

CONCRETE ARCH SLAB ON FRP DECKING

****From Fairfield BRO 1448(38)**

- xx. DESCRIPTION. This work shall consist of designing, manufacturing, transporting, and attaching corrugated FRP deck panels to composite arch tubes, and placing a reinforced concrete deck slab along the curved arch profile, in accordance with these specifications and in conformity with the geometry and dimensions shown in the Plans or established by the Engineer.
- xx. DEFINITIONS. Terms and definitions included herein shall be defined as outlined in the Vermont Agency of Transportation Standard Specifications, with the following added terms:
- (a) FRP Deck Panels. Corrugated stay-in-place form panels for reinforced concrete deck placement.
 - (b) Manufacturer. A firm licensed by Advanced Infrastructure Technologies for the manufacturing of the FRP deck panels.
- xx. MATERIALS. Materials shall meet the following requirements:
- (a) Cast-in-Place Concrete. Cast-in-Place concrete shall meet the requirements of Section 501 for Concrete, High Performance Class A.
 - (b) Reinforcing Steel. Reinforcing steel shall meet the requirements of Section 507 for Level II reinforcing (stainless clad or dual-coated reinforcing steel).
 - (c) FRP Deck Panels. The FRP deck panels shall be designed to meet the specific requirements of the bridge. FRP deck panels shall conform to the following:
 - (1) Resin Type. Resin shall be premium grade, chemically resistant Vinyl Ester.
 - (2) Glass Reinforcement. Reinforcement shall be straight and continuous, with fibers oriented in two directions (along the length and width of unit). Glass content shall be a minimum of 50% by weight.
 - (3) Flame Spread. Panels shall have a Class 1 flame spread rating (25 or less when tested in accordance with ASTM E-84), shall be listed by UL, and bear the UL label.
 - (4) UV Resistance. Panel material shall be made from a UV stabilized resin modified with acrylic monomers. Additional UV resistance shall come from surfacing mats and a surface coating of an acrylic polymer.
 - (d) Fasteners. Deck panels shall be fastened to the arches with self-drilling type 410 stainless steel screws, installed with fender washers. Fasteners shall be installed at every corrugation.

xx. GENERAL FABRICATION REQUIREMENTS.

- (a) General. The following shall design and supply the RFTA superstructure units that meet these specifications:

Advanced Infrastructure Technologies (AIT)
20 Godfrey Drive
Orono, ME 04473
Telephone: 207-866-6526
Fax: 207-866-6501
Contact: Jonathan Kenerson
E-mail: Jon@aitbridges.com

No substitutions for the above will be accepted.

- (b) Qualifications. The Manufacturer shall have five (5) years of experience manufacturing FRP deck panels. Documentation shall be provided to the Agency substantiating the Manufacturer's experience and demonstrating that the Manufacturer has adequate staff, experienced personnel, and in-house engineering.
- (c) Quality Control. The Manufacturer shall demonstrate a level of quality control testing that satisfies the Agency as to its ability and commitment to produce FRP deck panels. The Fabricator shall submit a Quality Control Plan to the Agency's Structures Engineer for review and approval prior to the commencement of work. The plan shall clearly define the quality control procedures, personnel, frequency of activities, and remedial actions required.

xx. DESIGN REQUIREMENTS. The concrete arch slab with FRP decking shall be designed by AIT in accordance with the AASHTO Standard Specifications for Highway Bridges; LRFD Bridge Design Specifications, Sixth Edition, Dated 2012 and its latest revisions; and the VTrans Structures Design Manual, dated 2010.

xx. SUBMITTALS.

- (a) Design. Three (3) copies of the bridge design shall be submitted to the Agency's Structures Engineer a minimum of 28 days prior to beginning any work. The design calculations shall substantiate that all proposed bridge components, including but not limited to the FRP deck panels and reinforced concrete deck, satisfy the requirements of the Contract Documents. The design calculations shall include an LRFR load rating for the seven standard axle configurations indicated in the load rating table in the Plans.

The design shall be submitted as Working Drawings to be reviewed for conformance in accordance with Subsection 105.03. The submitted documents shall be signed, stamped, and dated by a Professional Engineer (Structural or Civil) licensed in the State of Vermont. The Professional Engineer is responsible for ensuring that the design and

details of the concrete arch slab on FRP decking conforms to the requirements of the Contract Documents.

- (b) Working Drawings. Working drawings shall be submitted in accordance with Section 105 for any item of work requiring Fabrication or Construction Drawings under Section 105.

Construction Drawings for FRP decking arch erection and concrete deck placement shall be submitted in accordance with Section 105. The erection plan shall include the necessary computations to indicate the magnitude of stress in the FRP decking during erection and to demonstrate that all of the erection equipment has adequate capacity for the work to be performed, and provisions for all stages of construction, including temporary stoppages. Panel weight shall be indicated on Working Drawings.

Submittal of the erection plan is for the Agency's documentation only and shall in no way be construed as approval of the proposed method of erection. The Contractor shall follow the erection plan as submitted.

