A second to remember

NCDOT sees benefits of erosion control on Oak Island job

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Nestled on North Carolina's southeastern coastline lies the isle of Oak Island, a destination spot for beautiful sandy beaches and picturesque salt-water marshes.

The island is located between the seaport city of Wilmington, N.C., and the beaches of Myrtle Beach, S.C. The narrow, 14-mile-long island is separated from the mainland by the Intracoastal Waterway that serves as an inland passage for watercraft traveling parallel to the Atlantic Ocean.

The need for a second bridge to the island was debated for decades to provide an alternative hurricane evacuation route for residents and visitors as well as to ease heavy congestion at the single existing crossing over the Intracoastal Waterway. Finally, the second bridge to Oak Island was approved and permitted and the North Carolina Department of Transportation (NCDOT) let the $36.6 million project to construction in 2008.

NCDOT engineers designed the structure with a 980-ft span over the waterway with a vertical clearance of 65 ft for watercraft and two 12-ft lanes for motorists in each direction. The entire project length totaled more than 4 miles, primarily on new location. Post-construction storm water was managed with infiltration basins to minimize impacts to surrounding water quality. However, engineers were challenged with developing specifications that would stabilize the sandy, granular soil material used for constructing fill heights in excess of 60 ft.

Perplexing over a site

Over the decades, the Army Corps of Engineers dredged the waterway to provide an appropriate water depth for vessels traveling north and south along the Atlantic passage from Key West, Fla., to its unofficial terminus in New Jersey. Dredged spoil had been stockpiled over the years in the area where the new bridge would cross. On NCDOT projects, to provide for competitive bidding, contractors must obtain their own borrow sources, and engineers anticipated that the dredge spoil would be a likely source to construct the roadbed and approach fills for the bridge.

Many challenges exist for soil stabilization on a project located on a coastal barrier island. The fine sandy, granular soils are generally void of nutrients required for long-term stabilization of grasses as noted in Figure 1. These coastal soils are lacking in organic content and possess minimal moisture retention properties. The dredge spoils can contain higher levels

Figure 1. Fine sandy granular soils encountered on a barrier island bridge project.

of soluble salts that may be detrimental to vegetation establishment. The slope length and steepness of the proposed fill slopes being 2H:1V (horizontal to vertical) created erosion-prone conditions from wind and water.

The project location is prone to excessive rainfall intensities and rainfall depths with potential tropical storms and hurricanes. Average annual rainfall is approximately 45 in.; however, tropical events may dump a foot of precipitation in 24 to 48 hours. With warm summer temperatures and a moderate winter climate, year-round grading and construction activities are apt to occur when vegetative-stabilization windows are not optimum for grass establishment.

Figure 2. Stabilization consideration and estimated cost per acre.

Seeding and mulching	$2,000
Seeding and RECP	$9,000
Sodding	$18,000
Compost Seeding	
2 in. depth	$17,000
1 in. depth	$8,500

FACT FINDER

Compost seeding or compost blanket application is a vegetative establishment technique that utilizes a mixture of seed, fertilizer and compost applied pneumatically to roadway slopes.

NCDOT engineers considered several options to address stabilization efforts for this perplexing site. Conventional vegetative establishment consisted of soil scarification for seedbed preparation, and incorporation of dolomitic limestone, as needed, to adjust pH and granular fertilizer. Broadcast seeding or hydroseeding with warm- and cool-season grass species is the general means to apply the seed mix followed by grain straw with tackifier for surface cover protection. This conventional method is simply termed seeding and mulching.

Seeding along with a rolled erosion-control product was another option; sodding also was considered. Engineers knew it would be paramount to provide soil supplements to aid in moisture retention and supply a slow release, extended availability of plant nutrition. The department selected compost seeding for the stabilization method for the steep fill slopes approaching the bridge. Figure 2 provides stabilization considerations and estimated cost per acre.

Compost seeding or compost blanket application is a vegetative establishment technique that utilizes a mixture of seed, fertilizer and compost applied pneumatically to roadway slopes. NCDOT engineers had used compost seeding on a limited, trial basis at selected locations throughout the state and elected to use the U.S. Composting Council Seal of Testing Assurance (STA) specifications to outline criteria for the composted product.

The compost seeding option offered additional advantages for this project site. The large truck and hose operation used to apply the compost was able to easily access the slopes from the top of the slope at the roadbed area. Slopes were compost seeded in

stages or lifts as they were constructed, thus allowing the applicator to reach the target area completely for good uniform coverage. Seedbed preparation on steep slopes is not as critical for this method, as the seed will germinate in the compost layer and establish roots in and through this supplemental medium. Also critical for this site, as the compost weathers and decomposes, it improves the quality of the existing soil and root zone of the developing vegetation. Compost seeding provides seed and groundcover in one application. Results from using compost seeding are depicted in Figure 3.

Compost competency

One of the challenges of using compost seeding for this site was associated with its remote island location. The haul cost for transporting the product was reflected in the contract bid price. Approximately 250 cu yd of compost was needed for an application rate of 2 in. This challenge actually led to a cost savings idea for the project.

As anticipated, the contractor used stockpiled dredge spoil as a source of borrow to construct the embankment for the roadway and approach fill slopes as noted in Figure 4. NCDOT required the contractor to develop a reclamation plan for all borrow and waste sites used on private property in conjunction with the project. The plan addressed the means and methods proposed by the contractor for erosion control and sediment containment during construction as well as a final stabilization plan for slopes and other exposed surfaces. Once the contractor reached the pit property boundary, his reclamation plan required that he slope the perimeter cuts to a 2H:1V and stabilize with vegetation. After one attempt with conventional seeding and mulching, vegetation would not establish in the droughty, fine sandy spoil material (Figure 5).

Figure 3. Compost seeding initial application with germination (left); dense vegetative coverage (right).

Figure 4. Perimeter slopes of dredge spoil stockpiles.

NCDOT field engineers, in cooperation with the contractor and subcontractor, initiated a pilot project on the pit perimeter cuts to evaluate compost seeding at various application rates. Compost was applied at three rates: 2 in. (rate specified in contract), 1.5 in. and 1 in. The application was applied in May, which is a good window for establishing warm-season species in North Carolina. The sites were evaluated for vegetative density on 30-day intervals for common bermudagrass establishment. After seasonal rainfall and a 90-day evaluation period, the vegetation in the 1-in. rate compost seeding application plot was equal to or better than the plots with the higher application rate. The contractor made a supplemental agreement to perform compost seeding at a 1 in. depth for the duration of the project at a 50% reduction in unit bid price.

With limited vegetative establishment using conventional methods and a revised contract price for compost seeding, NCDOT engineers expanded use of the technique on roadway shoulder areas and medians along this environmentally sensitive corridor. At the official opening of the bridge, the roadway slopes and borrow sites were stabilized with vegetation suitable to restrain erosion.

With the knowledge gained on the Oak Island bridge construction project, NCDOT expanded the use of compost seeding statewide. In 2011, historically eroding roadway back slope cuts were targeted for compost seeding to stabilize these areas that have led to export of sediment from the right-of-way. The department continues to use compost seeding as one of the specialty tools in its BMP toolbox and will likely expand its use on future coastal construction projects. R&B

Figure 5. Compost seeding trial depicting 1.5 in. and 2 in. depth plots.

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