### AGREEMENT BETWEEN OWNER AND CONTRACTOR

The Parties to this agreement are:

### Owner:

FORT BEND GRAND PARKWAY TOLL ROAD AUTHORITY, a political subdivision of the State of Texas. c/o The Muller Law Group, PLLC 16555 Southwest Freeway, Suite 200 Sugar Land, Texas 77479

### Contractor:

Main Lane Industries, LTD 14115 Luthe Road, Suite 100 Houston, Texas 77039

THIS AGREEMENT ("Agreement") is made and entered into this 30<sup>th</sup> day of Narch, 2017 between the Parties, for and in consideration of the mutual covenants hereinafter set forth, and under the conditions expressed in the Bonds bearing even date herewith, the Contractor and Owner hereby agree as follows:

### Scope of Work:

Contractor shall commence and complete the Work generally described as follows:

Widening of the southbound frontage road, slope repair and signal modification at the FM 1093/SH 99 intersection

Fort Bend Grand Parkway Toll Road, Segment D,

Project No. GPD-017

for Fort Bend Grand Parkway Toll Road Authority,

Fort Bend County, Texas,

according to those particular Plans and Technical Specifications

prepared by PGAL, Inc. ("Engineer")

and all Extra Work in connection therewith, under the terms as stated in the General and Special Conditions of the Agreement, and, at Contractor's own proper cost and expense, to furnish all the materials, supplies, machinery, equipment, tools, superintendence, labor, insurance, and other accessories and services necessary to complete the said Work, in accordance with the conditions and prices stated in the Bid attached hereto and in accordance with the Contract Documents, including, but not limited to, Invitation to Bidders, Instructions to Bidders, General and Special Conditions of the Agreement, Plans, and other drawings and printed or written explanatory matter thereof, and the Technical Specifications, on file with Engineer. Contractor represents and warrants to the Owner that it has carefully examined this Agreement and all other Contract Documents, which are made a part of the Contract, and is thoroughly familiar therewith.



16555 Southwest Freeway + Suite 200 + Sugar Land, TX 77479 + 281.500.6050

March 30, 2017

# By Messenger Delivery

Ms. Donna Ospina Fort Bend County Judge's Office 401 Jackson Street Richmond, TX 77469

Re: Fort Bend Grand Parkway Toll Road Authority (the "Authority")

Dear Ms. Ospina:

In connection with the Authority's agenda item request for the April 4, 2017, Fort Bend County Commissioners Court meeting, enclosed is a copy of the Construction Contract of the FM 1093/SH 99 Intersection with Main Lane Industries, LTD for execution.

As always, please contact me with any questions.

Sincerely,

Jenny Salgado Legal Assistant

Enclosure

Under this Agreement and the Contract Documents, Contractor shall furnish all materials, appliances, tools, equipment, transportation, services, and all labor and superintendence necessary for the construction of the Work as described in the Technical Specifications and as shown on the Plans. The completed installation shall not lack any part that can be reasonably implied as necessary to its proper functioning or any subsidiary item that is customarily furnished, and Contractor shall deliver the installation to Owner in operating condition.

The Work, in general, under the Contract includes:

- 1. Widen southbound frontage road
- 2. Slope repair
- 3. Signal modifications at FM 1093

### Time for Completion:

The Contractor hereby agrees to begin work within 10 calendar days after Engineer has given written Notice to Proceed. Contractor hereby also agrees to achieve Final Completion of the Work within 135 calendar days after the date of the written Notice to Proceed.

### Surety Bonds Required:

It is further agreed by the parties to this Contract that Contractor will execute:

• a Payment Bond in the sum of 100% of the initial Contract Price, if the initial Contract Price is \$25,000 or more

### AND

• a Performance Bond in the sum of 100% of the initial Contract Price, if the initial Contract Price is \$100,000 or more,

for the satisfactory performance of the Work, the fulfillment of any guarantees required, and the prompt payment to all persons supplying labor and materials in the prosecution of the Work, in accordance with this Contract on the forms provided for this purpose; and it is agreed that this Contract shall not be in effect until such Bonds are furnished and approved by Owner. Upon increase of the Contract Price authorized by Change Order, Contractor shall immediately provide revised Bonds for such increased Contract Price. Contractor's failure to provide compliant Bonds may be grounds for immediate termination regardless of whether the Contractor has started work on the Project.

All Bonds shall be in the form prescribed by the Contract Documents except as required otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 370 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. A certified copy of the agent's authority to act must accompany all Bonds signed by an agent. Surety must have a minimum Best's Key Rating of "B+". If the surety company does not have such a rating due to the length of time it has existed, the surety company must be eligible to participate in the surety bond guarantee

program of the Small Business Administration and must be an approved surety listed in the current U.S. Department of Treasury Circular 570, and must meet all of the rules and regulations of the Treasury Department with respect to performance and payment bonds for federal jobs, including specifically the rules related to the underwriting limitation.

For bonds over \$100,000, the surety must also hold a certificate of authority from the United States Secretary of Treasury to qualify as a surety on obligations permitted or required under federal law, or have obtained reinsurance for any liability in excess of \$1,000,000 from a reinsurer that is authorized and admitted as a reinsurer in the State of Texas and is the holder of a certificate of authority from the United States Secretary of Treasury to qualify as a surety or reinsurer on obligations permitted or required under federal law. The person executing the Bonds must be a licensed Texas local recording agent and such licensing must be recorded in the files of the Texas Department of Insurance.

The person executing the Bonds must be authorized by the surety company to execute the Bonds on behalf of the company in the amount required for the contract and such authorization must be recorded in the files of the Texas Department of Insurance. The Contract shall not be in effect until such bonds have been provided by the Contractor and accepted by the Owner.

If the surety on any Bond furnished by Contractor is declared bankrupt, becomes insolvent, its right to do business is terminated in any state where any part of the Project is located, or it ceases to meet the requirements herein Contractor shall promptly notify Contractor, Owner and Engineer and shall, within 10 calendar days after the event giving rise to such notification, provide another Bond and surety to fulfill the required obligations.

### Contract Price:

The Contract Price for this Work is <u>Seven Hundred Ninety-One Thousand, Nine Hundred Ninety Six and 45/100 dollars (\$791,996.45)</u>. The initial Contract Price may increase or decrease due to Change Orders and the Contract Price Adjustment as provided by the Contract Documents.

Owner agrees to pay Contractor's invoices for work performed, in accordance with the terms of the Contract Documents, in an aggregate amount not to exceed the Contract Price, plus Change Orders and Extra Work approved by the Board of Directors of the Owner. Failure by Owner to make such payments to the Contractor shall constitute a default by Owner and shall entitle the Contractor to all rights and remedies arising under the Contract Documents for a default in payment of sums due.

Contractor and Owner agree that time is of the essence of this Contract. Therefore, Contractor and Owner agree that for each and every calendar day the Work or any portion thereof shall remain incomplete after the expiration of the time limits set in the Contract, or as extended under the provisions of the Contract Documents the Contract Price will decrease by \$500.00 for Final Completion ("Contract Price Adjustment"). The Owner shall have the option to deduct and withhold said amount from any monies that the Owner owes the Contractor or its sureties or to recover such amount from the Contractor or the sureties on the Contractor's performance bond.

IN WITNESS WHEREOF, the parties to these presents have executed this Agreement in the year and day first above written.

	FORT BEND GRAND PARKWAY TOLL ROAD ALTHORITY Owner  By: Name Dr. James D. Condrey, DDS Title: Chairman
	MAIN LANE INDUSTRIES, LTD Contractor  By: Name: Anthony Colombo Title: President
•	
(The following to be executed if Contractor is a Corp	poration)
I, <u>Crystal Erickson</u> certify that I am the secr herein; that <u>Anthony Colombo</u> , who signed th <u>President</u> of said Corporation; that said Contra Corporation by authority of its governing body and	nis Contract on behalf of Contractor, was then ct was duly signed for and on behalf of said
Corporate Seal	
1811-5798-0448, v. 1	
EFFECTIVE DATE	
THIS AGREEMENT IS EFFECTIVE ON T FORT BEND COUNTY COMMISSIONERS COU BE NULL AND VOID.	
DATE OF COMMISSIONERS COURT APPROV AGENDA ITEM NO.:	AL:

# $\mathbf{ATA}^{\mathbb{I}}$ Document A312 $^{\mathbb{I}}$ – 2010

### Performance Bond

Bond No 35BCSHO0044

This document has important legal

consequences. Consultation with

an attorney is encouraged with respect to its completion or

Any singular reference to

plural where applicable.

AIA Document A312-2010

Contractor, Surety, Owner or

other party shall be considered

combines two separate bonds, a Performance Bond and a

Payment Bond, Into one form.

This is not a single combined Performance and Payment Bond.

modification.

**CONTRACTOR:** 

(Name, legal status and address) Main Lane Industries, Ltd. 14115 Luthe Rd., Suite 100 Houston, TX 77039

SURETY:

(Name, legal status and principal place of business)

**Hartford Fire Insurance Company** One Hartford Plaza, T-4

Hartford, CT 06115

OWNER:

(Name, legal status and address)
Fort Bend Grand Parkway Toll Road Authority, A Political Subdivision of the State of Texas, c/o The Muller Law Group, PLLC 16555 Southwest Freeway, Suite 200

Sugar Land, TX 77479

CONSTRUCTION CONTRACT

Date:

Amount: Seven Hundred Ninety-one Thousand Nine Hundred Ninety-six And 45/100THS --- \$791,996.45

Description:

(Name and location)
Widening of the Southbound Frontage Road, Slope Repair and Signal Modification at the FM 1093/SH 99 Intersection

BOND

Date: 2/24/2017

(Not earlier than Construction Contract Date)

Amount: Seven Hundred Ninety-one Thousand Nine Hundred Ninety-six And 45/100THS --- \$791,996.45

☐ See Section 16

CONTRACTOR AS PRINCIPA

Modifications to this Bond:

(rate Seal) Company: Main Lane Industr

SURETY

Company: (Corporate Seal) Hartford Fire Insurance Company

Signature: Name Anthony Columbo

Signature: Name

and Title: President.

and Title:

Attorney-in-Fact

(Any additional signatures appear on the last page of this Performance Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or BROKER:

OWNER'S REPRESENTATIVE:

(Architect, Engineer or other party:)

VTC Insurance Group 1175 West Long Lake Rd, Suite 200 Troy, MI 48098 (248)828-3377

1

- § 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.
- § 2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Section 3.
- § 3 If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after
  - the Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Section 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor
  - .2 the Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety;
  - .3 the Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.
- § 4 Failure on the part of the Owner to comply with the notice requirement in Section 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.
- § 5 When the Owner has satisfied the conditions of Section 3, the Surety shall promptly and at the Surety's expense take one of the following actions:
- § 5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;
- § 5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;
- § 5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Section 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or
- § 5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:
  - .1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or
  - .2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.
- § 6 If the Surety does not proceed as provided in Section 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Section 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

1

§ 7 If the Surety elects to act under Section 5.1, 5.2 or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication, for

the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract:

- .2 additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 5; and
- 3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.
- § 8 If the Surety elects to act under Section 5.1, 5.3 or 5.4, the Surety's liability is limited to the amount of this Bond.
- § 9 The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors and assigns.
- § 10 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.
- § 11 Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.
- § 12 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.
- § 13 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

### § 14 Definitions

- § 14.1 Balance of the Contract Price. The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.
- § 14.2 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.
- § 14.3 Contractor Default. Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.
- § 14.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.
- § 14.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.
- § 15 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 16 Modifications to this bond are as follows:

(Space is provided below f CONTRACTOR AS PRINCIP		! parties, other than ! SURETY	those appearing on the cover page.)
Company:	(Corporate Seal)	Company:	(Corporate Seal)
Signature:		Signature:	
Name and Title: Address		Name and Title: Address	
CAUTION: You should sign changes will not be obscure		, on which this text ap	opears in RED. An original assures that

AIA Document A312TM - 2010. The American Institute of Architects.



## Payment Bond

Bond No 35BCSHO0044

This document has important legal

consequences. Consultation with

an attorney is encouraged with

other party shall be considered

combines two separate bonds, a Performance Bond and a

Payment Bond, into one form.

This is not a single combined

Performance and Payment Bond.

respect to its completion or

Any singular reference to Contractor, Surety, Owner or

plural where applicable.

AIA Document A312-2010

modification.

CONTRACTOR:

(Name, legal status and address) Main Lane Industries, Ltd. 14115 Luthe Rd., Suite 100 Houston, TX 77039

SURETY:

(Name, legal status and principal place of business)

Hartford Fire Insurance Company

One Hartford Plaza, T-4 Hartford, CT 06115

OWNER:

(Name, legal status and address) Fort Bend Grand Parkway Toll Road Authority, A Political Subdivision of the State of Texas, c/o The Muller Law Group, PLLC

16555 Southwest Freeway, Suite 200

Sugar Land, TX 77479

CONSTRUCTION CONTRACT

Date:

Amount: Seven Hundred Ninety-one Thousand Nine Hundred Ninety-six And 45/100THS --- \$791,996.45

Description:

(Name and location)

Widening of the Southbound Frontage Road, Slope Repair and Signal Modification at the FM 1093/SH 99 Intersection

BOND

Date: 2/24/2017

(Not earlier than Construction Contract Date)

Amount: Seven Hundred Ninety-one Thousand Nine Hundred Ninety-six And 45/100THS --- \$791,996.45

Modifications to this Bond: See Section 18

CONTRACTOR AS PRINGIPAL

Company:

rate Seal)

SURETY Company:

(Corporate Seal) re Insurance Company Hartford R

Signature Name Anthony Columbo

and Title: President

Signature! Name Kathleen M. Irelan and Title:

Attorney-in-Fact (Any additional signatures appear on the last page of this Payment Bond.)

(FOR INFORMATION ONLY - Name, address and telephone)

AGENT or BROKER:

**OWNER'S REPRESENTATIVE:** 

(Architect, Engineer or other party:)

VTC Insurance Group

1175 W Long Lake Rd, Suite 200

Troy, MI 48098

(248)828-3377

- § 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.
- § 2 If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.
- § 3 If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Section 13) of claims, demands, liens or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety.
- § 4 When the Owner has satisfied the conditions in Section 3, the Surety shall promptly and at the Surety's expense defend, indemnify and hold harmless the Owner against a duly tendered claim, demand, lien or suit.
- § 5 The Surety's obligations to a Claimant under this Bond shall arise after the following:
- § 5.1 Claimants, who do not have a direct contract with the Contractor,
  - have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and
  - .2 have sent a Claim to the Surety (at the address described in Section 13).
- § 5.2 Claimants, who are employed by or have a direct contract with the Contractor, have sent a Claim to the Surety (at the address described in Section 13).
- § 6 If a notice of non-payment required by Section 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Section 5.1.1.
- § 7 When a Claimant has satisfied the conditions of Sections 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:
- § 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and
- § 7.2 Pay or arrange for payment of any undisputed amounts.
- § 7.3 The Surety's failure to discharge its obligations under Section 7.1 or Section 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Section 7.1 or Section 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.
- § 8 The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Section 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.
- § 9 Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

- § 10 The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to, or give notice on behalf of, Claimants or otherwise have any obligations to Claimants under this Bond.
- § 11 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.
- § 12 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Section 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.
- § 13 Notice and Claims to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.
- § 14 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.
- § 15 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

### § 16 Definitions

§ 16.1 Claim. A written statement by the Claimant including at a minimum:

- .1 the name of the Claimant;
- .2 the name of the person for whom the labor was done, or materials or equipment furnished;
- 3 a copy of the agreement or purchase order pursuant to which labor, materials or equipment was furnished for use in the performance of the Construction Contract;
- .4 a brief description of the labor, materials or equipment furnished;
- .5 the date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
- .6 the total amount earned by the Claimant for labor, materials or equipment furnished as of the date of the Claim:
- .7 the total amount of previous payments received by the Claimant; and
- .B the total amount due and unpaid to the Claimant for labor, materials or equipment furnished as of the date of the Claim.
- § 16.2 Claimant. An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.
- § 16.3 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

1

- § 16.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.
- § 16.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.
- § 17 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.
- § 18 Modifications to this bond are as follows:

(Space is provided below for addit CONTRACTOR AS PRINCIPAL	ional signatures of addea	l parties, other than thos SURETY	se appearing on the cover page.)
Company:	(Corporate Seal)	Company:	(Corporate Seal)
Signature:		Signature:	
Name and Title:		Name and Title:	
Address		Address	
CAUTION: You should sign an origin changes will not be obscured.	ial AIA Contract Document	, on which this text appea	ars in RED. An original assures that

1

# POWER OF ATTORNEY

Direct Inquiries/Claims to: THE HARTFORD BOND, T-12 One Hartford Plaza Hartford, Connecticut 06155

Hartford, Connecticut 06155 Bond Claims@thehartford.com Call: 888-266-3488 or fax: 860-757-5835

KNOW ALL PERSONS BY THESE PRESENTS THAT:	Agency Code: 35-351225
X Hartford Fire Insurance Company, a corporation duly organiz	zed under the laws of the State of Connecticut
X Hartford Casualty Insurance Company, a corporation duly o	
Hartford Accident and Indemnity Company, a corporation of	luly organized under the laws of the State of Connecticut
Hartford Underwriters Insurance Company, a corporation d	uly organized under the laws of the State of Connecticut
Twin City Fire Insurance Company, a corporation duly organ	
Hartford Insurance Company of Illinois, a corporation duly of	organized under the laws of the State of Illinois
Hartford Insurance Company of the Midwest, a corporation	duly organized under the laws of the State of Indiana
Hartford Insurance Company of the Southeast, a corporation	
having their home office in Hartford, Connecticut, (hereinafter collectively ret	ferred to as the "Companies") do hereby make, constitute and appoint,
having their name onice in Hartiord, Confidential, (Hereinalia) concerns, in	
up to the amount of Unlimited:	ndler Alan P. Chandler, Jan J. Donald,
Susan L. Small of Farmington Hills MI, Jeffrey A. Char Wendy L. Hingson, Kathleen M. Irelan, Meagan Kress, Ro	obert Trobec of TROY, Michigan

their true and lawful Attorney(s)-in-Fact, each in their separate capacity if more than one is named above, to sign its name as surety(ies) only as delineated above by \( \subseteq \), and to execute, seal and acknowledge any and all bonds, undertakings, contracts and other written instruments in the nature thereof, on behalf of the Companies in their business of guaranteeing the fidelity of persons, guaranteeing the performance of contracts and executing or guaranteeing bonds and undertakings required or permitted in any actions or proceedings allowed by law.

In Witness Whereof, and as authorized by a Resolution of the Board of Directors of the Companies on May 6, 2015 the Companies have caused these presents to be signed by its Senior Vice President and its corporate seals to be hereto affixed, duly attested by its Assistant Secretary. Further, pursuant to Resolution of the Board of Directors of the Companies, the Companies hereby unambiguously affirm that they are and will be bound by any mechanically applied signatures applied to this Power of Attorney.



John Gray, Assistant Secretary

M. Ross Fisher, Senior Vice President

STATE OF CONNECTICUT

s. Hartford

**COUNTY OF HARTFORD** 

On this 11th day of January, 2016, before me personally came M. Ross Fisher, to me known, who being by me duly sworn, did depose and say: that he resides in the County of Hartford, State of Connecticut; that he is the Senior Vice President of the Companies, the corporations described in and which executed the above instrument; that he knows the seals of the said corporations; that the seals affixed to the said instrument are such corporate seals; that they were so affixed by authority of the Boards of Directors of said corporations and that he signed his name thereto by like authority.

CEDTIFICATE

Notary Public My Commission Expires March 31, 2018

I, the undersigned, Assistant Vice President of the Companies, DO HEREBY CERTIFY that the above and foregoing is a true and correct copy of the Power of Attorney executed by said Companies, which is still in full force effective as of February 24th, 2017

Signed and sealed at the City of Hartford.



Kevin Heckman, Assistant Vice President

### IMPORTANT NOTICE

To obtain information or make a complaint:

You may contact your agent.

You may call Hartford Insurance Group at the toll free telephone number for information or to make a complaint at:

### 1-800-392-7805

You may also write to The Hartford:

The Hartford Hartford Financial Products 2 Park Avenue, 5<sup>th</sup> Floor New York, New York 10016 1-212-277-0400

You may contact the Texas Department of Insurance to obtain information on companies, coverages, rights or complaints at:

### 1-800-252-3439

You may write the Texas Department of Insurance

P.O. Box 149104 Austin, TX 78714-9104 Fax Number (512) 475-1771 Web: http://www.tdi.state.tx.us

E-mail: ConsumerProtection@tdi.state.tx.us

PREMIUM OR CLAIMS DISPUTES: Should you have a dispute concerning your premium or about a claim you should contact the agent first. If the dispute is not resolved, you may contact the Texas Department of Insurance.

ATTACH THIS NOTICE TO YOUR POLICY: This notice is for your information only and does not become a part or condition of the attached document.

### **AVISO IMPORTANTE**

Para obtener informacion o para someter una queja.

Puede comunicarse con su agente.

Usted puede llamar al numero de telefono gratis de The Hartford Insurance Group para indormacion o para someter una quela al

1-800-392-7805

Usted tambien puede escribir a The Hartford.

The Hartford Hartford Financial Products 2 Park Avenue, 5<sup>th</sup> Floor New York, New York 10016 1-212-277-0400

Puede comunicarse con el Departamento de Seguros de Texas para obtener informacion acerca de compañías, coberturas, derechos o quejas al:

### 1-800-252-3439

Puede escribir al Departamento de Seguros de Texas

P.O. Box 149104 Austin, TX 78714-9104 Fax Number (512) 475-1771 Web: http://www.tdi.state.tx.us

E-mail: ConsumerProtection@tdi.state.tx.us

DISPUTAS SOBRE PRIMAS O RECLAMOS: Si tiene una disputa concerniente a su prima o a un reclamo, debe comunicarse con su agente primero. Si no se resuelve la disputa, puede entonces comunicarse con el departamento (TDI).

UNA ESTE AVISO A SU POLIZA: Este aviso es solo para proposito de informacion y no se convierte en parte o condicion del documento adjunto.

# **CERTIFICATE OF INTERESTED PARTIES**

FORM **1295** 

1 of 1

				1 07 1				
	Complete Nos. 1 - 4 and 6 if there are interested parties. Complete Nos. 1, 2, 3, 5, and 6 if there are no interested parties.	CER	OFFICE USE					
1	Name of business entity filing form, and the city, state and country of the business entity's place of business.		icate Number: -165179					
	Main Lane Industries, Ltd.	-	200210					
	Houston , TX United States	Date Filed:						
2	Name of governmental entity or state agency that is a party to the contract for which the form is	02/10	/2017					
	being filed.	Date	Acknowledged:					
	Fort Bend Grand Parkway Toll Road Segment D	3/27/17						
				ddaa				
3	Provide the identification number used by the governmental entity or state agency to track or identified description of the services, goods, or other property to be provided under the contract.  GPD-017	y the co	mitact, and prov	nue a				
	Slope Repair and Signal Modifications.		Nature of	interest				
4	Name of Interested Party City, State, Country (place of busi	ness)	(check ap	THE RESERVE OF THE PARTY OF THE				
			Controlling	Intermediary				
-								
_								
-								
-								
-								
-								
-								
5	Check only if there is NO Interested Party.	/	7 ,					
6	AFFIDAVIT I swear, or affirm, under penalty of perjuy, that the	e above	disclosure is true	e and correct.				
	AIMEE COBBS  Notary Public, State of Taxas  Comm. Expires 11-10-2020  Notary ID 130897127  Signature of authorized agent of co	ontracting	g business entity					
	AFFIX NOTARY STAMP / SEAL ABOVE	,	6					
	Sworn to and subscribed before me, by the said	10+	day of Fe	briary.				
(	Signature of officer administering oath  Printed name of officer administering oath	Title of	ant to	ing oath				

# SPECIFICATIONS AND BID

**FOR** 

FORT BEND GRAND PARKWAY TOLL ROAD
SEGMENT D,
WIDENING OFSOUTHBOUND FRONTAGE ROAD,
SLOPE REPAIR AND SIGNAL MODIFICATIONS AT
FM 1093/SH 99 INTERSECTION
(PROJECT NO. GPD-017)

# FORT BEND GRAND PARKWAY TOLL ROAD AUTHORITY

Notice To Bidder:

ALL BIDS ARE TO BE SUBMITTED TO THE FORT BEND GRAND PARKWAY TOLL ROAD AUTHORITY, C/O BROWN & GAY ENGINEERS, INC., 10777 WESTHEIMER, SUITE 400, HOUSTON, TEXAS, 77042 BY 2:00 P.M. ON TUESDAY, FEBRUARY 14, 2017.

BIDDER IS REQUIRED TO FILL IN INFORMATION BELOW:

BIDDER (Company Name)
BIDDER (Company Name)
TOTAL AMOUNT OF BID \$ 791, 996. 45

11

FORT BEND COUNTY, TEXAS

### SALES TAX EXEMPTION

### NOTICE TO CONTRACTORS

The Contractor's attention is directed to TEX. TAX CODE ANN. 151.311, which was amended by the Texas Legislature, effective October 1, 1993.

Under Section 151.311, as amended, tangible personal property purchased by a contractor for use in the performance of a contract for the improvement of real property for an organization such as Fort Bend Grand Parkway Toll Road Authority (FBGPTRA) is exempt from the payment of sales and use tax thereon when the property is incorporated into the realty in the performance of the contract. Building materials, etc., are exempt from tax if they are: (1) necessary and essential for the performance of the contract; and (2) completely consumed at the job site (i.e., after being used once for their intended purpose they are used up or destroyed). Items that can be re-used on other jobs are not tax exempt.

Services purchased by a contractor are also tax exempt, where: (1) the contract is for an improvement to real estate for an exempt organization; and (2) the contract expressly requires the specific service to be provided or purchased by the person performing the contract; or (3) the service is integral to the performance of the contract.

Machinery and equipment, including repair and replacement parts for the same, are not tax exempt when used in the performance of a contract for the improvement of real estate for FBGPTRA.

The Contractor should be aware that the Texas Comptroller of Public Accounts issues rules interpreting applicable provisions of the tax code from time to time. The rules should be consulted when answering specific questions. The Contractor can obtain additional information concerning the applicable sales and use tax, as well as sales tax permits and information regarding resale certificates, from the State Comptroller's Office, at (800) 252-5555.

# FORT BEND GRAND PARKWAY TOLL ROAD AUTHORITY FORT BEND GRAND PARKWAY SEGMENT D PROJECT NO. GPD-017 FIHE GRAND DARKWAY SOLITHEORNIAGE DOAT

	SEQ	-	01	ო	4	Ŋ	ဖ	7	00	თ	10	11	12	13	14	15	10	17	48	19	20	21	23	23	24	25	26	27	28	53	30	31	35
	UNT	12070.00	126820.00	3192.00	1400.00	3275.00	500.00	5688.00	1014.00	1880.00	107160.00	923.00	20000.00	3150.00	37350.00	353.00	6000.00	500.00	3000.00	80000.00	50000.00	1852.00	463.00	945.00	1700.00	550.00	21000.00	2000.00	12600.00	1200.00	6020.00	7740.00	3000.00
	RICE AMOUNT	85.00	85.00	8.00	10.00	5.00	5.00	3.00	2600.00	40.00	120.00	1.00	200.00	175.00	450.00	1.00	6000.00	500.00	3000.00	80000.00	10000.00	4.00	1.00	9.00	10.00	2.00	25.00	25.00	15.00	15.00	10.00	00.09	3000.00
FM 1093	QUANTITY BID PRICE	142.00	1492.00	399.00	140.00	655.00	100.00	1896.00	0.39	47.00	893.00	923.00	100.00	18.00	83.00	353.00	1.00	1.00	1.00	1.00	5.00	463.00	463.00	105.00	170.00	275.00	840.00	80.00	840.00	80.00	602.00	129.00	1.00
ROAD AT	LIND	λ	λS	Ľ,	≿	Շ	Շ	SΥ	AC	MG	λ	Շ	Շ	<u>"</u>	Շ	Շ	Ā	ËA	Ą	rs S	Θ	Ľ	느	느	ь	Щ	L.	<u>"</u>	Π̈́	Ľ	Ľ,	T.	Ą
OF THE GRAND PARKWAY SOUTHBOUND FRONTAGE ROAD AT FM 1093	BID ITEM DESCRIPTION	REMOVING CONC (PAV)	REMOVING CONC (RIPRAP)	REMOVING CONC (CURB)	REMOVING CONC (PAVERS)	EXCAVATION (ROADWAY)	EMBANKMENT (FINAL)(DENS CONT)(TY C)	BLOCK SODDING	FERTILIZER	VEGETATIVE WATERING	CONC PVMT (CONT REINF)(FAST TRK) (13")	CEM STABIL BKFL	FLOWABLE BACKFILL	DRILL SHAFT (TRF SIG POLE) (24 IN)	RIPRAP (CONC)(4 IN)	RIPRAP (CONC)(CL A)	INLET (COMPL)(CURB)(TY C)	INLET (COMPL)(EXT TY C)	ADJUSTING INLET (CAP)	MOBILIZATION	BARRICADES SIGNS AND TRAFFIC HANDLING	TEMP SEDMT CONT FENCE (INSTALL)	TEMP SEDMT CONT FENCE (REMOVE)	BIODEG EROSN CONT LOGS (INSTL) (8")	BIODEG EROSN CONT LOGS (INSTL) (12")	BIODEG EROSN CONT LOGS (REMOVE)	PORT CTB (FUR & INST)(LOW PROF)(TY 1)	PORT CTB (FUR & INST)(LOW PROF)(TY 2)	PORT CTB (REMOVE)(LOW PROF)(TY 1)	PORT CTB (REMOVE)(LOW PROF)(TY 2)	CONC CURB (MONO) (TY II)	CONC CURB (U-TURN)	CURB RAMPS (TY1)
WIDENING OI	DESC SP	6001	6009	6021	6040	6001	9009	6002	6001	6001	6043	6005	6001	6030	6001	6005	6175	6259	9009	6001	6001	6038	6039	6040	6041	6043	6009	6010	6057	6058	6005	6010	6004
	ALT ITEM	104	104	104	104	110	132	162	166	168	360	400	401	416	432	432	465	465	479	200	502	206	206	206	909	909	512	512	512	512	529	529	531