The time required for preparation and review of these submittals will be charged to the allowable Contract time. Delay caused by untimely submittals or insufficient data will not be considered justification for time extension. No additional compensation will be made for any additional material, equipment, or other items found necessary to comply with the project specifications as a result of the Engineer's review.

- xx. INSPECTION. The FRP deck panels shall be inspected by the Agency in accordance with Subsection 106.04.

- xx. HANDLING, STORING, AND SHIPPING. The Contractor shall be responsible for receiving, unloading, and storing the panels at the jobsite in accordance with these special provisions.

- (a) Handling. Care shall be taken when handling the FRP panels such that no damage is caused, and that the panels are protected from cuts, scratches, gouges, abrasions, and impacts. Individual panels shall be lifted from two pick points with padded straps, located approximately one quarter of the total length from each end. Wire slings will not be permitted.
- (b) Storing. Panels shall be stored under cover, dry, and stacked off the ground with one end elevated to permit draining of incidental water.
- (c) Shipping. The Contractor shall secure the necessary hauling permits.

xx. INSTALLATION.

- (a) Installation Plan. A written installation plan (in conjunction with the construction of the Composite Arch Superstructure and FRP Mechanically Stabilized Earth Arch Headwalls) shall be submitted to the Engineer within 30 days following the bid award. The written installation plan shall provide, as a minimum, the following information:
- (1) Construction plan, sequence, and schedule.
 - (2) Temporary storage conditions.
 - (3) Any temporary bracing plans.
 - (4) A list of all equipment to be used. Manufacturer performance data will be required for all concrete placement equipment.
 - (5) The intended method and sequence of placing the concrete. This shall include a written narrative and diagrams and/or photographs as necessary so that the process will be clearly defined.
 - (6) The name(s) of the responsible person/people in charge for the Contractor.
- (b) Methods, Equipment, and Erection. Cranes, lifting devices, and other equipment for FRP decking erection shall be of adequate design and capacity to safely erect, align, and secure all members and components in their final positions without damage. The Contractor is solely responsible for the methods and equipment employed for the erection of the composite arch components.
- (c) FRP Deck Panels. The FRP deck panels shall be installed following the composite arch profile as shown in the Plans. Square up panel into final position with proper bearing. The Contractor shall follow the installation instructions and recommendations as follows:
- (1) Drills used to attach the FRP decking to the hollow composite arches shall be capable of being adjusted to a torque setting such that the screws do not strip out the hole. Drive all screws at 500 rpm or less. Do not over tighten.
 - (2) Fasten panels to arches with one fastener per corrugation at each arch bearing location.
 - (3) Nest side laps of adjacent deck panels.

- (4) If the design calls for end laps, each successive course of panels shall alternate the top and bottom panels.
- (5) Panel ends at the edge of the structure shall be cut in a straight line parallel to the direction of the arch span to accommodate headwall alignment and/or bridge skew.
- (d) Batching, Placing, and Testing Concrete. Concrete shall not be placed until an Agency representative has approved placement. Batching, placing, and testing concrete shall meet the requirements of Section 501 for Concrete, High Performance Class A.
- (e) Cold Weather. When the concrete is cast in ambient air temperatures of 10°C (50°F) or less, the requirements of Subsection 501.07(b) shall apply.
- (f) Technical Assistance. The Contractor shall have a representative from Advanced Infrastructure Technologies present at the project site during the attachment of the FRP deck panels to the arch units to provide technical assistance to the Contractor in the event unusual problems or special circumstances arise.
- xx. METHOD OF MEASUREMENT. The quantity of Special Provision (Concrete Arch Slab on FRP Decking) to be measured for payment will be on a lump sum basis in the complete and accepted work.
- xx. BASIS OF PAYMENT. The accepted quantity of Special Provision (Concrete Arch Slab on FRP Decking) will be paid for at the Contract lump sum price. Payment will be full compensation for designing and detailing deck components; making the required submittals; performing quality control testing; fabricating, furnishing, transporting, handling, and erecting the FRP decking; placing the reinforced concrete deck; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.

Partial payment will be made as follows:

- (a) An initial payment of 15% of the Contract lump sum price will be made when all Working Drawings have been submitted and marked conforming in accordance with Section 105.
- (b) The next 70% of the Contract lump sum price will be paid on a prorated basis for the estimated duration of the Contract work remaining.
- (c) The remaining 15% of the Contract lump sum price will be paid when construction of the Concrete Arch Slab on FRP Decking is completed to the satisfaction of the Engineer.

Erecting rigidified fiber reinforced polymer tubular arches (RFTA) and filling the hollow tubes with expansive self-consolidating

concrete (SCC) will be paid for separately under Contract item 900.645 Special Provision (Composite Arch Superstructure).

MSE headwalls and reinforced backfill will be paid for separately under Contract item 900.645 Special Provision (FRP Mechanically Stabilized Earth Arch Headwalls).

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
900.645 Special Provision (Concrete Arch Slab on RFP Decking)	Lump Sum