



MARYLAND TRANSIT ADMINISTRATION

MARYLAND DEPARTMENT OF TRANSPORTATION

Martin O'Malley, Governor • Anthony G. Brown, Lt. Governor
Darrell B. Mobley, Acting Secretary • Ralign T. Wells, Administrator

TO: All Planholders

FROM: Maryland Transit Administration

SUBJECT: **ADDENDUM NO. 5**
Contract No.: T-1384-0140
Metro Shot Tower Station Structural Preservation & Miscellaneous Improvements

DATE: May 9, 2013

Enclosed and effective this date is Addendum No. 5 to the subject Contract. This change does not delay the Step 1-Technical Bid and Step 2-Price Bid Due date from **May 16, 2013 at 2pm EST**.

The Bidder shall acknowledge receipt of this Addendum by completing and returning this form with the bid package.

All other terms and conditions remain unchanged.

Sincerely,

Rick Owens, Procurement Officer
Professional Services/Construction/Installation Section
Procurement Division

Acknowledgement of receipt of ADDENDUM # 5 to Solicitation #T-1384-0140

Vendor Name: _____

Authorized Representative's Signature

Date

ADDENDUM NO.: 5
DATE: 05/09/13
CONTRACT NO.: T-1384-0140

The following additions, deletions, and modifications are hereby made a part of the Contract Documents of Metro Shot Tower Station Structural Preservation & Miscellaneous Improvements, Contract No.: T-1384-0140.

Item No.	Page	Modification
I. SPECIAL PROVISIONS		
1	Section 07101	<p>P 275 –</p> <ul style="list-style-type: none"> • ITEM 2.01 MANUFACTURER has been removed; PRODUCTS AND MATERIALS has been revised: Fiber Properties Table has been reduced with the “Tensile Strength” and “Strain” description edited. <p>P 276 –</p> <ul style="list-style-type: none"> • Resin Properties Table has been reduced with “Tensile Strength” and “Elongation@ break” changed; Composite Properties table has been removed <p>P 279 –</p> <ul style="list-style-type: none"> • Paragraph 3.03 E. has been edited to instruct the Contractor that multiple layers of FRP will be necessary to provide the required FRP thickness.

SECTION 07101**FIBER REINFORCED POLYMER (FRP) COMPOSITES****PART 1: GENERAL****1.01 DESCRIPTION:**

- A. This section provides description of installation of fiber reinforced polymer composites.
- B. Related Work Specified Elsewhere:
 - 1. Section 02220 – Site Demolition
 - 2. Section 03050 – Portland Cement Concrete
 - 3. Section 03300 – Cast-In-Place Concrete
 - 4. Section 05120 – Structural Steel
 - 5. Section 05500 – Miscellaneous Metal
 - 6. Section 16025 – Electrical Demolition and Reinstallation Work

1.02 DEFINITIONS:

- A. Catalyst: A substance that initiates a chemical reaction and enables it to proceed under milder conditions than otherwise required and that does not, itself, alter or enter into the reaction. See hardener.
- B. Composite: A combination of two or more materials differing in form or composition on a macro scale. The constituents retain their identities; they do not dissolve or merge completely into one another, although they act in concert. Normally, the components can be physically identified and exhibit an interface between one another. See composite FRP.
- C. Composite FRP: A polymer matrix, either thermosetting or thermoplastic, reinforced with a fiber or other material with a sufficient aspect ratio (length to thickness) to provide a discernible reinforcing function in one or more directions. See composite.
- D. Cure: The process of causing irreversible changes in the properties of a thermosetting resin by chemical reaction. Cure is typically accomplished by addition of curing agents or initiators, with or without heat and pressure. Full cure is the point at which a resin reaches its specified properties. Resin is undercured if its specified properties have not been reached.

- E. Cure Time: The time necessary to cure a thermosetting resin system, thermoset-based composite, or prepreg at a given temperature.
- F. Curing Agent: A catalytic or reactive agent that, when added to resin, causes polymerization. Also called hardener.
- G. Debonding: A separation at the interface between substrate and the reinforcing layer.
- H. Delamination: Separation of the layers of the FRP laminate from each other.
- I. Epoxy: A polymerizable thermosetting polymer containing one or more epoxide groups, cured by reaction with phenols, anhydrides, polyfunctional amines, carboxylic acids, or mercaptans. An important matrix resin in FRP; also used as structural adhesive.
- J. Fabric: Arrangement of fibers held together in two or three dimensions. It may be woven, nonwoven, knitted or stitched. Fabric architecture is the specific description of the fibers, their directions and construction.
- K. Fiber: A general term used to refer to filamentary materials. The smallest unit of a fibrous material. Often, fiber is used synonymously with filament.
- L. Fiber Reinforced Polymer (FRP) System: Composite material consisting of a polymer matrix reinforced with cloth, mat, strands, or any other fiber form. See composite.
- M. Hardener: Substance added to thermosetting resin to cause polymerization. Usually applies to epoxy resins.
- N. Impregnation: The process of saturating the interstices of a reinforcement or substrate with a resin.
- O. Inhibitor: A substance that retards a chemical reaction, such as ultraviolet degradation. Also used to prolong shelf life of certain resins.
- P. Initiator: Chemicals, most commonly peroxides, used to initiate the curing process for unsaturated polyester and vinyl ester resins. See catalyst.
- Q. Lay-Up: The process of placing the FRP reinforcing material in position for installation.
- R. Ply: A single layer of fabric or mat.

- S. Polymer—A compound formed by the reaction of simple molecules that permit their combination to proceed to high molecular weights under suitable conditions.
- T. Prepreg—A fiber or fiber sheet material containing resin whose reaction has progressed to the stage where consistency is tacky. Multiple plies of prepreg are typically cured with applied heat and pressure. Also preimpregnated fiber or sheet.
- U. Resin—A component of a polymeric system that requires a catalyst or hardener to polymerize or cure for use in composites. Resin often refers to the mixed polymer component or matrix of the FRP.
- V. Wet Lay-Up—A method of making a laminate system by applying the resin system as a liquid, when the fabric or mat is put in place.

1.03 SUBMITTALS:

- A. Shop drawings:
 - 1. Show installation details of FRP composites.
 - 2. The shop drawings shall contain material's mechanical properties, number of layers, overlap and joint details.
 - 3. Show relationship of threaded hanger rod bolts to fiber reinforced polymer and to the plan and sequence of installation.
- B. Manufacturer's product data, Material Safety Data Sheet (MSDS) and recommended application procedures.
- C. Test results from the system manufacturer verifying the mechanical properties of the specified materials.
- D. Energy dissipation results, verifying materials capability for dissipating energy imparted from the explosion.
- E. Contractor's certificate of training by the manufacturer of the FRP.
- F. Quality control and quality assurance, inspection and testing procedures for proper installation of the FRP.
- G. Samples
 - 1. Fiber reinforced polymer (FRP): Submit three samples of at least one square foot in size which shows full cross section and type to be used.

2. Resin: Submit three samples

1.04 PRODUCT DELIVERY, STORAGE, HANDLING AND DISPOSAL

- A. All components of the FRP system must be delivered and stored in the original factory-sealed, unopened packaging or in containers with proper labels identifying the manufacturer, brand name, system identification number, and date. Catalysts and initiators should be stored separately. All components must be protected from dust, moisture, chemicals, direct sunlight, physical damage, fire, and temperatures outside the range specified in the system data sheets. Any component that has been stored in a condition different from that stated above must be disposed of, as specified in Section 1.04-F.
- B. All components of the FRP system, especially resins and adhesives, that have been stored longer than the shelf life specified on the system data sheet shall not be used and must be disposed of, as specified in Section 1.04-F.
- C. All components of the FRP system, especially fiber sheets, must be handled with care according to the manufacturer recommendations to protect them from damage and to avoid misalignment or breakage of the fibers by pulling, separating, or wrinkling them or by folding the sheets. After cutting, sheets shall be either stacked dry with separators or rolled gently at a radius no tighter than 12 inch or as recommended by the manufacturer.
- D. All components of the FRP system, especially resins and adhesives, must be handled with care to avoid safety hazards, including but not limited to skin irritation and sensitization and breathing vapors and dusts. Mixing resins shall be monitored to avoid fuming and inflammable vapors, fire hazards, or violent boiling. The contractor is responsible for ensuring that all components of the FRP system at all stages of work conform to the local, state, and federal environmental and worker's safety laws and regulations.
- E. The contractor is responsible for providing the proper means of protection for safety of the personnel and the workplace. The contractor shall inform the personnel of the dangers of inhaling fumes of primer, putty, or resin and shall take all necessary precautions against injury to personnel. The resin mixing area shall be well vented to the outside.
- F. Any component of the FRP system that has exceeded its shelf life or pot life or has not been properly stored, as specified in Section 1.04-A, and

any unused or excess material that is deemed waste shall be disposed of in a manner amiable to the protection of the environment and consistent with the MSDS.

1.05 QUALITY ASSURANCE:

- A. The contractor shall be responsible for the quality control of all materials and processes in the project. The quality control and quality assurance (QC/QA) plan must be approved by the owner or its representative. It shall include specific procedures for personnel safety, tracking and inspection of all FRP components prior to installation, inspection of all prepared surfaces prior to FRP application, inspection of the work in progress to ensure conformity with specifications, QA samples, inspection of all completed work including necessary tests for approval, repair of any defective work, and clean-up. Any part of the work that fails to comply with the requirements of the contract documents shall be rejected by the engineer and shall be remedied or removed and replaced by the contractor at its own expense to be in full compliance with the contract documents.
- B. Installation of the FRP composite system must comply with pertinent provisions of the following codes and standards. The latest revision of the code or standard in effect at the time of execution of the contract shall be used.
1. ASTM D3039: Test Method for Tensile Properties of Fiber-Resin Composites.
 2. ASTM D4541: Test Method for Pull-Off Strength of Coatings using Portable Adhesion Tester.
 3. ASTM D2563: Recommended Practice for Classifying Visual Defects in Glass Reinforced Plastic Laminate Parts.
 4. ASTM C882: Test Method for Bond Strength of Epoxy-Resin System used with Concrete.
 5. ACI 440.2R-02: Guide for the Design and Construction of Externally Bonded FRP System for Strengthening Concrete Structures.
 6. ACI 440R-96: State-of –the-Art Report on Fiber Reinforced Plastic Reinforcement for Structures.
 7. ACI 503.R: Guide for Selection of Polymer Adhesives with Concrete.
 8. ACI 222R: Corrosion of Metals in Concrete

9. ACI 224.1R: Causes, Evaluation and Repair of Cracks in Concrete Structures.
10. ACI 224R-01: Control of Cracking in Concrete Structures.
11. ACI 546R: Concrete Repair Guide.
12. ICRI #03730: Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion.
13. ICRI #03732: Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.
14. ICRI #03733: Guide for Selecting and Specifying Materials for Concrete Repairs of Concrete Surfaces.
15. NCHRP #514: Bonded Repair and Retrofit of Concrete Structures Using FRP Composites: Recommended Construction Specifications and Process Control Manual.

1.06 TOLERANCE

- A. Tolerances recommended by the manufacturer shall be followed, unless more stringent requirements are specified in these specifications or in the contract documents. In case of any conflict or appearance of any conflict, the engineer shall provide clarification before proceeding.

1.07 QUALIFICATION

- A. The manufacturer/supplier must be prequalified by the owner or its representative for each of its FRP systems after providing the following necessary information:
 1. System data sheets and MSDSs for all components of the FRP system;
 2. A minimum of three years of documented experience or three documented similar field applications with acceptable reference letters from respective owners;
 3. A comprehensive hands-on training program for each FRP system to qualify contractors/applicators. The contractor/applicator must be prequalified by the owner or its representative.
 4. A certificate of completed training from the manufacturer/supplier for at least one field representative who will be present on site throughout the project.

- B. All materials shall be compatible chemically and be supplied by the same manufacturer. No substitution shall be allowed without the prior written authorization of the engineer.

1.08 PROJECT CONDITIONS:

- A. Safety Requirements
 - 1. Consult OSHA for appropriate safety equipment and measures for application of chemicals, resins, and epoxies.