880.00 33 13280.00 34 1665.00 35 3520.00 36 3245.00 37 1451.25 38 285.00 39 665.00 40	1828.75 41 20925.00 42 2820.00 43 3600.00 44 390.00 45 4600.00 46 390.00 47	645.00 49 915.00 50 1000.00 51 143.00 52 115.20 53 855.25 54 364.65 55 1092.00 56	227.50 57 1932.00 58 6050.00 59 13731.00 60 3926.05 61 5209.50 62 1560.00 63	1375.00 65 340.00 66 448.00 67 494.90 68 186.00 69 180.00 70 300.00 71
8.00 8.00 11.00 13.5 1.50	1.75 775.00 940.00 3600.00 390.00 460.00 390.00	645.00 915.00 100.00 0.65 1.20 0.55 0.55	4.55 6.90 5.00 11.50 11.50 11.50 195.00	275.00 4.00 0.28 0.35 1.00 30.00 50.00
110.00 1660.00 185.00 320.00 295.00 1075.00 190.00	1045.00 27.00 3.00 1.00 10.00 1.00 1.00	1.00 1.00 10.00 220.00 96.00 1555.00 663.00 240.00	50.00 280.00 1210.00 1194.00 233.00 453.00 8.00 6.00	5.00 85.00 1600.00 1414.00 186.00 6.00 6.00
5555555	- 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	444444	444444	<b>ጀጀተተተጀጀ</b> ጀ
CONDT (PVC) (SCH 40) (1") CONDT (PVC) (SCH 40) (2") CONDT (PVC) (SCH 40) (2") CONDT (PVC) (SCH 40) (4") CONDT (PVC) (SCH 40) (4") CONDT (PVC) (SCH 40) (4") ELEC CONDR (NO. 8) BARE ELEC CONDR (NO. 6) BARE ELEC CONDR (NO. 6) INSULATED	TRAY CABLE (4 CONDR) (12 AWG) GROUND BOX TY A (122311) W/APRON GROUND BOX TY C (162911) W/APRON ELC SRV TY D 120/240 060 (NS)SS(E)SP(0) IN SM RD SN SUP&AM TY10BWG(1) SA(P) IN SM RD SN SUP&AM TY10BWG(1) SA(T) IN SM RD SN SUP&AM TYFRP(1)UA(P) IN SM RD SN SUP&AM TYFRP(1)UA(P) IN SM RD SN SUP&AM TYFRP(1)UA(P)	IN SM RD SN SUP&AM TYS80(1)SA(P) IN SM RD SN SUP&AM TYS80(1)SA(U-1EXT) REMOVE SM RD SN SUP&AM WK ZN PAV MRK REMOV (W)4"(BRK) WK ZN PAV MRK REMOV (W)4"(BDT) WK ZN PAV MRK REMOV (W)4"(SLD) WK ZN PAV MRK REMOV (W)4"(SLD) PREFAB PAV MRK TY B (W)(6")(SLD)	PREFAB PAV MRK TY B (W)(6")(DOT) PREFAB PAV MRK TY B (W)(6")(BRK)CNTST PREFAB PAV MRK TY B (W)(8")(SLD) PREFAB PAV MRK TY B (W)(12")(SLD) PREFAB PAV MRK TY B (W)(24")(SLD) PREFAB PAV MRK TY B (V)(12")(SLD) PREFAB PAV MRK TY C (W) (ARROW) PREFAB PAV MRK TY C (W) (ARROW)	PREFAB PAV MRK TY C (W) (WORD) REFL PAV MRKR TY II-C-R ELIM EXT PAV MRK & MRKS (6") ELIM EXT PAV MRK & MRKS (8") ELIM EXT PAV MRK & MRKS (24") ELIM EXT PAV MRK & MRKS (ARROW) ELIM EXT PAV MRK & MRKS (DBL ARROW) ELIM EXT PAV MRK & MRKS (DBL ARROW)
6016 6023 6024 6033 6007 6009	6005 6002 6008 6301 6001 6023 6024	6027 6034 6076 6060 6061 6063 6095	6008 6010 6014 6016 6018 6050 6077	6085 6010 6002 6003 6007 6009 6012
618 618 618 618 620 620	621 624 628 644 644 644	644 644 644 662 662 662 662 668	668 668 668 668 668 668	668 672 677 677 677 677 677

8 4 8 1	1,0	78	79	8	81	82	83	8	82	86	87	88	89	8	9	92	93	94	95	96	97	86
22.80 96.80 247.05	58.25 80.00	90.00	20.00	40000.00	2000.00	4400.00	800.00	4400.00	800.00	4400.00	800.00	1820.00	3200.00	8470.00	264.00	8187.50	4500.00	42640.00	250.00	11160.00	7000.00	20000.00
0.04 0.08 0.15	0.25 10.00	15.00	10.00	40000.00	2000.00	200.00	200.00	200.00	200.00	200.00	200.00	70.00	200.00	1.75	1.20	1.25	1500.00	10.25	250.00	10.00	7000.00	20000.00
570.00 1210.00 1647.00	233.00 8.00	6.00	5.00	1.00	1.00	22.00	4.00	22.00	4.00	22.00	4.00	26.00	16.00	4840.00	220.00	6550.00	3.00	4160.00	1.00	1116.00	1.00	1.00
555	± សី	Ð	ΕA	ЕA	2	Ð	Æ	ΕA	EA	Ą	ËÀ	ĒĀ	Ą	H,	'n,	Щ	ΕĄ	Щ	ΕA	ሖ	Щ	30. FA
PAV SURF PREP FOR MRK (6") PAV SURF PREP FOR MRK (8") PAV SURF PREP FOR MRK (12") PAV SURF PREP FOR MRK (12")	PAV SURF PREP FOR MRK (ARROW)	PAV SURF PREP FOR MRK (DBL ARROW)	PAV SURF PREP FOR MRK (WORD)	INSTALL HWY TRF SIG (ISOLATED)	REMOVING TRAFFIC SIGNALS	VEH SIG SEC (12")LED(GRN)	VEH SIG SEC (12")LED(GRN ARW)	VEH SIG SEC (12")LED(YEL)	VEH SIGSEC (12")LED(YEL ARW)	VEH SIG SEC (12")LED(RED)	VEH SIG SEC (12")LED(RED ARW)	BACK PLATE (12 IN) (3 SEC)	LOUVER (12") (ADJUSTABLE)	TRF SIG CBL (TY A) (12 AWG) ( 5 CONDR)	TRF SIG CBL (TY A)(14 AWG)(1 CONDR)	TRF SIG CBL (TY C)(14 AWG)(2 CONDR)	PED POLE ASSEMBLY (15')	VEH LP DETECT (SAWCUT)	REMOVAL OF PEDESTRIAN RAMPS	DITCH CLEANING RESHAPING (FOOT)	EMERGENCY VEHICLE PREEMPTION SYSTEM	FORCE ACCOUNT - LAW ENFORCEMENT (\$20,000. FA
6002 6004 6006 6008	6009	6010	6016	6002	6004	6001	6002	6003	6004	6005	9009	6023	6047	6010	6027	6028	6001	6004	6057	6001	6666	
678 678 678 678	678	678	8/9	089	680	682	682	682	682	682	682	682	682	684	684	684	687	688	069	760	9000	F001

Tot Bid Amount 791996.45

Signed:

Date: 14-Feb-17

Title: VICE-PRESIDENT

Highway: Fort Bend Grand Parkway Segment D:

Widening of the Grand Parkway Southbound

Frontage Road at FM 1093

County: Fort Bend

The enclosed Texas Department of Transportation Specifications, General Notes and Specification Data in this document have been selected by me, or under my responsible supervision, as being applicable to this project(s).

NOTE:

For the purpose of constructing this Proposal and the attached form of Contract, the Texas Department of Transportation Standard Specifications for Construction of Highways, Streets and Bridges, as adopted by the Texas Department of Transportation on November 1, 2014, hereinafter referred to are approved and incorporated herein by reference for all purpose by the Fort Bend Grand Parkway Toll Road Authority as official specifications, together with and to be modified by the Special Provisions and Special Specifications as are listed herein.



Project Manager

**PGAL** 

1/20/2017

Date

Fort Bend Grand Parkway Segment D Widening of Grand Parkway Southbound Frontage Road at FM 1093/SH 99 Project No. GPD-017

### **General Notes:**

### General:

If fixed features require, the governing slopes shown may vary between the limits shown and to the extent determined by the Engineer.

Notify the Engineer immediately if discrepancies are discovered in the horizontal control or the benchmark data.

References to manufacturer's trade name or catalog numbers are for the purpose of identification only. Similar materials from other manufacturers are permitted if they are of equal quality, comply with the specifications for this project, and are approved, except for roadway illumination, electrical, and traffic signal items.

Grade street intersections and median openings for surface drainage.

If a foundation is to be placed where a riprap surface or an asphalt concrete surface presently exists, use caution in breaking out the existing surface for placement. Break out no greater area than is required to place the foundation. After placing the foundation, wrap the periphery with 0.5 in. pre-molded mastic expansion joint. Then replace the remaining portion of the broken out surface with Class A or Class C concrete or cold mix asphalt concrete to the exact slope, pattern, and thickness of the existing riprap or asphalt. Payment for breaking out the existing surface, wrapping the foundation, and replacing the surface is subsidiary to the various bid items.

The lengths of the posts for ground mounted signs and the tower legs for the overhead sign supports are approximate. Verify the lengths before ordering these materials to meet the existing field conditions and to conform to the minimum sign mounting heights shown in the plans.

Furnish aluminum Type A signs instead of plywood signs for signs shown on the Summary of Small Signs sheet.

Clearly mark or highlight on the shop drawings, the items being furnished for this project. Submit required shop drawings in accordance with the shop drawing distribution list shown in the note for Item 5 for review and distribution.

Procure permits and licenses, which are to be issued by the City, County, or Municipal Utility District.

### General: Roadway Illumination and Electrical

For roadway illumination and electrical items, use materials from pre-qualified producers as shown on the Construction Division (CST) of the Department's material producers list. Check the latest link on the TxDOT website for this list. The category/item is "Roadway Illumination and Electrical Supplies." No substitutions will be allowed for materials found on this list.

Fort Bend Grand Parkway Segment D Widening of Grand Parkway Southbound Frontage Road at FM 1093/SH 99 Project No. GPD-017

Perform electrical work in conformance with the National Electrical Code (NEC) and Department standard sheets.

### General: Traffic Signals

For traffic signal items except controller (Fort Bend County specification), use materials from the Pre-Oualified Producers List (located at

http://www.dot.state.tx.us/GSD/purchasing/supps.htm) and the materials pre-qualified for illumination and electrical items (located at <a href="http://ftp.dot.state.tx.us/pub/txdot-info/emd/mpl/riaes.pdf">http://ftp.dot.state.tx.us/pub/txdot-info/emd/mpl/riaes.pdf</a>) as shown on the Department's Material Producers List and the Roadway Illumination and Electrical Supplies List. Check the latest links on the TxDOT website for these lists. No substitutions will be allowed for materials found on these lists.

### General: Site Management

Mark stations every 100 ft. and maintain the markings for the project duration. Remove the station markings at the completion of the project. This work is subsidiary to the various bid items.

Do not mix or store materials, or store or repair equipment, on top of concrete pavement or bridge decks unless authorized by the Engineer. Permission will be granted to store materials on surfaces if no damage or discoloration will result.

Personal vehicles of employees are not permitted to park within the right of way, including sections closed to public traffic. Employees may park on the right of way at the Contractor's office, equipment, and materials storage yard sites.

Assume ownership of debris and dispose of at an approved location. Do not dispose of debris on private property unless approved in writing by the Engineer.

Control the dust caused by construction operations. For sweeping the base material in preparation for laying asphalt and for sweeping the finished concrete pavement, use one of the following types of sweepers or approved equal:

Tricycle Type

Truck Type - 4 Wheel

Wayne Series 900 Elgin White Wing Elgin Pelican M-B Cruiser II Wayne Model 945 Mobile TE-3 Mobile TE-4 Murphy 4042

Fort Bend Grand Parkway Segment D Widening of Grand Parkway Southbound Frontage Road at FM 1093/SH 99 Project No. GPD-017

### General: Traffic Control and Construction

Schedule work so that the base placement operations follow the subgrade work as closely as practical to reduce the hazard to the traveling public and to prevent undue delay caused by wet weather.

When design details are not shown on the plans, provide signs and arrows conforming to the latest "Standard Highway Sign Designs for Texas" manual.

### General: Utilities

- 1. All utility coordination shall be established prior to the start of any construction work.
- 2. The approximate location of known underground utilities have been shown on the plan sheet and exact locations of the underground utilities are not certain. The contractor shall contact the utility companies or the utility coordination committee, locate the utilities in the construction area prior to start any construction work. The presence or absence of utilities signs in the area does not mean that there are no buried utilities in the area. It is contractor's responsibility to follow established procedures to locate the underground utilities. The contractor agrees to be fully responsible for any and all damages which might be caused by his failure to exactly locate and protect the underground utilities.
- 3. Under no circumstances shall the natural drainage pattern be blocked by construction.
- 4. When utilities are exposed, the contractor will provide support to prevent damages to utilities.

Consider the locations of underground utilities depicted in the plans as approximate and employ responsible care to avoid damaging utility facilities. Depending upon scope and magnitude of planned construction activities, advanced field confirmation by the utility owner or operator may be prudent. Where possible, protect and preserve permanent signs, markers, and designations of underground facilities.

If the Contractor damages or causes damage (breaks, leaks, nicks, dents, gouges, etc.) to the utility, contact the utility facility owner or operator immediately.

At least 48 hours before starting work, make arrangements for locating existing Fort Bend County-owned above ground and underground fiber optic, communications, power, illumination, and traffic signal cabling and conduit. Do this by calling the Brian Fields at Fort Bend County at 832-473-2887 to schedule marking of underground lines on the ground. Use caution if working in these areas to avoid damaging or interfering with existing facilities.

Notify the Engineer at least 48 hours before constructing junction boxes at storm drain and utility intersections.

Fort Bend Grand Parkway Segment D Widening of Grand Parkway Southbound Frontage Road at FM 1093/SH 99 Project No. GPD-017

Install or remove poles and luminaires located near overhead or underground electrical lines using established industry and utility safety practices. Consult the appropriate utility company before beginning such work.

If overhead or underground power lines need to be de-energized, contact the electrical service provider to perform this work. Costs associated with de-energizing the power lines or other protective measures required are at no expense to the Department.

If working near power lines, comply with the appropriate sections of Texas State Law and Federal Regulations relating to the type of work involved.

Perform electrical work in conformance with the National Electrical Code (NEC) and Department standard sheets.

### Item 5: Control of Work

Submit shop drawings to Engineer for the fabrication of items as documented in Table 1 below.

Table 1
2014 Construction Specification Required Shop/Working Drawing Submittals

Spec Item No.'s	Product	Submittal Required	Approval Required (Y/N)	Contractor/ Fabricator P.E. Seal Required	
465	Pre-cast Junction Boxes, Grates, and Inlets	Y	Υ	N	
680	Installation of Highway Traffic Signals	Υ	Y	N	
682	Vehicle and Pedestrian Signal Heads	Υ	Υ	N	
684	Traffic Signal Cables	Y	Υ	N	
686	Traffic Signal Pole Assemblies (Steel) (Non- Standard only)	Y	Y	Y	
687	Pedestal Pole Assemblies	Y	Y	N	
688	Detectors	Y	Υ	N	

### Item 7: Legal Relations and Responsibilities

Maintain the roadway slope stability. Maintaining slope stability is subsidiary to the various bid items.

### **Item 8: Prosecution and Progress**

No lane closures are allowed the day before, during, and day after the seven national Holidays unless otherwise approved by the Engineer.

The Department will not adjust the number of days for the project and milestones, if any, due to differences in opinion regarding any assumptions made in the preparation of the schedule or for errors, omissions, or discrepancies found in the time determination schedule.

Calendar days will be computed and charged based on in accordance with Section 8.3.1.5.

Fort Bend Grand Parkway Segment D Widening of Grand Parkway Southbound Frontage Road at FM 1093/SH 99 Project No. GPD-017

The Engineer and the Contractor may mutually agree, in writing, to increase or decrease this maximum number of days.

Failing to achieve Final Completion within the days specified by the Engineer the Contractor will be assessed liquidated damages of \$1,500 per day which will be withheld from any amount owed the Contractor. If the amount owed the Contractor is insufficient to withhold the amount, the Contractor shall pay the difference to the Authority.

The Lane Closure Assessment Fee is \$ 500.00 per hour. This fee applies to the Contractor for closures or obstructions that overlap into restricted hour traffic for each hour or portion thereof, per lane, regardless of the length of lane closure or obstruction. For Restricted Hours subject to Lane Assessment Fee refer to the Item, "Barricades, Signs, and Traffic Handling."

### **Item 104: Removing Concrete**

Removing concrete curb is paid as a separate bid item if the existing pavement on which it rests is not removed at the same time.

### Item 110: Excavation

If manipulating the excavated material requires moving the same material more than once to accomplish the desired results, the excavation is measured and paid for only once regardless of the manipulation required.

The total excavation quantity shown on the plans includes the quantity for excavating to 2 ft. behind the back of the proposed curb.

### Item 132: Embankment

If salvaged base is used for the embankment material, break it into small pieces to achieve the required density and to facilitate placing in the embankment. Obtain approval of the material before placing in the embankment.

Furnish Type C material with a maximum Liquid Limit (LL) of 65, a minimum Plasticity Index (PI) of 5, and composed of suitable earth material such as loam, clay, or other materials that form a suitable embankment.

The embankment material used on the project which has a Liquid Limit exceeding 45 will be tested for Liquid Limits at the rate of one test per 20,000 cu. yd. or per total quantity less than 20,000 cu. yd., unless otherwise directed. Only use material that passes the above tests.

Provide a finished grade with the top 4 in. capable of sustaining vegetation. Use fertile soil that is easily cultivated, free from objectionable material and highly resistant to erosion. This work is paid under the Item, "Topsoil."

Fort Bend Grand Parkway Segment D Widening of Grand Parkway Southbound Frontage Road at FM 1093/SH 99 Project No. GPD-017

Item 161: Compost

Item 162: Sodding for Erosion Control Item 164: Seeding for Erosion Control

Item 166: Fertilizer

Item 168: Vegetative Watering

Refer to the "Fertilizer, Seed, Sod, Straw, Compost, and Water" plan sheet for material specifications, application rates, and for watering requirements.

### Item 360: Concrete Pavement

Where the pavement curb is left off for a later tie, provide the dowels or the tie bars as indicated on the paving detail sheets. The dowel bars and tie bars are subsidiary to the various bid items.

Repair portions of the concrete pavement surfaces that are damaged while in a plastic state before that area receives permanent pavement markings and opens to traffic. Perform repairs that are structurally equivalent to and cosmetically uniform with the adjacent undamaged areas. Do not repair by grouting onto the surface.

On pavement widening, hand finishing in place of the longitudinal float will be permitted.

Where existing pavement is widened with new pavement, place the new pavement a minimum of 2 ft, wide.

Equip the batching plants to proportion by weight, aggregates and bulk cement, using approved proportioning devices and approved automatic scales.

For mono curb, the curb height transitions will be paid at the contract unit price of the larger curb height in the transition. The 2.5-in. laydown curbs for driveways will be paid at the unit price bid for the Item, "Conc Curb (Mono) (Ty II)."

High-early strength cement may be used for frontage road and city street intersection construction.

Do not use limestone dust of fracture as fine aggregate.

If the concrete design requires greater than 5.5 sacks of cementitious material per cubic yard, obtain written approval. If placing concrete pavement mixes from April 1 to October 31, inclusive, use Mix Design Option 1 as specified in Section 421.4.2.6.1.

Perform saw cutting as shown on the plans in accordance with Section 360.4.10, "Sawing Joints." This saw cutting is subsidiary to this bid Item.

Use coarse aggregate to produce concrete with a maximum Coefficient of Thermal Expansion (CTE) of 5.5x10<sup>-6</sup> in/in/°F. Before construction, submit test specimens to the TxDOT Construction Division for aggregate acceptance. Provide samples or test specimens as directed. Test results are final. Testing is required for naturally occurring aggregates.

Fort Bend Grand Parkway Segment D Widening of Grand Parkway Southbound Frontage Road at FM 1093/SH 99 Project No. GPD-017

Provide all concrete mix designs to the Engineer.

### Items 360, 420, and 421: All Concrete Items

For the concrete cylinder split samples, transport the test cylinders to the appropriate Laboratory assigned to this project, when applicable. Transporting the test cylinders is subsidiary to the various bid items.

### Item 400: Excavation and Backfill for Structures

Plugging existing pipe culverts is subsidiary to the various bid items.

If Recycled Cement Treatment (Type D) is included in the plans, the following additional requirements apply:

- 1. Use only approved sand, crushed concrete, or salvaged base free from deleterious matter, as aggregate for cement-stabilized backfill
- 2. Provide crushed concrete or salvaged base backfill material in accordance with the Item, "Cement Treatment (Plant-Mixed)(Type D)" (base or crushed concrete), except the recycled Type D material must not contain Reclaimed Asphalt Pavement (RAP).
- 3. For backfill material below the spring line of pipes, use cement-stabilized sand rather than Recycled Type D backfill material.
- 4. For the cement-stabilized sand backfill, use a minimum of 7 percent of hydraulic cement based on the dry weight of backfill material. The cement content for the crushed concrete and salvaged base is specified in the Item, "Cement Treatment (Plant-Mixed) (Type D)."
- 5. Place and compact the stabilized backfill material using a gradation that provides a dense mass without segregating and is impervious to passing of water.

### Item 465: Junction Boxes, Manholes, and Inlets

If required on the plans, build manholes and inlets to stage 1 construction, cover with temporary pavement, and complete in a later phase of construction. This temporary covering and pavement are subsidiary to the various bid items.

Construct manholes and inlets in graded areas, first to an elevation at least 4 in. above the top of the highest entering pipe and cover with a wooden cover. Complete the construction of such manholes and inlets to the finished elevation when completing the grading work for such manholes and inlets. Adjust the final elevation, if required, since this elevation is approximate.

Construct manholes and inlets in paved areas to an elevation so their temporary wooden covers are flush with the surface of the base material.

Do not leave excavations or trenches open overnight.

Fort Bend Grand Parkway Segment D Widening of Grand Parkway Southbound Frontage Road at FM 1093/SH 99 Project No. GPD-017

### Item 502: Barricades, Signs, and Traffic Handling

Do not reduce the existing number of lanes open to traffic except as shown on the following time schedule.

DAY	Daytime closure Hours	Nighttime closure Hours				
Monday	9:00 AM-3:00 PM	7:00 PM-5:30 AM				
Tuesday	9:00 AM-3:00 PM	7:00 PM-5:30 AM				
Wednesday	9:00 AM-3:00 PM	7:00 PM-5:30 AM				
Thursday	9:00 AM-3:00 PM	7:00 PM-5:30 AM				
Friday	9:00 AM-3:00 PM	7:00 PM-5:30 AM				
Saturday	Any	Any				
Sunday	Any	Any				

Use a traffic control plan for handling traffic through the various phases of construction. Follow the phasing sequence unless otherwise agreed upon by the Engineer and the Project Manager. Ensure this plan conforms to the latest "Texas Manual on Uniform Traffic Control Devices" and the latest Barricade and Construction (BC) Standard Sheets. The latest versions of Work Zone Standard Sheets WZ (BTS-1) and WZ (BTS-2) are the traffic control plan for the signal installations.

Submit changes to the traffic control plan to the Engineer. Provide a layout showing the construction phasing, signs, striping, and signalizations for changes to the original traffic control plan.

Furnish and maintain the barricades and warning signs, including the necessary temporary and portable traffic control devices, during the various phases of construction. Place and construct these barricades and warning signs in accordance with the latest "Texas Manual on Uniform Traffic Control Devices" for typical construction layouts.

Cover work zone signs when work related to the signs is not in progress, or when any hazard related to the signs no longer exists.

Keep the delineation devices, signs, and pavement markings clean. This work is subsidiary to the Item, "Barricades, Signs, and Traffic Handling."

If a section is not complete before the end of the workday, pull back the base material to the existing pavement edge on a 6H: 1V slope. Edge drop-offs during the hours of darkness are not permitted.

Fort Bend Grand Parkway Segment D Widening of Grand Parkway Southbound Frontage Road at FM 1093/SH 99 Project No. GPD-017

Cover or remove the permanent signs and construction signs that are incorrect or that do not apply to the current situation for a particular phase.

Do not mount signs on drums or barricades, except those listed in the latest Barricades and Construction standard sheets.

Use traffic cones for daytime work only. Replace the cones with plastic drums during nighttime hours.

Use shadow vehicles with Truck Mounted Attenuators (TMA) for lane and shoulder closures.

### Item 506: Temporary Erosion, Sedimentation and Environmental Controls

The Storm Water Pollution Prevention Plan (SWP3) consists of temporary erosion control measures needed and provided for under this Item. The disturbed area is less than one acre and use of erosion control measures is not anticipated. If physical conditions encountered at the job site require necessary controls, BMP installation, maintenance, and removal will be paid as extra work on a force account basis per Articles 4.4 and 9.7. Since the disturbed area is less than 5 acres, a "Notice of Intent" (NOI) is not required.

Use appropriate measures to prevent, minimize, and control the spill of hazardous materials in the construction staging area. Remove and dispose of materials in compliance with State and Federal laws.

Before starting construction, review with the Engineer the SWP3 used for temporary erosion control as outlined on the plans. Before construction, place the temporary erosion and sedimentation control features as shown on the SWP3.

Schedule the seeding or sodding work as soon as possible. The project schedule provides for a vegetation management plan.

After completing earthwork operations, restore and reseed the disturbed areas in accordance with the Department's specifications for permanent or temporary erosion control.

Implement temporary and permanent erosion control measures to comply with the National Pollution Discharge Elimination System (NPDES) general permit under the Clean Water Act.

Before starting grading operations and during the project duration, place the temporary or permanent erosion control measures to prevent sediment from leaving the right of way.

### Item 512: Portable Traffic Barrier

Where required by the Engineer, provide anchor pins for Type 2 Low Profile Concrete Barriers (LPCB) as shown on the current LPCB standard. Anchor pins are subsidiary to the Low Profile Concrete Barrier.

Fort Bend Grand Parkway Segment D Widening of Grand Parkway Southbound Frontage Road at FM 1093/SH 99 Project No. GPD-017

After completing the project, - Low Profile Concrete Barriers (LPCB) used for traffic handling will become the property of the Contractor. -

Item 529: Concrete Curb, Gutter, and Combined Curb and Gutter

Item 530: Intersections, Driveways, and Turnouts

Item 531: Sidewalks

An air-entraining admixture is not required.

For concrete curbs, use Grade 7 aggregate conforming to Section 421.2.6 of the Item, "Hydraulic Cement Concrete."

For reinforcing steel in sidewalks and pedestrian ramps, use No. 4 bars at a maximum 18 in. spacing center-to-center in both directions.

### Item 618: Conduit

When backfilling bore pits, ensure that the conduit is not damaged during installation or due to settling backfill material. Compact select backfill in 3 equal lifts to the bottom of the conduit; or if using sand, place it 2 in. above the conduit. Ensure backfill density is equal to that of the existing soil. Prevent material from entering the conduit.

Construct bore pits a minimum of 5 ft. from the edge of the base or pavement. Close the bore pit holes overnight.

Unless otherwise shown on the plans, install underground conduit a minimum of 24 in. deep. Install the conduit in accordance with the latest National Electrical Code (NEC) and applicable Department standard sheets. Place conduit under driveways or roadways a minimum of 24 in. below the pavement surface.

If using casing to place bored conduit, the casing is subsidiary to the conduit.

If placing the conduit under existing pavement to reach the service poles, bore the conduit in place and extend it a minimum distance of 5 ft. beyond the edge of shoulder or the back of curb.

### Item 620: Electrical Conductors

Test each wire of each cable or conductor after installation. Incomplete circuits or damage to the wire or the cable are cause for immediate rejection of the entire cable being tested. Remove and replace the entire cable at no expense to the Department. Also test the replacement cable after installation.

When pulling cables or conductors through the conduit, do not exceed the manufacturer's recommended pulling tensions. Lubricate the cables or conductors with a lubricant recommended by the cable manufacturer.

Fort Bend Grand Parkway Segment D Widening of Grand Parkway Southbound Frontage Road at FM 1093/SH 99 Project No. GPD-017

For both transformer and shoe-base type illumination poles, provide double-pole breakaway fuse holders as shown on the Department's Construction Division (CST) material producers list. Check the latest link on the Department website for this list. The category is "Roadway Illumination and Electrical Supplies." The fuse holder is shown on the list under Items 610 and 620. Provide 10 Amp time delay fuses.

Ensure that circuits test clear of faults, grounds, and open circuits.

Split bolt connectors are allowed only for splices on the grounding conductors.

For Roadside Flashing Beacon Assemblies (Item 685) and Pedestal Pole Assemblies (Item 687) within the project, provide single-pole breakaway disconnects as shown on the Construction Division (CST) material producers list. Check the latest link on the Department website for this list. The category is "Roadway Illumination and Electrical Supplies." The fuse holder is shown on the list under Item 685. For underground (hot) conductors, install a breakaway connector with a dummy fuse (slug). Provide dummy fuse (slug). For grounded (neutral) conductors, install a breakaway connector with a white colored marking and a permanently installed dummy fuse (slug).

For electrical licensing and electrical certification requirements for this project, see Item 7 of the Standard Specifications and any applicable special provisions to Item 7.

### Item 624: Ground Boxes

The ground box locations are approximate. Alternate ground box locations may be used as directed, to avoid placing in sidewalks or driveways.

Ground metal ground box covers. Bond the ground box cover and ground conductors to a ground rod located in the ground box and to the system ground.

Ground the existing metal ground box covers as shown on the latest standard sheet ED (4)-14.

During construction and until project completion, provide personnel and equipment necessary to remove ground box lids for inspection. Provide this assistance within 24 hours of notification.

Construct concrete aprons in accordance with the latest standard sheet ED (4)-14. Make the depth of the concrete apron the same as the depth of the ground box, except for Type 1 and Type 2 ground boxes. For Type 1 or Type 2 ground boxes, construct the concrete apron in accordance with details shown on the "Ground Box Details Installations" standard.

### Item 628: Electrical Services

Verify and coordinate the electrical service location with the engineering section of the appropriate utility district or company.

Fort Bend Grand Parkway Segment D Widening of Grand Parkway Southbound Frontage Road at FM 1093/SH 99 Project No. GPD-017

Identify the electrical service pole with an address number assigned by the Utility Service Provider. Provide 2-in. numerals visible from the highway. Provide numbers cut out aluminum figures nailed to wood poles or painted figures on steel poles or service cabinets.

### Item 644: Small Roadside Sign Assemblies

Sign locations shown on the plans are approximate. Before placing them, obtain approval of and then stake the exact locations for these signs.

Use the Texas Universal Triangular Slip Base with the concrete foundation for small ground mounted signs, unless otherwise shown in the plans.

Remove existing street name signs from existing stop signs and re-install them above the new stop signs. Removing and re-installing existing street name signs is subsidiary to the Item, "Small Roadside Sign Assemblies."

When design details are not shown on the plans, provide signs and arrows conforming to the latest "Standard Highway Sign Designs for Texas" manual.

Use Type E Super High Specific Intensity (Fluorescent Prismatic) yellow green reflective sheeting background to fabricate school signs (S1-1, S3-1, S4-3, S5-1, W16-2, SW16-9p, and SW16-7pL(R)).

Assume ownership of the removed existing signs.

Locations of the relocated signs are approximate. Before placing them, obtain approval of and then stake the exact locations for these signs.

Replace existing signs that become damaged during relocation at no expense to the Department.

### Item 662: Work Zone Pavement Markings

At the end of each workday, mark roadways that remain open to traffic during construction operations with standard pavement markings, in accordance with the latest "Texas Manual on Uniform Traffic Control Devices."

Using raised markers for removable work zone pavement markings on final concrete surfaces is optional.

For transition lane lines and detour lane lines, use raised pavement markers as shown for solid lines on the latest Barricade and Construction standard sheet for "Work Zone Pavement Marking Details."

Fort Bend Grand Parkway Segment D Widening of Grand Parkway Southbound Frontage Road at FM 1093/SH 99 Project No. GPD-017

Item 662: Work Zone Pavement MarkingsItem 666: Reflectorized Pavement MarkingsItem 668: Prefabricated Pavement Markings

Item 6019: Longitudinal Prefabricated Pavement Markings (PPM) with Warranty

Item 6020: Multipolymer Pavement Markings (MPM) with Warranty

Item 6038: Multipolymer Pavement Markings (MPM)

Use Type III glass beads for thermoplastic and multipolymer pavement markings.

Use a 0.100 in. (100 mil) thickness for thermoplastic pavement markings, measured to the top of the thermoplastic, not including the exposed glass beads.

