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MANUFACTURERS OF FLOATING BOOMS & BAFFLES SYSTEMS

PROCEDURE #: 463A	EFFECTIVE DATE: 22/11/05	REVIEW: AS REQUIRED
SUBJECT:	STANDARD PRACTICE FOR THE INSTALLATION OF GEOTEXTILE TUBES USED AS COASTAL AND RIVERINE STRUCTURES	

This standard practice was developed by the Mentanza Pty Ltd for use with respect to Mentanza Pty Ltd products only in this regard and can be superseded by other existing or new specifications on the subject matter in whole or in part. Neither Mentanza Pty Ltd nor related parties warrant or indemnifies any projects developed according to this practice either at this time or in the future.

1. Scope

1.1. This practice provides guidelines for the installation of geotextile tubes used as coastal and riverine structures. This practice, however, is not to be considered as all-encompassing since each material and site specific condition usually presents its own challenges and special issues.

1.2. This practice includes installation of the main geotextile tube, its scour apron(s) and the filling procedure.

1.3. This practice presumes that the proper geotextile tubes and ancillary materials have been chosen and fabricated for the site specific conditions per the plans and specifications.

1.4. This standard may involve hazardous operations, equipment and climates. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. Referenced Documents

2.1. ASTM Standards: D 422 Test Method for Particle-Size Analysis of Soils

2.2. GRI Documents: GTXX Test Methods, Properties and Frequencies for High Strength Geotextile Tubes used as Coastal and Riverine Erosion Control Structures

3. Terminology

3.1. Geotextile Tube - A large tube [greater than 7.5 feet (2.3 m) in circumference] fabricated from high strength, woven geotextile, in lengths greater than 20 linear feet (6.1 m). Geotextile tubes used in coastal and riverine applications are most often filled hydraulically with a slurry of sand and water, although many other fill materials have been used. Tubes can also be filled by a combination mechanical/hydraulic method.

3.2. Scour Apron - An apron of geotextile designed to protect the foundation of the main geotextile tube from the undermining effects of scour. In coastal and riverine applications, scour can be present at the base of the tube due to wave and current action. There may be aprons on both sides of the main tube, or only on one side. Scour aprons also reduce local erosion and scour caused during the hydraulic filling process of the main tube. Scour aprons are typically anchored by a small tube at the water's edge or by sandbags attached to the apron.

3.3. Fill Port -Also called a fill spout or fill nozzle, fill ports are sleeves sewn into the top of the geotextile tube into which the pump discharge pipe is inserted. Ports are typically 12 to 18 inches (300 to 450 mm) in diameter and 3 to 5 feet (0.9 to 1.5 m) in length. Fill ports are fabricated from the same geotextile as the main tube. Ports are spaced along the top of the tube to provide access to the contractor. Spacing is usually no closer than 25 feet (7.6 m) to accommodate sand slurry but can be as far apart as 100 feet (30 m) for some viscous fill materials. After pumping, ports are to be closed by tying, sewing or gluing.

4. Significance and Use

4.1. The use of geotextile tubes for coastal and riverine structures is a relatively new technology. While a few contractors who have followed the technology are well versed in proper installation practices, many are not. It is to this latter group of relatively inexperienced contractors and installers that this standard is focused.

4.2. This standard practice is focused on proper installation of the major facets of geotextile tubes, i.e., the main tube, its scour apron(s), and the filling sequence. There are many additional (and generally unique) situations which can, and do, arise which are beyond the scope of this practice and must be handled on a site specific basis.

5. Pre-Construction Approvals

5.1. Experience Level -Geotextile tubes and scour aprons shall be installed by contractors having demonstrated successful experience in filling large geotextile tubes The contractor shall be required to prove this experience with a letter provided by the manufacturer.

5.2. Manufacturer's Representative - Unless the contractor has satisfied the requirements of Paragraph 5.1, the contractor shall have an on-site representative of the geotextile tube manufacturer to provide instruction and training of the contractor/installer to assure proper deployment and filling procedures. The representative will be at the contractor's expense as necessary to assure that the requirements of these specifications are satisfied. ***Note 1: The decision as to length of time the manufacturer's representative is on the project is to be decided by the parties involved. They include the manufacturer, contractor, and owner.***

5.3. Plan of Construction -The contractor shall submit a Plan of Construction describing the sequence of operations for the construction of the sand-filled geotextile tubes. The plan shall address site preparation, deployment and filling of tubes, placement of scour apron and anchor tubes, and tie-out to the shoreline at each end of the reach. Equipment to be used for geotextile tube construction shall be specified.

6. Procedure

6.1. Fill Material - Material for filling the geotextile tubes for coastal and riverine applications will normally consist of fine sand dredged from a designated borrow site. Suitable material for filling the tubes will contain not more than 15 percent fines (percent by weight passing the No. 200 sieve) to minimize subsidence of the tubes after filling. If excessive fines are observed during the filling process, the contractor should divert the flow until more suitable borrow material can be located. ***Note 2: If the fill material is known to be primarily organic and/or fine-grained material, repeated fillings may be required to reach the design elevation of the tube. Note 3: Considerable care must be taken to avoid overstressing the geotextile and inducing creep strains and excessive distortion.*** This type of fill material is not suitable for designs where the primary objective is a specified elevation.