1.09 COORDINATION:

- A. Prior to the removal or disconnection of any utilities, the Contractor shall confirm the layout of all existing electrical conduits, HVAC, plumbing, alarms, and PA systems in the ceiling with the contract drawings.
- B. The Contractor shall coordinate with the MTA and obtain approval prior to any proposed power or service interruptions.
- C. It may be necessary for the Contractor to remove portions of the precast concrete ceiling panels and the masonry walls of the electrical equipment room to access the station roof slab above.

1.10 MAINTENANCE:

- A. Access to all areas of the station shall be maintained for all MTA personnel during construction.
- B. Emergency exits shall remain accessible at all times for all MTA employees, workers, and patrons.
- C. For maintenance procedures of electrical components, see specification Section 16025.

1.11 WARRANTY:

- A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.
- B. Material Warranty: Manufacturer of fiber reinforced polymer shall warrant that the product is free of defects in material and workmanship as supplied in original packaging. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under contract documents.

PART 2: PRODUCTS

2.01 PRODUCTS AND MATERIALS:

- A. FRP composite materials using isophthalic polyester, vinylester, and epoxy resins, and carbon fibers are covered by this specification. FRP composite materials are classified based on resin type, fiber type, and fiber architecture. Any material that does not meet these minimum requirements will be rejected:

Fiber Properties			
	English	Metric	Test Method
Tensile Strength	711 ksi	4,900 MPa	TY-030B-01
Tensile Modulus	33.4 Msi	230 GPa	TY-030B-01
Strain @ breakage	2.1 %	2.1 %	TY-030B-01

Resin Properties			
	English	Metric	Test Method
Tensile Strength (7 day)	8,000 psi	55.2 MPa	D-638
Elongation @ Break (7 day)	3%		D-638

- B. **Materials Property Verification:** The Contractor shall hire an independent testing agency to conduct tests on sample panels (12 inch X 12 inch) made during the installation of the composite system to verify the mechanical properties of the installed products.

- C. The lot numbers for the product materials used for preparing the sample must be recorded by the testing lab. Two identical 12 inch X 12 inch panels must be prepared daily or for every 1,000 square feet of fabric application. The witness panels shall be prepared by cutting a 12 inch X 12 inch sample of the saturated fabric to be installed on the concrete surface and placing it between two Mylar covered sheets of glass or Plexiglas. The samples shall be cured following the manufacturer's recommendations before they are sent to the lab for testing. The ultimate tensile strength, tensile modulus and percent elongation at failure must be recorded by the testing laboratory.

PART 3: EXECUTION

3.01 PREPARATION:

- A. Remove the architectural ceiling panels (including PA system, alarms, cameras, etc.), conduits/pipes, drip shield (steel interior liner), and support channels (including related hardware and gaskets) attached to the bottom of the station roof slabs.
- B. Contractor shall provide mitigation procedures for addressing active leaks after the drip shield is removed. Leak mitigation shall continue until the drip shield is reinstalled.
- C. Leave steel threaded hanger rods. Nuts and washers shall be removed.
- D. Using As-Builts as a guideline, locate the embedded steel beams for attachment of the threaded studs which will be used to support the steel anchorage straps. The studs shall be welded to the bottom of the flange, spaced as shown on the contract drawings. Once the installation of the threaded studs is complete, the areas around the bolt shall be filled with putty (see Section 3.01-I) to cover the exposed steel beams.
- E. The concrete surface shall be repaired, if necessary, and all concrete surfaces shall be cleaned and prepared prior to installing the FRP system. All necessary repair and restoration areas on the concrete surface shall be approved by the engineer prior to surface preparation.
- F. Surface Grinding: All irregularities, unevenness, and sharp protrusions (including Section 3.01-C) in the surface profile shall be ground away to a smooth surface with less than 1/32-inch deviation. Disk grinders or other similar devices shall be used to remove stain, paint, or any other surface substance that may affect the bond. Voids or depressions with diameters larger than 1/2 inch or depths greater than 1/8 inch, when measured from a 12-inch straight edge placed on the surface, shall be filled according to Section 3.01-I.

- G. Chamfering Corners: All corners and sharp edges shall be rounded or chamfered to a minimum radius of 1/2 inch as per ACI 440.2R-02. Ridges, form lines, and sharp or roughened edges greater than 1/4 inch shall be ground down or filled with putty, as specified in Section 3.01-I. Provisions shall be made to accommodate obstructions and embedded objects before installing the FRP system.
- H. Crack Injection: All cracks in the surface of concrete or the substrate that are wider than 1/100 inch shall be filled using pressure injection of epoxy according to ACI 224.1R. Smaller cracks may also require resin injection in aggressive environments. Follow ACI 224R-01 crack width criteria for various exposure conditions. The FRP system shall be installed no sooner than 24 hours after crack injection. Any surface roughness caused by injection shall be removed as specified in Section 3.01-F.
- I. Surface Profiling: After surface grinding, any remaining unevenness in the surface greater than that specified in Section 3.01-F, including out-of-plane variations, fins, protrusions, bug holes, depressions voids, and roughened corners, shall be filled and smoothed over using putty made of epoxy resin mortar or polymer cement mortar with strength equal to or greater than the strength of the original concrete. The patching material shall be cured a minimum of 7 days before installing the FRP system unless its curing and strength are verified by tests.
- J. Surface Cleaning: Finished surface of concrete shall be cleaned to the approval of the engineer. Cleaning shall remove any dust, laitance, grease, oil, curing compounds, wax, impregnations, stains, paint coatings, surface lubricants, foreign particles, weathered layers, or any other bond inhibiting material. If power wash is used, the surface shall be allowed to dry thoroughly before installing the FRP system. The cleaned surface shall be protected against redeposit of any bond inhibiting materials. Newly repaired or patched surfaces that have not cured a minimum of 7 days shall be coated with a water-based epoxy paint or other approved sealers.

3.02 TEST AREA:

- A. N/A

3.03 INSTALLATION/APPLICATION:

- A. Specific procedures for installing FRP systems may vary slightly for each system and manufacturer. Contractor must submit installation details for approval by the engineer prior to installation.
- B. Environmental conditions shall be examined before and during installation of the FRP system to ensure conformity to the contract documents and manufacturer's recommendations. Do not apply primers, putty, saturating

resins, or adhesives on cold, frozen, damp, or wet surfaces. Ambient and concrete surface temperatures shall be within 10–35°C (50–95°F), unless specified by the manufacturer. Moisture level on all contact surfaces shall be less than 10% at the time of installation of the FRP system, as evaluated according to ACI 503R- 93. Moisture restrictions may be waived for resins that have been formulated for wet applications.

- C. Application of bonded FRP systems shall not proceed if any moisture vapor transmission is present. Concrete dryness is necessary when using elevated temperature cure. Any bubble that develops from moisture vapor transmission can effectively be injected with the same adhesive material used for the FRP system.
- D. Shoring: Repaired members shall be shored temporarily with conventional methods, if specified in contract documents, or required by the engineer for safety. Shoring shall not be removed until the FRP system has fully cured and gained its design strength, as recommended by the manufacturer and approved by the engineer.
- E. The FRP system shall have a minimum composite thickness of 0.20 inches. **The contractor shall apply multiple layers of FRP, as recommended by the manufacturer, to achieve the minimum composite thickness.** The contractor shall provide all necessary equipment in sufficient quantities and in clean operating conditions for continuous uninterrupted FRP installation.
- F. Curing: The FRP system shall be allowed to cure as recommended by the manufacturer. Field modification of resin chemistry for rapid curing is not allowed. Elevated cure temperature may be used if rapid curing is necessary and approved by engineer. Cure of installed plies shall be monitored before placing subsequent plies. In case of any curing irregularity, installation of subsequent plies shall be halted.
- G. After the curing of the FRP system is complete and the protective coating has been applied, the anchorage straps shall be installed on the horizontal repair surface. See the contract drawings for the specified spacing, orientation, and connection details of the anchorage straps.

3.04 FIELD QUALITY CONTROL:

- A. Contractor must develop a field quality control plan and have it approved by the engineer. The plan shall include the following details.
 - 1. Inspection of materials
 - 2. Daily inspection plan

3. Inspection for fiber orientation
4. Inspection for debonding
5. Inspection for cure of resin
6. Inspection for adhesion
7. Inspection for cured thickness

3.05 REPAIR OF DEFECTIVE WORK

- A. Defects are of different types and may be generally classified as aesthetic, short-term critical, or long-term critical. Repair procedure depends on the type, size, and extent of defects. Repair procedures for any condition not addressed in these specifications or in the contract documents shall be submitted by the contractor and approved by the engineer prior to proceeding with the work.
- B. Repair of Protective Coating: Defects in protective coating can be of three types: small hairline cracks, blistering, and peeling. In all cases, moisture content of the substrate should be below 0.05% before applying a new coating. Prior to any repair of protective coating, the FRP system shall be examined visually or otherwise to ensure that no defect exists within or on the surface of the FRP. Defects in FRP, if found, shall be repaired as per Sections 3.05-C and 3.05-D. If protective coating appears to show small areas with cracks, the local surface shall be lightly sanded. Then, a new coating with appropriate primer shall be applied according to the manufacturer's recommendations. At the minimum, the coating shall be applied over an area extending 1 inch on either side of the defect. If the protective coating shows signs of blistering, the entire area of blisters as well as the surrounding area to a distance of at least 12 inch shall be carefully scraped clean. In no case should a blistered surface be recoated without complete removal of the existing coating. The area shall be wiped clean and then dried thoroughly. Once dry, the area can be recoated after application of the primer coat if required by the manufacturer. If the surface shows signs of excessive peeling, the entire coating shall be scraped off and the surface lightly sanded, wiped cleaned, and thoroughly dried before applying a new coat according to the manufacturer's recommendations.
- C. Epoxy Injection of Small Defects: Small entrapped voids or surface discontinuities no larger than 1/4 inch in diameter shall not be considered defects and require no corrective action unless they occur next to edges or when there are more than five such defects in an area of 10 square feet. Small defects of size between 1/4 and 1 1/4 inch in diameter shall be repaired using low-pressure epoxy injection as long as the defect is local

and does not extend through the complete thickness of the laminate in case of multiple-ply FRP systems. If any delamination growth is suspected between the FRP plies due to injection, the procedure shall be halted, and repair shall follow Section 3.05-D.

- D. **Patching of Minor Damages:** Minor defects are those with diameters between 1 1/4 and 6 inches and a frequency of less than five per any unit surface area of 10-ft length or width. The area surrounding the defects to an extent of at least 1 inch on all sides shall be carefully removed. The area shall be wiped cleaned and thoroughly dried. The area shall then be patched by adding an FRP patch of the same type as original laminate and extending at least 1 inch on all sides of the removed area. Repair can also be conducted using the procedure in Section 3.05-E.
- E. **Replacement of Large Defects:** Defects larger than 6 inch in diameter shall be carefully marked and scarfed out extending to a minimum of 1 inch on all sides. Scarfing shall be progressive through the layers in the case of multiple-ply FRP systems until past the defective area. In case the defect extends to the first FRP ply adjacent to the concrete, the entire thickness of the FRP and primer shall be removed. The substrate shall be appropriately prepared and primer reapplied after ensuring that the surface and FRP are clean and dry. Application of a new FRP system within the scarfed area shall follow procedures for the original FRP system, except that an additional layer extending a minimum of 6 inch on all sides of the scarfed area shall be added as a patch. Once cured, the protective coating shall be applied over the entire area.

3.06 CLEANING:

- A. The contractor is responsible for the cleanup of the equipment and the project site from hazardous and aesthetically undesirable FRP components using appropriate solvents, as recommended in the system data sheet.

3.07 PROTECTION:

- A. Temporary protection shall be installed, as specified in the contract documents, until the resin has fully cured, as approved by the engineer.

PART 4: MEASUREMENT AND PAYMENT

4.01 METHOD OF MEASUREMENT

- A. Fiber Reinforced Polymer installation will be measured by the square foot to the nearest square foot. The quantity to be paid for is the area covered with FRP composite material.