Use a 0.022 in. (22 mil) thickness for multipolymer pavement markings, measured to the top of the multipolymer, not including the exposed glass beads.

If using paint and bead markings as described above, purchase the traffic paint from the open market.

If the Type II markings become dirty and require cleaning by washing, brushing, compressed air, or other approved methods before applying the Type I thermoplastic markings, this additional cleaning is subsidiary to the Item, "Reflectorized Pavement Markings."

Establish the alignment and layout for work zone striping and permanent striping.

Stripe all roadways before opening them to traffic.

Place pavement markings under these items in accordance with details shown on the plans, the latest "Texas Manual on Uniform Traffic Control Devices," or as directed.

When design details are not shown on the plans, provide pavement markings for arrows, words, and symbols conforming to the latest "Standard Highway Sign Designs for Texas" manual.

### Item 672: Raised Pavement Markers

If other operations are complete on the project and if the curing time period is not yet elapsed, the contract time will be suspended until the curing is done.

Before placing the raised pavement markers on concrete pavement, blast clean the surface using an abrasive-blasting medium. This work is subsidiary to the Item, "Raised Pavement Markers."

Provide epoxy adhesive that is machine-mixed or nozzle-mixed and dispensed. Equip the machine or nozzle with a mechanism to ensure positive mix measurement control.

### Item 677: Eliminating Existing Pavement Markings and Markers

Remove existing pavement markings on concrete or asphalt surfaces by flail milling or as directed.

Fort Bend Grand Parkway Segment D Widening of Grand Parkway Southbound Frontage Road at FM 1093/SH 99 Project No. GPD-017

### Item 678: Pavement Surface Preparation for Markings

Clean asphalt concrete pavement as required under the applicable specifications or as directed.

On new concrete pavement or on existing concrete pavement when placing a new stripe on a new location, remove the curing compounds and contamination from the pavement surface by flail milling or as directed. In addition, air-blast the surface with compressed air just before placing the new stripe.

On existing concrete pavement when placing a new stripe on an existing location, after removing the existing stripe under the Item, "Eliminating Existing Pavement Markings and Markers," airblast the surface with compressed air just before placing the new stripe.

Do not clean concrete pavement by grinding.

### Item 680: Highway Traffic Signals

See Special Specification 9999 for minimum requirements.

Clearly mark or highlight on the shop drawings the items being furnished for this project.

Furnish labor, tools, equipment, and materials as shown on the plans and specifications for a complete and operating signal installation.

Furnish the type of controller cabinet specified on the plans. Refer to the table shown in the Departmental Material Specifications (DMS-11170, Fully Actuated, Solid-State Traffic Signal Controller Assembly), Section 11170.6.K, Type 4 cabinet, page 25 of 39, regarding the size of the cabinet, back panel configuration, and the size of the load bay. Use the following website to view this specification: <a href="http://www.txdot.gov/business/resources.dms.html">http://www.txdot.gov/business/resources.dms.html</a>

Complete traffic signal construction work, including correcting discrepancies shown on the Department inspector's "Traffic Signal Installation Inspection Report" before the beginning of the test period.

Provide a full-time qualified traffic signal technician responsible for complete installation and timings, maintaining, or replacing traffic signal devices.

Staking in the field is subject to approval.

Make adjustments in project construction, if needed, due to conflicts with underground utilities.

Do not aim the luminaire arms mounted on traffic signal poles into the intersection. Aim each arm perpendicular to the centerline of the roadway it is intended to cover, to develop the proper illumination pattern for the intersection.

Fort Bend Grand Parkway
Toll Road Authority

Fort Bend Grand Parkway Segment D Widening of Grand Parkway Southbound Frontage Road at FM 1093/SH 99 Project No. GPD-017

Allow the electrical work to be inspected by Fort Bend County (FBC). Complying with the provisions and requirements of the FBC electrical ordinance is not required. Such inspection does not make the FBC a party to this contract.

Provide continuous conductors without splices from signal controller to signal heads. Route the conductors for luminaires to the service enclosure. Splices or attachments to the terminal block in the access compartment of the mast arm pole are not permitted except for the luminaire cable.

Abrasions to the conductor insulation caused while pulling cable for the traffic signal system are cause for immediate rejection. Remove and replace the entire damaged cable at no expense to the Department.

When pulling cables or conductors through conduit, do not exceed the manufacturer's recommended pulling tensions. Lubricate the cables or conductors with a lubricant as recommended by the cable manufacturer.

Bond the controller housing, signal poles, conduit, and spans to a minimum No. 6 AWG stranded copper conductor. An equipment grounding conductor is required in every conduit to form a continuous grounding system. Effectively connect the grounding system to ground rods or concrete encased grounding electrodes as indicated in the plans.

Wrap signal heads with dark plastic or suitable material to conceal the signal faces from the time of installation until placing into operation. Do not use burlap.

Furnish signal heads from the same manufacturer.

Use Type C High Specific Intensity grade sheeting for signs mounted under or adjacent to the signal heads.

Furnish and attach compression type connectors. Install the connectors with a compression mechanical release hand-crimping tool to each individual conductor before making connections to the terminal strips.

The Contractor may use ready mix concrete.

Apply membrane curing on concrete work in accordance with Section 420.4.10.3, "Membrane Curing."

The standard 4.5-in. galvanized pipe type poles, except the breakaway type, are subject only to the Engineer's inspection for their acceptance. Mill test reports or documentation will not be required.

### Item 682: Vehicle and Pedestrian Signal Heads

Install two set screws on vehicle signal head mounting hardware fittings.

Fort Bend Grand Parkway Segment D Widening of Grand Parkway Southbound Frontage Road at FM 1093/SH 99 Project No. GPD-017

### Item 688: Pedestrian Detectors and Vehicle Loop Detectors

Provide pedestrian push buttons a minimum of 2 in. diameter in the smallest dimension.

Install a rubber grommet or bushing between the push button assembly and the signal pole to protect the conductors.

Provide a black tube loop detector wire as specified in the "International Municipal Signal Association, Inc." (IMSA) Specification No. 51-7, 1997.

If the loop sealant supplied by the Contractor is not on the Department's pre-qualified product list, before applying the sealant provide a 5-gal. container of loop sealant for testing.

### Governing Specifications and Special Provisions

All specifications and special provisions applicable to this project are identified as follows:

<u>Standard Specifications</u>: Adopted by the Texas Department of Transportation November 1, 2014. Standard Specifications are incorporated into the contract by reference and a copy may be purchase from TxDOT.

```
Items 1 to 9 including General Requirements and Covenants
Item
        104
                Removing Concrete
        110
                Excavation (132)
Item
Item
        132
                Embankment (100), (160), (204), (210), (216), (260), (400)
Item
        162
                Sodding for Erosion Control (166), (168)
Item
        166
                Fertilizer (520)
        168
Item
                Vegetative Watering
        260
                Lime Treatment (Road-Mixed) (105), (204), (210), (216), (247), (300), (310), (520)
Item
        276
                Cement Treatment (Plant-Mixed) (204), (210), (216), (247), (300), (520)
Item
Item
        292
                Asphalt Treatment (Plant-Mixed) (300), (301), (320), (520), (585)
Item
        360
                Concrete Pavement (421), (422), (438), (440), (529), (585)
Item
        400
                Excavation and Backfill for Structures (110), (132), (401), (402), (403), (416), (420), (421), (423)
Item
        401
                Flowable Backfill (421)
        416
                Drilled Shaft Foundations (405), (420), (421), (423), (440), (448)
Item
        432
Item
                Riprap (247), (420), (421), (431), (440)
        465
Item
                Junction Boxes, Manholes, and Inlets (400), (420), (421), (424), (440), (471)
        479
Item
                Adjusting Inlet (CAP) (400), (420), (421), (424), (440), (471)
Item
        500
                Mobilization
Item
        502
                Barricades, Signs, and Traffic Handling
        506
Item
                Temporary Erosion, Sedimentation, and Environmental Controls (161), (432), (556)
Item
        512
                Portable Concrete Traffic Barrier (420), (421), (424), (440), (442)
Item
        529
                Concrete Curb, Gutter, and Combined Curb and Gutter (360), (420), (421), (440)
        531
Item
                Sidewalks (104)(360)(420)(421)(440)
Item
        618
                Conduit (400), (476)
Item
        620
                Electrical Conductors (610), (628)
Item
        621
                Tray Cable (620)
        624
                Ground Boxes (420), (421), (432), (440), (618), (620)
Item
Item
        628
                Electrical Services (441), (445), (449), (618), (620), (627), (656)
Item
        644
                Small Roadside Sign Assemblies (421), (440), (441), (442), (445), (636), (643), (656)
Item
        662
                Work Zone Pavement Markings (656), (668), (672), (677)
Item
       668
                Prefabricated Pavement Markings (678)
Item
        672
                Raised Pavement Markers (677), (678)
Item
        .677
                Elim Exist Pav Mrk & Mrks (300), (302), (316)
Item
        678
                Pavement Surface Preparation for Markings (677)
Item
       680
                Highway Traffic Signals (416), (610), (618), (624), (625), (627), (628), (636), (656), (682), (684)
                (686), (688)(9999)
       682
Item
                Vehicle and Pedestrian Signal Heads
Item
       684
                Traffic Signal Cables
                Pedestal Pole Assemblies (445), (449), (656), (682)
Item
       687
Item
       688
                Pedestrian Detectors and Vehicle Loop Detectors (324), (618), (624), (682), (684)
Item
       690
                Removal of Ped Ramp & Pole (416), (421), (476), (610), (618), (620), (622), (624), (625), (627),
                (628), (634), (636), (656), (680), (682), (684), (685), (686), (687), (688)
```

Fort Bend Grand Parkway Segment D Widening of Grand Parkway Southbound Frontage Road at FM 1093

Item 760 Ditch Cleaning & Reshaping

### **Special Provisions:**

Special Provisions will govern and take precedence over the Specifications enumerated hereon wherever in conflict therewith. All Special Provisions are included herein.

Prevailing Wages

Special Provision General (FBGPTRA)

Special Provision 000-010 Important Notice to Contractors

Special Provision 000-100 Important Notice to Contractors – Utility Adjustment (FBGPTRA)

Special Provision to Item 2 Instructions to Bidders 002-001 (FBGPTRA)

Special Provision to Item 3 Award and Execution of Contract 003-005 (FBGPTRA)

Special Provision to Item 4 Scope of Work 004-001 (FBGPTRA)

Special Provision to Item 7 Legal Relations and Responsibilities 007-001 (FBGPTRA), 007-001, 007-003

Special Provision to Item 8 Prosecution and Progress 008-001 (FBGPTRA)
Special Provision to Item 9 Measurement and Payment 009-001 (FBGPTRA)

Special Specifications:

Item 9000 Emergency Vehicle Preemption System (Fort Bend County)

Item 9999 Paradigm Traffic Systems, Inc. Part Number: PT-P44168TS2-1-CS, NEMA

Cabinet Assembly / TS2-1, P44 Cabinet With 16 Position Backpanel (Fort Bend County)

### General:

The above-listed specification items are those under which payment is to be made. These, together with such other pertinent items, if any, as may be referred to in the above-listed specification items, and including the special provisions listed above, constitute the complete specifications for this project.

### PREVAILING WAGES:

This project is subject to the prevailing wage rate requirements of Chapter 2258 of the Government Code. The Contractor shall pay Fort Bend Grand Parkway Toll Road Authority sixty dollars (\$60.00) for each worker employed by the Contractor for the provision of services described herein for each calendar day or part of the day that the worker is paid less than the below stated rates. Contractors may also visit <a href="https://www.wdol.gov/dba.aspx">www.wdol.gov/dba.aspx</a>.

General Decision Number: TX170056 01/06/2017 TX56

Superseded General Decision Number: TX20160056

State: Texas

Construction Type: Highway

Counties: Austin, Brazoria, Chambers, Fort Bend, Galveston, Hardin, Harris, Jefferson, Liberty, Montgomery, Orange, San Jacinto and Waller Counties in Texas.

HIGHWAY CONSTRUCTION PROJECTS (excluding tunnels, building structures in rest area projects & railroad construction; bascule, suspension & spandrel arch bridges designed for commercial navigation, bridges involving marine construction; and other major bridges).

Note: Under Executive Order (EO) 13658, an hourly minimum wage of \$10.20 for calendar year 2017 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least \$10.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2017. The EO minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number Publication Date 0 01/06/2017

\* SUTX2011-013 08/10/2011

Rates Fringes

CEMENT MASON/CONCRETE FINISHER (Paving and Structures)......\$ 12.98

ELECTRICIAN.....\$ 27.11

FORM BUILDER/FORM SETTER
Paving & Curb\$ 12.34
Structures\$ 12.23
LABORER
Asphalt Raker\$ 12.36
Flagger\$ 10.33
Laborer, Common \$ 11.02
Laborer, Utility\$ 11.73
Pipelayer\$ 12.12
Work Zone Barricade
Servicer\$11.67
Service1 11.07
PAINTER (Structures)\$ 18.62
POWER EQUIPMENT OPERATOR:
Asphalt Distributor\$ 14.06
Asphalt Paving Machine\$ 14.32
Broom or Sweeper\$ 12.68
Concrete Pavement
Finishing Machine\$ 13.07
Concrete Paving, Curing,
Float, Texturing Machine\$ 11.71
Concrete Saw\$ 13.99
Crane, Hydraulic 80 Tons
or less\$ 13.86
Crane, Lattice boom 80
tons or less\$ 14.97
Crane, Lattice boom over
80 Tons\$ 15.80
Crawler Tractor\$ 13.68
Excavator, 50,000 pounds
or less\$ 12.71
Excavator, Over 50,000
pounds\$ 14.53
Foundation Drill, Crawler
Mounted\$ 17.43
Foundation Drill, Truck
Mounted\$ 15.89
Front End Loader 3 CY or
Less\$ 13.32
Front End Loader, Over 3 CY.\$ 13.17
Loader/Backhoe\$ 14.29
Mechanic
ivitiing iviachine 11331

Motor Grader, Fine Grade\$ 15.69	
Motor Grader, Rough\$ 14.23	
Off Road Hauler\$ 14.60	
Pavement Marking Machine\$ 11.18	
Piledriver\$ 14.95	
Roller, Asphalt\$ 11.95	
Roller, Other\$ 11.57	
Scraper\$ 13.47	
Spreader Box\$ 13.58	
Servicer\$ 13.97	
Steel Worker	
Reinforcing Steel\$ 15.15	
Structural Steel Welder\$ 12.85	
Structural Steel\$ 14.39	
TRUCK DRIVER	
Low Boy Float\$ 16.03	
Single Axle\$ 11.46	
Single or Tandem Axle Dump\$ 11.48	
Tour Jours And a Transfer on /Com.	
Tandem Axle Tractor w/Semi	

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

\_\_\_\_\_

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

#### Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

### Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

### Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

### WAGE DETERMINATION APPEALS PROCESS

- 1.) Has there been an initial decision in the matter? This can be:
- \* an existing published wage determination
- \* a survey underlying a wage determination
- \* a Wage and Hour Division letter setting forth a position on a wage determination matter
- \* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations Wage and Hour Division U.S. Department of Labor 200 Constitution Avenue, N.W. Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (Sec 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator U.S. Department of Labor 200 Constitution Avenue, N.W. Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board U.S. Department of Labor 200 Constitution Avenue, N.W. Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

END OF GENERAL DECISION

### FORT BEND GRAND PARKWAY TOLL ROAD AUTHORITY SPECIAL PROVISION – GENERAL

For this project, the following sections of the Texas Standard Specifications ("TSS") are hereby modified with respect to the clauses cited below and no other clauses or requirements of the TSS are waived or changed hereby.

**Global** – All references to "State" or "Department" are replaced with "Authority."

# FORT BEND GRAND PARKWAY TOLL ROAD AUTHORITY SPECIAL PROVISION TO ITEM 2 INSTRUCTIONS TO BIDDERS

Item 2, "Instructions to Bidders," of the Texas Department of Transportation Standard Specifications is hereby amended with respect to the clauses cited below. No other clauses or requirements are waived or changed.

Except for Section 1, the remainder of Item 2 is voided and replaced by the following:

Section 2, Eligibility of Bidders. For this project, the Fort Bend Grand Parkway Toll Road Authority (FBGPTRA) requires that bidders be prequalified by the Texas Department of Transportation. Submit to Texas Department of Transportation for approval a Confidential Questionnaire Form and an audited financial statement at least 10 days before the date that bids are to be opened. Once approved, the eligibility is valid for a period of one year. Comply with all technical prequalification requirements in the bid form. Obtain prequalification forms from the Construction Division.

Section 3, Issuing Bid Forms. Request bid forms orally, in writing, or electronically.

In the case of a joint venture, all joint venture participants must be prequalified. An equally divided portion of the Engineer's estimate must be within each participant's available bidding capacity.

The FBGPTRA will not issue a bid form for a proposed Contract if one or more of the following apply:

- The Bidder is disqualified by an agency of the federal government.
- The Bidder is suspended or debarred by the TxDOT Commission, or is prohibited from rebidding a specific proposal because of bid error or failure to enter into a Contract of the first awarded bid.
- The Bidder has not fulfilled the requirements for prequalification.
- The Bidder or a subsidiary or affiliate of the Bidder has received compensation from the FBGPTRA to participate in the preparation of the plans or specifications on which the bid or Contract is based.
- The Bidder did not attend an advertised mandatory pre-bid conference.

Section 4, Interpreting Estimated Quantities. The quantities listed in the bid form are approximate and will be used for the comparison of bids. Payments will be made for the work performed in accordance with the Contract.

Section 5, Examining Documents and Work Locations. Examine the bid form, plans, specifications, and specified work locations before submitting a bid for the work contemplated.

Submitting a bid will be considered evidence that the Bidder has performed this examination. Borings, soil profiles, water elevations, and underground utilities shown on the plans were obtained for use of the FBGPTRA in the preparation of plans. This information is provided for the Bidder's information only and the FBGPTRA makes no representation as to the accuracy of the data. Be aware of the difficulty of accurately classifying all material encountered in making foundation investigations, the possible erosion of stream channels and banks after survey data have been obtained, and the unreliability of water elevations other than for the date recorded.

Oral explanations, instructions, or consideration for contractor-proposed changes in the Items of work, specifications, plans or bid forms given during the bidding process are not binding. Only requirements included in the bid form, associated specifications, plans and FBGPTRA issued addenda are binding. Request explanations of documents in adequate time to allow the FBGPTRA to reply before the bid opening date.

Immediately notify the FBGPTRA of any error, omission, or ambiguity discovered in any part of the bid form, specifications or plans. The FBGPTRA will issue an addendum when appropriate.

**Section 6, Preparing the Bid.** Prepare the bid on the form furnished by the FBGPTRA. Bid forms may be printed or electronic. Informational forms will not be accepted.

Specify a unit price in dollars and cents for each Item for which an estimated quantity is given. When "Working Days" is an Item, submit the number of working days to be used to complete the Contract, or phases of the Contract shown on the plans.

An Item left blank will constitute an incomplete bid and will be handled as prescribed in Section 11, "Tabulating Bids." Include unit bid prices for each Item in the Item group or alternate Item group, except for instances when alternate Items pertain to foreign steel or iron materials.

If a bid form contains both regular bid Items for domestic and alternate bid Items pertaining to foreign steel or iron materials the bidder must either:

- Submit unit bid prices for domestic bid items only, or
- Submit unit bid prices for both the alternate foreign bid items and domestic bid items.

Verify whether addenda have been issued on a proposed Contract. Acknowledge all addenda.

Section 7, Nonresponsive Bids. A bid that has one or more of the deficiencies listed below is nonresponsive and will not be considered.

- The person or, in the case of a manually submitted joint venture bid, persons did not sign the bid form.
- The proposal guaranty did not comply with the requirements contained in Article 2.8,
   "Bid Guaranty."
- The bid was in a form other than the official bid form issued to the Bidder or Bidders.

- The bid was not in the hands of the letting official at the time and location specified in the advertisement. For electronic bids, "in the hands of the letting official" means CivCast vault acknowledgement.
- The bid form submitted had the incorrect number of Items.
- A computer printout, when used, was not signed in the name of the Bidder (or joint Bidders, in the case of a joint venture), or omitted required Items or included an Item or Items not shown in the bid form.
- The Bidder was not authorized to receive a bid form under Article 2.3, "Issuing Bid Forms."
- The Bidder failed to acknowledge receipt of all addenda issued.
- The Bidder bid more than the maximum or less than the minimum number of allowable working days shown on the plans when working days was an Item.
- The Bidder modified the bid in a manner that altered the conditions or requirements for work as stated in the bid form.
- The Bidder did not attend a specified mandatory pre-bid conference.
- The FBGPTRA will not accept or read any of the bids submitted on the same project by:
  - A joint venture and one or more of its partners, or
  - Affiliated bidders.

### Section 8, Electronic Bid.

**Section 8.1. Electronic Bid Form.** Use the electronic bid form in CivCast. Acknowledge an addendum by initialing each addendum listed under the addenda tab in CivCast.

Article 8.2. Bid Guaranty. For electronic bids, upload a copy of the guaranty check or bid bond on CivCast. Submit the original guaranty check or bid bond within 24 hours to FBGPTRA.

Article 8.3. Electronically Submitted Bids. Submit the electronic bid to the electronic vault using CIVCAST. It is the bidder's responsibility to ensure that the bid is received by the electronic vault on or before the time and date set for the opening.

Article 8.4. Revising Bid Forms. Make desired changes up until the time and date set for the opening of bids using CIVCAST. The electronically submitted bid with the latest time stamp by the electronic vault will be used for tabulation purposes.

Article 8.4.1. After Bid Opening. Revisions to bids are not allowed after the time and date set for the opening.

Article 8.5. Withdrawing Bids. Submit a written request to withdraw the bid. For a written request, submit a signed request to the Letting Official. A request to withdraw an electronic bid must be made by a person authorized to bind the Bidder and must be made prior to the time and date set for the opening. For written request for withdrawals of electronic bids and in the case of joint venture, the FBGPTRA will accept a request from any person authorized to bind a party to the joint venture to withdrawal a bid.

Article 8.6. The FBGPTRA will not be responsible for Internet unavailability. The FBGPTRA will not provide a computer for preparing, submitting, revising or withdrawing an electronic bid.

### Section 9, Printed Bid.

Article 9.1. Printed Bid Form. Make all entries and execute the bid form in ink. Acknowledge all addenda by checking the appropriate box on the addendum acknowledgement page. Provide the complete and correct name of the Bidder submitting the bid. A person authorized to bind the Bidder must sign the bid form. In the case of a joint venture, provide the complete and correct name of all Bidders submitting the bid. The bid form must be signed by person(s) authorized to bind the Bidder(s).

As an alternative to hand writing the unit prices in the bid form, submit a computer printout signed by the person authorized to bind the Bidder or for a joint venture the persons authorized to bind the Bidders. As a minimum, computer printouts must contain the information in the format shown on the "Example of Bid Prices Submitted by Computer Printout" form in the bid form.

Article 9.2. Bid Guaranty. The bid guaranty amount is fixed at the amount indicated on the bid form on the date the bid form is released to the public. Provide a bid guaranty in the amount indicated on the bid form as follows:

- For printed bids, use either a guaranty check or a bid bond.

Article 9.2.1. Guaranty Check. The guaranty check must be payable to the Fort Bend Grand Parkway Toll Road Authority and must be a cashier's check, money order, or teller's check drawn by or on a state or national bank, a savings and loan association, or a state or federally chartered credit union (collectively referred to as "bank"). The check must be dated on or before the date of the bid opening. Post dated checks will not be accepted. The type of check or money order must be indicated on the face of the instrument and the instrument must be no more than 90 days old. A check must be made payable at or through the institution issuing the instrument; be drawn by a bank and on a bank; or be payable at or through a bank. The FBGPTRA will not accept personal checks, certified checks, or other types of money orders as a bid guaranty.

Article 9.2.2. Bid Bond. The bid bond shall be on the American Institute of Architects, AIA Document 310, with powers of attorney attached, and in the amount specified on the bid bond form. The bond form must be dated on or before the date of the bid opening, bear the impressed seal of the Surety and be signed by the Bidder or Bidders, in the case of a joint venture, and an authorized individual of the Surety. As an alternative for joint venture Bidders, each of the Bidders may submit a separate bid bond, completed as outlined in this Subarticle. Bid bonds will only be accepted from Sureties authorized to execute a bond under and in accordance with state law.

Article 9.3. Submittal of Bid. Place the completed bid form and the bid guaranty in a sealed envelope marked to indicate the contents.

When submitting by mail or delivery service, place the envelope in another sealed envelope and address as indicated in the official advertisement. It is the bidder's responsibility to ensure that the sealed bid arrives at the location described in the official advertisement of the project on or before the time and date set for the opening. The bid must be in the hands of the Letting Official by that time, regardless of the method chosen for delivery, in order to be accepted.

In addition to the requirements above, all pages of a bid form printed from CIVCAST must be submitted.

Article 9.4. Revising Bid Forms. Revisions to bids will be handled as follows:

Article 9.4.1. Before Submission. Make desired changes to the printed bid form in ink and initial the changes.

Article 9.4.2. After Submission. Withdraw the bid in accordance with Article 2.11, "Withdrawing Bids." Make desired changes to the printed bid form in ink and initial the changes. Resubmit to the Letting Official in accordance with Article 2.9, "Delivery of Bid." The FBGPTRA will not make revisions to a bid on behalf of a Bidder.

Article 9.4.3. After Bid Opening. Revisions to bids are not allowed after the time and date set for the opening.

Article 9.5. Withdrawing Bids. Submit a signed written request to the Letting Official. The FBGPTRA will not accept telephone or electronic requests, but will accept a properly signed telefacsimile request. The request must be made by a person authorized to bind the Bidder, and must be in the hands of the Letting Official before the time and date set for the opening. In the case of joint venture, the FBGPTRA will accept a request from any person authorized to bind a party to the joint venture to withdrawal a bid.

Section 10, Opening and Reading of Bids. At the time, date and location specified in the official advertisement, the Letting Official will publicly:

- Open and read manually submitted bids; and
- Read electronically submitted bids.

### Section 11, Tabulating Bids.

Article 11.1. Official Total Bid Amount. The FBGPTRA will sum the products of the quantities and the unit prices bid in the bid form to determine the official total bid amount. Except as provided in Section 11.5.3., "Special Item Considerations," the official total bid amount is the basis for determining the apparent low Bidder. The total bid amounts will be compared and the results made public.

Article 11.2. Consideration of Bid Format. When a Bidder submits both an electronic bid and a properly completed manual bid, the unit bid prices in the manual bid will be used to determine

the total bid amount. If a bidder submits an electronic bid and an incomplete manual bid, the electronic bid will be used in the tabulation of the total bid amount.

If a bidder submits two or more manual bids, all responsive bids will be tabulated. The bid with the lowest tabulation will be used to determine the total bid amount.

Article 11.3. Rounding of Unit Prices. The FBGPTRA will round off all unit bids involving fractional parts of a cent to the nearest one-tenth cent (\$0.001) in determining the amount of the bid as well as computing the amount due for payment of each Item under the Contract. For rounding purposes, entries of five-hundredths of a cent (\$0.0005) or more will be rounded up to the next highest tenth of a cent, while entries less than five-hundredths of a cent will be rounded down to the next lowest tenth of a cent.

Article 11.4. Interpretation of Unit Prices. The FBGPTRA will make a documented determination of the unit bid price for tabulation purposes if a unit bid price is illegible. The FBGPTRA's determination will be final.

Article 11.5. Consideration of Unit Prices. Unit bid price entries such as no dollars and no cents, zero dollars and zero cents, or numerical entries of \$0.00, will be tabulated as one-tenth of a cent (\$0.001).

The FBGPTRA will consider proposals where unit bid prices have been left blank incomplete and nonresponsive. If a proposal has a regular and a corresponding alternate Item or group of Items, the bid will be considered complete if:

- The regular Item or group of regular Items has unit prices entered, or
- The alternate Item or group of alternate Items has unit prices entered.

The bid will be considered incomplete and nonresponsive if:

- A regular Item or group of regular Items is left blank, and
- A corresponding alternate Item or group of alternate Items is left blank.

Article 11.5.1. Consideration of Alternate Items. The FBGPTRA will make two calculations using one-tenth of a cent (\$0.001) for each Item if:

- A regular Item or a group of Items have an entry such as no dollars and no cents, zero dollars and zero cents, or numerical entries of \$0.00, and
- A corresponding alternate Item or group of Items, have an entry such as no dollars and no cents, zero dollars and zero cents, or numerical entries of \$0.00.

The FBGPTRA will select the regular Item or Items or the alternate Item or Items at the FBGPTRA's discretion if both the regular and alternate bid results in the same cost to the State.

The FBGPTRA will use the unit price that is greater than zero for bid tabulation if:

- A unit price greater than zero has been entered for either a regular bid or a corresponding alternate Item or group of Items, and
- An entry of no dollars and no cents, zero dollars and zero cents, or a numerical entry of \$0.00 has been entered for the other corresponding Item or group of Items.

If a unit price has been entered for both the regular Item and a corresponding alternate Item, the FBGPTRA will select the option (regular or alternate) that results in the lowest cost to the State. The FBGPTRA will select the regular Item or Items or the alternate Item or Items at the FBGPTRA's discretion if both the regular and alternate bid results in the same cost to the State.

### Article 11.5.2. Special Item Considerations.

Article 11.5.2.1. Rubber Additives. For proposed Contracts without federal funds, if an alternate Item for "Hot Asphalt-Rubber Surface Treatments" or "Hot Mix Asphalt Concrete Pavement" which contains ground tire rubber is shown in the bid form and the Bidder bids that alternate Item, the amounts bid for "Hot Asphalt-Rubber" and "Aggregate" or "Hot Mix Asphalt Concrete" will be reduced to 85% of the amounts actually bid. This reduction will only be used for the purposes of determining the lowest Bidder. To qualify, the ground tire rubber used must be produced from scrap tire ground in a facility in Texas. Payment for "Hot Asphalt-Rubber" and "Aggregate" or "Hot Mix Asphalt Concrete" will be at the actual unit prices bid.

Article 11.5.2.2. "Buy America." For proposed Contracts where unit bid prices are submitted for both domestic and foreign steel or iron materials, the total bid amount will be calculated using both the domestic and foreign steel unit bid prices. If the total bid amount using the foreign steel or iron materials is the low bid, and the lowest bid using domestic steel or iron materials exceeds the low bid using foreign steel or iron materials by 25% or more, the apparent low Bidder will be the bid using foreign steel or iron materials. If the difference between the low bid using foreign steel or iron materials and the lowest bid using domestic steel or iron materials is less than 25%, the apparent low Bidder will be the bid using domestic steel or iron materials.

Article 11.5.2.3. Home State Bidding Preference. For the purpose of determining the apparent low Bidder on proposed Contracts without federal funds, the total bid amount will be based upon the reverse application of the non-resident Bidder's home state bidding preference, if any.

Section 12, Consideration of Bid Errors. The FBGPTRA will consider a claim of a bid error by the apparent low Bidder if the following requirements have been met:

- Submit written notification to the FBGPTRA within 5 business days after the date the bid is opened.
- Identify the Items of work involved and include bidding documentation. The FBGPTRA may request clarification of submitted documentation.

The FBGPTRA will evaluate the claim of an error by the apparent low Bidder by considering the following:

The bid error relates to a material Item of work.

### 2014 Specifications

- The bid error amount is a significant portion of the total bid.
- The bid error occurred despite the exercise of ordinary care.
- The delay of the proposed work will not impact cost and safety to the public.

