ATTACHMENT 3

Doyle Drive Test Program
Contract No. 04A3362

DSM Technical Submittal

By:

Malcolm Drilling Company, Inc.

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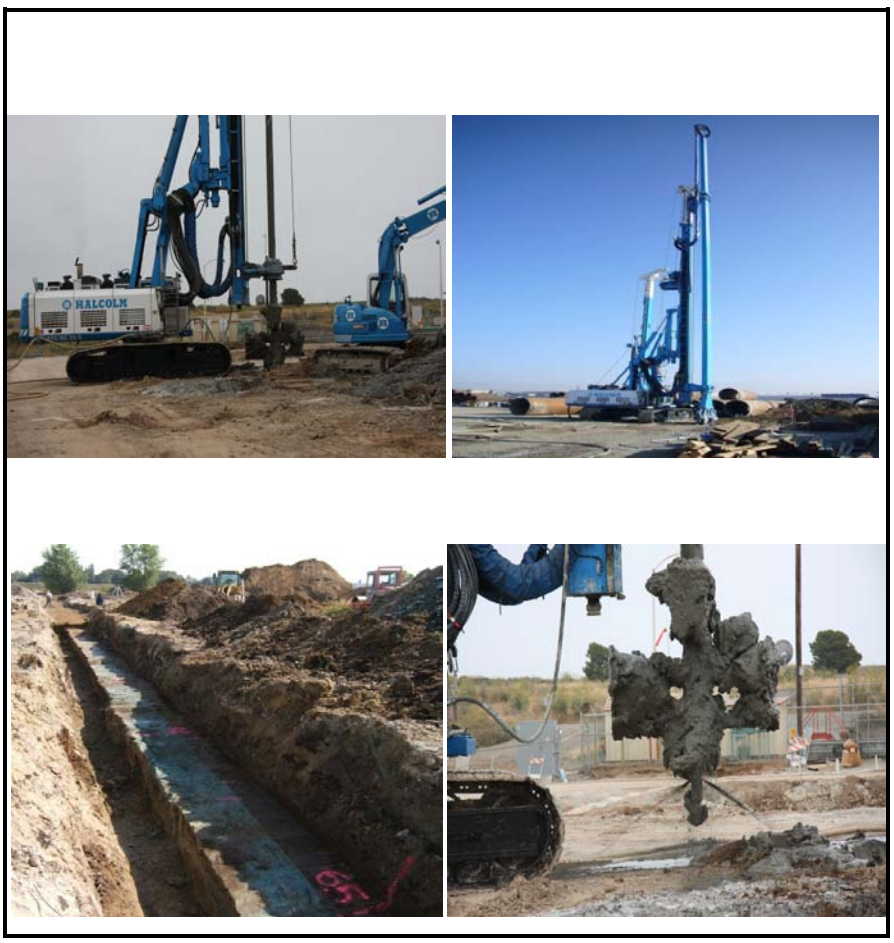


1. General

The DSM system utilizes mixing tools to shear the soil in situ and mix it with a cementitious slurry pumped at low pressure. This method has the ability to create large soil mix columns.

Other advantages of the DSM method are:

High productivity

Low waste.

The in-situ soil is used as a construction material

There is very little generation of spoil (important factor in contaminated areas)

No vibrations are induced during construction (very important when working in soft soils or in the vicinity of structures and services).

2. Construction Procedure

The construction process comprises the following sequence of steps:

2.1. Pre-excavation

A guide trench is first excavated to collect spoil; its dimensions depend on the nature of the soil and the amount of binder that is to be injected. A trench approximately 3 feet wide and 3 feet deep will be used.

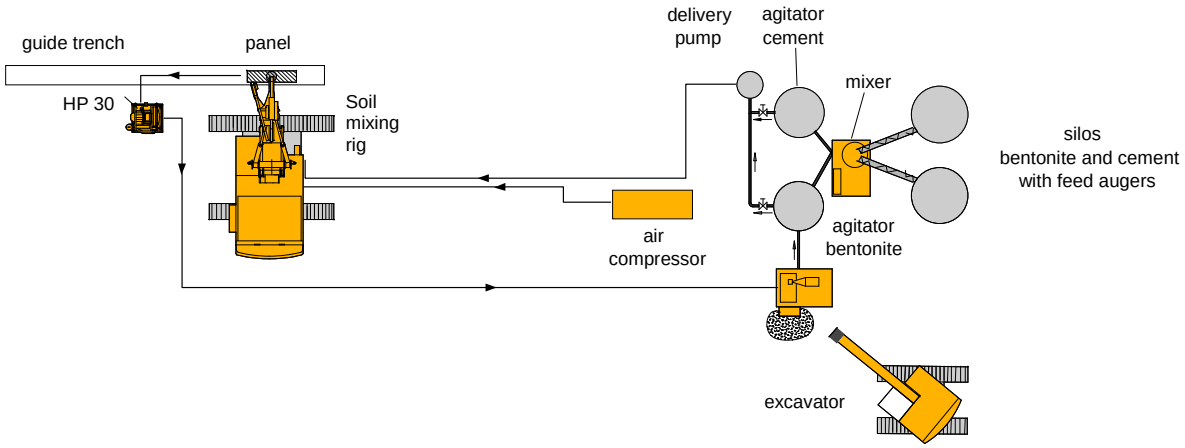
2.2. Cutting and Mixing cycles

The mixing tool is driven into the ground at a rate equal to the required injection volume of cement grout. The soil matrix is broken up by the soil mixing tool and at the same time a fluid is pumped through a set of nozzles, located below the mixing blades, where it is mixed thoroughly with the loosened soil as the blades progress. Penetration speed of the soil mixing tool and the volume of fluid pumped into the soil are adjusted by the operator to optimise the absorption of power and to create a homogeneous, fluid, mass that permits easy penetration and extraction of the machine. Spoils will be placed into designated spoils area and off hauled to an approved disposal location. Excess water will be pumped into baker tanks and off hauled to an approved location.