4.02 BASIS OF PAYMENT:

- A. The unit price bid per Square Foot for Fiber Reinforced Polymer installation includes the cost of all materials, labor, equipment, testing, and other services necessary to satisfactorily complete the work in accordance with these specifications and the directions of the Engineer including the installation of the threaded studs and anchorage straps. Include the cost of all repairs or replacement of the FRP resulting from failed test data in the unit price bid.

END OF SECTION



MARYLAND TRANSIT ADMINISTRATION

MARYLAND DEPARTMENT OF TRANSPORTATION

Martin O'Malley, Governor • Anthony G. Brown, Lt. Governor
Darrell B. Mobley, Acting Secretary • Ralign T. Wells, Administrator

TO: All Planholders

FROM: Maryland Transit Administration

SUBJECT: **ADDENDUM NO. 4**
Contract No.: T-1384-0140
Metro Shot Tower Station Structural Preservation & Miscellaneous Improvements

DATE: May 7, 2013

Enclosed and effective this date is Addendum No. 4 to the subject Contract. This change does not delay the Step 1-Technical Bid and Step 2-Price Bid Due date from **May 16, 2013 at 2pm EST.**

The Bidder shall acknowledge receipt of this Addendum by completing and returning this form with the bid package.

All other terms and conditions remain unchanged.

Sincerely,

Rick Owens, Procurement Officer
Professional Services/Construction/Installation Section
Procurement Division

Acknowledgement of receipt of ADDENDUM # 4 to Solicitation #T-1384-0140

Vendor Name: _____

Authorized Representative's Signature

Date

ADDENDUM NO.: 4
DATE: 05/07/13
CONTRACT NO.: T-1384-0140

The following additions, deletions, and modifications are hereby made a part of the Contract Documents of Metro Shot Tower Station Structural Preservation & Miscellaneous Improvements, Contract No.: T-1384-0140.

Item No.	Page	Modification
I. CONTRACT SPECIFICATIONS		
1	Bid Form	Revised Bid Form to: <ul style="list-style-type: none"> • Added new Line Items in place of current Line Items No. 11, 12 & 13 • Renumbered Line Items 11-19 to be 14-22 (Inclusive of Ins. Contingency) • Revised Quantity of Revised Number Line Item 18
II. SPECIAL PROVISIONS		
2	Section 03930	P 205 – <ul style="list-style-type: none"> • 4.04 – Revised language in para. A & B • 4.05 – Revised language in para. A & B • 4.06 – Revised language in para. A & B • 4.07 – Revised language in para. B P 206 – <ul style="list-style-type: none"> • 4.08 – Revised language in para. B • 4.09 – Revised language in para. B • 4.10 – Revised language in para. B
3	Section 07101	P 270 – 1.03 – Revised language in para. A.2 P275 – <ul style="list-style-type: none"> • 2.01 – Revised language in para. A • 2.02 – Revised language in para. A & C P279 – 3.03 – Revised language in para. E P282 – 4.02 – Revised language in para. A
III. CONTRACT DRAWINGS		
4	Sheets 4-24	Added new drawing “Civil Abbreviations and Symbols”; Renumbered all subsequent pages.

Also attached are the answers to contractors' questions.

MTA CONTRACT NO. T-1384-0140
 SHOT TOWER STATION STRUCTURAL PRESERVATION AND MISC. IMPROVEMENTS
 BID QUESTIONS - RESPONSES

No.	Question	Response
1	<p>Despite daily attempts, we have been unsuccessful in contacting the Specified Sole Source supplier of the FRP materials cited in Specification Section 07101. Our phone and email messages remain unanswered and as a result we do not have a quote from them for the material on the Shot Tower Station Preservation Contract. Please advise as to whether we can furnish a product under an "or equal" basis.</p>	<p>"or approved equal" will be added to paragraph 2.01 A. of SP 07101 as part of Addendum No. 4.</p>
2	<p>Rick, it has come to my attention that the specifications call out for aerospace grade resin that is autoclaved at 350 deg. Fahrenheit. This I believe is not the intended application and may have been mistakenly entered. Could you please have the Engineer clarify the specific attributes and needs of the fabric and resin? Most resins for this application needed are ambient cured.</p>	<p>Section 2.02 A. Tables of SP 07101 will be revised as part of Addendum No. 3 to clarify material specifications for this application. The Tables for minimum requirements for composite properties implies these requirements are based upon "standard cure, 70° - 75°F (21° - 24°C) - 5 days", whereas Specification section 3.03 F. states "The FRP system shall be allowed to cure as recommended by the manufacturer".</p>
3	<p>Q4: Reference Bid Form (BF) 5 of 8, Item #15, Fiber Reinforced Polymer (FRP) Composites - Quantity shown is 7,120 SF. Please confirm quantity shown. Measurement of the limits of FRP System shown on pages ST - 03 thru ST - 05 appear to yield a smaller quantity.</p>	<p>Quantity will be verified and corrected on the Bid Form in Addendum No. 4.</p>

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 SHOT TOWER STATION STRUCTURAL PRESERVATION AND MISC. IMPROVEMENTS
 BID QUESTIONS - RESPONSES

4	<p>Q5: Reference Special Provision (SP) 07101 FRP, Section 3.01 Preparation and SP 03930 Concrete Rehabilitation Part 4: Measurement and Payment - SP 07101 Section 3.01 E. states "All necessary repair and restoration on the concrete surface shall be approved by the engineer prior to surface preparation. SP 03930, Concrete Rehabilitation includes several possible required concrete repair items including Crack Repair, Map Cracking, Concrete Spall Repair Type I and Type 2. However, in the Measurement and Payment section of this Special Provision, only Concrete Crack Repair will be measured and paid for, all other potentially necessary forms of concrete restoration and repair are incidental to the FRP item. Having all of these potentially necessary rehabilitation methods as "incidental items" places a substantial degree of risk to interested contractors. Especially given the fact that we are unable to view the majority of the surface area where the FRP material is to be applied. Would MTA consider including a bid item with a nominal, small bid amount for Concrete Map Cracking, Spall Repair Type 1 and 2? (e.g. 10 SF of each item) Such a measure would mitigate significant risk.</p>	<p>Additional items will be added to the Bid Form as part of Addendum No. 4 to account for the concrete surface restoration. SP 03930 Concrete Rehabilitation will be edited to include new bid items.</p>
5	<p>Q7: Reference Page SP-270, SP 07101-3 Section 1.03 A.2. FRP Composites Submittals - Bullet #2 of this section refers to "material's mechanical properties used in calculations.." Please advise as to what type of calculations for the Composite FRP system may be required as no loadings or design criteria have been specified.</p>	<p>Paragraph 1.03 A. 2. of SP 07101 will be edited to remove submittal of calculations as part of Addendum No. 4.</p>
6	<p>Q8: Reference Page SP-276, SP 07101-9 Section 2.02 FRP Composites, Products and Materials - Note that Composite Properties for Tensile Strength given in this table are reflective of Carbon Fiber Laminate versus a Carbon Fiber Fabric. Section 2.02 C. refers to "The lot number for the <i>fabric</i> and the resin..." Please confirm that it is the intent to use Carbon Fiber Laminate.</p>	<p>Section 2.02 A. Tables in SP 07101 will be revised as part of Addendum No. 4 to clarify material properties and performance specifications for this application. The intent is for the Contractor to propose a composite material and means and method of fabrication/installation that meet these specifications and verifies it's performance in accordance with sections 2.02 (A) and 2.02 (B).</p>

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7	<p>Q9: Reference Plan Sheet 11 of 24, Detail 1 and SP 07101-9 FRP Composites - Detail on sheet 11 of 24 shows a 0.2" thick section of FRP composite. Please confirm thickness. Note the accommodating such thickness will require multiple layers (4-5 typical) of laminate, or 5++ layers of fabric, (if intent was to permit fabric).</p>	<p>Thickness is confirmed to be 0.20".</p>
8	<p>Reviewing the photos that were shown at the prebid and posted on your site it looks as if there is deterioration on the metal drip shield and ductwork. How are we to be compensated should the drip shield, ductwork not be able to be reinstalled.</p>	<p>Metal drip shield and ductwork will be reinstalled per requirement of contract documents and will be compensated per bid items for section 05500 and section 15025 as indicated in bid form</p>

BID FORM

Item	Section	Description	Estimate of Quantity	Unit	Unit Price	Total Price
001	01130	Mobilization	1	LS		
002	01210	Miscellaneous Work Allowance	1	ALLOW	\$250,000	\$250,000
003	01450	Quality Assurance and Quality Control	1	ALLOW	\$75,000	\$75,000
004	01500	Timber Barricade Wall	100	LF		
005	01500	Perimeter Fence	200	LF		
006	01521	Engineer's Field Office Type 1	1	LS		
007	01550	Maintenance and Control of Traffic	1	LS		
008	01562	Temporary Orange Construction Fence	400	LF		
009	03400	Precast Ceiling Panel Removal and Reinstallation	900	SF		
010	03930	Concrete Crack Repair	800	LF		
011	03930	Concrete Map Cracking Repair	600	SF		
012	03930	Concrete Spall Repair Type 1	20	CF		

BID FORM

013	03930	Concrete Spall Repair Type 2	40	CF		
014	04810	Masonry Repair and Repointing	225	SF		
015	05101	Vegetation Removal	1	LS		
016	05101	Existing Chain Link Fence Removal and Security Fence System	382	LF		
017	05500	Metal Drip Shield	200	SF		
018	07101	Fiber Reinforced Polymer (FRP) Composites	6925	SF		
019	09515	Metal Pan Ceilings	2700	SF		
020	15025	Mechanical Demolition and Reinstallation	1	LS		
021	16025	Electrical Demolition and Reinstallation	1	LS		

Basis of Award: Total amount of items 001 thru 021

_____ (figures)

_____ (words)

022		Insurance Premium (Contingency)	LS	LS		
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This amount will only be added to the base bid in the event that the bidder is excluded from the wrap-up insurance program or the program is terminated mid-term. The Insurance Cost Worksheet must be attached to the bid.

SECTION 03930**CONCRETE REHABILITATION****PART 1: GENERAL****1.01 DESCRIPTION:**

- A. This section includes specifications for concrete repair work, including crack repair, spall repair, cleaning of concrete surfaces, testing and all other necessary work as specified on the Contract drawings and as directed by the Engineer.

1.02 SUBMITTALS:

- A. **Product Data:** Include material descriptions, chemical composition, physical properties, test data, and mixing and application instructions.
1. Include Material Safety Data Sheets, if applicable.
- B. **Product Certificates:** Signed by manufacturers certifying that products furnished comply with requirements and are recommended by manufacturer for uses indicated.
- C. **Material Test Reports:** From a qualified testing agency indicating and interpreting test results for compliance of all materials with requirements indicated.
- D. **Plans or a written description of the planned system to be used to protect the surrounding Project site during operations.** Describe in detail the materials, methods, equipment, and sequence of operations to be used for each phase of the work.
- E. If alternative materials to those indicated are proposed for any phase of rehabilitation work, submit substitution request complying with Section 01600 and provide a written description of proposed materials and methods, including evidence of successful use on other comparable projects, and a testing program to demonstrate their effectiveness for this project.

1.03 QUALITY ASSURANCE:

- A. At the start of the work for each type of repair, the Contractor shall make available a technical representative from the manufacturer for each product used. A meeting shall be conducted between the Contractor, the Manufacturer's representative and the Engineer to discuss all aspects of the proposed work. The Manufacturer's representative shall be available to visit the site during the work if requested by the Engineer.

- B. Source Limitations: Obtain repair materials through one source from a single manufacturer for each type of repair work.

1.04 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver materials to Project site in manufacturer's original and unopened containers, labeled with type and name of products and manufacturers.
- B. Comply with manufacturers written instructions for minimum and maximum temperature requirements and other conditions for storage.
- C. Store cementitious material off the ground, under cover, and in a dry location.
- D. Store aggregates, covered and in a dry location, where grading and other required characteristics can be maintained and contamination avoided.

PART 2: PRODUCTS

2.01 REINFORCEMENT ACCESSORIES:

- A. Bar Supports: Devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete.