Acceptance of the bid error claim by the FBGPTRA will result in the rejection of all bids. The erring Contractor will not be allowed to bid the project when it is relet. Rejection of bids due to the Contractor's bid error may result in the application of sanctions by the FBGPTRA.

**Section 13, Gratuities.** Do not offer FBGPTRA employees benefits, gifts, or favors. The only exceptions allowed are ordinary business lunches. Failure to honor this policy may result in the termination of the Contract and sanctions under the Texas Administrative Code. Termination of the Contract will be in accordance with Article 8.7, "Termination of Contract."

**END OF SPECIAL PROVISION** 

### FORT BEND GRAND PARKWAY TOLL ROAD AUTHORITY

### **SPECIAL PROVISION TO ITEM 3**

### AWARD AND EXECUTION OF CONTRACT

Item 3, "Award and Execution of Contract," of the Texas Department of Transportation Standard Specifications is hereby amended with respect to the clauses cited below. No other clauses or requirements are waived or changed.

Section 1, "Award of the Contract," is voided and replaced in its entirety as follows:

The Authority will award, reject, or defer the Contract within 60 days after the opening of the proposal. The Authority reserves the right to reject any or all proposals and to waive technicalities in the best interest of the County.

Article 4.2., "Bonds," is supplemented by the following:

Performance Bond and Payment Bond forms provided by the Authority must be completed.

### FORT BEND GRAND PARKWAY TOLL ROAD AUTHORITY SPECIAL PROVISION TO ITEM 4

### **SCOPE OF WORK**

Item 4, "Scope of Work," of the Texas Department of Transportation Standard Specifications is hereby amended with respect to the clauses cited below. No other clauses or requirements are waived or changed.

Section 4, "Changes in the Work," is supplemented by the following:

For purposes of extra work, the following individuals have the authority shown to approve extra work. The Authority has no obligation to pay for extra work unless the Contractor secures written authorization executed by the appropriate person prior to commencement of the work. Extra work may not be split or severed to avoid the requirements of this section.

Mike Stone (Operations Manager):

\$ 50,000 or less

Board of Directors:

greater than \$50,000

### Article 4.1., "Change Orders," is added as follows:

The unit prices Bid shall govern for additions to, or deductions from the Contract. If materials or labor are required for which no unit price is bid, the price shall be that reached by agreement by the Authority and the Contractor after definite evidence is furnished by the Contractor to the Authority that the price is the current prevailing price in the area. If the Authority and the Contractor cannot agree, the Engineer shall determine the price for changes.

No compensation shall be allowed under a Change Order for any person not actively engaged in the performance of the specified work.

No extra work shall be paid for without an approved Change Order prior to the start of the extra work.

If additional time is required by reason of the Change, the number of days for completion provided for in this Contract shall be adjusted at the time the Change Order is entered into, and if no adjustment is made on the Change Order form, any additional time is to be considered waived by the Contractor.

Any extension of time given shall not release the Contractor or the Surety from their Performance and Payment Bonds or from all obligations hereunder, which shall remain in full force until the discharge of the Contract.

All time limits stated in the Contract Documents are the essence of the agreement. The provisions of this Article shall not exclude recovery of damage (including but not limited to fees

and charges of engineers, architects, attorneys and other professionals and court and arbitration costs for delay by either party.)

Section 6, "Requests for Additional Compensation and Damages," is revised by removing the first two paragraphs and replacing as follows:

In the event the Contractor requests additional compensation for work not clearly covered in the contract, the contractor shall notify the Authority in writing of his intention to make a claim for additional compensation before beginning such work, within 21 days of the day Contractor knows or should have known of such claim. The Contractor must provide a written estimate of the amount of the claim or assessment of damages within 30 days of timely notice of the claim. If such notice is not given, then the Contractor waives his right to file a claim for such work. Notice of such claim by the Contractor and the documentation of the cost of the claim work by Contractor shall not be construed as proof or substantiation of the validity of such claim. All such claims must be approved in writing by the Board of Directors of the Authority.

No claims for delay damages may be made nor will the Authority ever be obligated to pay delay damages. Contractor's sole remedy for damages caused by delay is an extension of the contract time. This limitation applies to delay caused by the Authority and delay caused by third parties only. Contractor will not be entitled to extension of time for delays resulting in whole or part from the Contractor's actions or omissions.

## FORT BEND GRAND PARKWAY TOLL ROAD AUTHORITY SPECIAL PROVISION TO ITEM 7 LEGAL RELATIONS AND RESPONSIBILITIES

Item 7, "Legal Relations and Responsibilities," of the Texas Department of Transportation Standard Specifications is hereby modified with respect to the clauses cited below. No other clauses or requirements are waived or changed.

Section 3, "Laws to be Observed," is supplemented by the addition of the following:

It is the intent of the Authority that all construction work shall be accomplished with minimum disturbance and inconvenience to the public.

The operation of heavy construction equipment over adjacent streets shall be avoided to the greatest extent practicable. If such operation is unavoidable, care shall be taken to prevent the creation of any nuisance, including, but not limited to, the tracking of dirt or the blowing of dust from uncovered loads.

If sites, buildings, and locations of historical, archaeological, educational, or scientific interests are discovered after construction operations are begun, operation in that particular area shall cease immediately and the sites, buildings, or location shall be investigated or evaluated by the Fort Bend Grand Parkway Toll Road Authority (FBGPTRA). An extension of time will be granted, if necessary, for delays caused by these investigations and evaluations. It is specifically understood, however, that if the Contractor is delayed by virtue of an investigation and evaluation that this delay will not be considered as basis for claim for damages or additional compensation of any kind by the Contractor and that an extension of time will be sole remedy of Contractor for such delay.

Section 6, "Personal Liability of Public Officials," is revised to read in its entirety as follows:

In carrying out provisions of the Contract Documents or in exercising any power or authority granted there under, there shall be no liability for the Project Engineer, the Section Engineer(s), Construction Phase Engineer, their respective officers, employees, subcontractors, or authorized assistants, either personally or otherwise, as they are agents and representatives of the Authority, and there shall be no liability, either personal or otherwise for any member of the Commissioners' Court, the FBGPTRA, or any of the FBGPTRA's officers, employees, or consultants. Neither the Contract Document nor FBGPTRA's or Contractor's course of conduct shall be deemed to create the relationship of principal and agent by and between the FBGPTRA and the Contractor.

Section 15, "Responsibility of Damage Claims," is voided and replaced by the following:

TO THE FULLEST EXTENT PERMITTED BY LAW, CONTRACTOR SHALL PROTECT, DEFEND, INDEMNIFY AND HOLD HARMLESS FORT BEND GRAND PARKWAY TOLL ROAD AUTHORITY, THE PROJECT ENGINEER, THE SECTION

ENGINEER(S), THE CONSTRUCTION PHASE ENGINEER, AND THEIR RESPECTIVE OFFICERS AND EMPLOYEES (COLLECTIVELY, THE "INDEMNIFIED PARTIES") FROM AND AGAINST EVERY LOSS, ITEM OF DAMAGE, INJURY, EXPENSE, DEMAND, CLAIM, CAUSE OF ACTION, JUDGMENT OR LIABILITY, OF WHATSOEVER KIND OR CHARACTER, WHETHER ARISING IN CONTRACT OR TORT OR UNDER ANY STATUTE, FOR EVERY ELEMENT OF RECOVERY, WHETHER DIRECT OR INDIRECT, INCLUDING SPECIAL AND CONSEQUENTIAL DAMAGES, AND INCLUDING ALL RELATED FINES, FEES AND COSTS, TO INCLUDE ALL FEES AND CHARGES OF ENGINEERS, ARCHITECTS, ATTORNEYS AND OTHER PROFESSIONALS AND ALL COURT OR ARBITRATION OR OTHER DISPUTE RESOLUTION COSTS, FOR:

- (I) BODILY INJURY OR DEATH OF AN EMPLOYEE OF ANY CONTRACTOR PARTIES, EVEN IF SUCH BODILY INJURY OR DEATH IS CAUSED IN WHOLE OR IN PART BY THE NEGLIGENCE, BREACH OF CONTRACT, BREACH OR VIOLATION OF A STATUTE, ORDINANCE, GOVERNMENTAL REGULATION, STANDARD, OR RULE, OR OTHER FAULT OF AN INDEMNIFIED PARTY; AND
- (II) BODILY INJURY TO OR DEATH OF ANY PERSON NOT ENCOMPASSED IN (I), ABOVE, PROPERTY DAMAGE OR ECONOMIC LOSS (INCLUDING LOSS OF USE) CAUSED BY OR ARISING OUT OF ANY BREACH OF THIS CONTRACT, OR THE BREACH OF ANY COMMON LAW DUTY, OR THE VIOLATION OF ANY STATUTE OR REGULATION BY THE CONTRACTOR PARTIES IN CONNECTION WITH THE PERFORMANCE (OR NON-PERFORMANCE) OF THE WORK, IN EACH INSTANCE, EVEN IF DUE IN PART TO THE NEGLIGENCE, BREACH OF CONTRACT, BREACH OR VIOLATION OF A STATUTE, ORDINANCE, GOVERNMENTAL REGULATION, STANDARD, OR RULE, OR OTHER FAULT OF AN INDEMNIFIED PARTY, PROVIDED, HOWEVER, THAT CONTRACTOR'S OBLIGATION OF INDEMNIFICATION SHALL NOT EXTEND TO THE PERCENTAGE OF DAMAGES, INJURIES, EXPENSES, DEMANDS, CLAIMS, CAUSES OF ACTION, JUDGMENTS, LIABILITIES, COSTS AND FEES CAUSED BY THE INDEMNIFIED PARTIES.

THIS INDEMNITY AGREEMENT IS INTENDED TO MEET THE TEXAS "EXPRESS NEGLIGENCE RULE" BECAUSE CONTRACTOR AGREES THAT IT APPLIES AND IS ENFORCEABLE EVEN AS TO LOSSES, DAMAGES, INJURIES, EXPENSES, CLAIMS, CAUSES OF ACTION, JUDGMENTS OR LIABILITIES JOINTLY OR CONCURRENTLY CAUSED BY THE NEGLIGENCE OR OTHER FAULT OF THE INDEMNIFIED PARTIES. THE TERM "FAULT" IN THE PREVIOUS SENTENCE INCLUDES THE VIOLATION OR BREACH BY THE INDEMNIFIED PARTIES OF ANY COMMON LAW DUTY, ANY TERM OF THIS CONTRACT, OR ANY STATUTE OR REGULATION.

NOTWITHSTANDING THE FOREGOING, THE CONTRACTOR ASSUMES NO RESPONSIBILITY FOR THE TIMELY DELIVERY AND ADEQUACY, ACCURACY AND/OR SUFFICIENCY OF THE PLANS, SPECIFICATIONS, OR DRAWINGS PRODUCED BY FBCTRA'S ENGINEERS, AND IT SHALL NOT BE LIABLE TO THE

FBCTRA FOR DAMAGES RESULTING FROM ERRORS, INCONSISTENCIES OR OMISSIONS IN SUCH PLANS, SPECIFICATIONS, OR DRAWINGS.

THIS INDEMNIFICATION OBLIGATION SHALL NOT BE LIMITED IN ANY WAY BY ANY OTHER PROVISION OF THIS CONTRACT OR BY ANY LIMITATIONS ON THE AMOUNT OR TYPE OF DAMAGES, COMPENSATION OR BENEFITS PAYABLE BY OR FOR THE CONTRACTOR PARTIES UNDER WORKERS' COMPENSATION ACTS, DISABILITY BENEFIT ACTS OR OTHER EMPLOYEE BENEFITS ACTS.

THIS INDEMNIFICATION OBLIGATION IS IN ADDITION TO ALL OTHER LEGAL, EQUITABLE, OR INDEMNIFICATION REMEDIES AVAILABLE TO THE INDEMNIFIED PARTIES. THIS INDEMNIFICATION OBLIGATION SURVIVES THE TERMINATION OR EXPIRATION OF THIS CONTRACT.

CONTRACTOR DOES HEREBY WAIVE, RELEASE AND FOREVER RELINQUISH AND DISCHARGE AUTHORITY FROM ALL OF CONTRACTOR'S CAUSES OF ACTION ARISING FROM BODILY INJURY OR DEATH OR DAMAGE TO ANY PROPERTY ARISING OUT OF THE WORK, REGARDLESS OF WHETHER THE INJURY OR DAMAGE IS CAUSED IN FULL OR IN PART BY THE NEGLIGENCE OR OTHER FAULT OF THE INDEMNIFIED PARTIES.

In the event that any statute, rule of law or equitable principle should be held applicable to any indemnity clause contained in this Contract in favor of one or more of the Indemnified Parties which would render void, voidable, or unenforceable any such indemnity clause as to any party by reason of any provisions contained therein, then and in only such event, such indemnity clause shall be deemed modified and read, construed and enforced as to such party with respect to the provisions held to violate the statute, rule of law or equitable principle to require indemnity by Contractor of the Indemnified Parties to the fullest extent required by such indemnity provision modified and limited only to the degree or extent necessary to bring such indemnity into compliance with such statute, rule of law or equitable principle, but otherwise, the indemnity shall remain in full force and effect and binding upon the parties hereto.

Each party hereto agrees and covenants that it will not contest the validity or enforceability of any indemnity or exculpatory provision of this Contract on the basis that the party has no notice or knowledge of such provision or that the provision is not "conspicuous."

If other provisions contain any indemnities or limitations, such indemnities shall be deemed to be cumulative of and to operate independently of the indemnities provided herein to the end that all indemnities provided in the Contract shall be construed to grant indemnity to the Indemnified Parties to the fullest extent of each such indemnity.

Contractor shall include in each of its subcontracts with its subcontractors of every tier provisions the same as in all material respects those contained herein. Such provisions shall be for the benefit of and in favor of the Indemnified Parties and such other parties on whom Contractor and such subcontractors may agree.

# FORT BEND GRAND PARKWAY TOLL ROAD AUTHORITY SPECIAL PROVISION TO ITEM 8 PROSECUTION AND PROGRESS

Item 8, "Prosecution and Progress," of the Texas Department of Transportation Standard Specifications is hereby amended with respect to the clauses cited below. No other clauses or requirements are waived or changed.

Section 1, "Prosecution of Work," is revised by removing the first sentence and replacing as follows:

Prior to beginning construction operations, a preconstruction conference between the Contractor and the Engineer will be conducted. Prior to the preconstruction conference, The Contractor shall submit to the Engineer a preliminary CPM progress schedule which details the first 100 days of the contract in accordance with the requirements of Article 5.2., Progress Schedule. Within 30 calendar days following the preconstruction conference, the contractor shall submit the final version of the Contract Schedule. If the contractor fails to submit the initial schedule within the 30 days, the Engineer may withhold \$1,000 per day until an initial (baseline) schedule that complies with the specifications is submitted. The engineer will review the schedule within 7 days, and determine if the schedule is acceptable. If the schedule is not acceptable, the contractor will have 7 days to make the necessary changes. If the contractor fails to submit the revised and corrected initial schedule within the 30 days, the Engineer may withhold \$1,000 per day until an initial schedule that complies with the specifications is submitted.

Section 3, "Computation of Contract Time for Completion," is revised to read in its entirety as follows:

Time is of the essence of this Contract. All references to days are references to calendar days unless expressly stated otherwise. Calculation of Contract Time will commence on the Notice to Proceed date and run continuously for the duration of the contract.

The Contractor must achieve Substantial Completion within the contract duration specified.

The Contractor must achieve Final Completion no more than the number of days specified by the Engineer from the date of Substantial Completion.

Work shall begin on the date fixed in the Contract requisition. It shall be prosecuted regularly and without interruption until completion. The entire work shall be finished and fully completed to the satisfaction of the Engineer by **FINAL COMPLETION.** 

Article 5.2., "Progress Schedule," is voided and replaced in its entirety as follows:

The Contractor must furnish a Critical Path Method schedule. Each schedule submittal must be accompanied by an electronic backup copy of the schedule. Schedules must be submitted at least monthly and must accompany each pay application. The schedule shall include all planned work activities and sequences. The initial schedule must utilize all of the contract time allowed in the contract. The schedule should incorporate major material procurements including preparation of shop drawings, submittals, fabrication and delivery of long lead items, known utility relocations, and other activities that may affect the completion of the Contract in the progress schedule. Each activity will be assigned a dollar value, the sum of which shall be equal to the adjusted contract value. The schedule activities must generally have durations shorter than one month and the work divided into discrete increments to allow easy identification of the specific task and simplify the updating process.

The Contractor may use Phoenix CPM Scheduling Software or Primavera P6. Schedules prepared and submitted in any other format will not be accepted.

The Engineer may require the Contractor to develop more detailed schedules for certain phases of the project such as major traffic changes, work requiring lane closures, or recovery schedules if the project falls behind schedule etc.

The contractor must provide a person proficient in CPM analysis to create and maintain the project schedule and be available when requested to meet with the Owner's Representative.

The CPM schedule must generally comply with construction industry standards as presented in "CPM in Construction" by James J. O'Brien or the AGC Guide to "Construction Planning and Scheduling". The schedule must have a clearly identifiable Critical Path. The Critical Path is defined as the longest path. It is the Fort Bend Grand Parkway Toll Road Authority's (the Authority) intention to conduct regular schedule update and review meetings with the Contractor to identify potential conflicts and opportunities on the project. The schedules submitted throughout the project will be essential elements in any delay claim.

### Article 5.3., "Schedule Format," is replaced to read in its entirety as follows:

The project schedule shall include but is not limited to the following:

- Begin the project schedule on the start date of contract time or start of compensable work on the project, whichever occurs first;
- Show the sequence and interdependence of activities required for complete performance of the work;
- Ensure all work sequences are logical and show a coordinated plan of the work;
- Show a predecessor and successor for each activity
- Clearly and accurately identify the critical path as the longest continuous path

- Provide a legend for all abbreviations and include the schedule filename, run date, data date, project start date, and project completion date in the title block of each schedule submittal;
- Through the use of calendars, incorporate seasonal weather conditions into the schedule for work (e.g., earthwork, concrete paving, structures, asphalt, drainage, etc.) that may be influenced by temperature or precipitation. Also, incorporate non work periods such as holidays, weekends, or other non-work days as identified in the Contract;
- No constraints or negative lags will be allowed.
- Show submittal and procurement periods.

### Article 5.4., "Activity Format," is replaced to read in its entirety as follows:

For each activity on the project schedule provide:

- A logical activity number utilizing an alphanumeric designation system tied to the sequence of work and traffic control plans;
- A concise description of the work represented by the activity;
- An activity duration in days;
- The estimated quantity of work;
- Plan and incorporate resources, such as crews and heavy equipment, for each activity. Accurately represent the planned labor and equipment hours necessary to achieve the estimated productivity rates;
- Code the activities so that organized plots of the schedule may be produced;

Article 5.5.1., "Bar Chart," is voided in its entirety.

Article 5.5.1.1., "Progress Schedule Reviews," is voided in its entirety.

Article 5.5.2.1., "Preliminary Schedule," is voided in its entirety.

Article 5.5.2.2., "Baseline Schedule," is voided in its entirety.

Article 5.5.2.2.1., "Review," is voided in its entirety.

Article 5.5.2.3., "Progress Schedule," is revised by removing the last two paragraphs and replacing as follows:

The cut-off day for recording monthly progress will be established by the Project Engineer. Submit the updated schedule no later than the 1<sup>st</sup> work day of the following month.

A monthly update narrative will be included in the monthly schedule update. This narrative should include but is not limited to the following:

- The status of the project completion date, listing reasons why any change may have occurred;
- List all activities that have been added, deleted, or otherwise changed in the schedule with explanations for the modifications and description of the impacts each has on the project schedule;
- Any revisions that may have been performed to the schedule, providing the purpose of the revision and description of the impact to the project critical path and completion dates; and
- The status of the critical path, explaining reasons for any changes in critical path, impacts to the critical path that occurred during the period represented, or identifying any potential impacts that may occur in the next 3 months, including but not limited to material deliveries, utility and right way clearances, or other potential impacts.

No direct compensation will be made for fulfilling these requirements, as this work is considered subsidiary to the Item 500-2001, Mobilization. If the contractor does not submit the monthly schedule update by the 1<sup>st</sup> workday of the following month, the Engineer may withhold \$1,000 per day until an updated schedule that complies with the specifications is submitted.

Any amounts withheld by the Engineer for failure to comply with any part of Section 5, Project Schedules, may be deducted from the Contract Amount by the Engineer at his discretion.

### Article 5.5.3., "Notice of Potential Time Impact," is revised to read in its entirety as follows:

Control of the contract duration, completion date, and contract amount are essential elements of this contract and shall only be adjusted in writing by Change Order. A Change Order amending the contract duration and the contract completion date or the contract amount shall only be considered after the Contractor has made such a request in a timely manner accompanied by proper documentation supporting such a request. The contract duration, completion date, and amount may not be adjusted by any other means.

Reasons for adjustment. The Engineer will consider adjustment of the contract duration, completion date, and contract amount for any changed condition or event which in the sole opinion of the Engineer is beyond the control of the Contractor; could not have been reasonably foreseen; and impacts the longest path on the properly prepared and submitted CPM schedule for the project.

Longest Path. Extensions of time will be granted only to the extent the changed conditions impact the longest path of the properly prepared CPM schedule. No extension of time will be granted for any change that does not impact the longest path, nor will any extension of time be granted for that portion of any delay event that is absorbed by float within the schedule.

Delays affecting activities not on the longest path by definition can not affect the completion date of the project and will not be considered as a reason to adjust the contract duration or the contract completion date but may be considered for cost impacts. In cases of non-critical delays the Contractor must provide timely documentation of the condition giving rise to the non-critical delay and documentation on the how the delay is causing the cost impact. All notice requirements contained in this provision pertain equally to critical as well as non-critical impacts without exception.

Timely notice of any impact is an essential element of this contract. The Contractor must provide the Engineer with notice of any delay which may impact the project completion date or impact cost within 7 calendar days from the commencement of the delay, or 7 calendar days from the date the Contractor should have reasonably been aware of the delay. Initial notice of the delay must be in writing and must generally describe the event or condition causing the delay and must specifically identify the schedule activities by activity ID and description which are being impacted, and generally the types and amounts of cost per day being incurred. The Contractor's initial notice shall also provide a brief explanation of why an alternative construction sequence eliminating or minimizing the delay is not possible or practical. This initial notice may be a letter containing all of the elements described above. The Engineer may request an immediate schedule review meeting with the Contractor upon notice of any delay to review the current CPM schedule and consider all possible alternatives.

FAILURE TO PROVIDE WRITTEN NOTICE WITHIN 7 CALENDAR DAYS OF THE COMMENCEMENT OF ANY DELAY MAY RESULT IN THE DENIAL OF ANY REQUEST FOR AN ADJUSTMENT TO THE CONTRACT DURATION, COMPLETION DATE, OR CONTRACT AMOUNT RESULTING FROM THAT DELAY.

Article 5.5.4., "Time Impact Analysis," is revised to read in its entirety as follows:

The Impact of the Delay will be evaluated using the Time Impact Analysis method. A Time Impact Analysis consists of the following steps:

- Step 1. Establish the status of the project immediately prior to the delay event or impact, or as near as practical prior to the commencement of the delay.
- Step 2. Using the schedule produced in Step 1, add an activity to the schedule for the delay event with an estimated duration, or the actual duration of the delay event in the case of delay which has ended. Logically connect the added activity representing the delay event to the appropriate predecessor and successor activities to determine the impact to the completion date.

Step 3. Track the effects of the impact on the schedule during the occurrence by progressing the schedule monthly including the delay activity included in Step 2.

Step 4. Immediately after the conclusion of the delay event, or as near as practical after the delay event has ended, establish the status of the project and provide details identifying any mitigating actions or circumstances used to keep the project ongoing during the impact period.

Submit Step 1 and 2 with the Notice of Potential Time Impact. Incorporate Step 3 into schedule updates until impact is complete. Submit Step 4 with the Final Documentation, no later than 10 days after the completion of the impact.

Determine the time impact by comparing the status of the work prior to the impact (Step 1) to the prediction of the effect of the impact (Step 2), and to the actual effects of the impact once it is complete (step 4). All four steps of the Time Impact Analysis shall be completed before consideration of a Contract time extension or adjustment of milestone date will be provided.

Final Documentation. After the delay event or condition has ended the Contractor has 10 days to prepare and submit the final documentation of the impact of the delay including all cost impacts. An additional 30 days to prepare the final statement of impacts may be granted by the Engineer if requested by the Contractor in writing prior to the conclusion of the initial 10 day period. This documentation shall include a concise Time Impact Analysis Statement prepared using the submitted CPM schedules and a statement of all additional costs incurred as a result of the delay event or condition with backup documentation to support the claimed cost.

## FAILURE TO PROVIDE WRITTEN DOCUMENTATION OF THE TIME AND COST IMPACT OF ANY DELAY WITHIN 10 DAYS OF THE CONCLUSION OF ANY DELAY MAY RESULT IN THE SUBSEQUENT DENIAL OF ANY REQUEST FOR AN ADJUSTMENT TO THE CONTRACT COMPLETION DATE OR COST IMPACTS.

Section 6, "Failure to Complete Work on Time," is revised to read in its entirety as follows:

Failing to achieve Final Completion within the days specified by the Engineer the Contractor will be assessed liquidated damages of \$1,500 per day which will be withheld from any amount owed the Contractor. If the amount owed the Contractor is insufficient to withhold the amount, the Contractor shall pay the difference to the Authority.

The Engineer may waive the collection of liquidated damages if the Work in its entirety, or any portion of the Work for which a date of completion is stipulated, has been substantially completed within the prescribed time of completion therefore.

If the Contractor fails to complete the Work within the time fixed by the Contract, or extensions thereof, and if the Engineer shall, nevertheless, permit the Contractor to continue and complete same, such permission shall neither modify nor waive any liability of the Contractor for damages arising from non-completion of the Work within the said time, but all such liabilities shall continue in full force against the Contractor

**END OF SPECIAL PROVISION** 

# FORT BEND GRAND PARKWAY TOLL ROAD AUTHORITY SPECIAL PROVISION TO ITEM 9 MEASUREMENT AND PAYMENT

Item 9, "Measurement and Payment," of the Texas Department of Transportation Standard Specifications is hereby amended with respect to the clauses cited below. No other clauses or requirements are waived or changed.

Section 6, "Payment for Material on Hand (MOH)," is supplemented by the following:

The Contractor shall furnish an affidavit that the material is stored in a bonded facility approved by the Fort Bend Grand Parkway Toll Road Authority (FBGPTRA). The estimate shall be made and included for 75 percent of the invoice material cost and invoice freight cost of materials involved after the Contractor has furnished the engineer with a copy of the paid invoices. Only materials requiring approved shop drawings, or where shop drawings are permitted due to quantities of units or because of stage construction, which are completely constructed and/or fabricated on the Contractor's order for a specific project, and on which an approved Test Report has been issued are eligible.

Section 8, "Retainage," is voided and replaced in its entirety as follows:

The Authority will withhold 5.0 percent retainage from the total amount approved for payment until the completion and final acceptance. The Contractor may withhold retainage on subcontractors in accordance with state and federal regulations.

The retainage will be released after all submittals are received and final quantities have been determined.

Article 9.7.1.1., "Labor," is voided and replaced in its entirety as follows:

The Contractor will receive an additional 15% as compensation based on the total wages paid said laborers and foremen. For cost of premiums on public-liability and workers compensation insurance, social security and unemployment insurance taxes, an amount equal to 55 percent of the sum of the labor cost, excluding the 15 percent compensation provided above, will be paid to the Contractor.

Article 9.7.1.3., "Materials," is voided and replaced in its entirety as follows:

The Contractor will receive the actual cost, including freight charges, of the materials used on such work to which cost will be added a sum equal to 15 percent thereof as compensation.

Section 10, "Final Payment," is supplemented by the following:

The Contractor shall after completion of his contract submit his final estimate for quantities installed during the construction period and the value thereof at the Contract unit prices.

The Engineer shall approve and submit the final estimate to the Commissioners' Court and the County shall at such time or within thirty (30) days from and after the date of said estimate as the County may elect, pay the entire sum so found to be due after audit and approval by the County Auditor, after deducting therefrom all previous payments and all amounts to be kept and all amounts to be retained under the provisions of the Contract. All prior partial estimates and payments shall be subject to correction in the final estimate and payment. It is mutually agreed between the parties to the Contract that no estimate or payment made under the Contract, except the final payment, shall exclude any claim of the County or shall constitute conclusive evidence of acceptable performance of the Contract either wholly or in part by the County; and no payments shall be construed to be an acceptance of any defective work or improper materials, or a release from any claims for damages. The Contractor hereby further agrees that the payment of the final amount due under the Contract and adjustment and payment of the bill rendered for any work done in accordance with any alterations to the Contract on a Change In Contract form shall release the County and the Engineer from any and all claims or liability on account of work performed under the Contract or alterations thereof. The Contractor agrees to examine the final estimate and, if he finds it correct, to execute thereon his release in full of all claims due by Fort Bend County, and to certify under oath to the payment by him of all claims against him for labor, materials, and supplies furnished by the Contractor by all persons and firms in the performance of the Contract.

### Section 11, "Electronic Wire Transfers," is added as follows:

If the Contractor requests in writing to the Engineer, the Authority will make payments via electronic wire transfer.

### FORT BEND GRAND PARKWAY TOLL ROAD AUTHORITY

### (FORT BEND COUNTY)

### **SPECIAL SPECIFICATION 9000**

### **EMERGENCY SIGNAL PREEMPTION DEVICE**

#### 1. DESCRIPTION

This Item governs for the furnishing and installation of traffic signal preemption devices at the locations as indicated on the plan drawings, Applied Information Type AI-500-085 Series Glance Preempt & Priority Field Monitoring Unit or equal.

### 2. MATERIALS

- 2.1 General Requirements
- 2.1.1 The Traffic Signal Preempt and Remote Monitoring System Field Device (TSPRMSFD) shall function correctly between -34 degrees C and +74 degrees C.
- The maximum size of the TSPRMSFD shall be 19" x 7,455" by 1.719" (1U), and 2.1.2 shall be suitable for placing in an AGENCY traffic cabinet.
- 2.1.3 The TSPRMSFD shall be provided with appropriately rated connects that allows the TSPRMSFD to be exchanged by unplugging connectors, without tools.
- 2.1.3 The TSPRMSFD shall incorporate an integrated GPS and cell modem.
- 2.1.4 The configuration of the TSPRMSFD shall be accomplished by accessing the internal web server with a browser. It shall be possible to configure the TSPRMSFD without any special software.
- 2.1.5 The TSPRMSFD shall be powered via a standard 120V input power.
- 2.1.6 The TSPRMSFD shall allow for the routing of the controller configuration packets to and from the controller (either by Ethernet or serial communications) for the three types of controller that are utilized by the AGENCY. In this way is shall be possible to configure the controller, and utilize the controller specific software to interrogate the controller, and the Traffic Signal Preempt and Remote Monitoring System (TSPRMS) shall provide the communications pipe which allows this to be accomplished.
- 2.1.7 The TSPRMSFD shall utilize field initiated communications. This allows for a low cost cellular data plans to be used, with infrequent polling. However, when an abnormal event occurs and is detected by the TSPRMSFD, then the TSPRMSFD will immediately initiate the transfer of a data packet to the TSPRMS to enable real-time alerting of response personnel to take place.
- The TSPRMSFD shall, within the size limitations above, include a battery and battery 2.1.8 charging/monitoring circuit, to allow the TSPRMS to function correctly even when

1-2 11-16

- all power to the intersection has failed. The battery shall continue to power the TSPRMSFD for a minimum of 5 hours after all power has failed to the intersection.
- 2.1.9 The TSPRMSFD shall incorporate an integrated GPS which will allow the TSPRMSFD to geo-locate itself on the map, without configuration.
- 2.1.10 The TSPRMSFD shall operate without requiring a static IP address. The only configuration required at the TSPRMSFD is to enter the URL of where the TSPRMS central software is hosted.
- 2.1.11 In the event that the cell service is interrupted or is not available, the TSPRMSFD shall store any events that occur in internal memory, and forward these events automatically to the TSPRMS when the cell service is restored. In this way, a complete record of events at the device can be maintained even if cell service is interrupted for a period.
- 2.1.12 The TSPRMSFD shall utilize HTTP and HTTPS protocols, and XML data structures, for communications with the TSPRMS. In this way the data will be open for future expansion and competition. The use of secret proprietary protocols is not permitted.
- The TSPRMSFD shall be a 1U 19" rack mount device, with all connections on the 3. rear, and LED indicators, power switches and selector switches on the front.