6.2. Fill Gradation - Gradation testing of hydraulic fill materials shall be conducted in accordance with ASTM D 422. Samples shall be obtained from the dredge discharge pipe immediately before inserting the pipe into the fill port. At a minimum, one gradation test shall be performed for each 1000 linear feet (300 m) of fill tube. Extremely large tubes may require more frequent testing. Also, additional testing may be warranted at any time that visual inspection of the sand fill materials indicate that the percentage of fines may exceed the requirements presented herein.

6.3. Tube Foundation - The foundation for the placement of the geotextile tube and its scour apron(s) shall be smooth and free of protrusions which could damage the geotextile. Remnant timber piles, piers, footings, underground utilities, etc., at or below grade, shall be removed if located within 20 feet (6.0 m) of the project site. Weak or unsuitable foundation material shall be removed or stabilized.

6.4. Tube Alignment - Tubes used in coastal and riverine applications normally require alignment within ± 2.0 feet (600 mm) of the baseline. The alignment can be facilitated by a number of methods, e.g., earthen cradles, tie-down straps, or physical buttressing. The filled tubes shall have an effective height of ± 0.5 feet (150 mm) of the specified elevation. Effective height is defined as the height from the existing tube foundation to the average top of the filled tube measured every 25 feet (7.0 m) along the length of the tube between fill ports. Any subsidence of the top elevation of the tube below the specified height shall be corrected by supplemental filling or, if the tube has been damaged, replacement of the tube. Filling tubes higher than the manufacturer's recommended height can lead to failure during construction. ***Note 4: At no time shall construction equipment be operated directly on the geotextile tube or its ancillary materials.*** Filled geotextile tubes and scour aprons can be traversed if a 1 foot (300 mm) minimum of soil is covering the geotextile. No hooks, tongs or other sharp instruments shall be used for handling. The geotextile tube or scour apron shall not be dragged along the ground.

6.5. Tube Anchorage -The main geotextile tube and scour apron shall be deployed along the alignment and secured in place as necessary to assure proper alignment after filling. No portion of the tube shall be filled until the entire tube segment has been fully anchored to the foundation along the correct alignment and pulled taut. Tolerance for deviation from the alignment shall be plus or minus 2 feet (600 mm). Means of assuring that the tubes are properly aligned within the specified tolerances, shall be incorporated into the placement methodology presented in the Plan of Construction.

6.6. Tube Overlaps -Tubes shall be overlapped at end joints or butted together so that there are no gaps unless permitted otherwise in the Plan of Construction. Beneath the geotextile tube, the ends of each geotextile scour apron shall be overlapped a minimum of 5 feet (1.5 m). The effective height of the tube structure at the overlap is typically 80% of the specified height. This equates to a 1-foot (300 mm) drop in effective height at the overlap for a 6 ft. (1.8 m) high structure.

6.7. Tube Filling - After completing the deployment and anchorage of the geotextile tube, filling with sand from the borrow area shall be accomplished in accordance with the approved Plan of Construction. The discharge line of the dredge shall be fitted with a "Y-valve" to allow control of the rate of filling. The Y-valve system must be fitted with an internal mechanism such as a gate, butterfly valve, ball valve, or pinch valve to allow the contractor to regulate discharge into the geotextile tube. Any excess discharge shall be directed away from the tubes toward the borrow area. The discharge pipe shall also be fitted with a pressure gage as an aid to monitor pressure within the tube. ***Note 5: The gauge can be attached to the discharge pipe continuously or only at times when excessive pressure is obvious.*** It should be noted that internal pressure and stress on the tube fabric can vary along the length of the tube, therefore stress failure of seams and fill ports is not precluded by simply monitoring discharge fill pressure. Discharge pressures at the tube fill port shall not exceed 5 psi (35 kPa). ***Note 6: As a rule of thumb, dredged discharge pipes should be limited to 10 inches (250 mm) diameter and smaller. This is due to the fact that as dredge discharge size increases, the flow rate being delivered by the pump increases greatly, increasing the potential for overstressing the tube. Dredge discharge pipes below 6 inches (150 mm) are often too small to adequately fill the tube to the proper height.***

6.7.1. The dredge discharge pipe shall be free of protrusions that could tear the fill port. It is generally accepted practice to support the dredge discharge pipe above the fill port in a manner which reduces stress on the fill port seams. Excessive movement of the dredge discharge pipe during filling can result in damage to the fill port. If a diffuser is used at the end of discharge pipe, it should not extend beyond the outside diameter of the discharge pipe. It is good practice to fill long tubes from multiple ports along the length of the tube. This reduces stress on the fill port and reduces the risk of sand bridging which can cause local stress on the fabric.

6.7.2. After filling the tube, the port sleeves shall be closed and attached to the main tube in a manner sufficient to prevent movement of the sleeve by subsequent wave action or other disturbances.

6.8. External Tube Backfilling - If the tube is not to be externally backfilled, the area should be left in a neat and properly graded manner. If the tube is to be externally backfilled, the lines and grade on the Plan of Construction must be followed.

6.9. Height to Width Ratio - The height to width ratio of the fully deployed tube shall not exceed a value of 0.5. ***Note 7: The height to width ratio is an indicator of the stability of the tube in coastal and riverine applications.*** The design engineer should evaluate stability with respect to sliding, overturning, bearing, global stability, and overtopping of waves and associated wave forces.