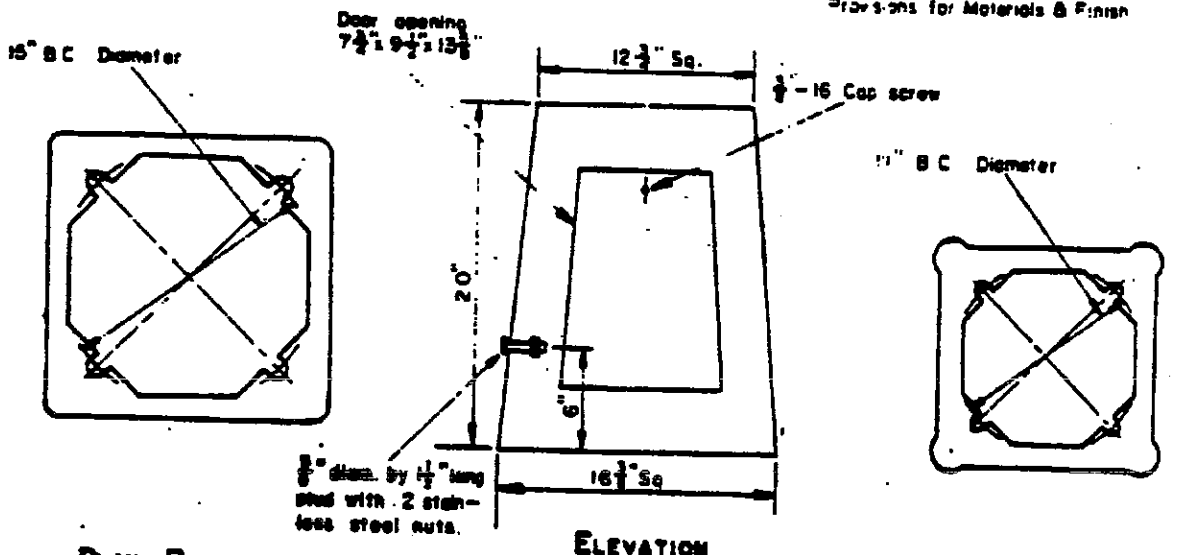
For Anchor Bolt Details, See
BC 808.08.

For Pole Attachment Bolt Details
See Below



S/S Bolt And Nut NC-8 Thread
1" x 3" With Two S/S Washers 1⅛".

See Specifications and Special Provisions for Materials & Finish



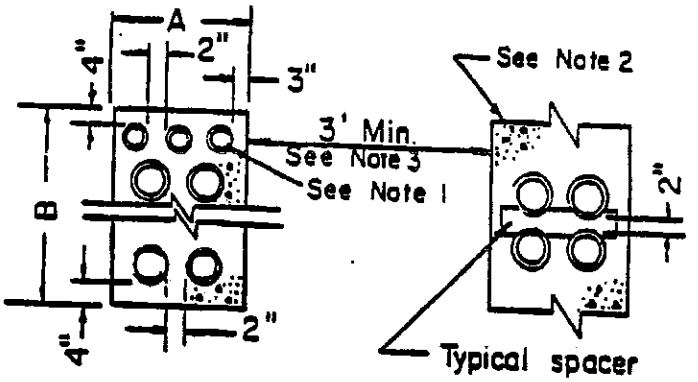
PLAN BOTTOM

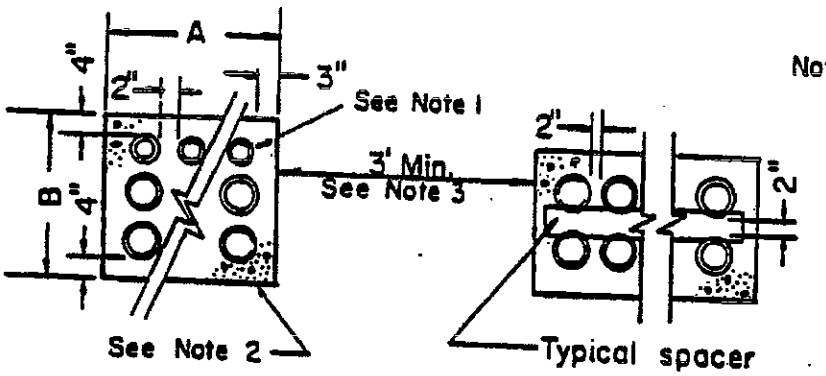
ELEVATION

PLAN TOP

PERMANENT MOLD ALUMINUM
TRANSFORMER BASES

CITY OF BALTIMORE DEPARTMENT OF PUBLIC WORKS				FHWA	TYPICAL TRANSFORMER BASES
APPROVED: C. E. [illegible] HEAD, BUREAU OF ENGINEERING	ISSUED	6-8-71		WASHINGTON OFFICE 8/18/72	
	REVISED	12-6-71		7/19/73	CATEGORY CODE 81506 Thru 82198
STANDARD NO. BC 81515		4-26-72			
		10-7-86			SCALE: NONE SHEET 1 OF 11





Note 1: 3-3" ducts to be included in the duct section where indicated on plans.

Note 2 All concrete shall be mix 1.

Note 3: This dimension shall apply when conduits are installed in parallel systems.

Note 4: Typical spacers shall be placed at each joint and every five (5) feet thereafter.

FOR 5" DUCT

CAT. CODE	TYPE	A	B	H	W
82430	X	1'-8"	1'-2"	1	2
82417	O	1'-8"	1'-10"	2	2
82415	M	1'-8"	2'-6"	3	2
82426	R	1'-8"	3'-2"	4	2
82410	H	1'-8"	3'-10"	5	2
82416	N	2'-4"	1'-10"	2	3
82414	L	3'-0"	1'-10"	2	4
82411	I	3'-8"	1'-10"	2	5
82433	Y	1'-0"	1'-2"	1	1