### 3. CONSTRUCTION

Perform work in accordance with the details shown on the plans and the requirements of this item.

### 4. MEASUREMENT

This Item will be measured as each unit per signalized intersection.

#### 5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Emergency Signal Preemption Device" of the types specified. This price will be full compensation for furnishing, installing and testing of the device, connections, equipment, labor and incidentals.

> 2 - 2 11-16

### FORT BEND GRAND PARKWAY TOLL ROAD AUTHORITY SPECIAL SPECIFICATION 9999

## PARADIGM TRAFFIC SYSTEMS, INC. PART NUMBER: PT-P44168TS2-1-CS, NEMA CABINET ASSEMBLY / TS2-1, P44 CABINET WITH 16 POSITION BACKPANEL PER FT BEND COUNTY SPECIFICATION REQUIREMENTS

### 1.0 SCOPE

- 1.1 This specification sets forth the minimum requirements for a shelf-mounted 16 phase full-actuated solid state controller unit with internal Time-Based Coordination (TBC), railroad/fire (emergency vehicle) preemption, diamond intersection operation in a traffic signal controller assembly and cabinet assembly. This specification also sets forth minimum requirements for a Video detection system, wireless in pavement detection system and battery backup (UPS).
- 1.2 Appendix A identifies the equipment type and options available in this specification. Equipment supplied shall be according to the selections made in Appendix A.

### 2.0 CONTROLLER UNIT

- 2.1 The controller unit shall meet the requirements of NEMA Standards Publication TS-2 2003 V2.06 or latest revision. The controller/cabinet unit shall meet all current AASHTO and ANSI standards applicable to the industry. The controller/cabinet unit shall comply with all current and applicable National Transportation Communications for ITS Protocol (NTCIP) standards. The controller/cabinet unit shall comply with all the criteria of this specification. Where a difference occurs between this specification and another specification or standard the requirements of this specification shall govern. The purchase document shall identify either a TS-2 Type 1 interface or TS-2 Type 2 interface. The cabinets for TS-2 Type 1 controllers are specified in this document. TS-2 Type 2 controller cabinets shall use a cabinet specification identified in the solicitation document. The controller shall be configurable to meet, at a minimum, all applicable sections of the NEMA Standards Publications for TS2 and NTCIP 1202 and ATC standard 6.10. Where differences occur, these specifications shall govern.
- The controller shall be compact so as to fit in limited cabinet space. It shall require no more than 7" shelf depth. External dimensions shall not be larger than 8.5" x 15.2 1/4" x 6.375" (H x W x D).
- 2.3 Hardware Design Requirements The top and bottom of the chassis shall be made from extruded aluminum and include an integral handle on the back for easy transport. The sides shall be constructed of injection molded polycarbonate. The model, serial number, and program information shall be displayed on the outside of the controller.
- 2.3.1 The controller unit shall be completely solid state and digitally timed. All timing shall be referenced to the 60 Hz power line.
- 2.3.2 The dimensions of the controller unit shall not exceed 305 mm high, 440 mm wide, and 305 mm

deep.

2.3.3 The front of the controller shall consist of a panel for the display, keyboard and connectors for all necessary user connections.

The display shall be a seven-inch (7"), color, TFT (Thin Film Transistor) LCD (Liquid Crystal Display) with high brightness. It shall be readable in direct sunlight. The display shall perform over the NEMA temperature range and shall have a resolution of 800 X 480 with an 18 bit color depth. The luminous intensity shall be a minimum of 800 nits. The display shall include an industrial, resistive touch screen that can be operated with gloved hands. The touch screen and display shall not be affected by condensation or water drops.

Front-panel operator inputs shall be via touch screen or by clearly labeled elastomeric keypad. These shall include a 10-digit numeric keypad, Main and Sub keys, toggle keys, special function and enter keys, six function keys, status and help keys and a large four-direction cursor control key.

- 2.3.4 The front panel shall include a built in speaker for enhanced controller audio feedback.
- 2.3.5 The front panel shall include a tri-color status LED.
- 2.3.6 The controller shall have the capability of supporting Ethernet communications, using TCP/IP communications protocols.
- 2.3.7 The controller shall provide four front-panel Ethernet ports
- 2.3.8 Two of the ports shall be connected to Ethernet switch ENET1 and the other two shall be connected to Ethernet switchENET2
- 2.3.9 The controller shall provide two USB 2.0 ports.
- 2.3.10 USB ports shall be used for USB thumb drives to update software, upload or download configuration, or uploading logged data.
- 2.3.11 All non-optional interface connectors shall be accessible from the front of the controller in the NEMA Configured Controller models. Configurations shall be offered to accommodate different versions, as follows:
  - 2.3.11.1 NEMA TS2 Type 1
  - 2.3.11.2 NEMA TS2 Type 2
  - 2.3.11.3 NEMA TS1
- 2.3.12 The D connector shall be compatible with the Econolite Model ASC/2, ASC/2S, and ASC/3 D connectors.
- 2.3.13 To facilitate special applications the controller shall have the capability of assignment of any input or output function to any input or output pin respectively on the interface connectors, with the exception of Flashing Monitor, Controller Voltage Monitor, AC+, AC-, Chassis Ground, 24VDC, Logic Ground and TS2 Mode bits.
- 2.3.14 The controller shall as a minimum have the following communications ports:
  - a. Port 1 SDLC for communications to other devices in the cabinet
  - b. Port 2 serial port for systems communications

- c. Console serial port for local communications
  An optional telemetry module shall utilize TDM/FSK data transmission at 1200 baud or 9600 baud over two pairs of wires. This module shall include the Econolite 25-pin D-sub connector.
- d. Ports on optional ATC-2070 communication modules see section 2.10.2
- 2.3.15 Serial communications shall operate at from 1200 to 115.2 K baud
- 2.3.16 All electronic modules including the power supply shall be easily removable from the controller using a screwdriver as the only tool. All power and signal connections to the circuit boards shall be via plug-in connectors.
- 2.4 Hardware Options
- 2.4.1 Optional Data Key
  - 2.4.1.1. A Datakey and receptacle shall be available for use as a database storage device (backup) or as a database transfer module. It shall be capable of storing a minimum 2MB of data.
  - 2.4.1.2. The Datakey shall be hot swappable, so that it can be inserted and removed without powering down the controller.
  - 2.4.1.3. The Datakey shall be capable of storing the entire controller database and shall retain the information without use of battery or capacitor backup.
  - 2.4.1.4. The controller shall not require this key to be present during normal operation.
  - 2.4.1.5. If the Datakey is present the controller shall automatically backup the database to the data key 20 minutes following the last data change.
- 2.4.2. Optional ATC-2070 type communications slot
  - 2.4.2.1. The controller shall provide support one ATC-2070 Type communications slot that can be added, if needed, providing access to ATC communications ports
- 2.5 Electronics
- 2.5.1 The electronics shall be modular in design and shall consist of vertical circuit boards. Horizontal circuit boards shall not acceptable.
- 2.5.2 In the interest of reliability, no sockets shall be used for any electronic device. All devices shall be directly soldered to the printed circuit board. Surface mount parts shall be used for the majority of the electronic components in the controller.
- 2.5.3 A built-in, high-efficiency switching power supply shall generate the primary, +5VDCinternal voltage, an isolated +24 VDC for internal and external use, VSTANDBY, LINESYNC, POWERUP and POWERDOWN signals. All voltages shall be regulated.
- 2.5.4 The 120 or 220VAC fuse shall be mounted on the front of the controller. Protection for the 24VDC supply shall be provided by a resettable electronic fuse.

- 2.5.5 All printed circuit boards shall meet the requirements of the NEMA Standard plus the following requirements to enhance reliability:
  - 2.5.5.1. Both sides of the printed circuit board shall be covered with a solder mask material.
  - 2.5.5.2. The circuit reference designation for all components and the polarity of all polarized capacitors and two-leaded diodes shall be clearly marked adjacent to the component. Pin 1 for all integrated circuit packages shall be designated on all printed circuit boards.
  - 2.5.5.3. All printed circuit board assemblies shall be coated on both sides with a clear moisture-proof and fungus-proof sealant.
- 2.5.6. Timing of the controller traffic application shall be derived from the AC power line.
- 2.5.7. To facilitate the transfer of user-programmed data from one controller to another, a Datakey receptacle for using a separate 2070-style, serial flash memory device shall be an available hardware option. In addition, two USB sockets and one SD Card socket shall be provided for memory devices that can be used for data transfer. These data transfer devices shall be easily removable and directly accessible from the outside of the controller. The controller will not require this Datakey, USB memory thumb drive, or SD Card to be present for proper operation.
- 2.5.8. All controller software shall be stored in Flash Memory devices. The controller software shall be easily updated without the removal of any memory device from the controller. The use of removable PROMS or EPROMS from the controller shall not be acceptable. The controller shall include an option that allows updating software using a Windows based computer, a USB memory thumb drive, or an SD card.
- 2.6 ATC Engine Board
- 2.6.1. The controller shall include an ATC engine board compliant to ATC standard 5.2b and proposed version 6.10.
- 2.6.2. The engine board shall include a PowerPC 83XX family processor with QUICC engine.
- 2.6.3. The engine board shall have a minimum of the following memory: 2.6.3.1. 128Mbytes of DDR2 DRAM memory used for application and OS program execution
  - 2.6.3.2. 64 Mbytes of FLASH memory used for storage of OS Software and user applications
  - 2.6.3.3. 2MB of SRAM memory used for non-volatile parameter storage
- 2.6.4. The engine board shall provide the seven ATC serial ports, Ethernet, USB and all other control signal required by ATC standard.
- 2.6.5. The operating system shall be Linux 2.6.35 or later
- 2.7. Graphical User Interface
- 2.7.1. The controller shall include an advanced graphics card.

- 2.7.2. The graphics card shall enable:
  - 2.7.2.1. Graphical display of status and programming selections
  - 2.7.2.1.1. The status displays shall include direction arrows for each of the phases and overlaps.
  - 2.7.2.1.2. The selection of programming sections menus shall be by use of icons.
  - 2.7.2.1.3. Programming shall use touch data entry, allowing touch gestures to select yes/no, select enable/disable, pull-down list selections, and more.
  - 2.7.2.2. Touch selection of status and programming
  - 2.7.2.3. Swiping to advance from one screen to the next
- 2.7.3. Program values shall be entered through either the keypad or the touch screen.
- 2.7.4. The controller shall allow connection of a tablet to the controller.
  - 2.7.4.1. The tablet connection shall be by Wi-Fi connection either by a Wi-Fi to USB adapter or an Ethernet to Wi-Fi adapter.
  - 2.7.4.2. Once connected it shall be possible to observe the exact same graphics displays as are visible on the touch screen of the controller.
  - 2.7.4.3. It shall be possible to change the controller's programming values from the tablet while it is connected.

- 2.8 Time Clock
- 2.8.1 The clock shall use the 60 Hz power line frequency as time base when power is present. The clock operating voltage range shall be 89 to 135V AC over the temperature range of -34°C to +74°C. A 10 year lithium battery shall maintain the time-of-day clock and digital data during a power outage lasting up to 30 days. Lead-acid, nickel-cadmium, or alkaline batteries are not acceptable.
- 2.8.2 The time base clock shall be maintained to within  $\pm 0.005\%$  at 20°C and to within a  $\pm 0.02\%$  over the specified operating temperature range as compared to coordinated universal time (WWV) standard for a period of 30 days during periods when AC power is not applied.
- 2.9 Clock/Calendar Programming Requirements
- 2.9.1 The clock shall be easily set to the year, month, day of month, day of week, hour, minute, and second.
- 2.9.2 Automatic daylight savings time shall be available by keyboard entry.
- 2.9.3 The dates for fixed and floating holidays and special events shall be keyboard programmable by the user.
- 2.9.4 Calendar adjustments for leap years shall be automatic.

2.9.5 The clock shall store sequences of operations in the form of 255 entries and 15 day plans.

Global Time Base Schedule				Actuated Traffic Signal Schedule	
Entry	Months	Dates of Month	Days of Week	Day Plan	Time Base Actions
1	1-12	1-31	1-7	1-15	entry 1 actions
:	11	11	11	11	:
255	11	11	11	t)	entry 255 actions

- 2.9.6 The structure and interrelationships of each type of program shall be in accordance with the following paragraphs:
- 2.9.6.1 A day plan shall consist of the following:

Hour: Minute Action 1 (time to implement: action to implement)

Hour: Minute Action 10 (time to implement: action to implement)

Where each action is unique, there shall be a minimum of ten actions per day plan.

There shall be a minimum of 15 day plans.

- 2.9.6.2 Each action in a day plan shall consist of a group of the following objects:
  - pattern (consisting of):

cycle length

offset

split

MUTCD flash (on/off)

free operation

- sequence
- special functions 1-8 (on/off)
- auxiliary functions 1-3 (on/off)
- mode of operation (a means of changing operating modes by T.O.D.)
- max II
- gap/ext II
- phase omits

Any or all of these may be selected within a single action.

Transfer into and out of flash shall be in accordance with the Texas MUTCD. It shall be possible to program each phase and overlap to flash either yellow or red via the front panel of the controller unit. This shall be accomplished by flashing the load switch driver outputs simultaneously.

- 2.9.6.3 An entry shall consist of time period implemented: <u>day plan</u>, <u>month(s)</u>, <u>date(s)</u> of month, and <u>day(s)</u> of week.
- 2.9.6.4 A minimum of 255 entries shall be programmable.

- 2.9.6.5 There shall be a copy feature that allows the transfer of entries between day plans.
- 2.9.6.6 Other programming schemes meeting the functional intent are acceptable but require approval in writing by the City Of College Station Traffic Engineer.
- 2.10 Program Requirements
- 2.10.1 Programming
- 2.10.1.1Programming of the controller unit shall be by the use of a keyboard and display on the front of the controller unit. Programming shall require only simple keystrokes aided by full menu displays. It shall be possible for the controller to interface with a laptop and using compatible software, upload, download, and save data to a database
- 2.10.1.2Ease of programming through a well-organized menu structure and ease in interpreting the display shall be required for acceptance. The menu structure shall contain a main menu that contains options for all sections of the controller on one screen. Each option shall be selectable by a numeric entry. Each subsequent menu shall be a detailed breakdown of one of the previous menu options. Each menu option shall be a descriptive name to prompt the user to the desired section for programming.
  - All entries shall be displayed and entered in plain English. Toggle type entries shall be set by entering YES/NO or ON/OFF responses. Non-alphanumeric symbols and abbreviations used to display information shall be clear and unambiguous in their meaning. Numeric entries shall be in the base 10 (decimal) number system. Entries in other number bases, such as hexadecimal or binary, are not acceptable.
- 2.10.1.3A user selectable 4 digit (minimum) code shall be available to secure access to timing and configuration of the unit. Display features shall be available without the need to access the unit. The controller units shall be supplied with the code preset to be all zeros (0000). Internal DIP switches may be used to establish codes.
- 2.10.1.4Instructions for use of the access code shall **not** be provided on the face of the unit.
- 2.10.1.5A keyboard entered coded command (a series of commands or entries, not a single entry) shall be provided which will set <u>all</u> controller and TBC timings and entries to a default or inactive value. This coded command shall allow new values to be entered without first deleting prior entries.
- 2.10.1.6With the intersection display active, a keyboard command shall enable the keyboard for the user to place a call to each phase individually.
- 2.10.2 Phase Operation
- 2.10.2.1In NEMA operating mode, the controller unit shall provide as a minimum, 16 possible phases and 8 possible overlaps. All overlaps shall be programmable through the keyboard and shall function as specified by TS-2.
- 2.10.2.2Each of the NEMA timing intervals shall be programmable for a minimum of 8 phases at a time

- from the same display screen in a spreadsheet format. The display may be rolled or paged down to display additional intervals or information.
- 2.10.2.3The controller unit shall have a copying mode whereby the user, after having programmed all intervals of one phase may copy this information into all or selected remaining phases. Other versions of the copying process that meet the functional intent are acceptable.
- 2.10.2.4In addition to the modes defined by TS-2, the following modes shall be available on a per phase basis:
  - 1. Soft recall
  - 2. Phase omit
- 2.10.2.5The following configurations, as a minimum, shall be programmed within the controller unit and be user selectable:
  - 1. 8 phase NEMA
  - 2. 8 phase sequential
  - 3. NEMA phasing to the left of the barrier, sequential phasing to the right of the barrier (quad sequential).
  - 4. 4 phase diamond
  - 5. 3 phase diamond
  - 6. Separate intersection (see Paragraph 2.8.1.3)
- 2.10.2.6The controller shall have a configuration which allows user programmable rings (compatibility lines, reference points to assure there shall be no concurrent selection and timing of conflicting phases). A minimum of 4 rings will be available in this configuration.
- 2.10.2.7The controller shall have programmable conflicting phase settings where simultaneous operation of compatible phases is not allowed.
- 2.10.2.8A dynamic maximum operation which increments the current maximum in programmable steps (dynamic max step) in seconds to a maximum limit (dynamic max limit) in seconds shall be provided. The operation shall function as defined by NEMA Standard Publication NTCIP 1202:1996 (TS 3.5) Object Definitions for Actuated Traffic Signal Controller Units, or latest revision.
- 2.10.2.9The TBC shall select and coordinate reversible left turn sequence operations (dual leading, leading and lagging, or lagging and leading left turns). It shall be possible to transfer operation from one sequence to another at a preprogrammed time. Transfer shall take place at T0 during coordination (see Paragraph 2.6.4.2).
- 2.10.3 Pedestrian Timing
- 2.10.3.1 Actuated pedestrian movements shall operate as follows:
  - 1. When NO pedestrian calls are present, the normal phase timings shall be effective for service of the intersection.
  - 2. When a pedestrian call is present, the call will be serviced by extended phase timings that account for pedestrian crossing times and override the normal phase timings. If the intersection is coordinated, it may drop out of coordination when servicing the pedestrian call if the pedestrian times exceed the vehicle splits. The controller shall return to

coordination in the manner described in this specification after the call is serviced.

2.10.3.2The controller shall rest in main-street green and Don't Walk when no actuated pedestrian calls are present.

### 2.10.4 Coordination

- 2.10.4.1A minimum of 16 timing plans, each with a unique cycle length and split combination, shall be required as per TS-2. Each of the 16 timing plans shall have 3 unique offsets available. Cycle length selections are to be each changeable from 30 to 255 seconds in one second increments. Split and offset selections adjustable from 0 to 254 in 1 second increments.
- 2.10.4.2The coordinator shall reference a system-wide reference cycle timer (system cycle timer). The term T0 shall refer to the point in the local cycle timer when the first coordinated phase (or leading coordinated phase if a pair of coordinated phases was selected by the user) is scheduled on for the first time. NOTE: This may not be the beginning of green in the case of early return. The offset shall be the amount the local cycle timer is behind the system cycle timer.

Example: If the offset is +10 seconds, T0 (the point at which the local cycle timer is at 0) will occur when the system cycle timer is at 10 seconds.

- 2.10.4.3 There shall be two modes of automatic coordination programming, fixed and floating force off modes. The following information shall be all that is required from the user to establish a pattern.
  - 1. Basic NEMA controller timing.
  - 2. Cycle length in seconds.
  - 3. Phase sequence desired for the particular pattern.
  - 4. Total seconds of the cycle that a phase is to be active including green, amber, and red clearance times when there is constant demand on all input detectors.
  - 5. The coordinated phase or phases (from Paragraph 2.6.4.9).
  - 6. The offset of the first coordinated phase serviced in the sequence from the reference clock's T0 in seconds.
- 2.10.4.4Using the above information in fixed force-off mode, the coordinator must perform the following functions for each pattern.
  - 1. Guarantee the coordinated phase(s) programmed time will be serviced in its entirety to achieve coordination between intersections (when not correcting). The programmed time of the first coordinated phase in the phase sequence shall start at T0.
  - 2. Calculate each phase's force off point (the point at which a phase's Green must terminate in order to not violate the following phases' programmed times).
  - 3. Calculate the beginning of each phase's permissive window (the point in the cycle when the coordinated phase is allowed to yield to each corresponding phase).
  - 4. Calculate the end of each phase's vehicle permissive window (the point preceding a phase's force off point by its minimum time and the prior phase's clearance time). Any phase receiving a vehicle call before the end of vehicle permissive window will be serviced during the current cycle.
  - 5. Calculate the end of each phase's pedestrian permissive window (the point preceding a phase's force off point by pedestrian Walk and pedestrian clearance times and the prior phase's clearance time). Any pedestrian call received by a phase before the end of

- pedestrian permissive window will be serviced during the current cycle up to the beginning of the phase vehicle green.
- 6. Guarantee that each phase's programmed time be serviced in full if a call was received before the beginning of permissive window and the phase does not terminate due to Gap out.
- 2.10.4.5Using the same information in floating force-off mode, the coordinator must operate in the same manner as fixed force-off mode except that if a non-coordinated phase is entered early, it will remain active only for the time programmed in the split time. Automatically setting the max timer in each split to accomplish this function is acceptable.
- 2.10.4.6No percentage inputs are allowed. Once the information for phase service is entered via the keyboard, the controller unit shall test the plan to insure that the plan does not violate any minimum times based on the specified numbers and cycle length. If a faulty plan is detected, the controller unit shall show an error code indicating the problem. If the error is not corrected, the controller unit shall run in free operation mode whenever the erroneous plan is selected. If actuated pedestrian movements are programmed, the coordinator shall ignore errors detected due to the pedestrian Walk and clearance times violating the phase split time for any actuated pedestrian.
- 2.10.4.7The coordinator shall be programmable to seek offsets by short-way (lengthening or shortening the cycle length up to 20%) and by dwell in the coordination phase awaiting the proper offset. The user shall determine which method and may program the longest permissible dwell times.
- 2.10.4.8The controller unit coordination program shall be designed to be programmed from the front panel to emulate the operation of a pre-timed controller by recall for applications where no vehicle detection is provided.
- 2.10.4.9For each configuration a coordinated phase must be selected from Ring 1. A coordinated phase must also be selected from other rings if a compatible phase with the Ring 1 coordinated phase exists. The coordinated phase or phase pair shall be selectable from one of the individual phases or phase pairs shown in the following table:

	CONFIGURATION					
Coordinated Phase(s)	8 Phase NEMA dual ring and 3φ Diamond	Quad Sequential	8 Phase Sequential	4φ Diamond		
Individual		4 or 8	2, 4, 6, or 8			
Pairs	2 & 6 or 4 & 8	2 & 6		2 & 5, 4 & 5, 1 & 6, or 1 & 8		

Compatible phase pairs shall not be forced to begin simultaneously.

- 2.10.4.10When establishing its offset from the reference point the coordinator shall reference only the leading edge of the sync pulse, regardless of its width.
- 2.10.4.11 The internal coordination and upload/download programs shall not interfere with normal

intersection operation except when changing ring structure in the controller or active phases. These operations (changing ring structure and active phases) shall require a confirmation and put the controller in a flash condition and a restart sequence. The implementation of revised timing parameters loaded into the timer shall be programmed to occur only at points in the controller coordination cycles which do not alter the controller phase sequence. The controller unit may temporarily drop out of synchronization during the upload/download, but must continue to operate.

- 2.11 Time-Based Coordinator (TBC)
- 2.11.1 The internal reference sync pulse, from which the local offset is calculated, shall re-sync at midnight, or the re-sync shall be user programmable with a default to midnight. A pulse shall be generated whenever the time-of-day clock shows a time that is an exact multiple of the current cycle length after this resynchronization. In case of a power failure, re-sync shall be calculated from the programmed re-sync time. The power failure recovery routine shall accommodate the case of a power failure at midnight.
- 2.12 Diamond Operation
- 2.12.1 Program Requirements for Diamond Operation
- 2.12.1.1Phase numbers shall be assigned to traffic movements as shown on the diamond intersection layout of Figure 1. Overlap A (OL A) is defined as phases 1+2. Overlap B (OL B) is defined as phases 5+6.

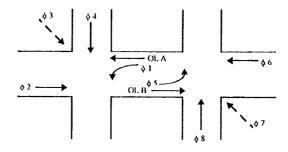


Figure 1

- 2.12.1.2There shall be 6 additional user programmable overlaps. All additional overlaps shall be programmable through the keyboard and shall function as specified by TS-2.
- 2.12.1.3The controller unit shall be programmable for 4 phase and 3 phase diamond operation as well as 2 independent 4 phase rings (separate intersection operation) as defined in Figure 2.

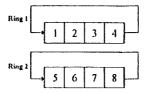


Figure 2

- 2.12.1.4The following modes shall be available for each phase and for the intervals identified as special intervals in 3 phase and 4 phase operation:
  - 1. Maximum recall
  - 2. Minimum recall
  - 3. Pedestrian recall
  - 4. Detector locking and non-locking memory
  - 5. Phase omit
- 2.12.1.5The controller unit shall be designed to provide pedestrian phasing with phases 2, 4, 6, and 8.
- 2.12.1.6All timing entries and displays shall be available for phases 3 and 7.
- 2.12.1.7The operation of the controller unit as a 4 phase, 3 phase, or separate intersection operation diamond shall be keyboard selectable. This shall be overridden while under closed loop system control or by TBC control.
- 2.12.2 Four Phase Operation
- 2.12.2.1The controller unit shall perform the sequences for 4 phase and/or 6 phase diamond operation defined in Figures 3a to 3f.
- 2.12.2.2The normal 4 phase operation sequence shall be  $25 \rightarrow 45 \rightarrow 16 \rightarrow 18$ . The 6 phase operation sequence shall be  $25 \rightarrow 35 \rightarrow 45 \rightarrow 16 \rightarrow 17 \rightarrow 18$ .
- 2.12.2.3The point at which operation may be switched from 4 phase to 3 phase operation shall be at the clearance interval 2516B or 2518B to the 3 phase clearance interval 2648.
- 2.12.3 Concurrent Timing Requirements

Refer to Figures 3a - 3f for the following descriptions:

- A. Intervals 4516B and 4516C shall time concurrently with interval 16, however interval 16 may not terminate green until interval 4516C has timed out.
- B. Intervals 3516B and 3516C shall time concurrently with interval 16, however interval 16 may not terminate green until interval 3516C has timed out.
- C. Intervals 1825B and 1825C shall time concurrently with interval 25, however interval 25 may not terminate green until interval 1825C has timed out.

- D. Intervals 1725B and 1725C shall time concurrently with interval 25, however interval 25 may not terminate green until interval 1725C has timed out.
- E. All left to right internal clearance times (intervals 4518B, 4517B, 3518B, 3517B, 2518B, 2517B, 2516B) shall use the same timing settings for minimum green, extension, maximum green, yellow clearance, and red clearance.
- F. All right to left internal clearance times (intervals 1845B, 1835B, 1745B, 1735B, 1645B, 1635B, 1625B) shall use the same timing settings for minimum green, extension, maximum green, yellow clearance, and red clearance.
- G. Separate timing settings for minimum green, extension, maximum green, yellow clearance, and red clearance shall be provided for each of the 4 external clearance intervals (1825B, 1725B, 4516B, 3516B).

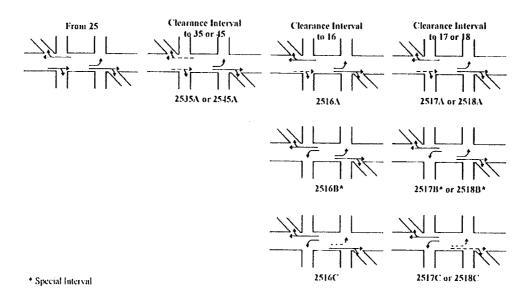


Figure 3a

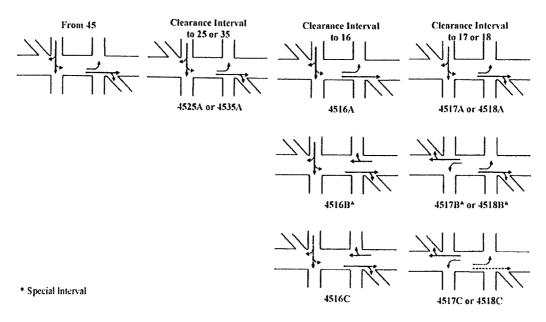
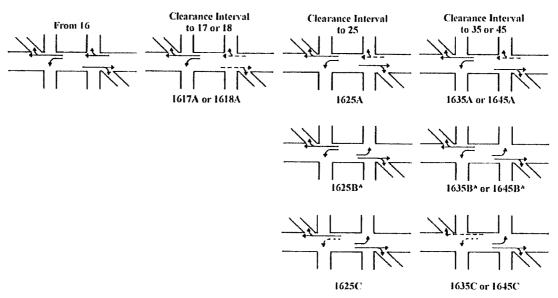


Figure 3b



\* Special Interval

Figure 3c

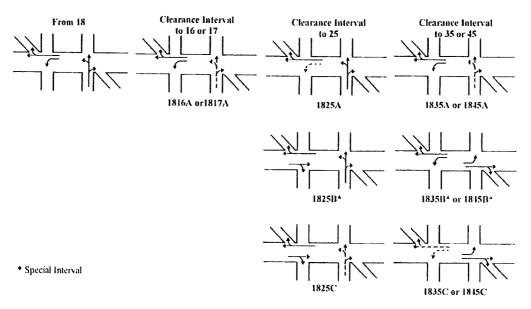


Figure 3d

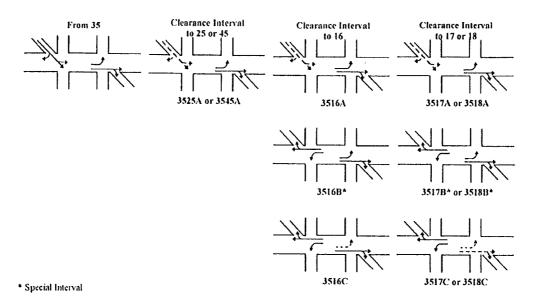


Figure 3e

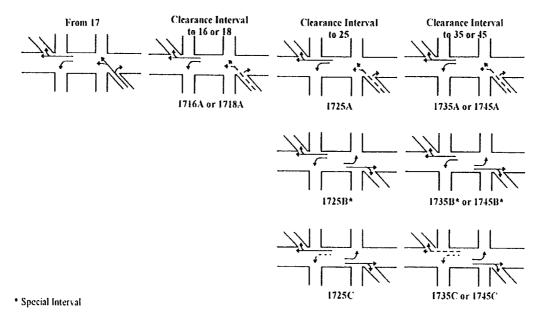


Figure 3f

## 2.12.4 Diamond Detector Operation

2.12.4.1 The loop detector layout for 3 phase, 4 phase, 6 phase, or separate intersection diamond operation shall be as defined in Figure 4. The detector operation defined shall be automatically loaded when any diamond sequences are selected.

