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Solidification/Stabilization of Soft River Sediments Using Deep Soil Mixing

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HERE IS THE PROBLEM

Contaminated sediments were dwelling at the bottom of many New York, New Jersey waterways. It has resulted in degradation of the environment and loss of habitat. Removal of the contaminated sediments by dredging may be a solution, but it is not that simple. In order to perform this task the possibility of contaminating the surrounding waterways had to be taken into consideration. The contaminated sediments could be solidified prior to dredging. This is the basis of the Solidification/Stabilization of Soft River Sediments Using Deep Soil Mixing project.

AND, HERE IS THE SOLUTION…

Removal of toxic sediments by dredging is one way to remediate environmentally impacted areas, and has been suggested by some as a potential step toward remediation of the most contaminated parts of the NY/NJ Harbor and surrounding waterways. Dredging could result in restoration of navigational, commercial and recreational uses in impacted and underutilized areas. One difficulty associated with dredging, however, is the potential for dispersion of sediments, and their associated contaminants, into the surrounding media.

One means of mitigating the potential for sediment dispersion during dredging and related activities would be to alter the characteristics of the sediment, specifically the high liquid content fine-grained matrices. For example, the sediments could be amended with a pozzolanic additives such as Portland cement, lime or other additives.

Specifically, in-situ solidification/stabilization of contaminated sediments could be achieved using Cement Deep Soil Mixing (CDSM) technology. In deep soil mixing,

powerful augers are used to mix slurry of pozzolanic additives into a soil or sediment *in-situ*, thereby stabilizing it for construction purposes. It is also possible that a similar technique could be used to stabilize contaminated river sediment.

THESE ARE OBJECTIVES OF THE STUDY…

- To provide New Jersey Department of Transportation (NJDOT) the results of using CDSM in-situ solidification/stabilization technology to treat contaminated sediments similar to those found in NY/NJ Harbor and surrounding bodies of water.
- To determine the extent of sediment dispersion during CDSM operation.

HERE IS WHAT WE DID…

The study involved mixing of 300- 400 cubic yards of river sediments at the Darling International Site Waterfront at Newark, New Jersey. The sediments were mixed with various percentages of cement ranging from 7% to 14%.
Following the mixing, in-siu and laboratory testing was performed to determine the strength gain of treated sediments over time. The total suspended solids were also monitored during the mixing operation.

Upon completion of the study, the solidified sediments were dredged using conventional digging buckets and disposed of at a permitted upland facility. The in-situ strength tests indicated that the shear strength of the cemented sediments significantly increased as a result of CDSM. The watery very soft silt sediments were transformed into cemented soil with the consistency of hard silt/clay.

The potential for CDSM to impact water quality was evaluated during the pilot test. Total Suspended Solids (TSS) was measured prior to, during and subsequent to the sediment mixing at high and low tides. The results indicate that noticeable increases in TSS (reaching a maximum of 450 ppm) over background in the vicinity of the equipment (in a radius of 75 feet and at a depth of at least 15 feet below the water surface) were detected. However, this phenomenon was highly localized, with increased solids observed only slightly over background at a radius of 75-125 feet and depths greater than 25 feet.

CONCLUSION…

In summary, the following conclusions can be made from the results of this study:

1. CDSM technology has potential for effectively stabilizing contaminated sediments, resulting in increased workability and improved material handling characteristics.

2. Sediments stabilized by CDSM can remain in place indefinitely without impeding removal. Since long term strength in average is expected to be three times or less the 28-day strength, cement stabilization would not impede dredging. Stabilized sediments could also be allowed to remain in place and properly capped.

3. The dispersion of sediments during mixing operation was detected only within a 125 feet distance from the mixing point.

WHAT IS THE NEXT STEP?

Before recommending the CDSM technology for full-scale implementation, several practical issues need to be addressed in a more comprehensive pilot study or phase II study.

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A final report is available online at
http://www.state.nj.us/transportation/research/research.html

If you would like a copy of the full report, please FAX the NJDOT, Division of Research and Technology, Technology Transfer Group at (609) 530-3722 or send an e-mail to **Research.Bureau@dot.state.nj.us** and ask for: **Solidification/Stabilization of Soft River Sediments Using Deep Soil Mixing**

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