FOR 3" DUCT

CAT CODE	TYPE	A	B	H	W
82435	Y	10"	1'-0"	1	1
82432	X	1'-4"	1'-0"	1	2
82422	P	1'-10"	1-0"	1	3

Supercedes previous standards B.C. 824.01
B.C. 824.02
B.C. 824.03
B.C. 824.04

CITY OF BALTIMORE
DEPARTMENT OF PUBLIC WORKS

APPROVED: William E. Kirby
HEAD, BUREAU OF ENGINEERING

STANDARD NO. B.C. 824.01

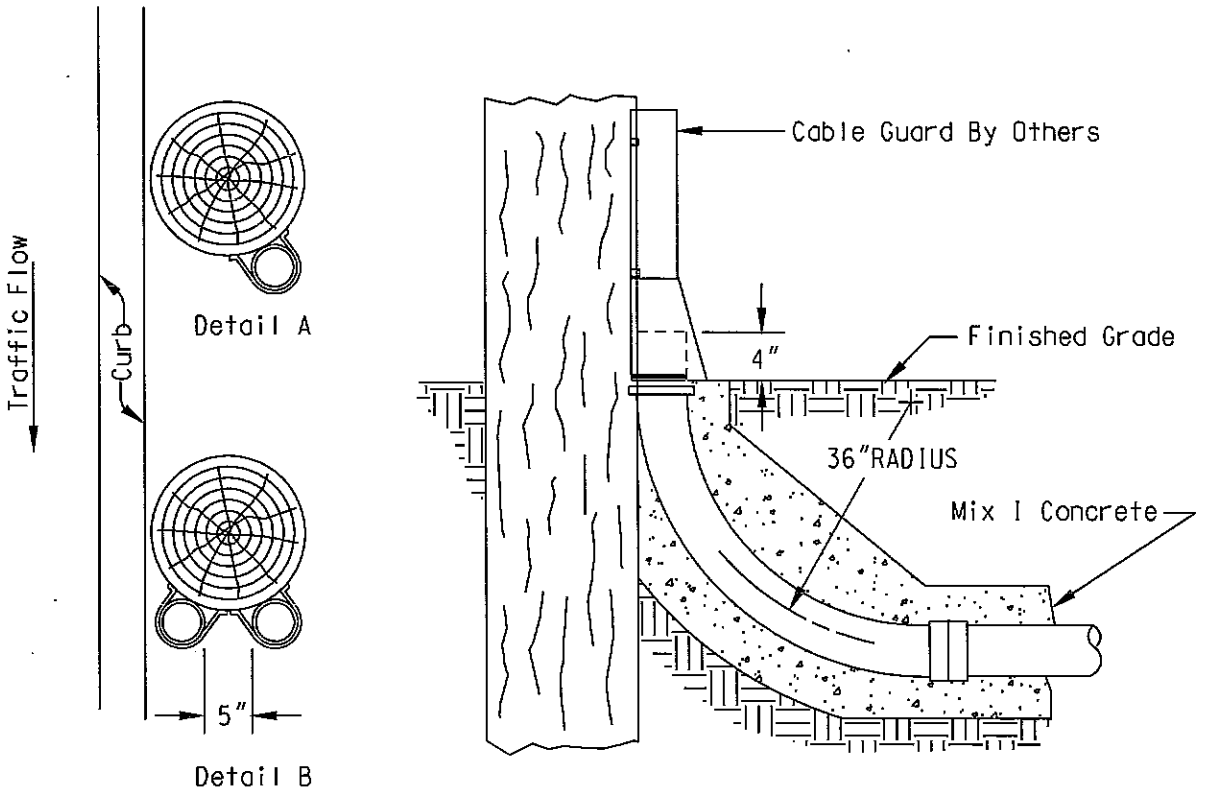
ISSUED 9-15-78
REVISED 10-31-80

FHWA
WASHINGTON OFFICE
9-20-78

STANDARD DUCT SECTIONS

CATEGORY CODE See Above

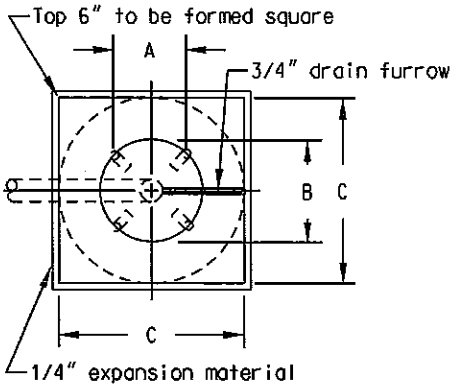
SCALE: NONE SHEET 1 OF 1



Install duct bends away from traffic flow if possible and inside curbside tangent to pole. See details A and B.

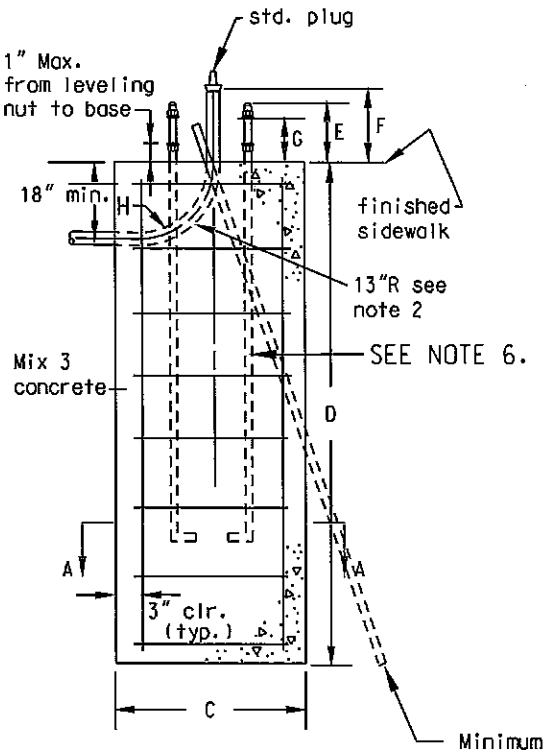
CAD FILE: DTL-013.dwg

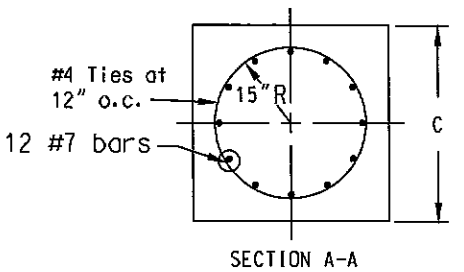
CITY OF BALTIMORE DEPARTMENT OF PUBLIC WORKS				FHWA WASHINGTON OFFICE	CONDUIT POLE CONNECTION SINGLE & DOUBLE
APPROVED: _____	ISSUED				CATEGORY CODE:
	REVISED	8-5-93			
STANDARD NO. 824.05					SCALE: NONE / SHEET 1 OF 1



NOTES:

1. The base excavation for Strain Poles and Mast arm poles may be augered with a 3 foot diameter auger provided the top six inches of the base are blocked square.
2. Standard PVC conduit elbow encased in concrete.
3. Where foundations are constructed outside of sidewalk areas, the top of the foundation shall be constructed to an elevation one inch shall be formed around the out side edge. above the finished grade and a one inch chamfer shall be formed around the out side edge.
4. Block out new base with a 1/4 inch expansion material (see B.C. 655.01)
5. Poles to be six feet back of face of curb unless otherwise noted.
6. For anchor bolt dimensions refer to standard traffic anchor bolts detail.
7. The top of all anchor bolts are to be level.
8. Reinforcing steel not required for Pedestal and Push Botton Pole bases.
9. Grounds for Pedestal and Push button foundations carried to main control pole.