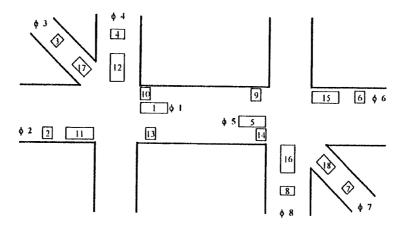


Figure 4

2.12.4.2The controller unit software shall provide the logic for detector operation described below:

### Detector 1

In 4 phase operation:

- 1. Shall call phase 6 if overlap A is not green and phase 7 is not called.
- 2. Shall call phase 6 if overlap A is not green and phase 8 is not called.
- 3. Extend intervals 2516B, 2517B, 2518B, 4517B, 4518B, 3517B, and 3518B.

In 3 phase operation: call and extend phase 1 (left turn)

### Detector 5

In 4 phase operation:

- 1. Shall call phase 2 if overlap B is not green and phase 3 is not called.
- 2. Shall call phase 2 if overlap B is not green and phase 4 is not called.
- 3. Extend intervals 1625B, 1635B, 1645B, 1735B, 1745B, 1835B, and 1845B.

In 3 phase operation: call and extend phase 5 (left turn)

## Detectors 2, 3, 4, 6, 7, and 8

These setback detectors (or detector sets) belong to the parent phases with the same number (e.g. detector 2 belongs to phase 2) as shown in Figure 4. These detectors shall have a 2 second delay set during red conditions of their parent phase. The detector(s) are used to extend during green.

### Detectors 11, 12, 15, 16, 17, and 18

These detectors are stop bar detectors and are used to call the associated parent phases shown in Figure 4. The parent phase green plus a call for that phase plus a 0.2 second gap on the detector shall disable the detector until the end of green.

### Detectors 9 and 10

In 4 phase operation:

- 1. Shall extend phase 2 if phase 3 is called.
- 2. Shall extend phase 2 if phase 4 is called.
- 3. Shall call phase 6 if overlap A is not green and phase 7 is not called.
- 4. Shall call phase 6 if overlap A is not green and phase 8 is not called.
- 5. Extend intervals 2516B, 2517B, 2518B, 4517B, 4518B, 3517B, and 3518B.

In 3 phase operation: shall function as a phase 1 calling detector during phase 3 or 4 and as a phase 1 extending detector when a phase 3 or 4 call exists.

### Detectors 13 and 14

In 4 phase operation:

- 1. Shall extend phase 6 if phase 7 is called.
- 2. Shall extend phase 6 if phase 8 is called.
- 3. Shall call phase 2 if overlap B is not green and phase 3 is not called.
- 4. Shall call phase 2 if overlap B is not green and phase 4 is not called.
- 5. Extend intervals 1625B, 1635B, 1645B, 1735B, 1745B, 1835B, and 1845B.

In 3 phase operation: shall function as a phase 5 calling detector during phase 7 or 8 and as a phase 5 extending detector when a phase 7 or 8 call exists.

- 2.12.5 Three Phase Operation
- 2.12.5.1 The controller unit shall be keyboard selectable for 3 phase diamond operation.
- 2.12.5.2The controller unit shall perform the sequences for 3 phase diamond operation defined in Figures 5a to 5b.
- 2.12.5.3The normal sequence of operation shall be  $4+8 \rightarrow 2+6 \rightarrow 1+5$ .
- 2.12.5.4The point at which operation may be switched from 3 phase to 4 phase operation shall be through the transition phase sequence to 4 phase interval 2516 as indicated in Figure 5a.
- 2.12.5.5The controller shall be programmable for simultaneous gap operation for phases 4 and 8 in 3 phase operation to allow a phase to extend out of a green rest state. When the phase(s) to be serviced next conflicts with both phases being serviced, both concurrent phases must reach a green rest state together before they terminate. Termination of the max timer or application of a force off shall override this feature. The phases shall not be allowed to advance to a green interval beyond the rest state which might override defeat the simultaneous gap operation.

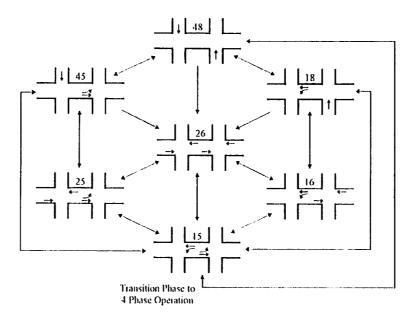


Figure 5a

# 3 Phase Diamond Sequence Figure 5b

From	IF	AND	GO TO
Interval	Call On	No Call On	Interval
48	2 and 6		2+6
	2 or 6	1 or 5	2+6
	l and 6	2	1+6
	2 and 5	6	2+5
	5	1 or 2 or 6	4+5
	4 and 5	8	4+5
			if min. time of 5 can be serviced before max. time of 4
	1	2 or 5 or 6	1+8
	1 and 8	4	1+8
	I and 5	2 6	if min, time of 1 can be serviced before max, time of 8
	i and 5	2 or 6	1+5
45	8		4+8
			if 4+8 was not serviced immediately prior to 4+5
	8	1 or 2 or 6	4+8
	2 and 6	8	2+6
	6	8 or 1	2+6
	2	8 or 6	2+5
	1 and 6	8 or 2	1+6
	1	8 or 2 or 6	1+5
18	4		4+8
			if 4+8 was not serviced immediately prior to 1+8
	4	5 or 2 or 6	4+8
	2 and 6.	4	2+6
	2	4 or 5	2+6
	6	4 or 2	1+6
	2 and 5	4 or 6	2+5
	5	4 or 2 or 6	1+5
26	(1 and 5) or 4 or 8	2 or 6	1+5
	5	6 or 4 or 8	2+5
	2 and 5	6	2+5
	1	2 or 4 or 8	1+6
	1 and 6	2	1+6
!5	1 or 8	****	1+5
	4	1 or 8	4+5
	6	1 or 4 or 8	2+6
6	4 or 5		1+5
	8	4 or 5	1+8
	2	4 or 5 or 8	2+6
5	4 and 8		4+8
	4	8	4+5
	8	4	1+8
	2 and 6	4 or 8	2+6
	2	4 or 6 or 8	2+5
	6	2 or 4 or 8	
	U	2 OF 4 OF 8	1+6

- 2.13 Coordination Control Hierarchy
- 2.13.1 When the system switch is in the system position, the controller unit shall be under the control of the master controller or TBC.
- 2.13.2 In the absence of any on-line closed loop system control by a master controller, the internal TBC shall control the coordinated, free, and flash operation of the intersection when the system switch is in the system position.
- 2.13.3 When a master controller brings the intersection on-line, its control shall supersede that of the internal time base coordination.
- 2.13.4 When the system switch is in the free position, the controller unit shall operate in a non-coordinated (free) mode.
- 2.14 Preemption (PE)
- 2.14.1 The internal preemptor supplied shall be easily programmable from the front panel for either railroad or emergency vehicle preemption sequences.
- 2.14.2 Phases shall be selectable such that a limited signal sequence may be operational during preempt (PE). It shall be possible to add phases to this special limited sequence, which is not in the intersection sequence. This shall be accomplished without adding external logic.
- 2.14.3 The following intervals shall be provided as a minimum. Terminology may vary but the meaning must be clear. Additional unspecified intervals that may lead to confusion shall be programmable to zero. If abbreviations are used on the display, they shall be defined on the front panel. While in preemption, the display will clearly identify the intervals being timed as preempt intervals. Yellow and red clearances from the phase timings may be utilized in place of the clearance intervals shown.

### 2.14.3.1Preemption Timing Interval Definition

All intervals are sequential.

- 0. PE Delay This time shall start immediately when the preempt command is received. It shall not affect the normal operation of the controller unit until the delay time out occurs. This interval may be used for emergency vehicle (fire lane) preemption delay. If 0 time is set, the interval shall be omitted.
- 1. PE Minimum Duration The preempt sequence shall not terminate until the preempt input signal is removed and the minimum duration time has expired.
- 2. PE Minimum Green Any vehicle signal that is green at the time this interval becomes active shall not terminate unless it has been displayed for at least the time programmed in this interval. If 0 time is set the interval shall be omitted.
- 3. PE Minimum Walk Preempt minimum walk time in seconds. A preempt initiated transition shall not cause the termination of a Walk prior to its display for this period.
- 4. PE Pedestrian Clearance At the time of preempt call, Walk indications shall immediately change to pedestrian clearance interval. The pedestrian clearance interval shall not terminate unless it has been displayed for at least the time programmed in this

- interval. If 0 time is set, the interval shall be omitted.
- 5. PE Track Green Signals programmed as track (or fire lane) signals shall remain green or be changed to green. All other signals shall be red. This interval shall be optionally programmable to zero during emergency vehicle PE.
- 6. PE Dwell Green Minimum dwell time in seconds. This parameter controls the minimum timing for the dwell movement. The phase(s) allowed during the dwell interval shall be selectable to include all phases that do not cross the track. The dwell interval shall not terminate prior to the completion of preempt duration time, preempt dwell time, and the call is no longer present. Each signal shall be keyboard programmable for red, red flash, yellow flash or green. As an alternative, a limited cycle shall be programmable for use with railroad preempts.
- 7. PE Exit Pedestrian Clear Preemption exit pedestrian clear time in seconds. This parameter controls the pedestrian clear timing for a Walk signal transition to the exit phase(s).
- 8. PE Exit Yellow This interval shall provide a solid yellow clearance for indications that were green or flashing yellow. Red and flashing red displays shall display solid red.
- 9. PE Exit Red Clearance This interval shall be an all red clearance in preparation for return to the normal cycle. Return phases shall be programmable from the keyboard.
- 10. PE Max Call This interval is the amount of time that a preempt call may remain active and be considered valid. When the preempt call has been active for this amount of time, the controller shall return to normal operation. The preempt call shall be considered invalid until the call is no longer active.

### 2.14.3.2Preempt Timing Interval Ranges

	TIMING INTERVAL	TIME	INCREMENTS
		(Seconds)	(Seconds)
0.	PE Delay (emergency vehicle preempt)	0-999	1
1.	PE Minimum Duration	0-999	1
2.	PE Minimum Green	0-255	1
3.	PE Minimum Walk	0-255	1
4.	PE Pedestrian Clearance	0-255	1
5.	PE Track Green	0-255	1
6.	PE Dwell Green	1-255	1
7.	PE Exit Pedestrian Clear	0-255	1
8.	PE Exit Yellow	3.0-25.5	0.1
9.	PE Exit Red Clearance	0-25.5	0.1
10.	PE Max Call	0-999	1

- 2.14.4 The phases to be serviced following the preempt sequence shall be front panel keyboard programmable.
- 2.14.5 Preempt sequences shall be selectable using external inputs. Preempt priority shall be assigned with number 1 being the highest. If a higher priority preempt input is received during a preempt sequence, the controller unit shall immediately transition to the new sequence subject to the constraints of PE minimum green and PE minimum walk. The transition shall take place in a safe manner from any point in the sequence meeting all Texas MUTCD requirements. Provisions shall

- be made to clear two conflicting track phases from a single preempt input. This may be provided by two track clearance phases for a single preempt or by combining two preempts.
- 2.14.6 Preempt 1 shall be reserved for a priority railroad preempt. If more than two preempts are provided it shall be possible to delete the priority override for all but the railroad preempt. If a non-priority preempt is activated during another preempt cycle, the one in progress shall continue through its entire cycle. If the second preempt input is still active when the first one is completed, the controller unit shall immediately go to all red flash or initiate the non-priority preempt. When all preempt inputs are removed, the controller unit shall proceed through the normal sequence to return red clearance (interval 9).
- 2.14.7 Once the controller unit has entered the first timed interval following preempt delay (interval 1), the sequence shall continue to the end even if the preempt call is dropped. If the call returns, the minimum preempt duration (interval 1) the controller unit should reinitiate track green and complete the preempt sequence.
- 2.14.8 The controller unit shall be programmable to be in flash or in limited sequence during interval 6. If flash is specified, the phases shall flash yellow or red as programmed from the front panel. Flash shall be implemented by simultaneously flashing the appropriate load switch driver outputs. If limited sequence is selected, all phases shall be programmable even if not normally used in the intersection sequence.
- 2.14.9 In the event of a power interrupt as defined by TS-2, if the preempt command is present when power is restored, the controller unit shall power up in cabinet flash operation and remain there until the PE command is removed.
- 2.14.10 Overlap phases shall begin and terminate with the parent phases as described in TS-2. If the PE call occurs during yellow or red displays between parent phases, the overlap phase shall display a minimum of 3 seconds of yellow and a minimum of 1 second of red clearance.
- 2.14.11 Don't Walk shall be displayed throughout the preempt sequence unless a limited cycle is run. During a limited cycle (interval 6) the pedestrian heads may be programmed to be dark.
- 2.14.12 Preempt routines shall have priority over all controller functions.
- 2.14.13 The controller shall be programmable to allow multiple track clearance phases either within a single preemption sequence or by mapping multiple preempts together in all modes of operation including 3 phase and 4 phase diamond modes.
- 2.15 NTCIP Compliance
- 2.15.1 The controller software shall comply with the referenced NTCIP standards when installed. The software shall comply with the versions of the relevant NTCIP standards that are current at the date of this document, or latest revision.
- 2.15.2 The software shall comply with NEMA Standard Publication TS-3.2 2003 (TS-3.2), or latest revision, the Simple Transportation Management Framework, and shall meet the requirements for Conformance Level 2. The software shall comply with NEMA Standard Publication

TS-3.3 2003 (TS 3.3), or latest revision, the Class B Profile, and shall include both an EIA/TIA 232-E and an FSK modern interface for NTCIP based communications.

- 2.15.3 The software shall implement all mandatory objects of all mandatory conformance groups as defined in Global Object Definitions, NEMA Standard Publication NTCIP 1201:1996 (TS 3.4), or latest revision:
  - Configuration Conformance Group and Actuated Signal Controller Object Definitions, NEMA Standard Publication NTCIP 1202:1996 (TS 3.5), or latest revision.
  - Phase Conformance Group
  - Detector Conformance Group
- 2.15.4 The software shall implement all mandatory objects of all optional conformance groups as defined in Global Object Definitions, NTCIP 1201:1996, or latest revision:
  - Database Management Conference Group
  - Time Management Conformance Group
  - Time Base Event Schedule Conformance Group
  - Report Conformance Group
  - STMF Conformance Group
  - PMPP Conformance Group and Actuated Signal Controller Object Definitions, NTCIP 1202: 1996, or latest revision.
  - Volume Occupancy Report Conformance Group
  - Unit Conformance Group
  - Special Function Conformance Group
  - Coordination Conformance Group
  - Time Base Conformance Group
  - Preempt Conformance Group
  - Ring Conformance Group
  - Channel Conformance Group
  - Overlap Conformance Group
  - TS-2 Port 1 Conformance Group

- 2.15.5 The software shall also implement the following optional objects as defined in the Global Object Definitions, NTCIP 1201:1996, or latest revision:
  - globalSetIDParameter
  - dbMakeID
  - eventLogOID
  - eventConfigAction
  - eventClassDescription
- 2.15.6 The software shall also implement the following optional objects as defined in the Actuated Signal Controller Object Definitions, NTCIP 1202:1996, or latest revision:
  - unitRedRevert
  - phaseDynamicMaxLimit
  - phaseDynamicMaxStep
  - phaseControlGroupTable
  - ringControlGroupForceOff
  - vehicleDetectorQueueLimit
  - vehicleDetectorFailTime
  - vehicleDetectorReportedAlarms
  - alarmGroupTable
  - specialFunctionOutputTable
  - preemptMinimumGreen
  - preemptMinimumWalk
  - preemptEnterPedClear
  - preemptState
  - preemptControlTable
  - ringControlGroupMax2
  - ringControlGroupMaxInhibit
- 2.15.7 All objects required by these procurement specifications shall support all values within its standardized range, unless otherwise approved by the Project Engineer. The standardized range is defined by a size, range, or enumerated listing indicated in the object's syntax field and/or through descriptive text in the object's description field of the relevant standard. The following provides the current listing of known variances for this project:

TABLE 2.1 OBJECT RANGE VALUES FOR ACTUATED SIGNAL CONTROLLERS

Овјест	MINIMUM PROJECT
	REQUIREMENTS
NTCIP 1201:1996	
moduleType	Value 3
dbCreateTransaction	All Values
dbErrorType	All Values
globalDaylightSaving	Values 2 & 3
maxTimeBaseScheduleEntries	255
maxDayPlans	15
maxDayPlanEvents	10
maxEventLogConfigs	255
eventConfigMode	Values 2 thru 5
eventConfigAction	Values 2 & 3
maxEventLogSize	255
maxEventClasses	7
maxGroupAddress	2
NTCIP 1202:1996	
maxPhases	16
phaseStartup	Values 2 thru 6
phaseOptions	All Values
maxPhaseGroups	2
maxVehicleDetectors	32
vehicleDetectorOptions	All Values
maxPedestrianDetectors	8
unitAutoPedestrianClear	All Values
unitControlStatus	All Values
unitFlashStatus	All Values
unitControl	All Values
maxAlarmGroups	1
maxSpecialFunctionOutputs	8
coordCorrectionMode	Values 2 thru 4
coordMaximumMode	Values 2 thru 4
coordForceMode	Values 2 & 3
maxPatterns	48
patternTableType	Either 2 or 3

Овјест	MINIMUM PROJECT REQUIREMENTS	
maxSplits	16	
splitMode	Values 2 thru 7	
localFreeStatus	Values 2 thru 11	
maxTimebaseASCActions	255	
maxPreempts	6	
preemptControl	All Values	
preemptState	Values 2 thru 9	
maxRings	4	
maxSequences	16	
maxChannels	16	
channelControlType	Values 2 thru 4	
channelFlash	All Values	
channelDim	All Values	
maxChannelStatusGroups	16	
maxOverlaps	8	
overlapType	Values 2 & 3	
maxOverlapStatusGroups	8	
maxPort I Addresses	255	
port l Status	Values 2 & 3	

- 2.15.8 The controller shall be able to implement all NTCIP messages called for in the specification without any additional vendor specific/proprietary statements.
- 2.15.9 The software shall be supplied with full documentation, including a CD-ROM disk and/or other approved storage media containing ASCII versions of the following MIB files in ASN.1 format:
  - the relevant version of each official NEMA standard MIB module referenced by the device functionality; and
  - if the device does not support the full range of any given object within a NEMA standard MIB module, a manufacturer specific version of the official NEMA standard MIB module with the supported range indicated in ASN.1 format in the Syntax field of the Object-Type macro. The filename of this file shall be the same as the standard MIB filename with the extension ".man".

- 2.15.10 The software shall be supplied with full documentation, including a CD-ROM disk or other approved storage media containing ASCII versions of any and all manufacturer-specific objects supported by the device in ASN.1 format in a manufacturer-specific MIB with accurate and meaningful description fields and supported ranges indicated in the syntax field of the object-type macros.
- 2.15.11 The manufacturer shall not place any restrictions as to the passage of any and all of this documentation to any portion of Ft Bend Co.
- 2.15.12 The manufacturer shall provide a copy of the following table that has been completed to describe the operation of their controller including which objects are used and the procedures that are done with these objects to implement the functions listed using NTCIP.

Table 2.2

Function	Objects	Procedures to Implementation
Example: Function X	Object T	Get object T then send objects Y
	Object Y a	
	Object Z	
Change split time in an active coordination plan		
Change ring structure		
Change minimum Green in an active coordination plan		
Change alternate sequence in an active coordination plan		

- 2.16 Flashing Yellow Arrow Operation. Provide a Flashing Yellow Arrow (FYA) routine that:
  - is programmable in the controller unit,
  - provides as a minimum for operation of up to 4 FYA left turn signal displays per the MUTCD.
  - uses data entries in the controller unit to define when the signal face displays the protected (green arrow) and the permissive (flashing yellow arrow),
  - can be programmed for permissive only, permissive-protected, or protected only operation by time of day, transition from FYA permissive-protected operation to protected only operation must be accomplished after concurrent termination of both the FYA and the associated opposing through movement.

## 3.0 MALFUNCTION MANAGEMENT UNIT (MMU)

- 3.1 This specification sets forth the minimum requirements for a shelf-mountable, 16 channel, solid-state MMU. The MMU shall meet as a minimum, Section 4 of the NEMA Standards Publication TS-2 2003, or latest revision. Where differences occur, this specification shall govern.
- 3.2 No circuit cuts shall be allowed on circuit boards in any of the equipment supplied. Any wire jumpers included on circuit boards shall be placed in plated through holes that are specifically designed to contain them. Jumpers that are tack soldered to circuit traces or that are added to correct board layout errors are not acceptable
- 3.3 All ICs with 16 or more pins shall be mounted in machine tooled sockets or surface mounted. All sockets shall have two-piece, machined contacts and closed end construction to eliminate solder wicking. The outer sleeve shall be brass with tin or gold plating and tapered to allow easy IC insertion. The inner contact shall be beryllium copper sub-plated with nickel and plated with gold. All sockets shall have thermoplastic bodies meeting UL Specification 94V-0. Other high quality sockets may be acceptable but must have prior approval of the Ft Bend County Traffic Engineer. Surface mount devices will be allowed. Sockets meeting alternate specifications shall be submitted in writing with the solicitation. Zero insertion force sockets will not be allowed.
- 3.4 The design shall allow for removal or replacement of a circuit board without unplugging or removing other circuit boards.
- 3.5 The unit shall be designed so that one side of each board can be completely accessible for troubleshooting and testing the unit while it is still operating. This may be accomplished with extender boards or cables. This need apply to only one circuit board at a time.
- One set of extender boards (if required to meet Paragraph 3.5 above) for every 10 MMUs ordered or portion thereof shall be provided with the purchase order.
- 3.7 No more than two circuit boards shall be attached to each other to constitute a circuit assembly. Attaching hardware shall use captive nuts or other acceptable method to secure the boards together. Alternate methods shall be submitted in writing with the solicitation. The boards shall be designed so Ft Bend Co can test and operate the controller unit with the boards separated.
- 3.8 If this specification is used to support the purchase of a complete controller assembly, the unused red circuits shall be connected to the AC Line in the controller cabinet.

The MMU shall be pre-programmed according to Table 3-1.

Table 3-1

Channel	Load Switch	Phase
Channel 1	Load Switch 1	Phase 1 Vehicle
Channel 2	Load Switch 2	Phase 2 Vehicle
Channel 3	Load Switch 3	Phase 3 Vehicle
Channel 4	Load Switch 4	Phase 4 Vehicle
Channel 5	Load Switch 5	Phase 5 Vehicle
Channel 6	Load Switch 6	Phase 6 Vehicle
Channel 7	Load Switch 7	Phase 7 Vehicle
Channel 8	Load Switch 8	Phase 8 Vehicle

- 3.10 Provide an MMU that displays by LCD or other approved graphics display, the active or inactive state of each circuit on all 16 channels An icon must be used representing the red (Don't Walk), yellow, and green (Walk) circuit for each channel.
- 3.11. The MMU must be compatible with the controller and capable of monitoring FYA operation as defined by the MUTCD and still provide standard NEMA TS-2 monitoring functions.
- 3.12 Each MMU shall have a unique serial number that is permanently and neatly displayed on the face of the unit. If this serial number is located elsewhere on the unit then an additional temporary label that is neatly printed or typed shall be affixed to the MMU face.
- 3.13 Provide the MMU with an Ethernet port on the front face of the unit.

### 4.0 TS-2 CABINET ASSEMBLY

- 4.1 This specification describes the minimum acceptable requirements for a TS-2 cabinet assembly to house a NEMA TS-2 Type 1 solid state full-actuated controller unit. The assembly shall include the cabinet, flasher, card rack(s), a MMU, an external power supply, and 6 flash transfer relays. For cabinet assemblies of configuration 4 (16 position), the assembly shall include 16 load switches and for cabinet assemblies of configuration 3 (12 position), the assembly shall include 12 load switches. All cabinets shall include appropriate mounting hardware.
- 4.2 Cabinet Design Requirements
- 4.2.1 The cabinet shall be constructed using unpainted sheet aluminum with a minimum thickness of 3.2 mm. No wood, wood fiber products or other flammable material shall be used in the cabinet. All welds shall be neat and of uniform consistency.

3.9

4.2.2 The size of the cabinet shall be size 5 or size 6 as defined by TS-2 Clause 7.3 of the NEMA Standard Publication TS-2 2003, or latest revision, as specified by the plans. The load bay shall be configuration 3 (12 position) or configuration 4 (16 position) as defined by TS-2 Clause 5.3, as specified by the plans.

Cabinet Options	Size of Cabinet	Backpanel Configuration	Size of Load Bay
Option 1	Pole Mount TS-2 Size 5	Configuration 3	12 position load bay
Option 2	Base Mount TS-2 Size 5	Configuration 3	12 position load bay
Option 3	Base Mount TS-2 Size 6	Configuration 3	12 position load bay
Option 4	Base Mount TS-2 Size 6	Configuration 4	16 position load bay

- 4.2.3 Two aluminum-lifting eyes or ears shall be attached to the cabinet with a single carriage bolt or dual carriage bolts each to permit lifting the cabinet with a sling. The corners of each eye or ear shall be rounded and in the down position when shipped.
- 4.2.4 Vertical shelf support channels shall be provided to permit adjustment of shelf location in the field. The channels shall have a single continuous slot to allow shelves to be placed at any height within the cabinet. Channels with **fixed notches** or **holes** are **not acceptable**.
- 4.2.5 Each cabinet shall be equipped with an extra set of unistrut channels or a keyhole panel on either side of the front section of the cabinet to permit mounting of additional equipment as necessary.
- 4.2.6 Shelves shall be at least 330 mm deep and be located in the cabinet to provide a 12.5 mm clearance between the back of the shelf and the back of the cabinet. A 38 mm drawer shall be provided in the cabinet, mounted directly beneath the controller support shelf. The drawer shall have a hinged top cover and shall be capable of storing documents and miscellaneous equipment. This drawer shall support to 22.5 kg in weight when fully extended. The drawer shall open and close smoothly. Drawer dimensions shall make maximum use of available depth offered by the controller shelf and be a minimum of 600 mm.
- 4.2.7 Two shelves shall be provided in the cabinet and shall be at minimum 305 mm apart in height. There shall be sufficient shelf space to accommodate a controller unit 330 mm high, an MMU, one 8 position card rack and external power supply. An additional space at least 305 mm high, 325 mm wide, and 305 mm deep shall be provided. The controller unit, MMU, card racks, and power supply shall be placed on the shelves in such a manner that sufficient ventilation is provided to all components. Labels showing the proper placement of each component shall be provided along the shelves to ensure proper placement.
- 4.2.8 The cabinet shall be vented and cooled by 2 thermostatically controlled fans. The fans shall be a commercially available model with a capacity of at least 2.7 m3/minimum. The thermostats shall have an adjustable range of 20 C to 43 C. A press-to-test switch shall be provided to test the operation of the fans.

4.2.9 The cabinet shall be provided with a unique 5 digit serial number which shall be stamped directly on the cabinet or engraved on a metal or metalized mylar plate, epoxied or riveted with aluminum rivets to the cabinet. The digits shall be minimum 5 mm in height and located on the upper right sidewall of the cabinet near the front.

### 4.3 Cabinet Door

- 4.3.1 The cabinet shall be provided with one door in front that will provide access to the cabinet. The door shall be provided with 3 hinges with non-removable stainless steel pins, or a full-length piano hinge with stainless steel pins spot welded at the top of the hinge. The hinges shall be mounted so it is not possible to remove them from the door or cabinet without first opening the door. The bottom of the door opening shall extend at least to the bottom level of the back panel. The door and hinges shall be braced to withstand a 74 kg per vertical meter of door height load applied to the outer edge of the door standing open. There shall be no permanent deformation or impairment of any of the door or the cabinet body when the load is removed.
- 4.3.2 The cabinet door shall be fitted with a Number 2 Corbin lock and a cast aluminum or chrome plated steel handle with a minimum 16 mm diameter shaft (or equal cross-sectional area for a square shaft) and a 3 point latch. The lock and latch design shall be such that the handle cannot be released until the lock is released. One key shall be provided for each cabinet. A gasket shall be provided to act as a permanent dust and weather resistant seal at the controller cabinet door facing. The gasket material shall be of a nonabsorbent material and shall maintain its resiliency after long term exposure to the outdoor environment. The gasket shall have a minimum thickness of 6.25 mm. The gasket shall be located in a channel provided on the cabinet or on the door(s). An "L" bracket is acceptable in lieu of this channel if the gasket is fitted snugly against the bracket to insure a uniform dust and weather resistant seal around the entire door facing. Any other method is subject to written purchaser approval during inspection of an order.
- 4.3.3 A locking auxiliary police door shall be provided in the door of the cabinet to provide access to a panel that shall contain a signal shutdown switch, a signal flash switch, a manual-automatic switch, and a manual advance push-button switch on a 6 foot retractable cord. Manual control of the controller unit from the police door shall override any external control (external logic, etc.) in effect when the manual-automatic switch is in the manual position. Each actuation of the manual advance push-button switch shall advance the controller to the next interval. Manual control shall not override any calls for preemption. The police door shall be gasketed to prevent entry of moisture or dust and the lock shall be provided with one brass key.
- 4.3.4 The intake for the vent system shall be filtered with a permanent air filter. The minimum filter dimensions shall be 406.4 mm wide X 304.8 mm high X 25 mm thick. The filter shall be securely mounted so that any air entering the cabinet must pass through the filter. The cabinet opening for intake of air shall be large enough to use the entire filter. The air intake and exhaust vent shall be screened to prevent entry of insects. The screen shall have opening no larger than 8.1 mm². The total free air opening of the exhaust vent shall be large enough to prevent excessive back-pressure on the fan.

### 4.4 Wiring

4.4.1 All wiring within the cabinet shall be neat and routed such that opening and closing the door or raising or lowering the back panel will not twist or crimp the wiring. All wiring harnesses shall be

- braided, sheathed in nylon mesh sleeving, or made of PVC or polyethylene insulated jacketed cable. Wiring leading to the cabinet door shall be sheathed in nylon mesh sleeving or be PVC jacketed cable only. All SDLC cabling shall be Belden 7203A or approved equal.
- 4.4.2 SDLC cables shall be terminated with a bulkhead connector on a common PC board with a total of (7) connector so that all SDLC cables can be easily replaced. Unsoldering the SDLC cable is not acceptable.

#### 4.4.3 Size

- A. All conductors between the main power circuit breakers and the signal power bus shall be a minimum size 10 AWG stranded copper. All conductors carrying individual signal lamp current shall be a minimum size 16 AWG stranded copper. All AC service lines shall be of sufficient size to carry the maximum current of the circuit or circuits they are provided for. Minimum cabinet conductor wire size shall be 22 AWG stranded copper. All wiring and insulation shall be rated for 600V or greater.
- B. Conductors for AC common shall be white. Conductors for equipment grounding shall be green. All other conductors shall be a color different than the foregoing.
- 4.4.4 A barrier terminal block with a minimum of three compression fitting terminals designed to accept up to a number 4 AWG stranded wire shall be provided for connection of the AC power lines. The block shall be rated at 50A.
- 4.4.5 All terminals shall be permanently identified in accordance with the cabinet wiring diagram. Where through-panel solder lugs or other suitable connectors are used, both sides of the panel shall have the terminals properly identified. Identification shall be permanently attached and as close to the terminal strip as possible and shall not be affixed to any part which is easily removable from the terminal block panel.
  - A. Each controller input and output function shall be distinctly identified with no obstructions, at each terminal point in the cabinet, with both a number and the function designation. The same identification must be used consistently on the cabinet wiring diagrams.
  - B. Each load switch socket shall be identified by phase number, overlap number, and pedestrian phase number as applicable. No cabinet equipment, including the load switches themselves, may obstruct these identifications.
  - C. Each flash transfer base and power relay base shall be properly identified with no possible obstructions.
  - D. Each harness within the cabinet shall be distinctly identified by function on the connector end.
  - E. The flasher socket shall be distinctly identified with no possible obstruction.
  - F. All other sockets needed within the cabinet to fulfill the minimum requirements of the solicitation, or attachments thereof, shall be distinctly identified.
- 4.4.6 The controller unit harness (a plug) shall be long enough to reach any point 400 mm above the timer shelf. The MMU harness and any required auxiliary harness shall reach 600 mm from the MMU shelf.