2.02 EPOXY BONDING AGENT:

- A. Epoxy Bonding Agent for bonding new concrete to hardened concrete shall be: Sikadur 32 Hi-Mod LPL as manufactured by Sika Corporation; FX-742 Hydro-Ester High Modulus Epoxy Resin as manufactured by Fox industries; or approved equal, conforming to ASTM C 881-90, Type V, Grade I or II, Class B or C.

2.03 REPAIR MATERIALS FOR CONCRETE CRACK REPAIR:

- A. Cracks in substructure concrete shall be repaired using injection methods, where permissible. For injection repair of cracks, FX-751 LV Hydro Ester Manufactured by Fox Industries or approved equal shall be used. If injection methods cannot be used, trowel grade FX-7631 Low Modulus Hydro Ester, or approved equal, may be used.

2.04 REPAIR MATERIAL CONCRETE MAP CRACKING REPAIR:

- A. Repair material for map cracking shall be FX-821-50 Liquid MMA Polymer manufactured by Fox Industries or approved equal.

2.05 REPAIR MATERIAL FOR CONCRETE SPALL REPAIR TYPE 1 (UP TO 2" DEPTH):

- A. Repair material for spalls up to 2" depth shall be a polymer-modified, cementitious patching mortar: Sika Top 123 Plus as manufactured by Sika Corporation; FX-753 Hydro-Ester High Modulus Trowel, mixed with FX-701 filler as manufactured by Fox Industries; or approved equal, conforming to ASTM C 881-90, Type I or II, Grade I, Class B or C.
- B. Epoxy Sealer for spalls shall be Armatec 110 as manufactured by Sika Corporation; FX- 436 Penetrating Sealer manufactured by Fox Industries or approved equal.

2.06 REPAIR MATERIAL FOR CONCRETE SPALL REPAIR TYPE 2 (GREATER THAN 2" IN DEPTH):

- A. Repair material for spalls greater than 2" in depth shall be a polymer-modified mortar in trowel or machine application. Trowel grade materials shall be SikaTop 122 *Plus* as manufactured by Sika Corporation mixed with AASHTO (American Association of State Highway and Transportation Officials: #7 aggregate; FX-753 Hydro-Ester High Modulus Trowel, mixed with FX-701 filler as manufactured by Fox Industries; or approved equal. Machine applied mortar shall be Sikacem 133 as manufactured by Sika Corporation or approved equal.
- B. Epoxy Sealer for spalls shall be Armatec 110 as manufactured by Sika Corporation; FX- 436 Penetrating Sealer manufactured by Fox Industries or approved equal.

2.07 CORROSION INHIBITIVE PRIMER:

- A. Corrosion inhibitive primer for use on all reinforcing steel and wire mesh prior to placing repair materials shall be Armatec 110 as manufactured by Sika Corporation; FX-404 Corrosion Inhibitor Polymer Modified Coating manufactured by Fox Industries or approved equal.

2.08 MIXING OF PRODUCTS:

- A. Mix products in clean containers according to manufacturer's written instructions.
- B. Do not add water, thinners, or additives unless recommended by manufacturer.
- C. When practical, use manufacturer's premeasured packages to ensure that materials are mixed in proper proportions. When premeasured packages are not used, measure ingredients using graduated measuring containers; do not estimate quantities or use shovel or trowel as a unit of measure.

- D. Do not mix more materials than can be used within recommended open time. Discard materials that have begun to set.

PART 3: EXECUTION

3.01 GENERAL:

- A. No repair work on superstructures shall be performed while trains are moving or stationed on the structure during revenue hours.
- B. All work done under this section shall be performed in accordance with the Progress Schedule developed by the Contractor and approved by the Engineer.
- C. The type of product and methods to be used (hand-gun injection or mechanical pressure injection) for repairing cracks shall be in accordance with the manufacturer's specifications and as approved by the engineer.
- D. Adequate precautions for the protection of the public, MTA employees and the Contractor's employees shall be employed. This includes all provisions for the control of dust, debris, sandblasting, water or water blasting or other materials through the erection of barriers, enclosures or other approved means.
- E. Upon the completion of the work, the Contractor shall promptly remove all machinery, equipment, tools, surplus materials, false work, shoring, scaffolding, rubbish, debris, and any and all other property of the Contractor to the satisfaction of the Engineer.

3.02 CONCRETE CRACK REPAIR:

- A. Prior to commencing repair work, clean the surface around the repair area of all loose matter, dirt, broken or loose concrete, and stains using high pressure water or other approved means.
- B. Clean all cracks using vacuum or compressed air. Compressors must employ in-line traps or filters to prevent water or oil from contaminating cracks.
- C. The location of cracks to be repaired shall be as shown on the contract drawings.
- D. Attach the ports and seal the surface using a sealant compatible with the crack repair material selected and as recommended by the manufacturer.
- E. Injection equipment and the installation of crack repair material shall be in accordance with the manufacturer's recommendations.

- F. Testing of repaired area: The contractor shall obtain 2-inch diameter cores, at locations to be determined by the Engineer. Sufficient time shall elapse between the installation of the repair materials and coring to allow the repair materials to set properly, but no sooner than 8 hours after the repair material injection is completed. Depth of cores shall not be less than 2 inches.
- G. Finishing:
1. Remove all ports and spills and repair core holes. Core holes shall be repaired using the material specified for the repair of spalls less than 2" in depth.
 2. Where crack repairs are made on decks, the finished surface of the crack repair shall be flush with the existing surface.
 3. Remove all debris, tools, equipment, etc. from the site and restore the site to a condition that is acceptable to the Engineer.

3.03 CONCRETE MAP CRACKING REPAIR:

- A. Before the repair work begins, clean the surfaces indicated on the contract drawings of all loose matter, dirt, broken concrete, and stains by sand blasting or water jetting. Clean all cracks using vacuum or compressed air. Compressors must employ in-line traps or filters to prevent water or oil from contaminating cracks.
- B. Use vacuum processors, pressure injection machines or hand guns to apply the repair material. Brush apply repair material to surfaces where cracks have not opened up sufficiently for application of mechanical injection methods.
- C. The engineer shall determine the application methods (mechanical or brush) suitable for each repair area.
- D. The repair material shall be applied a minimum 2 feet beyond the repair area on all surfaces adjacent with the repair area.

3.04 REPAIR OF CONCRETE SPALL TYPE 1 (UP TO 2" DEPTH):

- A. Prior to commencing repair work, clean the surface around the repair area of all loose matter, dirt, broken or loose concrete, and stains using high pressure water or other approved means
- B. After marking the location of the spall, neatly saw-cut the perimeter indicated for removal to a depth of at least ½ inch. Make cuts perpendicular to concrete surfaces. Remove loose and deteriorated concrete by breaking up and dislodging.

- C. Depth of removal shall be as indicated on the contract drawings.
 - 1. Provide fractured aggregate surfaces with a profile of at least 1/8 inch that are approximately perpendicular or parallel to original concrete surfaces.
 - 2. Thoroughly clean removal areas of loose concrete, dust, and debris.
- D. Moisten concrete surface and apply bonding compound and repair mortar in accordance with the manufacturer's recommendations.
- E. Finishing:
 - 1. Neatly apply mortar in the repaired area and finish flush with the surrounding surface. The surface of the repair shall receive a steel trowel finish.
 - 2. Remove all debris, tools, equipment, etc. from the site and restore the site to a condition that is acceptable to the Engineer.

3.05 REPAIR OF CONCRETE SPALL TYPE 2 (GREATER THAN 2" DEPTH):

- A. Prior to commencing repair work, clean the surface around the repair area of all loose matter, dirt, broken or loose concrete, and stains using high pressure water or other approved means
- B. After marking the location of the spall, neatly saw-cut the perimeter indicated for removal to a depth of at least 1/2 inch. Make cuts perpendicular to concrete surfaces. Remove loose and deteriorated concrete by breaking up and dislodging from reinforcing.
- C. Depth of concrete removal shall extend beyond the reinforcing as shown on the Plans or as directed by the Engineer.
 - 1. Provide fractured aggregate surfaces with a profile of at least 1/8 inch that are approximately perpendicular or parallel to original concrete surfaces.
 - 2. Thoroughly clean removal areas of loose concrete, dust, and debris.
- D. Reinforcing Bar Preparation: Remove loose and flaking rust from reinforcing bars by wire brushing until only tightly bonded light rust remains. Where section loss of reinforcing bars is more than 25 percent the bar shall be repaired as follows:

1. Remove additional concrete as necessary to provide at least a $\frac{3}{4}$ -inch clearance at existing bars.
 2. Attach epoxy coated welded wire fabric with wire ties.
 3. Apply corrosion inhibitive primer to the reinforcing steel, in accordance with manufacturer's requirements.
- E. Moisten concrete surface and apply bonding compound and repair mortar in accordance with the manufacturer's recommendations.
- F. Finishing:
1. Neatly apply mortar in the repaired area and finish flush with the surrounding surface, as directed by the Engineer. The surface of the repair shall receive a steel trowel finish.
 2. Remove all debris, tools, equipment etc. from the site and restore the site to a condition that is acceptable to the Engineer.

PART 4: MEASUREMENT AND PAYMENT

4.01 REINFORCEMENT ACCESSORIES:

- A. Reinforcement accessories will not be measured for payment.
- B. Reinforcement accessories will be considered incidental to the fiber reinforced polymer (FRP) composites item. No separate payment will be made for any mobilization, coordination, scheduling, tools, equipment, labor or incidentals required to complete the work.

4.02 EPOXY BONDING AGENT:

- A. Epoxy bonding agent will not be measured for payment.
- B. Epoxy bonding agent will be considered incidental to the fiber reinforced polymer (FRP) composites item. No separate payment will be made for any mobilization, coordination, scheduling, tools, equipment, labor or incidentals required to complete the work.

4.03 CONCRETE CRACK REPAIR:

- A. Concrete crack repair will be measured per linear foot of repair.
- B. Crack repair will be paid for at the contract unit price which shall be full compensation for all material, equipment, tools, labor, and all work incidental to complete the item as specified. No separate payment will be made for any mobilization, coordination, scheduling, tools, equipment, labor or incidentals required to complete work.

4.04 CONCRETE MAP CRACKING REPAIR:

- A. Concrete map cracking repair will be measured per square foot of repair.
- B. Concrete map cracking repair will be paid for at the contract unit price which shall be full compensation for all material, equipment, tools, labor, and all work incidental to complete the item as specified. No separate payment will be made for any mobilization, coordination, scheduling, tools, equipment, form work, labor or incidentals required to complete work.

4.05 CONCRETE SPALL REPAIR TYPE 1:

- A. Concrete spall repair type 1 will be measured per cubic foot of repair.
- B. Concrete spall repair type 1 will be paid for at the contract unit price which shall be full compensation for all material, equipment, tools, labor, and all work incidental to complete the item as specified. No separate payment will be made for any mobilization, coordination, scheduling, tools, equipment, labor or incidentals required to complete work.

4.06 CONCRETE SPALL REPAIR TYPE 2:

- A. Concrete spall repair type 2 will be measured per cubic foot of repair.
- B. Concrete spall repair type 2 will be paid for at the contract unit price which shall be full compensation for all material, equipment, tools, labor, and all work incidental to complete the item as specified. No separate payment will be made for any mobilization, coordination, scheduling, tools, equipment, labor or incidentals required to complete work.

4.07 EPOXY SEALER FOR SPALLS:

- A. Epoxy sealer for spalls will not be measured for payment.
- B. Epoxy sealer for spalls will be considered incidental to the concrete spall repair type 1 and type 2 items. No separate payment will be made for any mobilization, coordination, scheduling, tools, equipment, labor or incidentals required to complete work.

4.08 CORROSION INHIBITIVE PRIMER:

- A. Corrosion inhibitive primer will not be measured for payment.
- B. Corrosion inhibitive primer will be considered incidental to the concrete spall repair type 1 and type 2 items. No separate payment will be made for any mobilization, coordination, scheduling, tools, equipment, shoring of girders, form work, labor or incidentals required to complete work.

