What is S/S Treatment?

Involves mixing a binding agent into contaminated media such as soil, sediment, sludge or industrial waste.

S/S treatment protects human health and the environment by immobilizing hazardous constituents within treated material.

Geotechnical improvement of treated material

Physical (solidification) and chemical (stabilization) changes to the treated material.

Mobility Reduction Terms: Stabilisation (UK), Inertage (France), Immobilization (EU).
### Mass Stabilisation of Soft Soils
- Clay, mud, peat...

### Mass Stabilisation of Dredged Sediments
- Soft sediments, clean / contaminated

### Mass Stabilisation of Contaminated Soils

**Application areas:**
- Roads, streets, railroads, pipelines, parking areas, sport fields, commercial areas, residential areas, industrial areas, harbours, storage areas, river embankments, soil solidification and remediation
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Types of Sites Applied

- Wood Preserving Sites
- Herbicide and Pesticide Sites
- Oil Refinery Sludge Lagoons
- Manufactured Gas Plants
- Sediment including PCB
- Metal Refining, Smelting, Plating, Recycling
- Residual Ash
S/S Agents

Portland cement, Cement kiln dust
Fly ash e.g. Class F and C (pozzolanic fly ashes)
Lime e.g. quicklime, hydrated lime, lime kiln dust
Slag e.g. ground granulated blast furnace slag
Organoclay®
EnviroBlend®
Bentonite clay
Activated carbon
Cement-based proprietary mixtures
Silicate, phosphate, and sulfate
e.g. triple super phosphate
Binding Agent Pricing

- Priced by transportation costs:
  - Industrial waste/byproducts, finely divided materials available on site, e.g. spent fullers earth, ash

- Priced per ton:
  - Common construction materials:
    - portland cement, blended cements, Class C or F fly ash, GGBFS, lime.

- Priced per pound:
  - Specialized materials, sorptive, reactive, or compounding
    - Carbons, organophilic clays, oxidizers, reducers
Laboratory Formulation

Large scale laboratory mixing in drum

Solidified samples prepared for strength and permeability testing
Thoroughness of Mixing = Efficiencies

MIXING ENERGY and SHEAR

VS.

SPOON: FOLDING ACTION
Auger Mixing
Road Reclaimer
Excavator-Based
Horizontal Axis Insitu Mixers
Efficient Use of Binders Matters

Most of the cost in a mass stabilization project comes from the binder, which represents about 50-70% of the total project cost.

Efficiencies (Cost Savings) are improved by:
- Thorough mixing (mixing shear & energy) resulting in intimate contact of binder and subject material.
- Introduction of binder at mixing point.
- Locating and metering of binder to avoid under-dose and overdose.
- Use of dry binders in wet materials to conserve drying capacity of binders.
Dock side Treatment
Ashtabula Harbor, Ohio

Dredge and S/S treat 120,000 cy (92,000 m$^3$) of contaminated sediment.

Placement of S/S treated dredge into Elkem 5C Pond, a 9-acre former settling pond. Additional material needed to facilitate closure of pond.
Solidification of Elkem 5C Pond

- Solidification of existing contents 153,000 m³

Binder added dry 20% by weight. UCS goals range from 1,000 psf to 1,500 psf (0.05 to 0.07 MPa).
Unconsolidated shear strength goal of 1,250 psf (0.08 Mpa)
Mixing depths variable - 5 - 20 ft.
Atlantic Wood Industries
AWI Project

- Insitu S/S of 47,000 cu yd creosote- and pentachlorophenol-impacted soils
- Treatment depths ranging from 8 to 27 feet.
- Performance standard
  - $>50$ psi UCS
  - $<4 \times 10^{-6}$ cm/sec
Soft Marine Sludge Treatment in Harbour Construction
Vuosaari, Finland
All cargo operations have been moved to the new Vuosaari harbour from the city centre.
Building the TBT safety wall, forming the TBT-lagoons and transporting mud to the lagoons.
MASS STABILISATION OF DREDGED SEDIMENTS

Vuosaari, Finland
Stabilising the lagoons.
Mass stabilisation was used as a method for processing TBT-contaminated dredged mud to be a part of new harbour structures.

Environmental:
- TBT-contaminated dredged mud

Site facts:
- Area: 11 ha
- Depth max. 6 m
- Volume: 500,000 m$^3$

Project for three ALLU stabilization systems
Valencia harbour, Spain

- Project to extend freight container storage area
- Project for two ALLU stabilisation systems

MASS STABILISATION OF DREDGED SEDIMENTS
MASS STABILISATION OF DREDGED SEDIMENTS

Valencia harbour, Spain

- Environmental:
  - Dredged mud
  - 1…1.5 m dry crust

- Site facts:
  - Area: 5 ha
  - Depth max. 5 m
  - Vol: 250,000 m$^3$
MASS STABILISATION OF DREDGED SEDIMENTS

Coal harbour, Australia

• Dredged Marine Sludge:
  • 2 to 5 meters depth

• Site facts:
  • Storage area for coal
  • 140 kg/m³ binder
  • Depth max. 5 m
  • Vol: 300.000 m³

• Project for two ALLU stabilisation systems
MASS STABILISATION OF DREDGED SEDIMENTS

Kokkola harbour, Finland

• Dredged contaminated silt
• Total 12,500 m³
• Binder 30 kg cement + 100 kg fly ash/m³
Harbour construction, Brasil

- Marine Sludge
- Max. depth 6-18m
- Mass stabilisation depth 3-6 m
- Binder cement 120kg/m³
- Area 50x120m
MASS STABILISATION OF DREDGED SEDIMENTS

Solidifying dredged mud, Italy
MASS STABILISATION OF DREDGED SEDIMENTS

Processing dredged mud in a basin, Italy
Soil stabilization needed to support planned infrastructure of LNG facility expansion in Louisiana
Soil subject to treatment. Soil has no bearing capacity. Wooden mat “roads” needed to move heavy equipment around on site
Example of cleared and grubbed area in foreground prior to stabilization treatment.
Closer view of cleared & grubbed soil before stabilization treatment.
Plumbing and mounting of ALLU PMX-300 Power Mixer onto Cat 349 Excavator at local equipment yard
ALLU PMX Power Mixer and PF-7 Pressure Feeder at project site
Staking out the test plot. Note:

- Proximity to active waterway,
- Puddles caused by recent rain on “tight” clay/silty soil, and
- Cracking of clay/silt due to wetting & drying.
Testing consistency of soil subject to treatment. PMX operated without binder. Note high clay & silt content.
Testing consistency of soil subject to treatment. PMX operated without binder. Note high clay & silt content evidenced by soil “smear.”
Two binder addition methods tested:
- Spreader
- Pressure Feed
Test plot using “spreader” method of binder addition
PMX mixing of "spread" binder.
Test plot binder addition by ALLU PF-7 Pressure Feeder
Completed PMX-mixed area prior to compaction.
Test area after binder addition, PMX mixing, and compaction. Flagged for sampling and testing.
Contact

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