- 4.4.7 An unused, spare terminal block providing 10 terminals shall be provided. This block shall be double 8-32 X 5/16 inch binder head screw design with shorting bars. These terminal strips shall be located on the lower third of either side of the cabinet.
- 4.4.8 Copper ground buses shall be provided for both the power supply neutral (common) and chassis ground. Each bus bar must provide a minimum of 10 unused terminals with 8-32 X 5/16 inch or larger screws. The AC neutral and chassis ground buses shall be jumpered together with a minimum number 10 AWG wire.
- 4.4.9 One 15A and one 30A thermal type circuit breakers shall be mounted and wired in the cabinet. One 15A breaker shall protect the base light, trouble light, duplex outlet, GFCI receptacle, modem duplex receptacle, and fans. The 30A breaker shall protect the signal load circuits, controller circuits, MMU, and card rack detector power supply. The breakers shall be Square "D" QUO 150 Series, or approved equal.
- 4.4.10 The circuit breakers shall be equipped with solderless connectors and installed on the right side wall (facing the cabinet) or lower right hand side of the back panel inside the cabinet. The breakers shall be easily accessible. The breakers shall be positioned so that the rating markings are visible.
- 4.4.11 A ground fault circuit interruption (GFCI) type duplex receptacle shall be mounted and wired in the lower right side wall of the cabinet. A quad duplex receptacle (for use with communications modems) shall be mounted and wired in the upper left side of the cabinet behind the preempt/interconnect panel. These receptacles shall be wired on the load side of the 15A circuit breaker.
- 4.4.12 The above breakers are in addition to any auxiliary fuses that may be furnished with the controller to protect component parts, such as transformers, etc.
- 4.4.13 The cabinet shall include a surge protection device (SPD) on the AC service input that meets or exceeds the following requirements: The SPD shall be installed on the load side of the cabinet over current device. The SPD shall be equipped with a light or indicator to indicate when a failure has occurred in the surge protection circuitry and have NO/NC contacts for remote alarm. The SPD shall conform to the following:
  - Withstand a peak surge current for an 8 X 20 microsecond waveform; minimum 20,000A for 15 occurrences at 3 minute intervals between surges without damage or degradation to the SPD (less than a 10% change in operating parameters).
  - Suppressed Voltage Rating as defined by UL1449, 2nd edition or latest revision, shall be 400V maximum and Voltage Protection Rating as defined by UL1449, 3rd edition, of 600V maximum.
  - Devices that are wired in series shall be rated for 30A maximum continuous operating current at 120V/60 Hz.
  - Nominal line or system voltage shall be 120V AC.
  - Minimum short circuit current rating shall be 20 kA.
  - Maximum continuous operating voltage (rms) shall be a minimum of 135V AC.
  - Rated to operate in ambient temperature range of -34°C to +74°C.
  - The SPD unit shall be tested by a nationally recognized test lab for compliance with current UL 1449, 2nd edition or latest revision. A copy of the test results shall be

- provided upon request.
- Protected modes shall be L-G, L-N & N-G.
- Be provided with documentation listing the following information: product/model number; circuit description; nominal operating voltage; maximum continuous load current; maximum continuous operating voltage, modes of protection, connection means, maximum surge current, and suppressed voltage rating, and installation instructions.
- Shall be provided in an enclosure suitable for the temperature range and outdoor environments.
- Shall be provided with mounting hardware, be surface mountable and fit into a space 6 inches long X 5 inches wide X 4 inches deep or less.
- Connections shall be either wire clamping box terminals, lugs, or minimum number 12 AWG wire. Connections for NO/NC contacts shall accept or be minimum stranded number 18 AWG wire.
- 4.4.14 The SPD ground connection shall be connected to the cabinet ground bus by means of a short, copper ground strap or minimum number 10 AWG insulated conductor.
- 4.4.15 If connected in series, the SPD shall be connected to the line filter. Number 10 AWG or larger wire shall be used for connections to the SPD, line filter and load switch bus.

- 4.4.16 A rigid LED light 24 Vdc shall be installed in the top of the cabinet. A second rigid LED light 24 Vdc shall be installed under the bottom shelf of the cabinet. This light shall turn on when the cabinet door is opened, and turn off when the cabinet door is closed. A MOV or other such transient suppression device shall be placed across the AC power input to the light.
- 4.4.17 A radio frequency interference (RFI) suppresser shall be provided and installed on the load side of the signal circuit breaker and shall be protected by the surge protector. This filter shall be rated at 50A and shall provide a minimum attenuation of 50 decibels over the frequency range of 200 Kz to 75 Mz.
- 4.4.18 Surge suppression devices shall be placed on the coil side of all relays in the cabinet. DC relay coils shall have, as a minimum, a reversed biased diode across the coil. AC relays shall have MOV's or equal suppression across their coils. RC networks are acceptable. One suppression device shall be supplied for each relay.
- 4.4.19 Except where soldered, all wires shall be provided with lugs or other approved terminal fittings for attachment to binding posts. Insulation parts and wire insulation shall be insulated for a minimum of 600V.
- 4.4.20 The outgoing traffic control signal circuits shall be of the same polarity as the line side of the power source.
- 4.4.21 A switch shall be provided on the inside face of the cabinet door that shall be labeled "Test-Normal" When the switch is in the normal position, the call for flashing operation shall remove the power from the controller unit. When the switch is in the Test position, the call for flashing operation shall permit the controller unit to continue to run so that its operation can be observed.
- 4.4.22 A switch shall be provided near the "Test-Normal" switch to cause the controller unit, and any auxiliary equipment, to stop timing. It shall be labeled "Stop Timing"
- 4.4.23 The cabinet shall be wired so that activation of the MMU will cause the controller unit, and any auxiliary equipment, to stop timing.
- 4.4.24 Conflict and manual flash shall be wired for all red.
- 4.4.25 The cabinet shall be designed and equipped with enough transfer relays for changing any main street indications (movement TS-2, 6, and/or 1, 5) to amber for the conflict and/or manual flash operation on the face of the back panel or a side panel, using only simple tools.
- 4.4.26 Transfer relays shall be the plug-in type manufactured by Midtex (Part No. 136-62T3A1) or AEMCO (Part No. 136-4992), or approved equal. The relays shall have contacts a minimum of 3/8 inch diameter in size and shall be rated at a minimum of 30A/102/240V AC, 20A/28V DC.
- 4.4.27 The red enable and remote reset from the MMU shall be terminated on the face of the back panel.
- 4.4.28 A 75A, solid state relay shall be wired between the RFI filter output and the load switch power bus. The relay shall be controlled by the signal shutdown switch and the flash switch. The relay shall be mounted to a heat sink designed to allow maximum current flow at 74° C without damaging the relay.

- 4.4.29 All exposed AC wiring points, including the RFI filter, surge suppresser, and solid state relay shall be covered with a clear non-conductive plastic cover to prevent accidental contact. Unless otherwise noted in this specification, wiring at terminal strips is exempt from this requirement.
- 4.4.30 The load switch outputs shall be brought out through posted 10-32 X 5/16 inch binder head screw terminals. Field wiring for the signal heads shall be connected at this terminal strip.

# 5.0 DETECTOR PANEL AND CARD RACK

- 5.1 The cabinet shall have a loop detector panel mounted on the left side of the cabinet. This panel shall provide for all connections between loops at the street and the detector amplifiers as described in the following sections.
- 5.2 Detector Card Rack
- 5.2.1 The card rack for cabinet configurations (16 position back panel) shall accommodate up to 12 each 2 channel or six each four channel TS 2 detector units plus (2) slots wired for opticom.
- 5.2.2 The detector card rack shall have a rigid frame and shall be fabricated from aluminum and shall have slots set in a modular fashion such that the PCB edge connectors shall plug into the rear while sliding between top and bottom card guides for each module. Mounting flanges shall be provided and be turned outward for ease of access. The detector card rack shall be bolted to a cabinet shelf. It shall be possible to unbolt the rack using simple tools.
- 5.2.3 All wiring to the rack shall be labeled and neatly run to other parts of the cabinet and detector termination panel. All loop inputs shall be wired with shielded twisted pair leads (Beldon 9451, 2 conductor, 22 AWG with 24 AWG drain wire, shielded cable or approved equal) to improve signal isolation. All grounds within the twisted pair leads shall be connected at the detector terminal panel.
- 5.2.4 The slots shall be numbered 1 to 8 left to right when viewed from the front of the rack. A flange shall be provided on the top and the bottom of the rack to label each individual channel.
- 5.2.5 The detector DC supply shall be bussed to a common point and wired to the intersection detector panel.
- 5.2.6 The chassis ground shall be bussed to a common point and wired to the detector panel.
- 5.2.7 The logic ground shall be bussed to a common point and wired to the detector panel.
- 5.2.8 The data address for the detector channels shall be according to TS-2.
- 5.3 Detector Panel
- 5.3.1 The detector panel shall provide all connections between the detector loops and the detector amplifiers.
- 5.3.2 The panel shall be constructed of 3.2 mm aluminum.

- 5.3.3 The panel shall contain a 76 mm horizontal slot in each corner to accommodate 6.3 mm mounting bolts.
- 5.3.4 All inputs from the loops shall be brought through posted 10-32 X 5/16 inch binder screw terminals or 8-32 X 5/16 inch binder screw terminals.
- 5.3.5 Each loop pair shall be protected by lightning surge suppressers preapproved for use on loop detector inputs by City of College Station's Traffic Engineer. The suppressers may be mounted either on the front or behind the panel.
- 5.3.6 The detector panel for cabinet configurations 1, 2, and 3 (12 position) shall provide the following connection points as a minimum for 16 detectors:

Connection Point	Number of Connection Points
External 24V Power Supply	1
Loop Inputs	32, 2 for each Detector
Logic Ground	1
Spares	6
Chassis Ground Bus	1 Bus

The detector panel for cabinet configuration 4 (16 position) shall provide the following connection points as a minimum for 24 detectors:

Connection Point	Number of Connection Points	
External 24V Power Supply	1	
Loop Inputs	48, 2 for each Detector	
Logic Ground	1	
Spares	0	
Chassis Ground Bus	1 Bus	

- 5.3.7 A chassis ground bus bar shall be provided on the panel and connected to the cabinet by an insulated braided copper ground strap and shall be tied to the loop lead-in grounds. The strap shall be bonded to the cabinet.
- 5.3.8 An additional neutral bus bar shall be provided on the panel and tied to the pedestrian commons.
- 5.3.9 Toggle switches shall be provided to permit the user to input a vehicle or pedestrian call to the control unit. Switches will be provided as follows:
  - 16 vehicle and 8 pedestrian switches shall be provided on 12 position cabinets.
  - 24 vehicle and 8 pedestrian switches shall be provided on 16 position cabinets.

# 6.0 PREEMPT/COMMUNICATION PANEL

- 6.1 A preempt/communication panel shall be provided that contains all interface circuits and wiring for preemption and communication functions. The panel shall be located on the left side of the cabinet interior.
- 6.2 Three input relay circuits, with 120V AC coil and contacts rated for the application, shall be

provided on the preempt panel. These circuits shall be used to isolate the incoming preempt commands from the controller unit logic circuitry. The circuits shall be programmable to operate with either a normally open or normally closed relay contact by jumpers on a terminal strip. A barrier strip protected from accidental contact by service personnel shall be supplied to connect the external input. It shall be possible to use either a neutral or hot 120V AC input. Relays used shall be plug-in Potter Brumfield K10P series/Magnecraft W-78 series or interchangeable approved equal. The relays shall be mounted in relay sockets.

- 6.3 Adequate protection of the input relay circuits as well as the preemptor circuitry shall be provided to eliminate damage or false preemption commands caused by line transients or lightning surges. The devices shall have a minimum rating of 20 Joules.
- Three momentary test switches, one for each preempt circuit, shall be provided on the preempt panel. The operator shall not be exposed to hazardous voltages during operation of the test switches.
- 6.5 All necessary interconnection cables and mounting hardware shall be provided.
- 6.6 There shall be a switch on the preempt/communication panel which shall release the local controller to operate in an isolated, full-actuated manner, when necessary for maintenance purposes. The switch positions shall be labeled "System" and "Free".
- 6.7 Terminal connections for 2 twisted pair communication lines shall also be provided with a coordinated 4 stage electrical protection; including primary overvoltage protection, resettable over current protection, secondary clamping voltage protection, and fast transient filtering. The secondary overvoltage stage shall allow peak voltages of no more than 250V. The fast transient filtering stage shall provide no less than 40 dB/decade of attenuation to transients above the required pass band. The 4 stage protection shall be provided in an integrated closure with input/output terminations and ground connection.
- There shall be an opticom panel mounted below the preempt/communication panel. This opticom panel takes the place of a 380 model card rack. This panel has 12 wire termination points and the first four terminations shall be labeled "Opticom Out A", "Opticom Out B", "Opticom Out C", and "Opticom Out D". The next four terminations shall be labeled "Opticom In A", "Opticom In B", "Opticom In C", and "Opticom In D". The next four terminations shall be labeled "Opticom A and B +", "Opticom C and D +", "Opticom A and B -" and "Opticom C and D -".

# 7.0 POWER SUPPLY

- 7.1 The power supply shall be a shelf-mounted, enclosed, 24V DC power supply in accordance to Clause 5.3.5 of the NEMA Standards Publication TS-2 2003, or latest revision.
- 7.2 One power supply cable per power supply shall be furnished and installed in each cabinet. The wires shall be terminated to bus bars, terminals on the front of the back panel, detector panels, or connector as appropriate. The connections shall be with forked spade lugs or otherwise as needed. Each individual wire shall be cut to the length required to reach the point at which it is to be connected.
- 7.3 Electrical requirements for the power supply shall be in accordance with Clause 5.3.5 of the NEMA Standards Publication TS-2 1998 as stated above except that the minimum average

continuous current capability shall be as shown below with DC voltages having less than 0.5 volts peak to peak ripple:

+12 VDC 5.0 Amps +24 VDC 2.0 Amps 12 VAC 0.250 Amps

### 8.0 TWO CIRCUIT SOLID STATE FLASHER

- 8.1 The solid state, two circuit flasher shall meet the electrical and physical characteristics described in Clause 6.3 of the NEMA Standards Publication TS-2 2003, or latest revision. The flasher shall be Type III (dual circuit rated at 15A per circuit) unit and so constructed that each component may be readily replaced if needed.
- 8.2 The two-circuit flasher shall be of solid state design and contain no electro-mechanical devices.

### 9.0 LOAD SWITCH

- 9.1 The solid state load switches shall meet the requirements set forth in Clause 6.2 of the NEMA Standards Publication TS-2 2003, or latest revision, and shall be "Triple-Signal Load Switch" type.
- 9.2 An indicator light for each circuit shall be provided in each load switch. The indicator light shall be on when a "Low Voltage Active" input to the load switch is present.

### 10.0 RISER

10.1 A 10" removable riser will be supplied with each cabinet. The riser shall be constructed using unpainted sheet aluminum with a minimum thickness of 3.2mm. No wood, wood fiber products or other flammable material shall be used in the cabinet. All welds shall be neat and of uniform consistency. The riser will be a (1) piece design so it can be added or removed to type 6 cabinet. The 3" mounting flange on the top and bottom will have the same anchor bolt hole pattern.

### 11.0 DOCUMENTATION

- 11.1 Each cabinet shall be provided with the following documentation:
  - A. Three complete, accurate, and fully legible diagrams and one schematic for every electronic device. This shall include but not be limited to cabinet wiring, back panel, detector panel, power panel, preempt panel, flasher circuit, load switch, card rack power supply, bus interface unit, and power supply diagrams.
  - B. Complete parts list including names of vendors for parts not identified by universal part numbers such as JEDEC, RETMA, or EIA.
  - C. Manufacturer's specifications for cooling fans which includes the CFM rating of fans.
- 11.2 Each controller unit shall be provided with the following documentation:
  - A. One service manual per unit which includes description of controller unit, description of its operation, and basic maintenance and troubleshooting information.
  - B. Two complete, accurate, and readable schematic diagrams for all circuitry in the controller unit. One set of these diagrams may be included in the service manual.

- C. Complete parts list including names of vendors for parts not identified by universal part numbers such as JEDEC, RETMA, or EIA. This may be included in the service manual.
- D. Pictorial of components layout for each circuit board or individual component identification permanently printed on each circuit board. Regardless of which of the above is provided, each electronic component on the board will need to be clearly identified or labeled. This may be included in the service manual.
- 11.3 Each MMU shall be provided with one each of the following documentation:
  - A. Complete and accurate schematic diagram.
  - B. Complete parts list including names of vendors for parts not identified by universal part numbers such as JEDEC, RETMA, or EIA.
  - C. Pictorial of component's layout on circuit board(s).
  - D. One service manual per unit, which includes description of MMU unit, description of its operation and basic maintenance, and troubleshooting information.
- Respondent shall be prepared to furnish NEMA certification for the complete cabinet assembly from an independent laboratory.

### 12.0 SOLICITATION REQUIREMENTS

- 12.1 The supplier's facilities shall be of sufficient size and staffing that any and all warranty repairs to the cabinet assembly provided shall be made on a timely basis. Timely return of equipment is interpreted as a period of time no longer than 18 calendar days from the date of receipt by the supplier to the return receipt of the equipment at the specified location. This requirement may be met by field service. Failure to meet these requirements may result in rejection of future solicitation.
- 12.2 The controller cabinet shall be delivered on 100 mm X 100 mm runners covered with 12.5 mm plywood to facilitate handling. Runners consisting of stacked 50 mm X 50 mm boards are not acceptable.
- 12.3 For ventilation purposes while testing, no cabinet components shall be packaged in boxes or bubble wrapped when shipped.
- 12.4 Polypropylene strapping material shall be used to secure all cabinet components for shipping. All load switches and flash transfer relays must also be secured, but glass filament tape may be used for these components. Other means of securing components are acceptable but require written approval by the Ft Bend County Traffic Engineer.

### 13.0 TEST AND ACCEPTANCE OF CONTROLLER CABINET ASSEMBLY

- 13.1 The supplier shall burn in each controller cabinet assembly for a period of 48 hours at a temperature of 60°C or for a period of 96 hours at a temperature of 23°C. A certification shall be included with or attached to each controller cabinet indicating the dates of the burn in period, number of hours, burn in temperature, and results.
- 13.2 Ft Bend County may test any controller cabinet assembly under load in a shop environment for a period of at least 120 hours. During this time, the entire controller cabinet assembly will be inspected for compliance with the specifications.
- 13.3 Ft Bend County may then perform any or all tests described in NEMA Standard Publication TS-2 2003, or latest revision on one or more complete controller cabinet assemblies on a random sample basis. Environmental sampling and testing shall be in accordance with the Traffic Operations Division Manual of Testing Procedures, Test Method TEX-1170-T, May 1999, or latest revision. Testing will be performed in the normal operating (i.e. non-flashing) range of 95-135V AC. All traffic signal cabinet assembly components shall operate normally at 95V AC as the unit would operate at 120V AC. If any of the assemblies fail any of the tests, the supplier will be permitted to make one complete repair of the order on a timely basis which will be determined by Ft Bend County and the testing will be redone. The supplier shall reimburse Ft Bend Co for any retesting required during acceptance. The cost for each retest will be based on time and charges and is estimated at \$1,500.00 per test.
- 13.4 Minor discrepancies noted in sampling and test of this item received shall be corrected within a maximum of 30 days of written notice of the discrepancies or as stated in the notice. Major discrepancies that in the opinion of Ft Bend County will substantially delay receipt and acceptance of the item will be cause for cancellation of the purchase order. Discrepancies found in partial shipments shall be corrected prior to the delivery of subsequent shipments.

- 13.5 The traffic signal controllers and cabinets shall be identical to the approved pre-shipment sample. Any deviations from the approved sample shall be submitted for evaluation and approval before any shipment is accepted for payment.
- 13.6 Deviations from the approved sample after shipment of any parts of the order shall be cause for rejection and non-payment of the remainder of the order. Excessive delays or noncompliance by the vendor at any point in the approval process may be cause for cancellation and non-payment.
- 13.7 Date of acceptance will be date that the Ft Bend County Traffic Engineer approves the controller cabinet assembly.
- 13.8 The Ft Bend County Traffic Engineer shall be provided closed loop software to monitor controller operations during testing.

### 14.0 MEASUREMENT

14.1 Measurement shall be made of each controller cabinet assembly with components required to make a complete assembly as specified in solicitation.

# 15.0 WARRANTY

- 15.1 The cabinet assembly including all contents shall be fully warranted for parts and labor for a minimum of 5 years from the date of acceptance.
- 15.2 Software/firmware updates shall be included as part of the warranty.

### 16.1 BATTERY BACK-UP SYSTEM

### 16.2 GENERAL

This specification establishes the minimum requirements for a complete emergency battery back-up system for use at traffic signals utilizing Light Emitting Diodes (LED) signals and pedestrian heads. The Battery Back-up System (BBS) shall include, but not be limited to the following: UPS with Inverter, Charger, Tap Switching Transformer and Internal Power Transfer Switch.

- 16.2.1 Automatic / Manual Bypass Transfer Switch unit.
- 16.2.2 Batteries
- 16.2.3 Cabinet
- 16.2.4 Mounting hardware
- 16.2.5 Wiring

The BBS shall provide reliable emergency power to a traffic signal in the event of a power failure or interruption.

## 16.3 OPERATION

The BBS shall provide the following operational modes when operating on battery power:

- a. Full operation of all traffic signal devices
- b. Flash operation
- c. Combination of full and flash operation
- 16.4 Run Time
- 16.4.1 The BBS shall provide a minimum of 8.0 hours of full time operation with a 450 watt load. The minimum battery size requirement is listed in section 7.0, Battery Type.
- 16.5 Compatibility
- 16.5.1 The BBS shall be compatible with Model 332, 336, and 337 cabinets; the ITS cabinet; model 170 and 2070 controllers and any NEMA style cabinet and enclosures; the advanced transportation controller; and all cabinet components for full time operation.
- 16.6 Output Capacity
- 16.6.1 The BBS shall provide a minimum of 1100W/1100VA@25°C active output capacity with 83 percent minimum inverter efficiency with 30% minimum loading.
- 16.7 Output Voltage
- 16.7.1 When operating in backup mode, The BBS output shall be  $120\text{VAC} \pm 2\%$ , pure sine wave output,  $\leq 3\%\text{THD}$ ,  $60\text{Hz} \pm 0.3$  Hz.
- 16.8 DC System Voltage
- 16.8.1 The BBS DC system voltage shall be 48VDC nominal.
- 16.9 Transfer Time
- 16.9.1 The maximum transfer time allowed, from disruption of normal utility line voltage to stabilized inverter line voltage from batteries, shall be 5 milliseconds (ms). The same maximum allowable time shall also apply when switching from the inverter line voltage to utility-line voltage. Transfers to and from battery operation shall not interfere with the operation of the other equipment in the intersection.
- 16.10 Operating Temperature
- 16.10.1 The BBS and all components shall operate without performance degradation over a temperature range of -40°C to +74°C with a maximum load of 70% of rated output of the BBS inverter.
- 16.11 Feedback Level
- 16.11.1 The BBS shall be tested and certified to Electrical Standards UL 1778 and CSA 107.3.
- 16.12 Surge Protection
- 16.12.1 The BBS shall have surge protection compliant with IEEE/ANSI C.62.41 Cat. A & B.
- 16.13 Reliability

- 16.13.1 The BBS system shall have a Mean-Time-Before-Failure (MTBF) of 174,955 hours at a temperature of 25 degree C (77 degree F) and 103,030 hours at a temperature of 50 degree C (122 degree F).
- 16.14Power and Control Connections
- 16.14.1 The BBS shall be easily installed, replaced, or removed by using easily removable cables for AC input, AC output, DC input, external transfer control/alarm and battery temperature sense.
- 16.15 AC Connection
- 16.15.1 The AC input and output shall hard wired connections.
- 16.17 DC Connection
- 16.17.1 The DC connection shall be a recessed one piece Anderson Style connector rated to handle the maximum DC current required by the inverter while running on batteries.
- 16.18 Temperature Probe Connections
- 16.18.1 The battery temperature sense inputs shall be panel-mounted Telco style connector.
- 16.19 Unit Failure
- 16.19.1 In the event of inverter/charger failure, battery failure or complete battery discharge, the automatic bypass transfer switch shall revert to Normally Closed (NC) (de-energized) state, where utility line power is connected to the cabinet.
- 16.20 Overload
- 16.20.1 The BBS Inverter Module must be able to shutdown in order to protect against internal damage in the event of an overload at the output. The Inverter shall support an overload up to 115% for 2 minutes and then turn off the inverter output. The fault recovers when the overload is removed and line power returns.
- 16.21 Schedule
- 16.21.1 The BBS shall provide a (2) time-of-day schedule settings programmable by the user.

  The time-of-day schedule shall allow the user to program schedule operational modes as required, per intersection.
- 16.21.2 The BBS time-of-day function when programmed shall automatically change operational modes based on the time-of-day schedule. Operational modes shall be Red Flash or Full Operation.
- 16.21.3 The BBS shall not switch from Flash Operation to Full Operation mode when the remaining battery capacity is ≤40 percent.
- 16.22 AC Feedback
- 16.22.1 The BBS shall prevent a malfunction feedback to the cabinet or from feeding back to the utility service.

- 16.23 BBS Failure Mode
- 16.23.1 In the event of BBS failure (inverter/charger or battery) or complete battery discharge, the internal power transfer relay shall revert to Normally Closed (de-energized) state and provide utility power to the intersection when utility line power is available to the cabinet.
- 16.24 Automatic Shutdown
- 16.24.1 The BBS shall initiate an automatic shutdown when battery output reaches 42.5VDC. Destructive Discharge or Overcharge
- 16.24.2 The BBS shall be equipped with an integral system to prevent the battery from destructive discharge or overcharge.
- 17.1 Automatic Bypass Transfer Switch
- 17.2 Rating
- 17.2.1 The BBS shall include an Automatic/Manual Transfer Switch rated at 120VAC/30 amps.
- 17.2.2 Automatic & Manual Bypass Switch
- 17.2.2.1The Automatic Bypass Transfer Switch shall be a combination automatic/manual bypass switch. Placing the bypass switch in the "Bypass" mode shall transfer the intersection load from the UPS output directly to commercial power. AC commercial power must still be available to the UPS input, allowing the UPS to keep the batteries charged. An Inverter Input breaker shall be provided and located on the Bypass Switch so to shut off commercial power to the UPS input, allowing safely disconnecting and removing the inverter. With the inverter turned off, the batteries can be safely disconnected from the system.
- 17.3 Indicator Light
- 17.3.1 The Automatic Bypass Transfer Switch shall include a bypass indicator light that automatically notifies the user when the Manual bypass switch is in Bypass position. The indicator light shall be illuminated when in UPS mode.
- 17.4 Status Relay
- 17.4.1 The Automatic Transfer Switch shall have an optional bypass status relay with normally open, dry contacts that automatically close when the Manual bypass switch is in Bypass position.
- 17.5 Integrated Switch
- 17.5.1 The manual bypass switch and the automatic transfer relay shall be integrated together within the Automatic Bypass Transfer Switch allowing the manual bypass switch to be rated at 15 Amp and to be integrated with the bypass indicator light.
- 17.6 Terminal Blocks
- 17.6.1 The Automatic Bypass Transfer Switch shall have terminal blocks capable of accepting #6 AWG

wiring for the AC input and output with #10 AWG from the Automatic Bypass Transfer Switch to inverter/charger module.