4.09 CLEANING OF CONCRETE SURFACES PRIOR TO REPAIRS:

- A. The cleaning of surfaces to be repaired will not be measured for payment.
- B. Payment for cleaning of surfaces will be considered incidental to the concrete spall repair type 1 and type 2 items. No separate payment will be made for any mobilization, coordination, scheduling, tools, equipment, labor, or incidentals required to complete the work.

4.10 CONCRETE CORING:

- A. Concrete Coring for testing crack repairs will not be measured for payment.
- B. Concrete Coring for testing crack repairs will be considered incidental to the concrete crack repair item. No separate payment will be made for any mobilization, coordination, scheduling, tools, equipment, labor, or incidentals required to complete the work.

END OF SECTION

SECTION 07101**FIBER REINFORCED POLYMER (FRP) COMPOSITES****PART 1: GENERAL****1.01 DESCRIPTION:**

- A. This section provides description of installation of fiber reinforced polymer composites.
- B. Related Work Specified Elsewhere:
 - 1. Section 02220 – Site Demolition
 - 2. Section 03050 – Portland Cement Concrete
 - 3. Section 03300 – Cast-In-Place Concrete
 - 4. Section 05120 – Structural Steel
 - 5. Section 05500 – Miscellaneous Metal
 - 6. Section 16025 – Electrical Demolition and Reinstallation Work

1.02 DEFINITIONS:

- A. Catalyst: A substance that initiates a chemical reaction and enables it to proceed under milder conditions than otherwise required and that does not, itself, alter or enter into the reaction. See hardener.
- B. Composite: A combination of two or more materials differing in form or composition on a macro scale. The constituents retain their identities; they do not dissolve or merge completely into one another, although they act in concert. Normally, the components can be physically identified and exhibit an interface between one another. See composite FRP.
- C. Composite FRP: A polymer matrix, either thermosetting or thermoplastic, reinforced with a fiber or other material with a sufficient aspect ratio (length to thickness) to provide a discernible reinforcing function in one or more directions. See composite.
- D. Cure: The process of causing irreversible changes in the properties of a thermosetting resin by chemical reaction. Cure is typically accomplished by addition of curing agents or initiators, with or without heat and pressure. Full cure is the point at which a resin reaches its specified properties. Resin is undercured if its specified properties have not been reached.

- E. Cure Time: The time necessary to cure a thermosetting resin system, thermoset-based composite, or prepreg at a given temperature.
- F. Curing Agent: A catalytic or reactive agent that, when added to resin, causes polymerization. Also called hardener.
- G. Debonding: A separation at the interface between substrate and the reinforcing layer.
- H. Delamination: Separation of the layers of the FRP laminate from each other.
- I. Epoxy: A polymerizable thermosetting polymer containing one or more epoxide groups, cured by reaction with phenols, anhydrides, polyfunctional amines, carboxylic acids, or mercaptans. An important matrix resin in FRP; also used as structural adhesive.
- J. Fabric: Arrangement of fibers held together in two or three dimensions. It may be woven, nonwoven, knitted or stitched. Fabric architecture is the specific description of the fibers, their directions and construction.
- K. Fiber: A general term used to refer to filamentary materials. The smallest unit of a fibrous material. Often, fiber is used synonymously with filament.
- L. Fiber Reinforced Polymer (FRP) System: Composite material consisting of a polymer matrix reinforced with cloth, mat, strands, or any other fiber form. See composite.
- M. Hardener: Substance added to thermosetting resin to cause polymerization. Usually applies to epoxy resins.
- N. Impregnation: The process of saturating the interstices of a reinforcement or substrate with a resin.
- O. Inhibitor: A substance that retards a chemical reaction, such as ultraviolet degradation. Also used to prolong shelf life of certain resins.
- P. Initiator: Chemicals, most commonly peroxides, used to initiate the curing process for unsaturated polyester and vinyl ester resins. See catalyst.
- Q. Lay-Up: The process of placing the FRP reinforcing material in position for installation.
- R. Ply: A single layer of fabric or mat.

- S. Polymer—A compound formed by the reaction of simple molecules that permit their combination to proceed to high molecular weights under suitable conditions.
- T. Prepreg—A fiber or fiber sheet material containing resin whose reaction has progressed to the stage where consistency is tacky. Multiple plies of prepreg are typically cured with applied heat and pressure. Also preimpregnated fiber or sheet.
- U. Resin—A component of a polymeric system that requires a catalyst or hardener to polymerize or cure for use in composites. Resin often refers to the mixed polymer component or matrix of the FRP.
- V. Wet Lay-Up—A method of making a laminate system by applying the resin system as a liquid, when the fabric or mat is put in place.

1.03 SUBMITTALS:

- A. Shop drawings:
 - 1. Show installation details of FRP composites.
 - 2. The shop drawings shall contain material's mechanical properties, number of layers, overlap and joint details.
 - 3. Show relationship of threaded hanger rod bolts to fiber reinforced polymer and to the plan and sequence of installation.
- B. Manufacturer's product data, Material Safety Data Sheet (MSDS) and recommended application procedures.
- C. Test results from the system manufacturer verifying the mechanical properties of the specified materials.
- D. Energy dissipation results, verifying materials capability for dissipating energy imparted from the explosion.
- E. Contractor's certificate of training by the manufacturer of the FRP.
- F. Quality control and quality assurance, inspection and testing procedures for proper installation of the FRP.
- G. Samples
 - 1. Fiber reinforced polymer (FRP): Submit three samples of at least one square foot in size which shows full cross section and type to be used.

2. Resin: Submit three samples

1.04 PRODUCT DELIVERY, STORAGE, HANDLING AND DISPOSAL

- A. All components of the FRP system must be delivered and stored in the original factory-sealed, unopened packaging or in containers with proper labels identifying the manufacturer, brand name, system identification number, and date. Catalysts and initiators should be stored separately. All components must be protected from dust, moisture, chemicals, direct sunlight, physical damage, fire, and temperatures outside the range specified in the system data sheets. Any component that has been stored in a condition different from that stated above must be disposed of, as specified in Section 1.04-F.
- B. All components of the FRP system, especially resins and adhesives, that have been stored longer than the shelf life specified on the system data sheet shall not be used and must be disposed of, as specified in Section 1.04-F.
- C. All components of the FRP system, especially fiber sheets, must be handled with care according to the manufacturer recommendations to protect them from damage and to avoid misalignment or breakage of the fibers by pulling, separating, or wrinkling them or by folding the sheets. After cutting, sheets shall be either stacked dry with separators or rolled gently at a radius no tighter than 12 inch or as recommended by the manufacturer.
- D. All components of the FRP system, especially resins and adhesives, must be handled with care to avoid safety hazards, including but not limited to skin irritation and sensitization and breathing vapors and dusts. Mixing resins shall be monitored to avoid fuming and inflammable vapors, fire hazards, or violent boiling. The contractor is responsible for ensuring that all components of the FRP system at all stages of work conform to the local, state, and federal environmental and worker's safety laws and regulations.
- E. The contractor is responsible for providing the proper means of protection for safety of the personnel and the workplace. The contractor shall inform the personnel of the dangers of inhaling fumes of primer, putty, or resin and shall take all necessary precautions against injury to personnel. The resin mixing area shall be well vented to the outside.
- F. Any component of the FRP system that has exceeded its shelf life or pot life or has not been properly stored, as specified in Section 1.04-A, and

any unused or excess material that is deemed waste shall be disposed of in a manner amiable to the protection of the environment and consistent with the MSDS.

1.05 QUALITY ASSURANCE:

- A. The contractor shall be responsible for the quality control of all materials and processes in the project. The quality control and quality assurance (QC/QA) plan must be approved by the owner or its representative. It shall include specific procedures for personnel safety, tracking and inspection of all FRP components prior to installation, inspection of all prepared surfaces prior to FRP application, inspection of the work in progress to ensure conformity with specifications, QA samples, inspection of all completed work including necessary tests for approval, repair of any defective work, and clean-up. Any part of the work that fails to comply with the requirements of the contract documents shall be rejected by the engineer and shall be remedied or removed and replaced by the contractor at its own expense to be in full compliance with the contract documents.
- B. Installation of the FRP composite system must comply with pertinent provisions of the following codes and standards. The latest revision of the code or standard in effect at the time of execution of the contract shall be used.
1. ASTM D3039: Test Method for Tensile Properties of Fiber-Resin Composites.
 2. ASTM D4541: Test Method for Pull-Off Strength of Coatings using Portable Adhesion Tester.
 3. ASTM D2563: Recommended Practice for Classifying Visual Defects in Glass Reinforced Plastic Laminate Parts.
 4. ASTM C882: Test Method for Bond Strength of Epoxy-Resin System used with Concrete.
 5. ACI 440.2R-02: Guide for the Design and Construction of Externally Bonded FRP System for Strengthening Concrete Structures.
 6. ACI 440R-96: State-of-the-Art Report on Fiber Reinforced Plastic Reinforcement for Structures.
 7. ACI 503.R: Guide for Selection of Polymer Adhesives with Concrete.
 8. ACI 222R: Corrosion of Metals in Concrete

9. ACI 224.1R: Causes, Evaluation and Repair of Cracks in Concrete Structures.
10. ACI 224R-01: Control of Cracking in Concrete Structures.
11. ACI 546R: Concrete Repair Guide.
12. ICRI #03730: Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion.
13. ICRI #03732: Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.
14. ICRI #03733: Guide for Selecting and Specifying Materials for Concrete Repairs of Concrete Surfaces.
15. NCHRP #514: Bonded Repair and Retrofit of Concrete Structures Using FRP Composites: Recommended Construction Specifications and Process Control Manual.

1.06 TOLERANCE

- A. Tolerances recommended by the manufacturer shall be followed, unless more stringent requirements are specified in these specifications or in the contract documents. In case of any conflict or appearance of any conflict, the engineer shall provide clarification before proceeding.

1.07 QUALIFICATION

- A. The manufacturer/supplier must be prequalified by the owner or its representative for each of its FRP systems after providing the following necessary information:
 1. System data sheets and MSDSs for all components of the FRP system;
 2. A minimum of three years of documented experience or three documented similar field applications with acceptable reference letters from respective owners;
 3. A comprehensive hands-on training program for each FRP system to qualify contractors/applicators. The contractor/applicator must be prequalified by the owner or its representative.
 4. A certificate of completed training from the manufacturer/supplier for at least one field representative who will be present on site throughout the project.

- B. All materials shall be compatible chemically and be supplied by the same manufacturer. No substitution shall be allowed without the prior written authorization of the engineer.

1.08 PROJECT CONDITIONS:

- A. Safety Requirements
 - 1. Consult OSHA for appropriate safety equipment and measures for application of chemicals, resins, and epoxies.

1.09 COORDINATION:

- A. Prior to the removal or disconnection of any utilities, the Contractor shall confirm the layout of all existing electrical conduits, HVAC, plumbing, alarms, and PA systems in the ceiling with the contract drawings.
- B. The Contractor shall coordinate with the MTA and obtain approval prior to any proposed power or service interruptions.
- C. It may be necessary for the Contractor to remove portions of the precast concrete ceiling panels and the masonry walls of the electrical equipment room to access the station roof slab above.

1.10 MAINTENANCE:

- A. Access to all areas of the station shall be maintained for all MTA personnel during construction.
- B. Emergency exits shall remain accessible at all times for all MTA employees, workers, and patrons.
- C. For maintenance procedures of electrical components, see specification Section 16025.

1.11 WARRANTY:

- A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.
- B. Material Warranty: Manufacturer of fiber reinforced polymer shall warrant that the product is free of defects in material and workmanship as supplied in original packaging. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under contract documents.