DIMENSION	DIMENSION SCHEDULE			
	PEDESTAL AND PUSH BUTTON BASE	STRAIN POLE	MAST ARM POLE	INNER HARBOR POLE
A	5 3/4"	10 5/8"	14 1/8"	14 1/8"
B	8 1/8"	15"	20"	20"
C	18"	36"	36"	36"
D	36"	9'-6"	9'-6"	9'-6"
E	4"	7 1/2"	7 1/2"	6 1/2"
F	6"	8"	8"	8"
G	0	6"	6"	8"
H	3"	4"	4"	4"

CAD FILE: DTL-002.dwg

CITY OF BALTIMORE
DEPARTMENT OF PUBLIC WORKS

FHWA
WASHINGTON OFFICE

POLE, POST AND PEDESTAL FOUNDATION DETAILS - TRAFFIC

APPROVED: _____

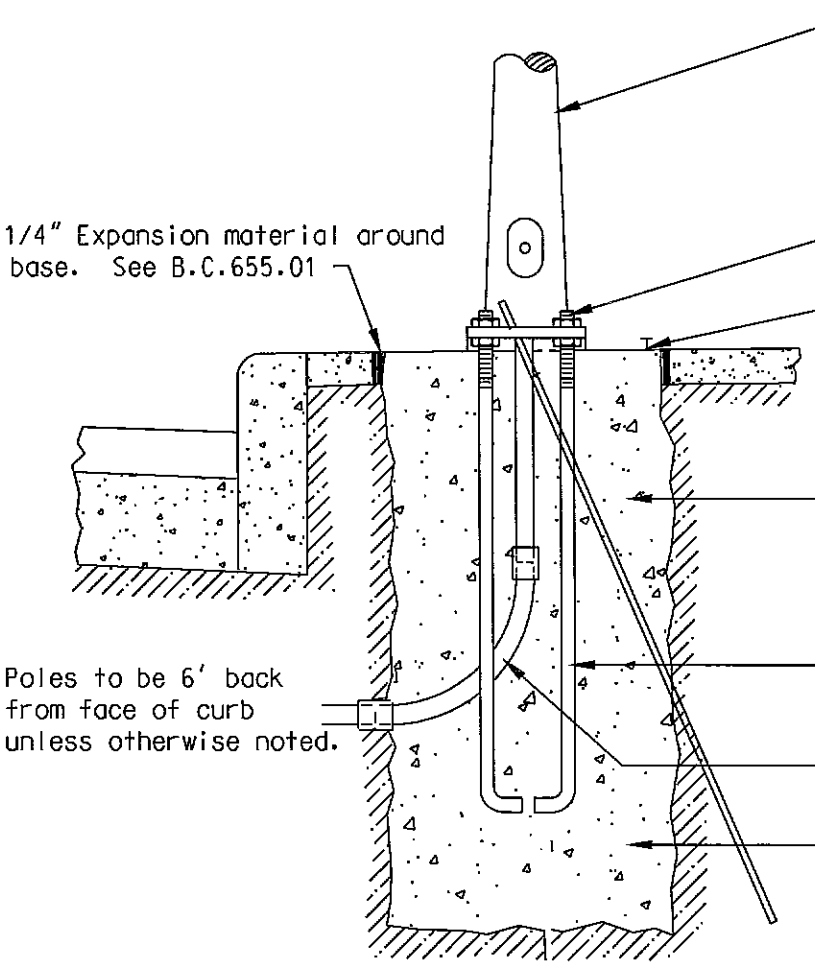
ISSUED	
REVISED	8-5-93
	10-20-93
	11-1-95

CATEGORY CODE:

STANDARD NO. BC 885.07

SCALE: NONE

SHEET 1 OF 1



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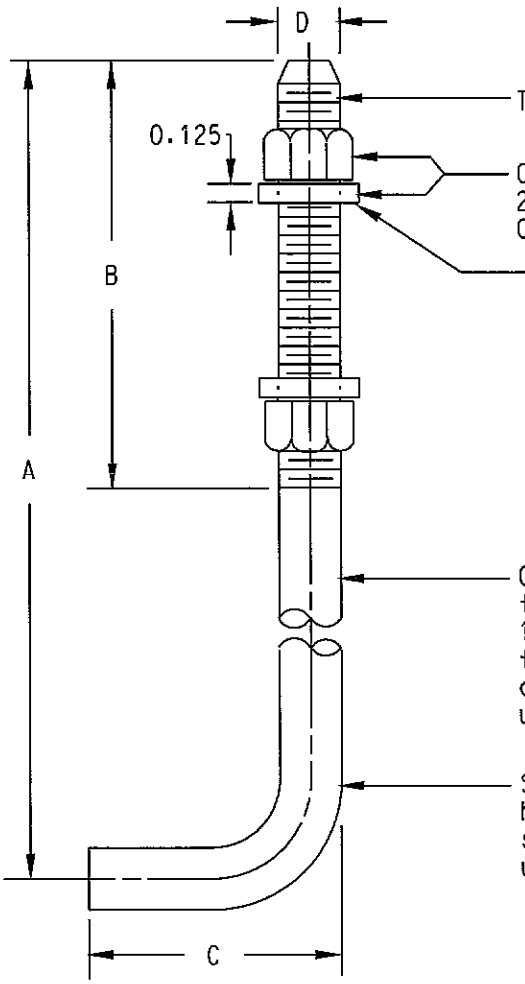
CITY OF BALTIMORE DEPARTMENT OF PUBLIC WORKS				FHWA WASHINGTON OFFICE	VARIOUS POLE AND FOUNDATION DETAILS TRAFFIC	
APPROVED: _____	ISSUED				CATEGORY CODE:	
	REVISED					
STANDARD NO. BC 885.07B					SCALE: NONE	SHEET 1 OF 1



Anchor nuts, bolts, and washers shall be hot-dipped galvanized in accordance with ASTM A153. Nuts and washers shall meet the Physical and Chemical Requirements of ASTM A 307.

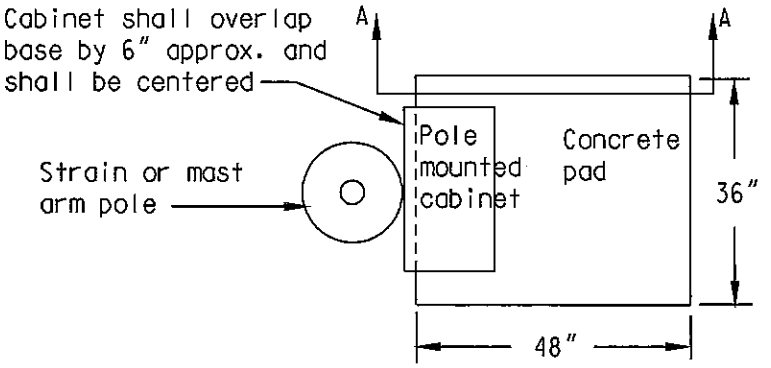
DIMENSION SCHEDULE

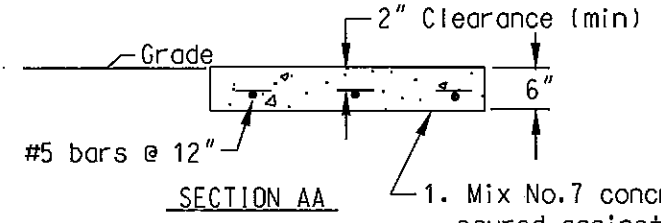
	STRAIN POLE MAST ARM POLE	INNER HARBOR TYPE LIGHT POLE	STANDARD LIGHT POLE	PEDESTRIAN POLE PUSH BUTTON POLE	BASE MOUNTED CONTROL CABINET
A	60"	48"	40"	24"	16"
B	9"	6"	6"	6"	3"
C	6"	4"	4"	5"	3"
D	* 1 1/2"	1 1/4"	1"	1"	3/4"

* Anchor bolts for 32' strain Pole shall be 1 3/4" in diameter.