- 18.1 Functionality
- 18.2 Output Voltage Regulation Mode
- 18.2.1 The BBS shall include AVR (Auto Voltage Regulation) Functionality.
- 18.2.2 AC Input Voltage Range for Output Regulation
- 18.2.3 The Buck/Boost mode shall have a minimum range of 88 175 VAC
- 18.3 Transfer Set Points
- 18.3.1 There shall not be any user definable transfer set points for the buck boost mode.
- 18.4 Regulated Voltage
- 18.4.1 Whenever AVR mode is selected the output of the system shall be regulated between 108-130VAC. When the output of the system can no longer be maintained with this range, the BBS shall transfer to Backup Mode.
- 18.5 Circuit Breakers
- 18.5.1 The BBS shall be equipped with an AC Input circuit breaker that protects both the UPS and the loads connected to the output. Should the AC Input breaker on the UPS trip, it shall allow the UPS to go to inverter mode to power the intersection off of batteries. Should an overload condition still exist when the inverter is energized the inverter will revert to its internal electronic protection, preventing damage to the inverter due to the overload or short circuit condition, on the output. Once this overload condition is cleared the inverter will energize and power the intersection utilizing the available battery power. If the condition does not clear itself, the inverter will stay in the standby mode until manually cleared by a technician.
- 18.5.2 The BBS shall have a flush mounted Battery circuit breaker installed on the front panel of the BBS inverter module.
- 18.6 Line Qualify Time
- 18.6.1 The BBS shall have a user definable line qualify time. The user shall be able to select a minimum of six (6) possible settings. The settings shall be 3, 10, 20, 30, 40 and 50 seconds. The default line qualify time shall be 3 seconds.
- 18.7 Battery Charger
- 18.7.1 The BBS shall have an integral charger that is compatible with Gel and AGM battery topology. The charger shall be an intelligent charger with control systems that automatically incorporates bulk, absorption and float charging modes.
- 18.8 Battery Temperature Compensation

- 18.8.1 The integral Intelligent Charger shall use temperature compensation. The charging system shall compensate over a range of 2.5 6.0 mV/°C per cell, user adjustable when required.
- 18.9 Battery Temperature Sensor
- 18.9.1 A temperature probe which plugs into the front panel of the BBS shall be used to monitor the internal temperature of the batteries. The Temperature sensor shall be 2 meter in length, external to the inverter/charger module and taped to the side of a center battery within the battery string.
- 18.10 Battery Temperature Charging
- 18.10.1 The batteries shall not be recharged whenever the battery temperature exceeds 50°C.
- 18.11 Recharge Time
- 18.11.1 The recharge time for the batteries from "protective low-cutoff" to 90 percent or more of full charge capacity shall not exceed 12 hours. The BBS charger shall be capable of providing 15 amps at 54VDC.
- 19.1 User Interfaces and Displays
- 19.2 Inverter/Charger Display
- 19.2.1 The BBS inverter/charger unit shall include a backlit LCD display for viewing all status and configuration information. The screen shall be easily viewable in both bright sunlight and in darkness.
- 19.3 Screen Size
- 19.3.1 The screen shall be large enough to display the following information with the use of menu scrolling buttons to read required information. All active readings shall be real time.
- Operating Mode (Line, Standby, Backup, Buck / Boost)
- Utility input voltage
- BBS output voltage and current
- Battery Temperature
- Input Frequency
- Output Power
- Battery Voltage
- Charger Current
- Shed Timer Relays time to activation
- Ethernet MAC Address and IP Address
- Accumulated output power in kW hours
- Battery Runtime Remaining
- Unit Serial number
- Unit Firmware Version
- Any alarms and faults
- 19.4 Keypad

- 19.4.1 The BBS inverter/charger unit shall include a keypad for navigating system information.
- 19.5 Web-based Interface
- 19.5.1 The BBS shall be provided with a web-based-interface for user configuration and management through a web browser.
- 19.6 Minimum Capabilities
- 19.6.1 The BBS shall allow the user to do the following through the web browser
- View Logs
- Change modes of operation
- Configure email alarms
- Adjust line qualify time
- Program relay contacts
- Configure network parameters.
- Inverter/charger firmware to be upgradeable remotely via Ethernet.
- Communication module firmware upgradeable remotely.
- 19.7 Status LEDs
- 19.7.1 The BBS shall have discrete status LED indications on the front of the inverter/charger.
- 19.8 Green Output LED
- 19.8.1 This LED will be ON any time that the output of the BBS is in normal mode. When the BBS output is either in Backup Mode or AVR Modes the LED will flash On and Off.
- 19.9 Red Fault LED
- 19.9.1 This LED will be Solid On any time that there are any faults in the system
- 19.10 Red Flashing Alarm LED
- 19.10.1 This LED will Flash On and Off any time that there are any alarms in the system.
- 19.11 Event Log
- 19.11.1 The BBS shall maintain an event log containing a minimum of 200 of the most recent events recorded by the BBS. These events shall be down loadable remotely via Ethernet and automatically reported to the central monitoring software. The Events Log shall be date and time stamped
- 19.12 Events, Alarms and Faults
- 19.12.1 The BBS shall display and log the following events, alarms and faults.
- Operating Mode
- Weak Battery
- Overload
- High and Low Temperatures
- User Input, S2 is shorted

- Line Frequency out of specifications
- No temperature probe
- Low Battery
- Battery Breaker Open
- BBS is performing a Self-Test
- Fan Fail
- Incorrect Firmware
- AC Input Breaker Open
- Short Circuit
- Output Voltage High
- Output Voltage Low
- Battery Voltage High
- Battery Voltage Low
- Isolation Relay Fail
- Temperature High

### 19.13 Counters

- 19.13.1 The BBS shall keep track of the following:
- The number of times that the unit was in Backup Mode
- The accumulated number of hours and minutes that the unit has operated in Backup mode since the last reset
- 19.14 Programmable Relay Contacts
- 19.14.1 The BBS shall provide the user six (5) programmable dry relay contacts and one (1) 48VDC relay contact. As a minimum, the programmable options shall be On Battery, Low Battery, Timer, Alarm, Fault, and Off. The BBS shall also have three (3) input dry relay contacts. BBS Self Test, User Alarm, and BBS Shutdown.
- 19.15 Relay Contact Terminals
- 19.15.1 The relay contacts shall be made available on the front panel of the BBS via 6, 3 position plug-in terminal blocks with screw down wiring connections.
- 19.16 Contacts
- 19.16.1 Each relay, C-1 through C-5 shall have their own common and their own set of normally open (NO) and normally closed (NC) terminals. The terminals for each relay shall be oriented as NO-C-NC on the terminal block. C-6 shall provide continuous 48 VDC voltage for powering of enclosure DC fan.
- 19.17 Labeling
- 19.17.1 The contacts on the terminal block shall be labeled 1-18, left to right. Additionally, each set of contact shall be labeled with the NO-C-NC designation, as well as C1...C6 from left to right. Printed labels noting all alarms and faults shall be provided with the BBS Inverter/Charger to be installed when required.
- 19.18 Rating

- 19.18.1 The relay contacts shall be rated at a minimum of 1 amp @ 250 VAC.
- 19.19 On Battery Relay Contact
- 19.19.1 The dry relay contacts that are configured for "on battery" shall only energize when the Inverter is operating in Backup Mode
- 19.20 Timer Relay Contacts
- 19.20.1 The BBS shall include a timer that will energize the "timer" configured dry relay contact after the user configured time has elapsed. The timer is started when the BBS enters Backup Mode. The user shall be able to configure the timer to the required time. The format shall be Hours, Minutes, Seconds.
- 19.21 Low Battery Relay Contact
- 19.21.1 The BBS shall have an adjustable low battery relay setting. This setting shall be adjustable so that the user can set the point at which the low battery relay contact is energized.
- 20.0 Communications
- 20.1 Serial Interface
- 20.1.1 The BBS shall be equipped with an industry standard RS-232 serial connection for user configuration and management. The serial port shall be an EIA-232 (DB9-Female) connector.
- 20.2 Ethernet Interface
- 20.2.1 The BBS shall have an internal Ethernet communication interface for user configuration and management. The Ethernet Port shall be an RJ-45, EIA 568B Pin Out Connector.
- 20.3 Remote Monitoring
- 20.3.1 The BBS shall be include remote monitoring & alarms transmission capabilities through the Ethernet RJ-45 IP Addressable Port, using SNMP protocol.
- 20.4 Notification
- 20.4.1 System shall have the capability of notifying Operations, Maintenance or TMC via e-mail of any alarms, faults or events, user selectable. E-mail set up must allow for different levels of notifications based on the criticalness of the alarms.
- 20.5 User Configuration Menus
- 20.5.1 All BBS configuration and System menus shall be accessible and programmable from the RS-232 and Ethernet Port.
- 20.6 Communication Protocols

- 20.6.1 The BBS shall support TCP and UDP over IP protocol communications.
- 20.7 Application Layer Protocols
- 20.7.1 The BBS shall support FTP, Telnet, and HTTP.
- 20.8 SNMP
- 20.8.1 The BBS shall be SNMP compliant.
- 21.0 Batteries
- 21.1 Battery Type
- 21.1.1 The battery shall be comprised of extreme temperature, float cycle, GEL VRLA (Valve Regulated Lead Acid). Individual batteries shall meet the following specifications:
  - Voltage Rating: 12V
  - Amp-hour rating: 109 AH, at the 20 hour rate, to 1.75 Volts per cell, minimum battery rating. Larger AH batteries are acceptable providing they do not exceed the group size listed below. (Case 31)
  - Group size: Case 31
  - -Batteries shall be easily replaced and commercially available off the shelf
  - Batteries shall provide 100% runtime capacity out-of-box. Each battery must meet its specification without the requirement of cycling upon initial installation and after the initial 24 hour top off charge.
- 21.2 Battery String
- 21.2.1 Batteries used for the BBS shall consist of a 4 batteries configured for a 48 VDC battery buss system.
- 21.3 Operating Temperature
- 21.3.1 The battery system shall consist of one or more strings of extreme temperature; float cycle GEL VRLA (Valve Regulated Lead Acid) batteries. Batteries shall be certified to operate at extreme temperatures from -40°C to +71°C.
- 21.4 Terminals
- 21.4.1 The batteries shall have maintenance-free threaded insert terminals eliminating annual torqueing. Battery terminals that require annual torqueing of each post connection shall not permitted.
- 21.5 Ability to Function
- 21.5.1 An integral lifting handle should be provided on the batteries for ease of removal/installation.
- 22.0 Cabinet
- 22.1 BBS Cabinet Dimensions

- 22.1.1 The dimensions for the BBS cabinet shall not exceed 50 inches in height, 17 inches in width and 17 inches in depth.
- 22.2 Inverter/Charger Mounting
- 22.2.1 The Inverter/Charger Unit shall be shelf or rack mounted on a standard EIA19" rack.
- 22.3 Automatic Transfer Switch Mounting
- 22.3.1 The Automatic Transfer switch shall be mounted on EIA 19" Rail.
- 22.4 Interconnect Wiring
- 22.4.1 All interconnect wiring shall be provided and shall be UL Style 1015 CSA TEW.
- 22.5 BBS Replacement
- 22.5.1 The BBS equipment and batteries shall be easily replaced and shall not require any special tools for installation.
- 22.6 Hot Swappable
- 22.6.1 The BBS inverter and batteries shall be hot swappable. There shall be no disruption to the Traffic Signal when removing the inverter or batteries for maintenance.
- 22.7 Quick Disconnects
- 22.7.1 All inverter and battery connections shall be of the quick disconnect type for ease of maintenance
- 22.8 Ancillary Installation Hardware
- 22.8.1 All necessary installation hardware (bolts, fasteners, washers, shelves, racks, etc.) shall be included.
- 22.9 Cabinet Sizing
- 22.9.1 The external cabinet shall be capable of housing batteries up to a group 31 size, inverter/charger power module, automatic transfer switch, control panels, wiring, wiring harnesses, and all other ancillary equipment.
- 22.10 Cabinet Types
- 22.10.1 The BBS can be installed either as:
  - (1) free-standing base-mounted cabinet with optional 8" riser for easy cable entrance.
  - (2) pole-mounted cabinet with optional pole mount bracket kit.
  - (3) side-mounted to a Traffic Controller cabinet with no mounting brackets required.
- 22.11 Rating
- 22.11.1 All external cabinets shall be NEMA 3R rated. The enclosure shall be made of 0.125 (5052-H32) aluminum.

- 22.12 Ventilation
- 22.12.1 The external cabinet shall be ventilated through the use of louvered vents, filter, and one thermostatically controlled fan. The filter shall be the re-usable type and matching the dimensions of the louver with both located on the bottom half of the door.
- 22.13 The cabinet fan shall be DC operated for longer reliability.
- 22.14 Ancillary Hardware
- 22.14.1 The BBS cabinet shall come with all bolts, washers, nuts required to mount it to a Controller cabinet.
- 22.15 Accessibility
- 22.15.1 All components, terminations, terminal blocks, relays, etc. shall be fully accessible.
- 22.16 Shelves
- 22.16.1 Battery shelves shall be located in the bottom half of the enclosure. The bottom battery shelf shall be removable and the top battery shelf will be welded to the enclosure sides. Air must be allowed for flow from the bottom of the cabinet and up the back internal wall. Neither the top battery shelf nor the Power Module shelf shall inhibit the airflow to the top of the cabinet.
- 22.17 Locking
- 22.17.1 The cabinet shall include a 3 point locking system, including a Type 2 Corbin lock and utilize a handle with pad locking capability.
- 22.18 Cabinet Options
- 22.18.1 The following options shall be available for the cabinet:
- On-Battery lamp mounted externally on the top of the cabinet that illuminates when the BBX is operating in inverter mode.
- Battery Heater Mats to increase battery capacity in cold climates.
- Receptacle plate assembly that mounts on the transfer switch panel to provide utility power to the battery heater mats.
- Automatic Generator Transfer switch that senses a generator is connected and automatically switches to the generator source.
- Internal lamp with door push-button switch to illuminate the interior of the cabinet.
- Status monitoring dry contacts for the Automatic Transfer Switch and the Generator Transfer Switch.
- 23.0 Maintenance
- 23.1 Probe Jacks
- 23.1.1 The BBS shall provide voltmeter standard probe input-jacks (+) and (-) to read the exact battery voltage drop at the inverter input.

- 23.2 Self-Testing
- 23.2.1 The BBS Inverter Module shall be programmable to perform automatic self-testing, programmed in weekly intervals and programmed by the user to meet their specific requirements or manufacturer's recommendation. During self-test the BBS Inverter Module shall identify a weak battery or multiple batteries in the string that have reached a weak state and notify maintenance by initiating a Weak Battery Alarm.
- 23.3 Remote Battery Monitoring Specifications:
- 23.3.1 Provide a remote battery monitor system (RBMS) to be permanently installed into the UPS/Battery cabinet to monitor the four UPS batteries (4-12V battery blocks). The RBMS shall have the ability to monitor, read and record both the battery string and individual battery voltages, admittance (internal battery resistance), individual battery temperatures and to provide a real-time evaluation of the battery bank health.
- 23.4 The RBMS shall have a built in web interface for communications over Ethernet. The device shall be hardened and operate at a temperature range of -40C to +65C. The device shall include individual 12 volt battery sensors and operate in the range of -40C to +80C. Communications shall be SNMP via TCP/IP.
- 23.4 The RBMS shall include software to automatically poll each intersection, up to 100 per software program, reading individual battery voltage, admittance and temperature, confirming each is within its user programmable parameters. The system shall have the ability to program the intervals as to when each reading is taken, by days, weeks or months. The software shall be provided as part of the system cost.
- 23.5 The RBMS shall also perform as a battery balancer, continuously monitoring all batteries in the string and to interface with the UPSs charger voltage/current so to keep the batteries equal with all batteries within the battery string. The RBMS shall allow for any single 12V battery within the battery string to be replaced without replacing all batteries in the string during the battery warranty period.
- 24.0 Warranty
- 24.1 Battery Backup System
- 24.1.1 The BBS System shall include a five-year warranty on parts and labor on the entire BBS System, including batteries, to the Agency when utilizing the BBS Manufacturers own designed enclosure, meeting the above cabinet specifications.
- 24.1.2 Should the agency decide not to use the enclosure provided by the BBS Manufacturer, the manufacturer must provide a three-year warranty on parts and labor on the BBS Inverter Module only.
- 24.2 Batteries
- 24.2.1 The BBS Manufacturer must provide a 5 year unconditional full replacement warranty for every battery sold to the Agency with the BBS under this specification. Under the warranty time period,

the battery must provide a minimum of 70% of its original capacity; otherwise it will be considered to be non-compliant to the warranty and replaced at no cost to the Agency or DOT by the BBS manufacturer.

- 25.0 Vendor Support
- 25.1 Technical Support
- 25.1.1 The BBS manufacturer shall provide a toll-free technical support phone number. The toll-free phone number shall be included in the BBS manual.
- 25.1.2 Documentation
- 25.1.2.1 Equipment manuals must be provided for each BBS cabinet. Equipment manuals shall include installation, operation, programming, maintenance and troubleshooting.
- 26.0 Quality Assurance
- 26.1 Design and Production
- 26.1.1 Each BBS shall be manufactured in accordance with a written manufacturer's Quality Assurance program. The QA program shall include, as a minimum, specific design and production QA procedures.
- 26.2 ISO Certified
- 26.2.1 The BBS Power Module manufacturer shall be ISO 9001 or ISO 9002 certified.
- 26.3 Design Qualification Testing
- 26.3.1 The manufacturer shall be certified to carry out the CSA and UL standards testing on the BBS system.
- 27.0 VIDEO DETECTION
- 27.1 General
- 27.1.1 This specification sets forth the minimum requirements for a system that monitors vehicles on a roadway via processing of video images. The detection of vehicles passing through the field-of-view of an image sensor shall be made available to a large variety of end user applications as simple contact closure outputs that reflect the current real-time detector or alarm states (on/off) or as summary traffic statistics that are reported locally or remotely. The contact closure outputs shall be provided to a traffic signal controller and comply with the National Electrical Manufacturers Association (NEMA) type C or D detector rack or 170 input file rack standards.
- 27.1.2 The system architecture shall fully support Ethernet networking of system components through a variety of industry standard and commercially available infrastructures that are used in the traffic industry. The data communications shall support direct connect, [modem,] and multi-drop interconnects. Simple, standard Ethernet wiring shall be supported to minimize overall system cost and improve reliability, utilizing existing infrastructure and ease of system installation and

- maintenance. Both streaming video and data communications shall optionally be interconnected over long distances through fiber optic, microwave, or other commonly used digital communications transport configurations.
- 27.1.3 On the software application side of the network, the system shall be integrated through a client-server relationship. A communications server application shall provide the data communications interface between as few as one to as many as hundreds of Machine Vision Processor (MVP) sensors and a number of client applications. The client applications shall either be hosted on the same PC as the communications server or may be distributed over a local area network of PC's using the industry standard TCP/IP network protocol. Multiple client applications shall execute simultaneously on the same host or multiple hosts, depending on the network configuration. Additionally, a web-browser interface shall allow use of industry standard Internet web browsers to connect to MVP sensors for setup, maintenance, and playing digital streaming video.

## 27.2 System Hardware

- 27.2.1 The machine vision system hardware shall consist of three components: 1) a color, 559 step, 10x zoom, MVP sensor 2) a modular cabinet interface unit 3) a communication interface panel. Additionally, an optional personal computer (PC) shall host the server and client applications that are used to program and monitor the system components. The real-time performance shall be observed by viewing the video output from the sensor with overlaid flashing detectors to indicate the current detection state (on/off). The MVP sensor shall optionally store cumulative traffic statistics internally in non-volatile memory for later retrieval and analysis.
- 27.2.2 The MVP shall communicate to the modular cabinet interface unit via the communications interface panel and the software applications using the industry standard TCP/IP network protocol. The MVP shall have a built-in, Ethernet-ready, Internet Protocol (IP) address and shall be addressable with no plug in devices or converters required. The MVP shall provide standard MPEG-4 streaming digital video. Achievable frame rates shall vary from 5 to 30 frames/sec as a function of video quality and available bandwidth.
- 27.2.3 The modular cabinet interface unit shall communicate directly with up to eight (8) MVP sensors and shall comply with the form factor and electrical characteristics to plug directly into a NEMA type C or D detector rack providing up to thirty-two (32) inputs and sixty-four (64) outputs or a 170 input file rack providing up to sixteen (16) contact closure inputs and twenty-four (24) contact closure outputs to a traffic signal controller.
- 27.2.4 The communication interface panel shall provide four (4) sets of three (3) electrical terminations for three-wire power cables for up to eight (8) MVP sensors that may be mounted on a pole or mast arm with a traffic signal cabinet or junction box. The communication interface panel shall provide high-energy transient protection to electrically protect the modular cabinet interface unit and connected MVP sensors. The communications interface panel shall provide single-point Ethernet connectivity via RJ45 connector for communication to and between the modular cabinet interface module and the MVP sensors.

# 27.3 System Software

27.3.1 The MVP sensor embedded software shall incorporate multiple applications that perform a variety of diagnostic, installation, fault tolerant operations, data communications, digital video streaming, and vehicle detection processing. The detection shall be reliable, consistent, and

perform under all weather, lighting, and traffic congestion levels. An embedded web server shall permit standard internet browsers to connect and perform basic configuration, maintenance, and video streaming services.

- 27.3.2 There shall be a suite of client applications that reside on the host client / server PC. The applications shall execute under Microsoft Windows XP, Vista or Windows 7. Available client applications shall include:
  - Master network browser: Learn a network of connected modular cabinet interface units and MVP sensors, display basic information, and launch applications software to perform operations within that system of sensors.
- 27.3.3 Configuration setup: Create and modify detector configurations to be executed on the MVP sensor and the modular cabinet interface unit.
  - Operation log: Retrieve, display, and save field hardware run-time operation logs of special events that have occurred.
  - Software install: Reconfigure one or more MVP sensors with a newer release of embedded system software.
  - Streaming video player: Play and record streaming video with flashing detector overlay.
  - Data retrieval: Fetch once or poll for traffic data and alarms and store on PC storage media.
  - Communications server: Provide fault-tolerant, real-time TCP/IP communications to / from all devices and client applications with full logging capability for systems integration. The communications server shall operate as a Windows Service.

### 27.4 MVP Sensor

27.4.1 The MVP sensor shall be an integrated imaging color CCD array with zoom lens optics, high-speed, dual-core image processing hardware bundled into a sealed enclosure. The CCD array shall be directly controlled by the dual-core processor, thus providing high-quality video for detection that has virtually no noise to degrade detection performance. It shall be possible to zoom the lens as required for setup and operation. It shall provide JPEG video compression as well as standard MPEG-4 digital streaming video with flashing detector overlay. The MVP shall provide direct real-time iris and shutter speed control. The MVP image sensor shall be equipped with an integrated 559 step,10x zoom lens that can be changed using either configuration computer software. The digital streaming video output and all data communications shall be transmitted over the three-wire power cable.

# 27.5 Power

- 27.5.1 The MVP sensor shall operate on 110/220 VAC, 50/60Hz at a maximum of 25 watts. The camera and processor electronics shall consume a maximum of 10 watts and the remaining 15 watts shall support an enclosure heater.
- 27.6 Detection Zone Programming
- 27.6.1 Placement of detection zones shall be by means of a PC with a Windows XP, Vista or Windows 7 operating system, a keyboard, and a mouse. The PC monitor shall be able to show the detection zones superimposed on images of traffic scenes.
- 27.6.2 The detection zones shall be created by using a mouse to draw detection zones on the PC monitor.

Using the mouse and keyboard it shall be possible to place, size, and orient detection zones to provide optimal road coverage for vehicle detection. It shall be possible to download detector configurations from the PC to the MVP sensor and cabinet interface module, to retrieve the detector configuration that is currently running in the MVP sensor, and to back up detector configurations by saving them to the PC fixed disks or other removable storage media.

27.6.3 The supervisor computer's mouse and keyboard shall be used to edit previously defined detector configurations to permit adjustment of the detection zone size and placement, to add detectors for additional traffic applications, or to reprogram the MVP sensor for different traffic applications or changes in installation site geometry or traffic rerouting.

# 27.6 Optimal Detection

27.6.1 The video detection system shall optimally detect vehicle passage and presence when the MVP sensor is mounted 30 feet (10 m) or higher above the roadway, when the image sensor is adjacent to the desired coverage area, and when the distance to the farthest detection zone locations are not greater than ten (10) times the mounting height of the MVP. The recommended deployment geometry for optimal detection also requires that there be an unobstructed view of each traveled lane where detection is required. Although optimal detection may be obtained when the MVP is mounted directly above the traveled lanes, the MVP shall not be required to be directly over the roadway. The MVP shall be able to view either approaching or receding traffic or both in the same field of view. The preferred MVP sensor orientation shall be to view approaching traffic since there are more high contrast features on vehicles as viewed from the front rather than the rear. The MVP sensor placed at a mounting height that minimizes vehicle image occlusion shall be able to simultaneously monitor a maximum of six (6) traffic lanes when mounted at the roadside or up to eight (8) traffic lanes when mounted in the center with four lanes on each side.

### 27.7 Count Detection Performance

- 27.7.1 Using an installed camera that meets the optimal viewing specifications described above for count station traffic applications, the system will be able to accurately count vehicles with at least 98% accuracy under normal operating conditions (day and night), and at least 93% accuracy under artifact conditions.
- 27.7.2 Artifact conditions are combinations of weather and lighting conditions that result from shadows, fog, rain, snow, etc. The volume count will be accumulated for the entire roadway (all traveled lanes), and accumulated over time intervals that contain a minimum of one hundred (100) vehicles to ensure statistical significance.
- 27.8 Demand Presence Detection Performance
- 27.8.1 Using an installed camera that meets the optimal viewing specifications described above for intersection control traffic applications, the system will be able to accurately provide demand presence detection.
- 27.8.2 The demand presence accuracy will be based on the ability to enable a protected turning movement on an intersection stop line, when a demand exists. The probability of not detecting a vehicle for demand presence will be less than 1% error under all operating conditions. In the presence of artifact conditions, the MVP will minimize extraneous (false) protected movement calls to less than 7%.

- 27.8.3 To ensure statistical significance, the demand presence accuracy and error will be calculated over time intervals that contain a minimum of one hundred, protected turning movements.
- 27.8.4 These performance specifications will be achieved with a minimum of 2 presence detectors coupled with a single detector function (Type-9) to provide adequate road coverage to sample the random arrival pattern of vehicles at the stop line.
- 27.8.5 The calculation of the demand presence error will not include turning movements where vehicles do not pass through the presence detectors, or where they stop short or stop beyond the combined detection zones.
- 27.9 Speed Detection Performance
- 27.9.1 The MVP will accurately measure average (arithmetic mean) speed of multiple vehicles with more than 97% accuracy under all operating conditions for approaching and receding traffic.
- 27.9.2 The average speed measurement will include a minimum of 100 vehicles in the sample to ensure statistical significance. Optimal speed detection performance requires the camera location to follow the specifications described above for count station traffic applications with the exception that the camera must be higher than 13 m (40) feet.
- 27.9.3 The MVP will accurately measure individual vehicle speeds with more than 94% accuracy under all operating conditions for vehicles approaching the camera (viewing the front end of vehicles), and more than 90% accuracy for vehicles receding from the camera (viewing the rear end of vehicles).
- 27.9.4 These specifications will apply to vehicles that travel through both the count and speed detector pair and will not include partial detection situations created by lane-changing maneuvers.
- 27.9.5 To ensure statistical significance, the average speed accuracy and error will be calculated over time intervals that contain a minimum of one hundred vehicles.
- 27.9.6 Using a MVP sensor installed within the optimal viewing specifications described above or count station traffic applications.
- 27.10 Modular Cabinet Interface Unit
- 27.10.1 The modular cabinet interface unit shall provide the hardware and software means for up to eight (8) MVP sensors to communicate real-time detection states and alarms to a local traffic signal controller. It shall comply with the electrical and protocol specifications of the detector rack standards. The card shall have 1500 Vrms isolation between rack logic ground and street wiring.
- 27.10.2 The modular cabinet interface unit shall be a simple interface card that plugs directly into a 170 input file rack or a NEMA type C or D detector rack. The modular cabinet interface unit shall occupy only 2 slots of the detector rack. The modular cabinet interface unit shall accept up to sixteen (16) phase inputs and shall provide up to twenty-four (24) detector outputs.
- 27.11 Communications Interface Panel

- 27.11.1 The communications interface panel shall support up to six MVPs. The communications interface panel shall accept 110/220 VAC, 50/60 Hz power and provide predefined wire termination blocks for MVP power connections, a Broadband-over-Power-Line (BPL) transceiver to support up to 10MB/s interdevice communications, electrical surge protectors to isolate the modular cabinet interface unit and MVP sensors, and an interface connector to cable directly to the modular cabinet interface unit.
- 27.11.2 The interface panel shall provide power for up to eight (8) MVP sensors, taking local line voltage 110/220 VAC, 50/60 Hz and producing 110/220 VAC, 50/60 Hz, at about 30 watts to each MVP sensor. Two ½-amp SLO-BLO fuses shall protect the communications interface panel.
- 27.12 System Training and Testing
- 27.12.1 The supplier of the video detection system may supervise the installation and testing of the video detection system and computer equipment as required by the contracting agency.
- 27.12.2 Training is available to personnel of the contracting agency in the operation, set up, and maintenance of the video detection system. The MVP sensor and its support hardware / software is a sophisticated leading-edge technology system. Proper instruction from certified instructors is recommended to ensure that the end user has complete competency in system operation. The User's Guide is not an adequate substitute for practical classroom training and formal certification by an approved agency.
- 27.13 Warranty, Service, and Support
- 27.13.1 For a minimum of three (3) years, the supplier shall warrant the video detection system. An option for additional year(s) warranty for up to 6 years shall be available. Ongoing software support by the supplier shall include software updates of the MVP sensor, modular cabinet interface unit, and supervisor computer applications. These updates shall be provided free of charge during the warranty period. The supplier shall maintain a program for technical support and software updates following expiration of the warranty period. This program shall be available to the contracting agency in the form of a separate agreement for continuing support.

Appendix A

Each table will designate the options and quantity for each type of cabinet and controller. Check only one box per section.

QUANTITY		
Controller Type		
	Type 1 - SDLC	
	Type 2 - SDLC and A, B, C connectors	
Cabinet Size		200
	Size 5 Pole mount – Back panel Configuration 3 (12 position)	
	Size 5 Base mount – Back panel Configuration 3 (12 position)	
	Size 6 Base mount – Back panel Configuration 3 (12 position)	
	Size 6 Base mount – Back panel Configuration 4 (16 position)	
NTCIP		
	NTICP compliant	
L	Downward compatible with existing system	
QUANTITY		
Controller Type		
	Type 1 - SDLC	
	Type 2 - SDLC and A, B, C connectors	
Cabinet Size		
	Size 5 Pole mount – Back panel Configuration 3 (12 position)	
	Size 5 Base mount – Back panel Configuration 3 (12 position)	
	Size 6 Base mount - Back panel Configuration 3 (12 position)	1
QUANTITY		
Controller Type		
	Type 1 - SDLC	
	Type 2 - SDLC and A, B, C connectors	
Cabinet Size		
	Size 5 Pole mount with mounting hardware- Back panel	
	Configuration 3 (12 position)	
	Size 5 Base mount – Back panel Configuration 3 (12 position)	
	Size 6 Base mount – Back panel Configuration 3 (12 position)	
NTCIP	Size 6 Base mount – Back panel Configuration 4 (16 position)	Carron valor van
NICIP	NTICP compliant	1 S. A.
	Downward compatible with existing system	

# TOLL ROAD AUTHORITY BEND GRAND PARKWAY FORT

000

INDEX OF SHEETS
SEE SHEET 2 FOR INDEX OF SHEETS

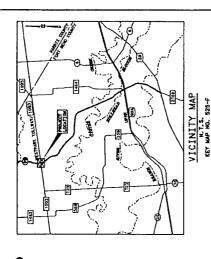
DESIGN SPEED - 45 MPH (SH 99 FRONTACE ROAD)

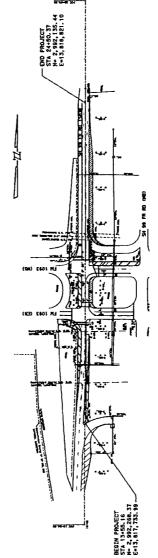
FORT BEND GRAND PARKWAY TOLL ROAD - SEGMENT D PLANS OF PROPOSED

1093  $\sum_{L}$  $\vdash$ FORT BEND COUNTY (SB) RD FRTG 99 SH

FROM 0.07 MILE SOUTH OF FM 1093 EB TO 0.10 MILE NORTH OF FM 1093 WB

FOR THE CONSTRUCTION OF WIDENING OF A FREEWAY FRONTAGE ROAD CONSISTING OF FAST TRACK CONCRETE PAVEMENT, DRAINAGE STRUCTURES, SIGNAL MODIFICATION, SIGNING, PAVEMENT MARKINGS, AND SLOPE & RIPRAP REPAIRS FT = 0.207 WILES FT = 0 WILES FT = 0.207 WILES ROADWAY LENGTH = 1095.21
BRIDGE LENGTH = 0
NET LENGTH OF PROJECT = 11993.21





EXCEPTIONS: NONE
EQUATIONS: NONE
RAILROAD CROSSINGS: NONE LOCATION MAP

PREPARED BY:

THEN CANALLY UTTAN XABURKER, P. E. PROJECT MANAGER

FORT BEND GRAND PARKKAY TOLL ROAD AUTHORITY BROWN Brown & Gay Engineers, Inc. & GAY Man - Common - Free Section - Free Sectio GART GEHBABER, P.E. ENDINEESTING MANAGER

DATE: 2-9-2/7

DATE: 2/1/2017

ALL BEARTINGS AND COORDINATES ARE BASED ON THE TEXAS COORDINATE SYSTEM, SOUTH CERTRAL ZONE, NORTH AMERICAN DATAM OF 1883, 1893 ADJUSTABENT. ALL DISTANCES AND COORDINATES SHOWN ARE SURFACE AND MAY BE CONVENTED TO GAID BY DIVIDING BY A COMBINED ADJUSTABENT FACTOR OF 1,00013. ALL ELEVATIONS ARE REFERENCED TO MAYO 88, 2011 ADJUSTMENT.

OSN STANDARD TO INVOYATION OF

HOTES

SPECIFICATIONS ADOPTO BY THE TEXAS DEPRIMENT OF TRANSPORTITION, HAVEDBERT 2014 AND ALTE 2014 AND VECTAL AND SECTAL AND SECTIONS AS INDICATED IN THE BID PROPOSAL SMALL OWER ON THIS PROJECT.

APPROVED BY:

RECOMMENDED BY:

CHAIRMAN, BOARD OF DIRECTORS

DATE 2 -15- 2017

. Washert Toh-of-Eliscovic dan