PART 2: PRODUCTS

2.01 MANUFACTURER:

- A. Subject to compliance with requirements, provide products from the following manufacturer **or approved equal**:

Toray Carbon Fibers America, Inc. (CFA)
 700 Parker Square, Suite 275,
 Flower Mound, TX 75028
 Phone: (917) 899-2930
 Fax: (917) 899-2938
 Internet: www.toraycfa.com

2.02 PRODUCTS AND MATERIALS:

- A. FRP composite materials using isophthalic polyester, vinylester, and epoxy resins, and carbon fibers are covered by this specification. FRP composite materials are classified based on resin type, fiber type, and fiber architecture. Any material that does not meet **these minimum requirements will be rejected**:

Fiber Properties				
		English	Metric	Test Method
Tensile Strength		500 ksi	3,450 MPa	TY-030B-01
Tensile Modulus		33.4 Msi	230 GPa	TY-030B-01
Strain		2.1 %	2.1 %	TY-030B-01
Density		0.065 lbs/in ³	1.80 g/cm ³	TY-030B-02
Filament Diameter		2.8E-04 in	7 μm	
Yield	6K	3,724 ft/lbs	400 g/1000m	TY-030B-03
	12K	1,862 ft/lbs	800 g/1000m	TY-030B-03
	24K	903 ft/lbs	1,650 g/1000m	TY-030B-03
Sizing Type	50C		1.0 %	TY-030B-05
& Amount	60E		0.3 %	TY-030B-05
	F0E		0.7 %	TY-030B-05

Resin Properties				
Compressive Properties (ASTM D-695), psi (MPa)				
	40°F (4°C)	60°F (16°C)	73°F (23°C)	90°F (32°C)
8 hour	-	-	-	8,000 (55.2)
1 day	-	8,100 (55.8)	10,700 (73.7)	10,600 (73.1)
3 day	8,100 (55.8)	11,200 (77.2)	11,100 (76.5)	11,000 (75.8)
7 day	11,200 (77.2)	11,600 (80.0)	11,200 (77.2)	11,800 (81.3)
14 day	12,500 (86.2)	12,400 (85.5)	11,800 (81.3)	11,900 (82.0)
	English	Metric	Test Method	
Tensile Strength (7 day)	4,900 psi	33.8 MPa	D-638	
Elongation @ Break (7 day)	1.2%		D-638	
Flexural Strength (7 day)	8,800 psi	60.6 MPa	D-790	
Flexural Modulus (7 day)	506 ksi	3,489 MPa	D-790	

Composite Properties			
	English	Metric	Test Method
Tensile Strength	104 ksi	715 MPa	ASTM D-3039
Tensile Modulus	9.0 Msi	61 GPa	ASTM D-3039
Tensile Strain	1.1 %	1.1 %	ASTM D-3039
Compressive Strength	97 ksi	668 MPa	ASTM D-695
Compressive Modulus	9.2 Msi	63.5 GPa	ASTM D-695
In-Plane Shear Strength	8.1 ksi	56 MPa	ASTM D-3518
ILSS	15.5 ksi	11 kgf/mm ²	ASTM D-2344
90° Tensile Strength	390 psi	23 MPa	ASTM D-3039

- B. **Materials Property Verification:** The Contractor shall hire an independent testing agency to conduct tests on sample panels (12 inch X 12 inch) made during the installation of the composite system to verify the mechanical properties of the installed products.
- C. The lot numbers for the **product materials** used for preparing the sample must be recorded by the testing lab. Two identical 12 inch X 12 inch

panels must be prepared daily or for every 1,000 square feet of fabric application. The witness panels shall be prepared by cutting a 12 inch X 12 inch sample of the saturated fabric to be installed on the concrete surface and placing it between two Mylar covered sheets of glass or Plexiglas. The samples shall be cured following the manufacturer's recommendations before they are sent to the lab for testing. The ultimate tensile strength, tensile modulus and percent elongation at failure must be recorded by the testing laboratory.

PART 3: EXECUTION

3.01 PREPARATION:

- A. Remove the architectural ceiling panels (including PA system, alarms, cameras, etc.), conduits/pipes, drip shield (steel interior liner), and support channels (including related hardware and gaskets) attached to the bottom of the station roof slabs.
- B. Contractor shall provide mitigation procedures for addressing active leaks after the drip shield is removed. Leak mitigation shall continue until the drip shield is reinstalled.
- C. Leave steel threaded hanger rods. Nuts and washers shall be removed.
- D. Using As-Builts as a guideline, locate the embedded steel beams for attachment of the threaded studs which will be used to support the steel anchorage straps. The studs shall be welded to the bottom of the flange, spaced as shown on the contract drawings. Once the installation of the threaded studs is complete, the areas around the bolt shall be filled with putty (see Section 3.01-I) to cover the exposed steel beams.
- E. The concrete surface shall be repaired, if necessary, and all concrete surfaces shall be cleaned and prepared prior to installing the FRP system. All necessary repair and restoration areas on the concrete surface shall be approved by the engineer prior to surface preparation.
- F. Surface Grinding: All irregularities, unevenness, and sharp protrusions (including Section 3.01-C) in the surface profile shall be ground away to a smooth surface with less than 1/32-inch deviation. Disk grinders or other similar devices shall be used to remove stain, paint, or any other surface substance that may affect the bond. Voids or depressions with diameters larger than 1/2 inch or depths greater than 1/8 inch, when measured from a 12-inch straight edge placed on the surface, shall be filled according to Section 3.01-I.

- G. Chamfering Corners: All corners and sharp edges shall be rounded or chamfered to a minimum radius of 1/2 inch as per ACI 440.2R-02. Ridges, form lines, and sharp or roughened edges greater than 1/4 inch shall be ground down or filled with putty, as specified in Section 3.01-I. Provisions shall be made to accommodate obstructions and embedded objects before installing the FRP system.
- H. Crack Injection: All cracks in the surface of concrete or the substrate that are wider than 1/100 inch shall be filled using pressure injection of epoxy according to ACI 224.1R. Smaller cracks may also require resin injection in aggressive environments. Follow ACI 224R-01 crack width criteria for various exposure conditions. The FRP system shall be installed no sooner than 24 hours after crack injection. Any surface roughness caused by injection shall be removed as specified in Section 3.01-F.
- I. Surface Profiling: After surface grinding, any remaining unevenness in the surface greater than that specified in Section 3.01-F, including out-of-plane variations, fins, protrusions, bug holes, depressions voids, and roughened corners, shall be filled and smoothed over using putty made of epoxy resin mortar or polymer cement mortar with strength equal to or greater than the strength of the original concrete. The patching material shall be cured a minimum of 7 days before installing the FRP system unless its curing and strength are verified by tests.
- J. Surface Cleaning: Finished surface of concrete shall be cleaned to the approval of the engineer. Cleaning shall remove any dust, laitance, grease, oil, curing compounds, wax, impregnations, stains, paint coatings, surface lubricants, foreign particles, weathered layers, or any other bond inhibiting material. If power wash is used, the surface shall be allowed to dry thoroughly before installing the FRP system. The cleaned surface shall be protected against redeposit of any bond inhibiting materials. Newly repaired or patched surfaces that have not cured a minimum of 7 days shall be coated with a water-based epoxy paint or other approved sealers.

3.02 TEST AREA:

- A. N/A

3.03 INSTALLATION/APPLICATION:

- A. Specific procedures for installing FRP systems may vary slightly for each system and manufacturer. Contractor must submit installation details for approval by the engineer prior to installation.
- B. Environmental conditions shall be examined before and during installation of the FRP system to ensure conformity to the contract documents and manufacturer's recommendations. Do not apply primers, putty, saturating

resins, or adhesives on cold, frozen, damp, or wet surfaces. Ambient and concrete surface temperatures shall be within 10–35°C (50–95°F), unless specified by the manufacturer. Moisture level on all contact surfaces shall be less than 10% at the time of installation of the FRP system, as evaluated according to ACI 503R- 93. Moisture restrictions may be waived for resins that have been formulated for wet applications.

- C. Application of bonded FRP systems shall not proceed if any moisture vapor transmission is present. Concrete dryness is necessary when using elevated temperature cure. Any bubble that develops from moisture vapor transmission can effectively be injected with the same adhesive material used for the FRP system.
- D. Shoring: Repaired members shall be shored temporarily with conventional methods, if specified in contract documents, or required by the engineer for safety. Shoring shall not be removed until the FRP system has fully cured and gained its design strength, as recommended by the manufacturer and approved by the engineer.
- E. **The FRP system shall have a minimum composite thickness of 0.20 inches.** The contractor shall provide all necessary equipment in sufficient quantities and in clean operating conditions for continuous uninterrupted FRP installation.
- F. Curing: The FRP system shall be allowed to cure as recommended by the manufacturer. Field modification of resin chemistry for rapid curing is not allowed. Elevated cure temperature may be used if rapid curing is necessary and approved by engineer. Cure of installed plies shall be monitored before placing subsequent plies. In case of any curing irregularity, installation of subsequent plies shall be halted.
- G. After the curing of the FRP system is complete and the protective coating has been applied, the anchorage straps shall be installed on the horizontal repair surface. See the contract drawings for the specified spacing, orientation, and connection details of the anchorage straps.

3.04 FIELD QUALITY CONTROL:

- A. Contractor must develop a field quality control plan and have it approved by the engineer. The plan shall include the following details.
 - 1. Inspection of materials
 - 2. Daily inspection plan
 - 3. Inspection for fiber orientation

4. Inspection for debonding
5. Inspection for cure of resin
6. Inspection for adhesion
7. Inspection for cured thickness

3.05 REPAIR OF DEFECTIVE WORK

- A. Defects are of different types and may be generally classified as aesthetic, short-term critical, or long-term critical. Repair procedure depends on the type, size, and extent of defects. Repair procedures for any condition not addressed in these specifications or in the contract documents shall be submitted by the contractor and approved by the engineer prior to proceeding with the work.
- B. **Repair of Protective Coating:** Defects in protective coating can be of three types: small hairline cracks, blistering, and peeling. In all cases, moisture content of the substrate should be below 0.05% before applying a new coating. Prior to any repair of protective coating, the FRP system shall be examined visually or otherwise to ensure that no defect exists within or on the surface of the FRP. Defects in FRP, if found, shall be repaired as per Sections 3.05-C and 3.05-D. If protective coating appears to show small areas with cracks, the local surface shall be lightly sanded. Then, a new coating with appropriate primer shall be applied according to the manufacturer's recommendations. At the minimum, the coating shall be applied over an area extending 1 inch on either side of the defect. If the protective coating shows signs of blistering, the entire area of blisters as well as the surrounding area to a distance of at least 12 inch shall be carefully scraped clean. In no case should a blistered surface be recoated without complete removal of the existing coating. The area shall be wiped clean and then dried thoroughly. Once dry, the area can be recoated after application of the primer coat if required by the manufacturer. If the surface shows signs of excessive peeling, the entire coating shall be scraped off and the surface lightly sanded, wiped cleaned, and thoroughly dried before applying a new coat according to the manufacturer's recommendations.
- C. **Epoxy Injection of Small Defects:** Small entrapped voids or surface discontinuities no larger than 1/4 inch in diameter shall not be considered defects and require no corrective action unless they occur next to edges or when there are more than five such defects in an area of 10 square feet. Small defects of size between 1/4 and 1 1/4 inch in diameter shall be repaired using low-pressure epoxy injection as long as the defect is local and does not extend through the complete thickness of the laminate in case of multiple-ply FRP systems. If any delamination growth is suspected

between the FRP plies due to injection, the procedure shall be halted, and repair shall follow Section 3.05-D.

- D. **Patching of Minor Damages:** Minor defects are those with diameters between 1 1/4 and 6 inches and a frequency of less than five per any unit surface area of 10-ft length or width. The area surrounding the defects to an extent of at least 1 inch on all sides shall be carefully removed. The area shall be wiped cleaned and thoroughly dried. The area shall then be patched by adding an FRP patch of the same type as original laminate and extending at least 1 inch on all sides of the removed area. Repair can also be conducted using the procedure in Section 3.05-E.
- E. **Replacement of Large Defects:** Defects larger than 6 inch in diameter shall be carefully marked and scarfed out extending to a minimum of 1 inch on all sides. Scarfing shall be progressive through the layers in the case of multiple-ply FRP systems until past the defective area. In case the defect extends to the first FRP ply adjacent to the concrete, the entire thickness of the FRP and primer shall be removed. The substrate shall be appropriately prepared and primer reapplied after ensuring that the surface and FRP are clean and dry. Application of a new FRP system within the scarfed area shall follow procedures for the original FRP system, except that an additional layer extending a minimum of 6 inch on all sides of the scarfed area shall be added as a patch. Once cured, the protective coating shall be applied over the entire area.