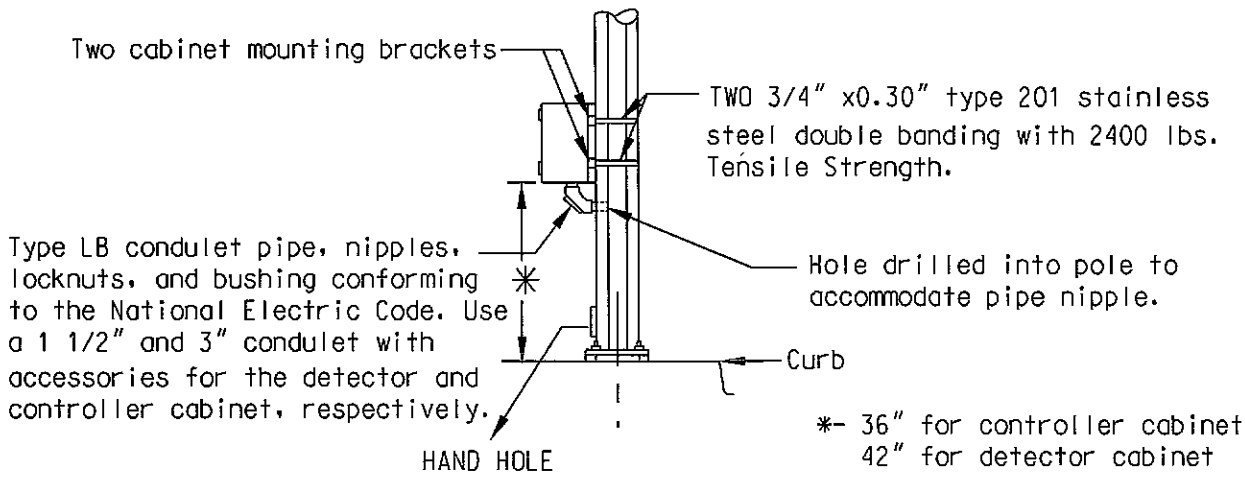
CAD FILE: DTL-001.dwg

CITY OF BALTIMORE DEPARTMENT OF PUBLIC WORKS			FHWA WASHINGTON OFFICE	STANDARD ANCHOR BOLTS
APPROVED: _____	ISSUED			CATEGORY CODE:
	REVISED	8-5-93 10-20-93		
STANDARD NO. 808.08				SCALE: NONE / SHEET 1 OF 1



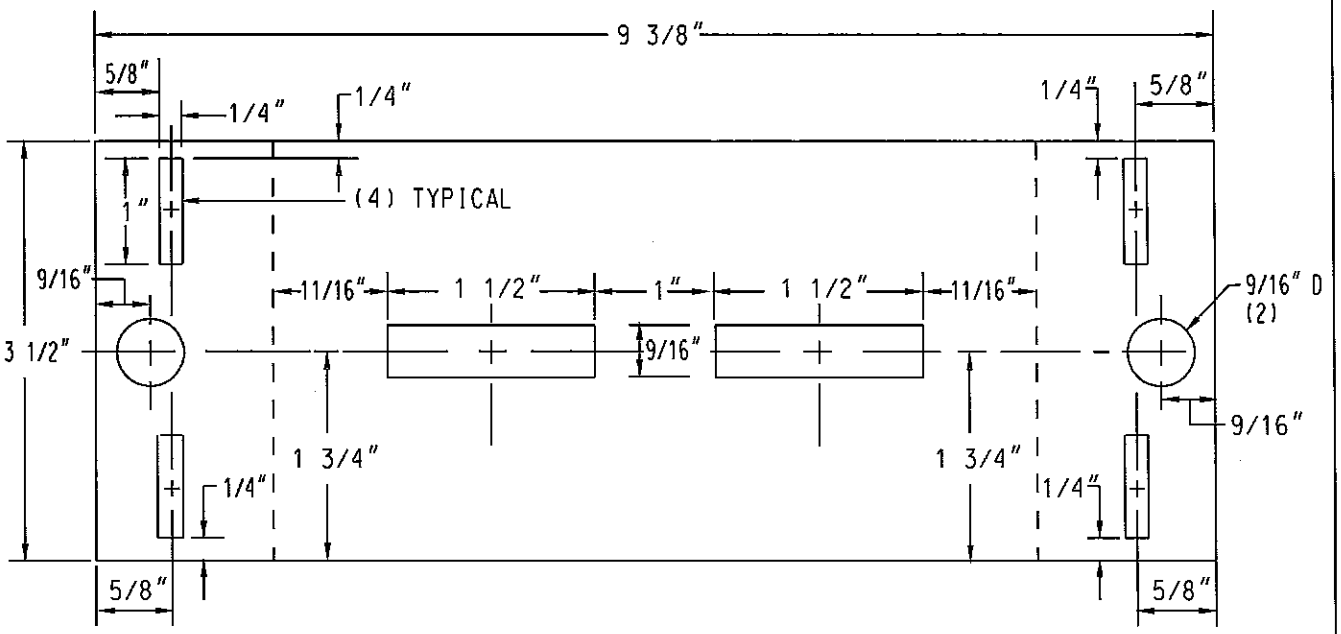


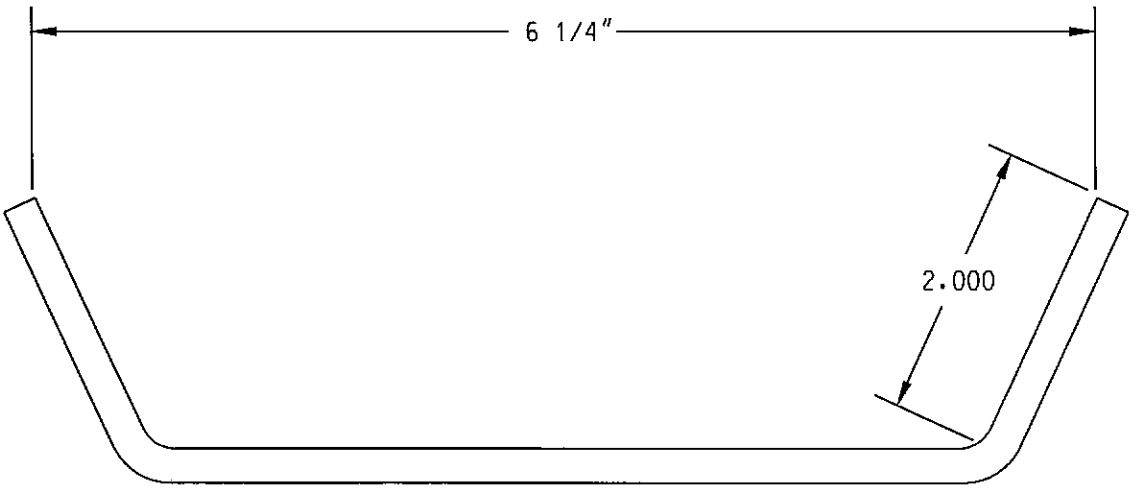
1. Mix No.7 concrete to be poured against undisturbed ground.
2. If the pole is in or adjacent to a sidewalk, the pad is eliminated.



