ARX-TRANSPORT™

Granular Solids Transportation Using Foam for Underground Void Backfilling Applications

1. GENERAL
	1. DESCRIPTION
		1. Work Included: This work shall consist of producing and mixing ARX-TRANSPORT foam with granular solids, such as sand, crusher fines, or tailings in the appropriate proportions to produce a homogeneous mixture. Properly proportion the foam and solids such that the solids are held in suspension, resulting in a flowable and pumpable mixture, as indicated by the specifications or as directed by the engineer. An ARX-TRANSPORT installer shall furnish labor, material, equipment, and supervision for the installation of the foamed-solids mixture in accordance with the drawings and specifications.
	2. QUALITY ASSURANCE
		1. Use skilled labor that is experienced and familiar with the specified requirements and the methods for proper performance of this work.
	3. SUBMITTALS
		1. The prime contractor shall list the product and the installer of the ARX-TRANSPORT and shall not employ any product or producer without the prior approval of the engineer.
		2. Product data: within 30 calendar days after award of the contract, the prime contractor shall submit for approval by the engineer:
			1. Manufacturer’s specifications, catalog cut sheet, and other engineering data needed to demonstrate to the issuing authority compliance with the specified requirements.
2. PRODUCTS
	1. MATERIALS
		1. Foam Liquid Concentrate: ARX-TRANSPORT shall be supplied by Aerix Industries™.
		2. Granular Solids: Granular solids to be used with ARX-TRANSPORT are not confined to a specific material but should be well graded, with a top size of 3/8 of an inch and bottom size of less than 10% minus 200 mesh. Concrete sand with a gradation conforming to ASTM C33 provides a baseline for useable materials. Many other materials with varying gradations, such as crusher fines, mine waste, beach sands, local native soils and tailings may be used depending on the application, specified end results and the installation delivery method and approved by the project engineer.
		3. Admixtures: admixtures such as anti-washout agents and various polymers may be used to enhance underwater placement and when specifically approved by the project engineer. Admixtures should be tested prior to the start of the project for compatibility with the foaming agent.
		4. Water: water may be added to the mixture of granular solids and ARX-TRANSPORT, if the solids are excessively dry, to prevent moisture being wicked from the foam and/or to enhance the pumpability of the material, as necessary. Add water to the granular solids to provide an overall moisture content for the solids of 3% to 10% by weight of the solids.
		5. Fine-Grain Powders: fine grain powdered materials such as Class F fly ash, or bentonite may be added to the granular solids in quantities less than 10% of the total by weight of the solids, prior to adding the ARX-TRANSPORT foam, to enhance pumpability of the mixture.
	2. PROPERTIES
		1. Durability: Using ASTM C33 concrete sand as the baseline material in an underground void filling scenario, the foam when mixed with the sand should facilitate 48 to 72 hours of lateral movement, after placement.
		2. Foam: ARX-TRANSPORT foam concentrate shall be diluted with water in the ratio range from 1:50 to 1:60. Foam density shall be in the range from 2.0 pcf to 2.5 pcf.
		3. Foam and Sand Mixture: Best results will be obtained when the density of the foamed-sand mixture is in the range from 70 pcf to 80 pcf, with a foam content ranging from 20 percent to 30 percent. The foam component of the mixture must collapse under static pressures of greater than 5 psi within 24 hours and achieve a minimum compaction of 93% per ASTM C29.
		4. Mixture Variability to Accommodate Project Conditions: The conditions and design parameters can vary widely between projects considering void size, depth, delivery method, desired flow distance, quantities, solids type, etc. ARX-TRANSPORT dilution ratios, mixture densities and foam breakdown times can be adjusted to accommodate these conditions at the direction of the engineer, with the recommendation of the manufacturer and approved by the project engineer
3. EXECUTION
	1. SUBGRADE CONDITIONS
		1. If possible, examine the areas and conditions under which work of this section will be performed. Determine the presence or absence of water (inundation) in the fill area. Anti-washout agents may be added in underwater applications to mitigate the segregation of the foam and particulate solids, at the direction of the engineer.
	2. EQUIPMENT
		1. Use only the approved job site proportioning, mixing and placing equipment recommended by Aerix Industries and approved by the project engineer.
	3. MIXING AND CONVEYING
		1. Mix the materials according to the project specifications and convey to the location of final placement.
		2. The foam shall be mixed with the sand using a drum-type mixer, volumetric mixer, continuous screw-type auger, pug mill, or other equipment platform that will adequately combine all ingredients into a homogeneous mixture. To prevent bubble degradation, or absorption of the foam, add water as necessary to maintain a *minimum* moisture content in the sand of 3% by weight of the sand. Moisture contents of up to about 10% may be necessary to facilitate pumpability.
		3. The foam and sand mixture shall be conveyed and/or placed using any standard piston-type concrete pump, or by gravity methods.
		4. The ARX-TRANSPORT mixture will be placed until boreholes, or the fill area is filled to rejection. After a period of 48 to 72 hours, any void resulting from the collapse/compaction of the material, shall be filled with additional foam/sand mixture, grout, or other material, as directed by the engineer.
		5. Boreholes: Boreholes may be necessary to access an underground fill area, such as an abandoned mine. Boreholes shall be drilled to a diameter necessary to accommodate a *minimum* 3-inch internal diameter borehole casing. The casing shall be internally and externally flush-joint and shall be used to convey the material into the fill area.
4. MEASUREMENT AND PAYMENT
	1. MEASUREMENT
		1. ARX-TRANSPORT shall be measured on a per-ton basis of particulate solids backfill material placed.
	2. PAYMENT
		1. Payment for ARX-TRANSPORT backfill material shall be made at contract unit prices for quantities determined as specified above.

ITEM NO. PAYMENT UNIT

 Backfill Solids Ton

*Drafted 08/2018*

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