3.06 CLEANING:

- A. The contractor is responsible for the cleanup of the equipment and the project site from hazardous and aesthetically undesirable FRP components using appropriate solvents, as recommended in the system data sheet.

3.07 PROTECTION:

- A. Temporary protection shall be installed, as specified in the contract documents, until the resin has fully cured, as approved by the engineer.

PART 4: MEASUREMENT AND PAYMENT

4.01 METHOD OF MEASUREMENT

- A. Fiber Reinforced Polymer installation will be measured by the square foot to the nearest square foot. The quantity to be paid for is the area covered with FRP composite material.

4.02 BASIS OF PAYMENT:

- A. The unit price bid per Square Foot for Fiber Reinforced Polymer installation includes the cost of all materials, labor, equipment, testing, and other services necessary to satisfactorily complete the work in accordance with these specifications and the directions of the Engineer including the installation of the threaded studs and anchorage straps. Include the cost of all repairs or replacement of the FRP resulting from failed test data in the unit price bid.

END OF SECTION

APPENDIX A

CONTRACT NO. T-1384-0140

LIST OF CONTRACT DRAWINGS

<u>Sheet Number</u>	<u>Drawing Number</u>	<u>GENERAL</u>
1	G-01	TITLE SHEET
2	G-02	INDEX OF DRAWINGS
3	G-03	GENERAL NOTES, SEQUENCE OF CONSTRUCTION, ADA SUMMARY & ABBREVIATIONS
4	G-04	CIVIL ABBREVIATIONS AND SYMBOLS
<u>Sheet Number</u>	<u>Drawing Number</u>	<u>STRUCTURAL</u>
5	ST-01	STATION KEY PLANS & SECTION
6	ST-02	PEDESTRIAN SAFETY AND M.O.T. PLAN
7	ST-03	LONGITUDINAL SECTION – CENTRAL
8	ST-04	CROSS SECTIONS
9	ST-05	LIMIT OF WORK PLAN
10	ST-06	DEMOLITION PLAN
11	ST-07	FRP ANCHORAGE DETAILS
12	ST-08	CEILING PANEL REPLACEMENT PLAN
<u>Sheet No.</u>	<u>Drawing No.</u>	<u>MECHANICAL</u>
13	ME-01	MEZZANINE HVAC DEMOLITION PLAN
14	ME-02	MEZZANINE HVAC PLAN
<u>Sheet No.</u>	<u>Drawing No.</u>	<u>ELECTRICAL</u>
15	EL-01	GENERAL NOTES, ABBREVIATIONS AND SYMBOLS
16	EL-02	PARTIAL CONDUITS LAYOUT FLOOR PLAN
17	EL-03	EAST ELECTRICAL ROOM - ENLARGED PLAN, SECTIONS AND DETAILS
18	EL-04	LIGHTING LAYOUT FLOOR PLAN - MEZZANINE LEVEL - EAST
19	EL-05	FIRE ALARM LAYOUT FLOOR PLAN
20	EL-06	SPEAKER LAYOUT FLOOR PLAN
21	EL-07	POWER SCHEDULE

APPENDIX A - Cont.

CONTRACT NO. T-1384-0140

LIST OF CONTRACT DRAWINGS

<u>Sheet</u> <u>No.</u>	<u>Drawing</u> <u>No.</u>	<u>LANDSCAPE</u>
22	LS-01	FENCING PLAN
23	LS-02	FENCING SECTIONS
24	LS-03	FENCING DETAILS



MARYLAND TRANSIT ADMINISTRATION

MARYLAND DEPARTMENT OF TRANSPORTATION

Martin O'Malley, Governor • Anthony G. Brown, Lt. Governor
Darrell B. Mobley, Acting Secretary • Ralign T. Wells, Administrator

TO: All Planholders

FROM: Maryland Transit Administration

SUBJECT: **ADDENDUM NO. 3**
Contract No.: T-1384-0140
Metro Shot Tower Station Structural Preservation & Miscellaneous Improvements

DATE: May 3, 2013

Enclosed and effective this date is Addendum No. 2 to the subject Contract. This change does delay the Step 1-Technical Bid and Step 2-Price Bid Due date from May 9, 2013 to **May 16, 2013 at 2pm EST.**

The Bidder shall acknowledge receipt of this Addendum by completing and returning this form with the bid package.

All other terms and conditions remain unchanged.

Sincerely,

Rick Owens, Procurement Officer
Professional Services/Construction/Installation Section
Procurement Division

Acknowledgement of receipt of ADDENDUM # 3 to Solicitation #T-1384-0140

Vendor Name: _____

Authorized Representative's Signature

Date

**KEY INFORMATION SUMMARY SHEET
STATE OF MARYLAND**

**MULTI-STEP
INVITATION FOR BID (IFB)**

**METRO SHOT TOWER STATION
STRUCTURAL PRESERVATION &
MISCELLANEOUS IMPROVEMENTS**

CONTRACT NO. T-1384-0140

IFB Issue Date: March 15, 2013

IFB Issuing Office: MD Department of Transportation
Maryland Transit Administration

Procurement Officer: Rick Owens
Office Phone: (410) 767-3360
Facsimile: (410) 333-4810
E-mail: rowens@mta.maryland.gov

Bids are to be delivered to: Maryland Transit Administration
6 St. Paul Street
Baltimore, MD 21202
Attention: Rick Owens

Questions Due by: March 29, 2013 by 4:00pm

Pre-Bid Meeting: April 11, 2013
Maryland Transit Administration
6 St. Paul Street, Rooms
Baltimore, MD 21202

**Step 1-Technical Bid and
Step 2-Price Bid due by:** May 16, 2013 2:00 pm

Step 2-Price Bid to be opened: TBD

Prospective Bidders who have received this document from a source other than the Procurement Officer's authorized agency and who wish to assure receipt of any changes or additional materials related to the IFB should immediately visit MTA's website (www.mta.maryland.gov) to download this IFB. Follow links "Business", "Procurements", "Bids/Solicitations" to view the specifications and/or addenda.

Disadvantaged Business Enterprises are encouraged to respond to this solicitation.

**METRO SHOT TOWER STATION STRUCTURAL PRESERVATION &
MISCELLANEOUS IMPROVEMENTS**

INSTRUCTIONS TO BIDDERS

I. GENERAL

The Technical and Price Bids will be reviewed for consistency with and response to the requirements of this Multi-Step IFB.

All interested Bidders must submit their bids in a separate sealed carton or envelope and clearly labeled **“Technical and Price Bids for Contract No. T-1384-0140 – Metro Shot Tower Station Structural Preservation & Miscellaneous Improvements”** and deliver the documents to:

Rick Owens, Procurement Officer
MTA, Contract Administration Division
6 Saint Paul Street, 7th Floor
Baltimore, Maryland 21202
Phone: 410-767-3360 Fax: 410-333-4810
E-mail: rowens@mta.maryland.gov

Bids must be delivered on or before **2:00 PM Eastern Standard Time (EST) on Thursday, May 16, 2013**. Any bids not received by the time and date shall not be accepted. If bids are mailed, it is the Bidder’s responsibility to make allowances for on-time delivery.

II. BIDS

A two part submittal: Step One- Technical Bid and Step Two – Price Bid

Step One – Technical Bid must be sealed separately from Step Two – Price Bid but submitted simultaneously to the Procurement Officer (address listed above). One (1) unbound original, so identified, and five (5) copies of Step One-Technical Bid are to be submitted. One (1) original of Step Two-Price Bid is to be submitted. Each sealed package must bear the Multi-Step title and number, name and address of the Bidder, the step number (One or Two), and the closing date and time for receipt of the bids on the outside of the package.

A. STEP ONE-TECHNICAL BID PREPARATION AND SUBMITTAL

Technical Proposals shall be responsive and conform to all requirements in these instructions and the requirements of the Contract Documents.

B. STEP ONE-TECHNICAL BID REQUIREMENTS

Each offeror shall submit a Step-One Technical Bid in response to the

requirements of this Multi-Step IFB. To facilitate, timely and efficient evaluations by the MTA's Evaluation Committee, the following submission requirements shall be followed.

The Step-One Technical Bid shall consist of:

- Transmittal Letter
- Executive Summary
- Experience and Capabilities
- Technical Capabilities
- Management Approach
- Fully Executed Documents:
 - Contractor's Questionnaire Pre-Award Evaluation Data
 - Bid/Proposal Affidavit
 - Buy America Certificate
 - Certification Regarding Lobbying
 - MDOT DBE Form A, "Certified DBE Utilization and Fair Solicitation Affidavit"
 - MDOT DBE Form B, "DBE Participation Schedule"
 - Certification Regarding Investment Activities in Iran
 - Location of the Performance of Services Disclosure
 - Mercury Affidavit
 - Conflict of Interest Affidavit
 - Non Disclosure Agreement
 - Signed copy of the Cover Letter for each Addendum issued by the MTA

Failure of the Bidder to submit each and every Step-One Technical Bid form required by this Multi-Step IFB, fully executed, in a correctly labeled, sealed envelope, duly executed by the authorized officer as listed in the "Transmittal Letter" may render the Step-One Technical Bid incomplete and unresponsive and may be cause for rejection or determination of unacceptability. Bidders whose Step-One Technical Bids are determined "Acceptable" by MTA, will have their Step-Two Price Bid scheduled for public opening.

1.0 TRANSMITTAL LETTER

A letter of transmittal signed by an officer authorized to make a binding commitment for the firm submitting the bid. The letter must contain the following:

- a) A statement that except as noted in the bid Executive Summary that the Bidder has accepted, agreed to, and will comply with all contract documents contained in this solicitation.

- b) A statement that the firm understands that by submitting a response to this solicitation, it represents that it is not in arrears in the payment of any obligation due to the State of Maryland, including the payment of taxes and employee benefits, and that it shall not become so in arrears, during the term of the contract, if selected for a contract award.
- c) A statement that the technical and price bid is valid for a minimum of 180 days from date of submission.

2.0 EXECUTIVE SUMMARY

Bidder's standard executive letter outlining the company size, over-all capabilities, project controls, history and related project information. (Minimum of two (2) pages to a maximum of four (4) pages)

3.0 PRIME CONTRACTOR'S EXPERIENCE AND CAPABILITIES

This section should focus on the type of work your company is known for throughout the construction industry. Additionally, complete and attach MTA forms, List of Current (Backlog) and Completed Project for the last five years. The provided reference information such as owner's names, address, phone numbers and contact person must be correct.

Provide technical information on the type of similar projects your company has constructed in the last five (5) years per your list of completed projects in the last five years.

4.0 FINANCIAL RESPONSIBILITY

Provide evidence regarding bonding capacity, in the form of a letter from a surety or insurance company, indicating bonding capacity for the firm. Letters indicating "unlimited" bonding capability are not acceptable.

5.0 CONSTRUCTION MANAGEMENT APPROACH

Provide your company's construction management approach.

C. EVALUATION OF STEP-ONE TECHNICAL BID

If MTA requires clarification, verification, and /or support of technical data submitted by a bidder in its Step-One Technical Bid. MTA will request the needed information in writing. Such data shall be furnished by the Bidder and received by MTA within five (5) business days following request by MTA. Bidders shall not submit any unsolicited information. Such information will not be accepted by MTA and will not be used in the Bid evaluation process.