CAD FILE: DTL-006.dwg

CITY OF BALTIMORE DEPARTMENT OF PUBLIC WORKS				FHWA WASHINGTON OFFICE	POLE MOUNTED TRAFFIC SIGNAL CABINETS	
APPROVED: _____	ISSUED				CATEGORY CODE:	
	REVISED				SCALE: NONE	SHEET 1 OF 1
STANDARD NO.						

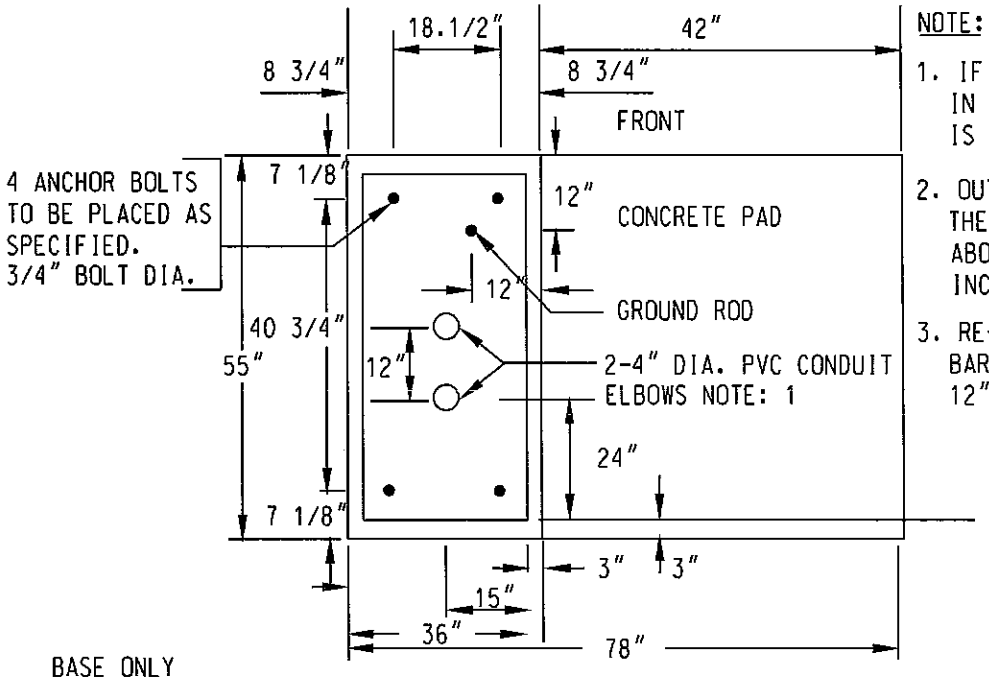




Material - 1/4" Aluminum # 5052-H32 or 3303-H14
Bend Radius - 1/4"

CAD FILE: DTL-008.dwg

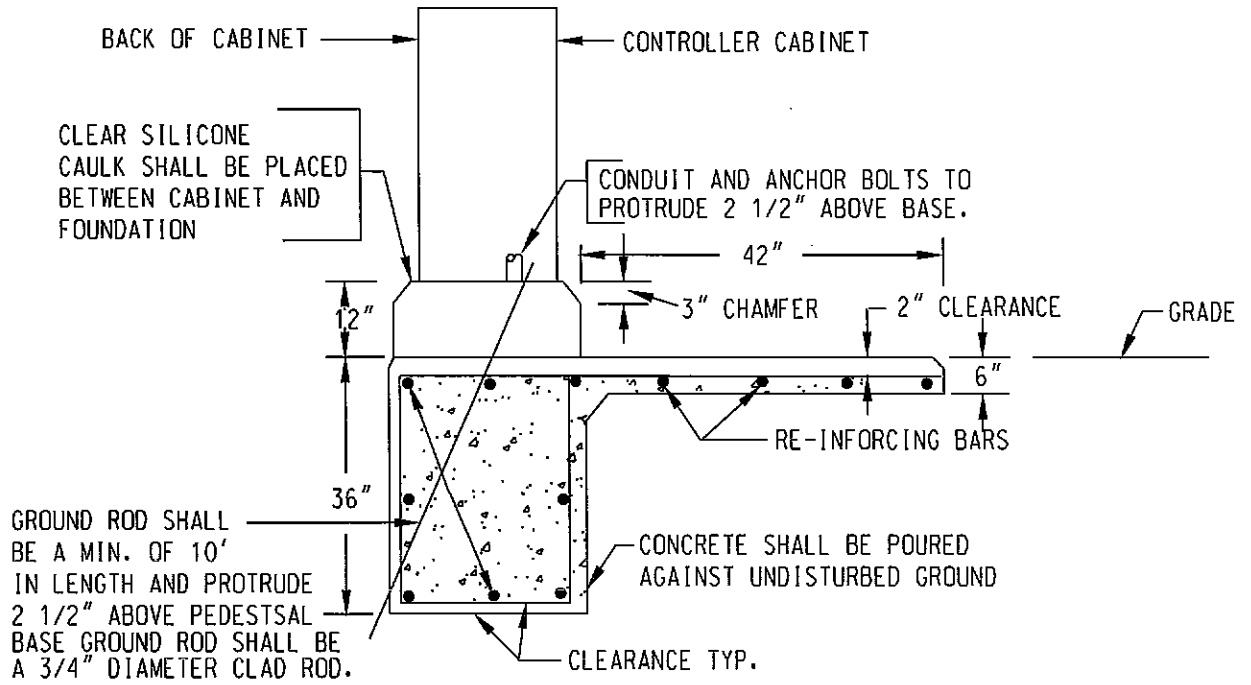
CITY OF BALTIMORE DEPARTMENT OF PUBLIC WORKS				FHWA WASHINGTON OFFICE	TRAFFIC SIGNAL CABINET MOUNTING BRACKET
APPROVED: _____	ISSUED				CATEGORY CODE:
	REVISED	8-5-93			
STANDARD NO.					SCALE: NONE / SHEET 1 OF 1



NOTE:

1. IF THE BASE IS CONSTRUCTED IN A SIDEWALK AREA THE PAD IS ELIMINATED.
2. OUTSIDE OF SIDEWALK AREAS THE PAD SHALL BE ONE INCH ABOVE GRADE WITH A ONE INCH CHAMFER.
3. RE-INFORCING SHALL BE #5 BARS WITH #4 TIES SPACED 12" APART.

