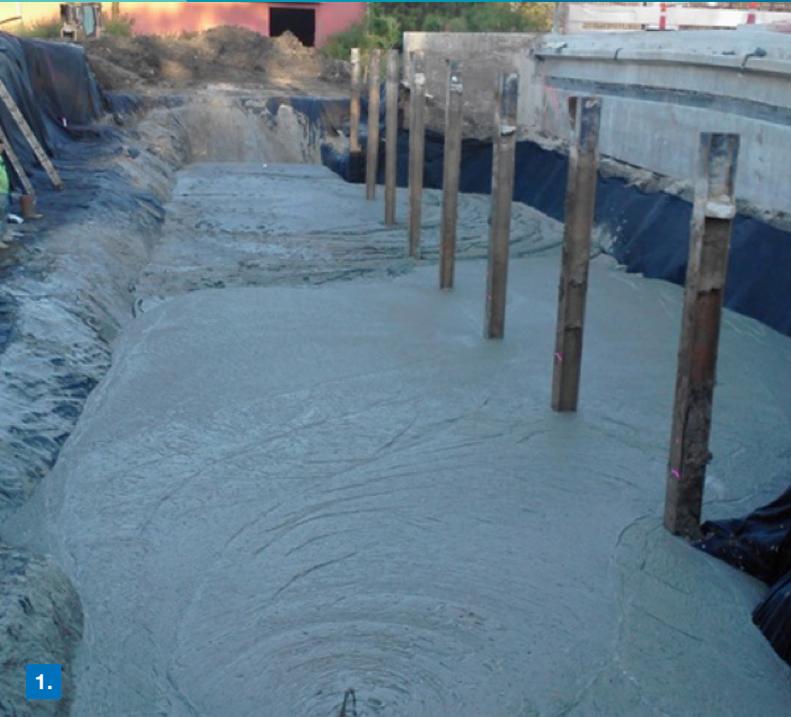


Soil Stabilised Beneath Flood-prone Bridge



1.



2.

INDUSTRY

Infrastructure

STRUCTURE

Bridge

PROBLEM

Embankment Instability

LOCATION

North Dakota, USA

DURATION / YEAR

2011

TECHNOLOGY

Terefil™

BUSINESS UNIT

Aerix Industries USA

Pictured:

1. Placement of pervious cellular lightweight concrete fill at the Rose Coulee.
2. Bridge excavation after the removal of soil.
3. Cross section of project design.

Summary

Located in Fargo, the most populous city in the USA's state of North Dakota, the Rose Coulee Bridge is an important thoroughfare for the community.

In 2011, the North Dakota Department of Transportation undertook a soil stabilisation project to address instability in the south embankment of the bridge, which was threatening the integrity of the structure.

The bridge is located in a flood zone and water levels would often rise to completely saturate the soils under and around the bridge. As water levels subsided, soils would wash out, compromising the bridge's foundation.

The upper portion of the embankment was unloaded and excavated material was replaced with a pervious advanced structural lightweight cementitious fill.

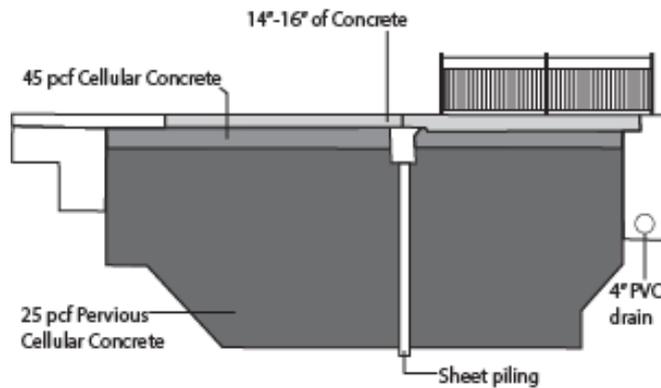
Objectives

The Department of Transportation sought a lasting and cost-effective solution to stabilise the soil, with the ability to withstand the weight and pressure of the bridge.

Solution

A system of pervious and non-pervious fill, sheet piling and drain tile was developed. The advanced lightweight fill material used is highly flowable, easily placed, and does not require pre-loading or compaction for settlement mitigation. It flows into spaces to fill voids and exhibits shrinkage of less than 0.1%.

Soil Stabilised Beneath Flood-prone Bridge continued



3.

It contains a uniformly distributed matrix of air bubbles generated by mixing cement slurry with stable preformed foam. Cementitious materials encapsulate the air bubbles and then dissipate leaving a void structure as a replacement to traditional aggregate. Compared to typical foam fills, the patented technology used has increased stability, a greater lift thickness and can be pumped greater distances. Extensive compressibility testing has validated the ability of this advanced fill formulation to resist bubble collapse from pressure.

Two layers were applied. First, the excavated material was replaced with 2,600 cubic yards (almost 2,000m³) of pervious fill at 25pcf (400kg/m³). The pour took seven days and was placed in fabric lined dirt forms.

Once the first layer had cured for 48 hours, 300 cubic yards (approximately 230 m³) of non-pervious fill was formulated and poured at 45 pcf (720kg/m³), with strength of 300psi (2,068 kPa).

Sheet piling was then driven through the centre of the embankment to approximately 53ft (16m) deep for additional reinforcement, and a four inch wrapped perforated PVC drain pipe was installed to move water away from the concrete slab.

The 25pcf cementitious fill material offered the unique advantage of allowing water to pass through the material, greatly reducing its buoyancy.

Since installation, the bridge has not experienced any settlement and continues to be seen as a success for the state of North Dakota.

This project was completed by Aerix Industries, the USA manufacturer of the fill material, which is branded by Mainmark as Terefil™.