1. EVALUATION FACTORS CRITERIA

All Step-One Technical Bids submitted in response to this Multi-Step IFB will be evaluated according to the following criteria by Pass/Fail:

- a. Submittal of Required Documents per ITB Section II.B
- b. The Respondent shall have at least 10 (ten) years of verifiable experience in integrating, managing and successfully completing civil engineering, structural strengthening and rail transportation projects similar to the scope of work
- c. The Respondent must demonstrate skills experience with installing Fiber Reinforcement Polymer (FRP) System
- d. The Respondent’s Project Manager shall have at least 5 (five) years of verifiable experience in integrating, managing and successfully completing civil engineering, structural strengthening and rail transportation projects similar to the scope of work

2. KEY SCHEDULED DATES (STEP ONE and STEP TWO)

EVENT	Scheduled Date
Solicitation Documents available	3/14/13
Pre-Bid Conference	4/11/13
Step-One Technical Bid and Step-Two Price Bid due	5/16/13
Step-Two Price Bid to be opened	TBD

D. STEP TWO-PRICE BID REQUIREMENTS

The Step-Two Price Bid shall consist of the following documents fully executed:

- Bid Form
- Bid Bond in the amount of \$ _____
Or 5% of the bid price (if applicable)
Or
Individual Surety Bid Bond in the Amount of \$ _____
Or 5% of the bid price (if applicable) and an executed Affidavit of Individual Surety (Attachment A) & Surety Affidavit (Attachment B).
- Completed Insurance Cost Worksheet

E. EVALUATION OF STEP-TWO PRICE BID

Once the technical bid has been found to be acceptable, price bids from only those vendors whose technical bid has been acceptable shall be considered and evaluated. Price bids will be solicited at the same time as technical bids, in separated sealed envelopes. Price information will be opened after the technical review is complete. Price information from vendors whose technical bids have been found unacceptable shall be returned unopened.



MARYLAND TRANSIT ADMINISTRATION

MARYLAND DEPARTMENT OF TRANSPORTATION

Martin O'Malley, Governor • Anthony G. Brown, Lt. Governor
Darrell B. Mobley, Acting Secretary • Ralign T. Wells, Administrator

TO: All Planholders

FROM: Maryland Transit Administration

SUBJECT: **ADDENDUM NO. 2**
Contract No.: T-1384-0140
Metro Shot Tower Station Structural Preservation & Miscellaneous Improvements

DATE: April 22, 2013

Enclosed and effective this date is Addendum No. 2 to the subject Contract. This change does delay the Step 1-Technical Bid and Step 2-Price Bid Due date from April 25, 2013 to **May 9, 2013 at 2pm EST.**

The Bidder shall acknowledge receipt of this Addendum by completing and returning this form with the bid package.

All other terms and conditions remain unchanged.

Sincerely,

Rick Owens, Procurement Officer
Professional Services/Construction/Installation Section
Procurement Division

Acknowledgement of receipt of ADDENDUM # 2 to Solicitation #T-1384-0140

Vendor Name: _____

Authorized Representative's Signature

Date

KEY INFORMATION SUMMARY SHEET

**STATE OF MARYLAND
MULTI-STEP
INVITATION FOR BID (IFB)**

**METRO SHOT TOWER STATION
STRUCTURAL PRESERVATION &
MISCELLANEOUS IMPROVEMENTS**

CONTRACT NO. T-1384-0140

IFB Issue Date: March 15, 2013

IFB Issuing Office: MD Department of Transportation
Maryland Transit Administration

Procurement Officer: Rick Owens
Office Phone: (410) 767-3360
Facsimile: (410) 333-4810
E-mail: rowens@mta.maryland.gov

Bids are to be delivered to: Maryland Transit Administration
6 St. Paul Street
Baltimore, MD 21202
Attention: Rick Owens

Questions Due by: March 29, 2013 by 4:00pm

Pre-Bid Meeting: April 11, 2013
Maryland Transit Administration
6 St. Paul Street, Rooms
Baltimore, MD 21202

**Step 1-Technical Bid and
Step 2-Price Bid due by:** May 9, 2013 2:00 pm

Step 2-Price Bid to be opened: TBD

Prospective Bidders who have received this document from a source other than the Procurement Officer's authorized agency and who wish to assure receipt of any changes or additional materials related to the IFB should immediately visit MTA's website (www.mta.maryland.gov) to download this IFB. Follow links "Business", "Procurements", "Bids/Solicitations" to view the specifications and/or addenda.

Disadvantaged Business Enterprises are encouraged to respond to this solicitation.

**METRO SHOT TOWER STATION STRUCTURAL PRESERVATION &
MISCELLANEOUS IMPROVMENTS**

INSTRUCTIONS TO BIDDERS

I. GENERAL

The Technical and Price Bids will be reviewed for consistency with and response to the requirements of this Multi-Step IFB.

All interested Bidders must submit their bids in a separate sealed carton or envelope and clearly labeled “**Technical and Price Bids for Contract No. T-1384-0140 – Metro Shot Tower Station Structural Preservation & Miscellaneous Improvements**” and deliver the documents to:

Rick Owens, Procurement Officer
MTA, Contract Administration Division
6 Saint Paul Street, 7th Floor
Baltimore, Maryland 21202
Phone: 410-767-3360 Fax: 410-333-4810
E-mail: rowens@mta.maryland.gov

Bids must be delivered on or before **2:00 PM Eastern Standard Time (EST) on Thursday, May 9, 2013**. Any bids not received by the time and date shall not be accepted. If bids are mailed, it is the Bidder’s responsibility to make allowances for on-time delivery.

II. BIDS

A two part submittal: Step One- Technical Bid and Step Two – Price Bid

Step One – Technical Bid must be sealed separately from Step Two – Price Bid but submitted simultaneously to the Procurement Officer (address listed above). One (1) unbound original, so identified, and five (5) copies of Step One-Technical Bid are to be submitted. One (1) original of Step Two-Price Bid is to be submitted. Each sealed package must bear the Multi-Step title and number, name and address of the Bidder, the step number (One or Two), and the closing date and time for receipt of the bids on the outside of the package.

A. STEP ONE-TECHNICAL BID PREPARATION AND SUBMITTAL

Technical Proposals shall be responsive and conform to all requirements in these instructions and the requirements of the Contract Documents.

B. STEP ONE-TECHNICAL BID REQUIREMENTS

Each offeror shall submit a Step-One Technical Bid in response to the

requirements of this Multi-Step IFB. To facilitate, timely and efficient evaluations by the MTA's Evaluation Committee, the following submission requirements shall be followed.

The Step-One Technical Bid shall consist of:

- Transmittal Letter
- Executive Summary
- Experience and Capabilities
- Technical Capabilities
- Management Approach
- Fully Executed Documents:
 - Contractor's Questionnaire Pre-Award Evaluation Data
 - Bid/Proposal Affidavit
 - Buy America Certificate
 - Certification Regarding Lobbying
 - MDOT DBE Form A, "Certified DBE Utilization and Fair Solicitation Affidavit"
 - MDOT DBE Form B, "DBE Participation Schedule"
 - Certification Regarding Investment Activities in Iran
 - Location of the Performance of Services Disclosure
 - Mercury Affidavit
 - Conflict of Interest Affidavit
 - Non Disclosure Agreement
 - Signed copy of the Cover Letter for each Addendum issued by the MTA

Failure of the Bidder to submit each and every Step-One Technical Bid form required by this Multi-Step IFB, fully executed, in a correctly labeled, sealed envelope, duly executed by the authorized officer as listed in the "Transmittal Letter" may render the Step-One Technical Bid incomplete and unresponsive and may be cause for rejection or determination of unacceptability. Bidders whose Step-One Technical Bids are determined "Acceptable" by MTA, will have their Step-Two Price Bid scheduled for public opening.

1.0 TRANSMITTAL LETTER

A letter of transmittal signed by an officer authorized to make a binding commitment for the firm submitting the bid. The letter must contain the following:

- a) A statement that except as noted in the bid Executive Summary that the Bidder has accepted, agreed to, and will comply with all contract documents contained in this solicitation.

- b) A statement that the firm understands that by submitting a response to this solicitation, it represents that it is not in arrears in the payment of any obligation due to the State of Maryland, including the payment of taxes and employee benefits, and that it shall not become so in arrears, during the term of the contract, if selected for a contract award.
- c) A statement that the technical and price bid is valid for a minimum of 180 days from date of submission.

2.0 EXECUTIVE SUMMARY

Bidder's standard executive letter outlining the company size, over-all capabilities, project controls, history and related project information. (Minimum of two (2) pages to a maximum of four (4) pages)

3.0 PRIME CONTRACTOR'S EXPERIENCE AND CAPABILITIES

This section should focus on the type of work your company is known for throughout the construction industry. Additionally, complete and attach MTA forms, List of Current (Backlog) and Completed Project for the last five years. The provided reference information such as owner's names, address, phone numbers and contact person must be correct.

Provide technical information on the type of similar projects your company has constructed in the last five (5) years per your list of completed projects in the last five years.

4.0 FINANCIAL RESPONSIBILITY

Provide evidence regarding bonding capacity, in the form of a letter from a surety or insurance company, indicating bonding capacity for the firm. Letters indicating "unlimited" bonding capability are not acceptable.

5.0 CONSTRUCTION MANAGEMENT APPROACH

Provide your company's construction management approach.

C. EVALUATION OF STEP-ONE TECHNICAL BID

If MTA requires clarification, verification, and /or support of technical data submitted by a bidder in its Step-One Technical Bid. MTA will request the needed information in writing. Such data shall be furnished by the Bidder and received by MTA within five (5) business days following request by MTA. Bidders shall not submit any unsolicited information. Such information will not be accepted by MTA and will not be used in the Bid evaluation process.

1. EVALUATION FACTORS CRITERIA

All Step-One Technical Bids submitted in response to this Multi-Step IFB will be evaluated according to the following criteria by Pass/Fail:

- a. Submittal of Required Documents per ITB Section II.B
- b. The Respondent shall have at least 10 (ten) years of verifiable experience in integrating, managing and successfully completing civil engineering, structural strengthening and rail transportation projects similar to the scope of work
- c. The Respondent must demonstrate skills experience with installing Fiber Reinforcement Polymer (FRP) System
- d. The Respondent's Project Manager shall have at least 5 (five) years of verifiable experience in integrating, managing and successfully completing civil engineering, structural strengthening and rail transportation projects similar to the scope of work

2. KEY SCHEDULED DATES (STEP ONE and STEP TWO)

EVENT	Scheduled Date
Solicitation Documents available	3/14/13
Pre-Bid Conference	4/11/13
Step-One Technical Bid and Step-Two Price Bid due	5/9/13
Step-Two Price Bid to be opened	TBD

D. STEP TWO-PRICE BID REQUIREMENTS

The Step-Two Price Bid shall consist of the following documents fully executed:

- Bid Form
- Bid Bond in the amount of \$ _____
Or 5% of the bid price (if applicable)
Or
Individual Surety Bid Bond in the Amount of \$ _____
Or 5% of the bid price (if applicable) and an executed Affidavit of Individual Surety (Attachment A) & Surety Affidavit (Attachment B).
- Completed Insurance Cost Worksheet

E. EVALUATION OF STEP-TWO PRICE BID

Once the technical bid has been found to be acceptable, price bids from only those vendors whose technical bid has been acceptable shall be considered and evaluated. Price bids will be solicited at the same time as technical bids, in separated sealed envelopes. Price information will be opened after the technical review is complete. Price information from vendors whose technical bids have been found unacceptable shall be returned unopened.



MARYLAND TRANSIT ADMINISTRATION

MARYLAND DEPARTMENT OF TRANSPORTATION

Martin O'Malley, Governor • Anthony G. Brown, Lt. Governor
Darrell B. Mobley, Acting Secretary • Ralign T. Wells, Administrator

TO: All Planholders
FROM: Maryland Transit Administration
SUBJECT: **ADDENDUM NO. 1**
Contract No.: T-1384-0140
Metro Shot Tower Station Structural Preservation & Miscellaneous Improvements
DATE: March 28, 2013

Enclosed and effective this date is Addendum No. 1 to the subject Contract. This change does not delay the Bid Opening Date.

This Addendum is to inform all potential bidders that, for the site visit which is to be held after the pre-bid meeting on 04/11/13, it is recommended that all persons wanting to access mechanical areas gave proper PPE; hard hats, gloves and eyewear.

The Bidder shall acknowledge receipt of this Addendum by completing and returning this form with the bid package.

All other terms and conditions remain unchanged.

Sincerely,


Rick Owens, Procurement Officer
Professional Services/Construction/Installation Section
Procurement Division

Acknowledgement of receipt of ADDENDUM # 1 to Solicitation #T-1384-0140

Vendor Name: _____

Authorized Representative's Signature

Date