BASE ONLY
CABINET NOT SHOWN



CAD FILE: DTL-014.dwg

CITY OF BALTIMORE DEPARTMENT OF PUBLIC WORKS				FHWA WASHINGTON OFFICE	NEMA CONTROLLER CABINET FOUNDATION BASE
APPROVED: _____	ISSUED				CATEGORY CODE:
	REVISED				
STANDARD NO.					SCALE: NONE / SHEET 1 OF 1

TRAFFIC SIGNAL STANDARD WIRING PRACTICE

VEHICLE SIGNAL CIRCUITS

3 SECTION, 4 SECTION WITH DUAL RED
4 CONDUCTOR CABLE,

FUNCTION	CONDUCTOR COLOR
RED INDICATION(S)	RED
YELLOW INDICATION	BLACK
GREEN INDICATION	GREEN
COMMON	WHITE

4 SECTION WITH ARROW
7 CONDUCTOR CABLE,

FUNCTION	CONDUCTOR COLOR
RED INDICATION	RED
YELLOW INDICATION	BLACK
GREEN INDICATION	GREEN
GREEN ARROW	BLUE
COMMON	WHITE
SPARE	ORANGE
SPARE	WHT./BLK.

5 SECTION, WITH ARROWS
7 CONDUCTOR CABLE,

FUNCTION	CONDUCTOR COLOR
RED INDICATION	RED
YELLOW INDICATION	BLACK
GREEN INDICATION	GREEN
GREEN ARROW	BLUE
YELLOW ARROW	WHT./ BLK.
COMMON	WHITE
SPARE	ORANGE

PEDESTRIAN SIGNAL CIRCUITS

SINGLE FACE

4 CONDUCTOR CABLE	CONDUCTOR COLOR
DON'T WALK INDICATION	RED
WALK	GREEN
COMMON	WHITE
SPARE	BLACK

SINGLE OR (DOUBLE FACE) WITH PUSH BOTTON

7 CONDUCTOR CABLE	CONDUCTOR COLOR
DON'T WALK INDICATION, PRIMARY STREET	RED
WALK INDICATION, PRIMARY STREET	GREEN
SPARE (DON,T; WALK INDICATION, SECONDARY STREET)	ORANGE
SPARE (WALK INDICATION, SECONDARY STREET)	BLUE
SIGNAL COMMON	WHITE
PUSH BUTTON	BLACK
PUSH BUTTON COMMON	WHT./BLK.

PUSH BUTTON ON SEPARATE POST

2 CONDUCTOR CABLE	CONDUCTOR COLOR
PUSH BUTTON	BLACK
PUSH BUTTON COMMON	WHITE

CAD FILE: DTL-022.dwg

CITY OF BALTIMORE DEPARTMENT OF PUBLIC WORKS				FHWA WASHINGTON OFFICE	TRAFFIC SIGNAL STANDARD WIRING PRACTICE
APPROVED: _____	ISSUED				CATEGORY CODE:
	REVISED	8-5-93			
STANDARD NO.					SCALE: NONE / SHEET 1 OF 2

TRAFFIC SIGNAL STANDARD WIRING PRACTICE

DETECTOR CIRCUITS

INDUCTIVE LOOP DETECTOR CABINETS

7 CONDUCTOR CABLE

FUNCTION	CONDUCTOR COLOR	DETECTOR CABINET TERMINAL #
AC +	RED	CIRCUIT BREAKER
CHANNEL 1 DETECTOR OUTPUT	GREEN	6
CHANNEL 1 DELAY OVERRIDE	ORANGE	4
CHANNEL 2 DETECTOR OUTPUT	BLACK	7
CHANNEL 2 DELAY OVERRIDE	BLUE	5
AC -	WHITE	14
SPARE	WHT./BLK	-

INDUCTIVE LOOP OR LEAD IN CABLE

2 CONDUCTOR WITH SHIELD *

FUNCTION	CONDUCTOR COLOR	DETECTOR CABINET TERMINAL #
CHANNEL 1 DETECTOR INPUT	BLACK	9
	RED	10
CHANNEL 2 DETECTOR INPUT	BLACK	11
	RED	12
* (SHIELD WIRE TO BE CONNECTED TO AC -)		14

OTHER DETECTORS

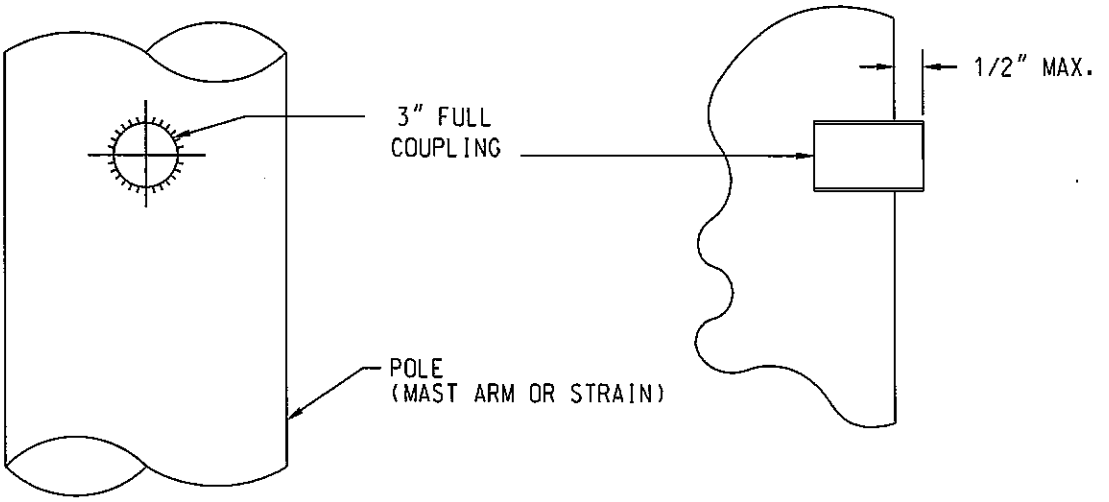
AC +	RED
DETECTOR OUTPUT	GREEN
AC -	WHITE
SPARE	BLACK

NOTES:

1. ALL CABLE TO BE #14 A.W.G., STRANDED, MEETING CURRENT I.M.S.A. SPECIFICATIONS.
2. INDIVIDUAL CONDUCTORS TO BE TERMINATED WITH SPADE LUGS.
3. SPLICES IN WIRE ARE NOT PERMITTED UNLESS OTHERWISE DIRECTED BY THE ENGINEER.

CAD FILE: DTL-022A.dwg

CITY OF BALTIMORE DEPARTMENT OF PUBLIC WORKS				FHWA WASHINGTON OFFICE	TRAFFIC SIGNAL STANDARD WIRING PRACTICE
APPROVED: _____	ISSUED				CATEGORY CODE:
	REVISED	8-5-93			
STANDARD NO.					SCALE: NONE / SHEET 2 OF 2



NOTES:

1. DRILL HOLE IN THE POLE TO FIT STANDARD PIPE COUPLING. FIELD WELD COUPLING TO MEET AWS WELDING SPECIFICATIONS.
2. WELDING TO BE PERFORMED BY A CERTIFIED WELDER.
3. ALL WELDING SHALL BE INSPECTED AND APPROVED BY SHA LAB PERSONNEL.
4. THE AFFECTED AREA SHALL BE CLEANED WITH METAL WIRE BRUSH AND SPRAYED WITH COLD GALVANIZED COMPOUND.
5. A HOLE MAY BE DRILLED WITHOUT WELDING A BLIND COUPLING FOR 3/4" THRU 1 1/2" SIZE, PROVIDED THERE IS NO OTHER HOLE WITHIN 12". AFTER DRILLING THE HOLE FOLLOW NOTE #4.
6. 3" FULL COUPLING SHALL HAVE INSIDE CHASE NIPPLE.
7. FOR COUPLING DETAILS SEE SPECIFICATIONS (SP-31A, SP-31B) FOR MASTARM.

CAD FILE: DTL-039.dwg

CITY OF BALTIMORE DEPARTMENT OF PUBLIC WORKS				FHWA WASHINGTON OFFICE	DEPARTMENT OF TRANSPORTATION FIELD DRILLED POLE/ARM TRAFFIC	
APPROVED: _____	ISSUED				CATEGORY CODE:	
	REVISED				SCALE: NONE	SHEET 1 OF 1
STANDARD NO.						

...\Specs\DGN\dtl-039.dgn 2/10/2009 2:42:51 PM

NOTES ON HANDBOX CONSTRUCTION

1. ANY SPACES BETWEEN THE CONDUIT AND THE HANDBOX WALL SHALL BE PATCHED WITH MORTAR AS APPROVED BY THE ENGINEER.

2. ALL METAL CONDUIT ENDS SHALL BE BONDED WITH OTHER CONDUIT ENDS USING BONDING BUSHINGS AND NO. 8 AWG SOLID BORE COPPER WIRE.

3. ALL ELECTRICAL CABLES ARE REQUIRED TO HAVE 3' MIN. SLACK IN HANDBOX. THIS WIRE IS TO BE SECURED IN THE HANDBOX SO IT DOES NOT LIE ON THE BOTTOM OF THE HANDBOX.

4. ALL LOOP DETECTOR WIRE TO LEAD-IN CABLE SPLICES IN THE HANDBOX SHALL BE IN ACCORDANCE WITH THE STANDARD SHOWN ON STANDARD NO. 2.

5. WHEN ALL CONDUIT AND ELECTRICAL WIRE IS IN PLACE, THE END OF THE CONDUIT SHALL BE SEALED WITH DUCT SEALER OR OTHER PLIABLE MATERIAL AS APPROVED BY THE ENGINEER.

6. ALTERNATE HAND BUILT BRICK HANDBOX SHALL BE USED FOR CONDUIT SIZES LARGER THAN 3" AS DIRECTED BY THE ENGINEER.

7. HANDBOX FRAME & COVER SHALL BE GALVANIZED PER ASTM A-123 & A-153.

8. HANDBOX TO BE INSTALLED AT FINAL GRADE.

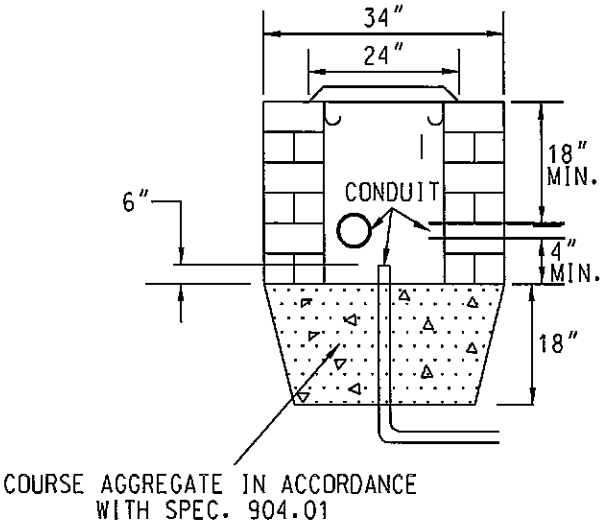
9. HANDBOX FRAME TO BE PLACED INTO MORTAR BED ON HANDBOX TOP AND PARGED.

10. ALL CONDUITS ENTERING FROM HANDBOX SUMP INTO HANDBOX SHALL PROJECT 6" ABOVE SUMP TOP.

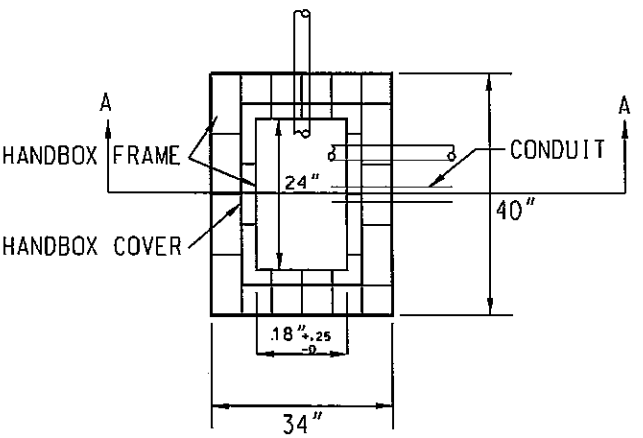
11. ALL CONDUIT ENTERING FROM HANDBOX SIDE WALL SHALL PROJECT 2" MAX.

CAD FILE: DTL-040.dwg

CITY OF BALTIMORE DEPARTMENT OF PUBLIC WORKS				FHWA WASHINGTON OFFICE	DEPARTMENT OF TRANSPORTATION NOTES ON HANDBOX CONSTRUCTION TRAFFIC
APPROVED: _____	ISSUED				CATEGORY CODE:
	REVISED				
STANDARD NO.					SCALE: NONE / SHEET 1 OF 1



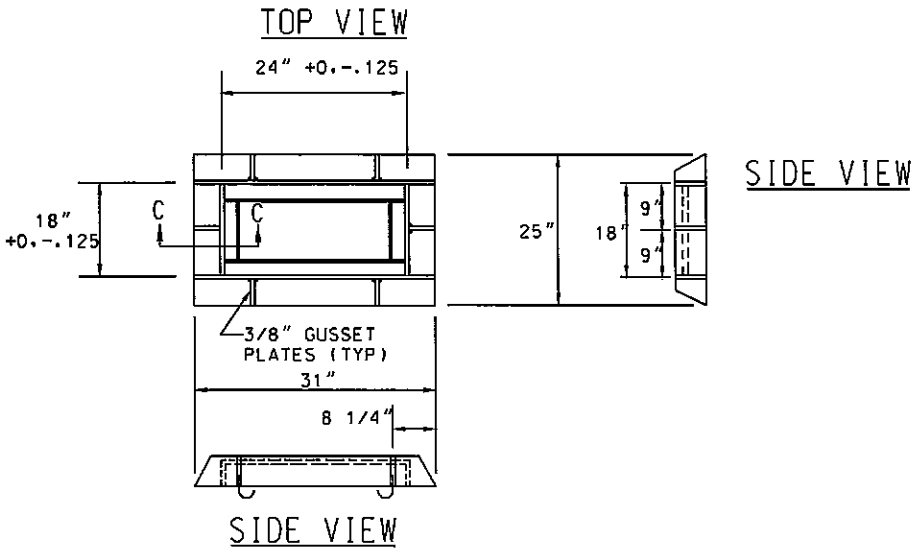
SECTION A-A

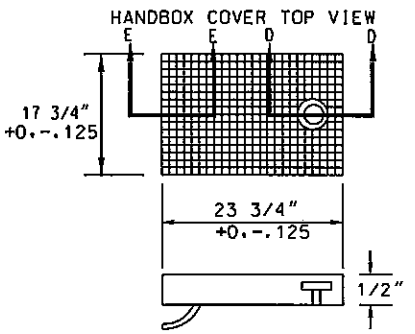


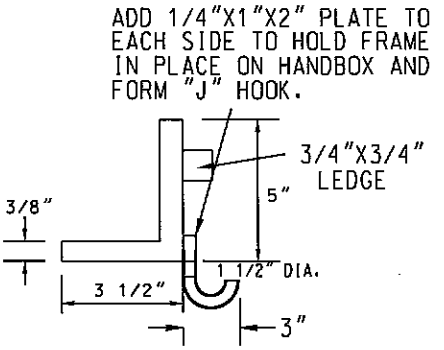
PLAN VIEW

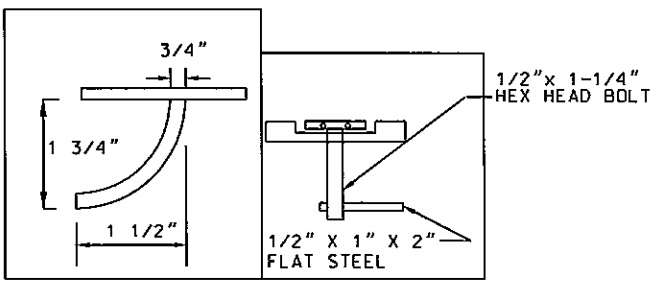
CAD FILE: DTL-041.dwg

CITY OF BALTIMORE DEPARTMENT OF PUBLIC WORKS				FHWA WASHINGTON OFFICE	ALTERNATE HANDBOX CONSTRUCTION DEPARTMENT OF TRANSPORTATION TRAFFIC
APPROVED: _____	ISSUED				CATEGORY CODE:
	REVISED				
STANDARD NO.					SCALE: NONE / SHEET 1 OF 1



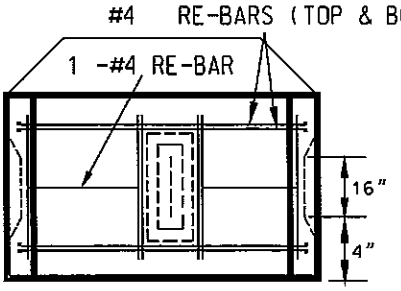






CAD FILE: DTL-042.dwg

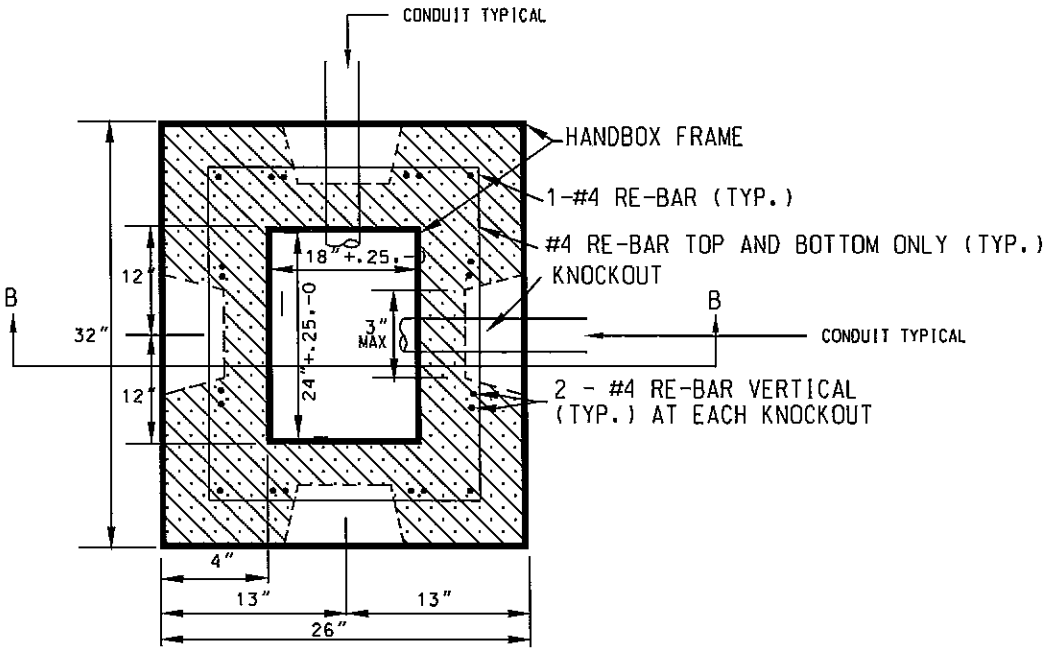
CITY OF BALTIMORE DEPARTMENT OF PUBLIC WORKS				FHWA WASHINGTON OFFICE	COLLECTOR HANDBOX FRAME AND COVER TRAFFIC
APPROVED: _____	ISSUED				CATEGORY CODE:
	REVISED				
STANDARD NO.					SCALE: NONE / SHEET 1 OF 1



SECTION B-B

NOTES:

1. CONCRETE IS TO BE 5000 PSI.
2. NO RE-BAR IN KNOCKOUTS.
3. FULL CONCRETE DIMENSIONS ARE REQUIRED. ANY AIR POCKETS MUST BE PATCHED BEFORE SHIPMENT.
4. ALL RE-BAR IS TO BE IN THE CENTER OF WALLS.
5. MINIMUM CONCRETE COVER FOR RE-BAR IS 1 1/2".



PLAN VIEW

CAD FILE: DTL-043.dwg

CITY OF BALTIMORE DEPARTMENT OF PUBLIC WORKS				FHWA WASHINGTON OFFICE	STANDARD PRECAST COLLECTOR HANDBOX TRAFFIC
APPROVED: _____	ISSUED				CATEGORY CODE:
	REVISED				
STANDARD NO.					SCALE: NONE / SHEET 1 OF 1