The cutting and mixing cycles will be carried out using the Single Phase System.

2.2.1. The single phase system

During the penetration phase, cutting, mixing, fluidifying and homogenising is performed while pumping cement grout into the soil.



After reaching the design depth, the flow of grout is reduced and the extraction of the machine begins and the binder is mixed thoroughly with the fluidified soil. The speed of extraction and flow of binder are adjusted to ensure that the total calculated quantity of binder is blended with the soil. For this project a 7' diameter mixing tool will be utilized.

2.3. Forming a continuous wall

A continuous wall is formed by a series of overlapping primary and secondary columns. The soil mixing technique proposed for this project will be the "hard-on-hard method", where secondary columns cut into hardened primaries forming a series of secant piles.

3. Quality Control

3.1. Before construction

Good knowledge of the type of soil and its conditions is fundamental; factors that affect the results of treatment of soils by Deep Mixing methods are:

- soil type
- soil consistency (CPT and/or SPT)
- bulk density
- grain size distribution
- water content
- Atterberg limits
- Soil Chemistry

Before commencing work in new ground, it is essential to review the soil investigation followed by tests and trials in order to determine the appropriate soil/binder mix,

3.2. During construction

During the CSM process the following tests will be carried out to monitor quality of the work:
Geometric checks of individual column positions. Real time monitoring of the inclination and deviation of the “X” and “Y” axes will allow for corrections to ensure that total deviation is less than 0.5%.

Real time monitoring of the grout quantity pumped over depth and other computer monitored parameters.

Periodic testing of the grout at the grout plant for specific gravity.

Soil/binder slurry testing.

Please refer to CSM Tech Submittal.

Grab Sampling

Grab samples are taken with a sampler that attaches to the end of an I beam. After a panel is mixed the sampler is lowered into the mix. The sampler then closes at a specified depth and is brought to the surface and dumped into a 5 gallon bucket. The mix is run through a #4 sieve before being placed into cylinders.

3.3. Post Construction

Please refer to CSM Tech Submittal.

3.4. Soil mixing records

Quality control procedures shall be maintained throughout the work so that the completed project complies with all requirements indicated herein and elsewhere in the contract documents.

Attachment (1) is a sample of the report that will be furnished for each DSM column. It will provide grout feed down and up over depth, drill-down and pull-up rates at half minute intervals, revolutions over depth, and withdrawal and penetration rates over depth. In addition the report will include documentation of daily construction progress and materials testing and construction monitoring results.

3.5. Documentation

Quality control procedures shall be maintained throughout the work so that the completed project complies with all requirements indicated herein and elsewhere in the contract documents. This documentation shall include CSM and DSM test details and results as well as coring strength and hydraulic results.

4. Mix design

4.1. Components of the Binder

The components of binders normally used in soil cement walls are: cement, bentonite, and water. It is possible also to use additives if required or admixtures such as fly-ash, retarders, fillers, etc. Proposed binder components for this project are:

Cement: Portland Cement Type II

Bentonite: Sodium bentonite (API 13A) without additives

Additives: Delvo, or equivalent.

4.2. Mix design and rate of consumption

The mix proportions will be determined by suitability tests prior to the start of construction.

The following tables give values for a first design of the mix proportions. They should be used for reference only and will be confirmed by appropriate suitability tests.

4.2.1. Binder slurry (target mix design)

Cement	550 kg (1210 pounds)
Water	800 liters (211 gallons)
Bentonite	55 kg (121 pounds)
W/C ratio	1.45
Injection rate	50% Vol. Column
Specific gravity of grout	1.405 +/- 0.2

4.2.2. Required wall characteristics

Compressive strength	1mPa	145 psi

Attachment 1

Malcolm Drilling

Report	MX1-1.1 Cement mix data report		
Site	635 Elliott	**Mixture**	1299A
Foremen	Wayne Broughton	**Components**	4
Shift		**W/C - factor**	1.38

	Title	Req. quantity	Unit	Density factor
K1	water	830.00	Liter	1.000
K2	cement	600.00	Kg	3.150
K3	bent	45.00	Kg	2.150
K4	mixing-time	15.00	Second	

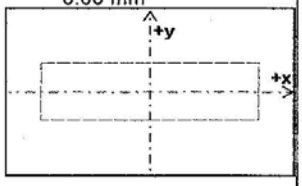
	Title	Req. quantity	Unit	Density factor
K5				
K6				
K7				

Notice: all required quantities are based on a size of 1 m³

Date	Start	End	Duration	Size[l]	K1/quantity	K2/quantity	K3/quantity	K4/quantity	K5/quantity	K6/quantity	Density [kg/l]
04/18/08	6:50:12	6:53:08	0:02:56	1000.00	831.43	590.97	47.86				1.412
04/18/08	6:53:09	6:56:12	0:03:03	1000.00	819.60	606.59	36.63				1.421
04/18/08	6:56:13	7:04:34	0:08:21	1000.00	837.15	583.64	46.89				1.405
04/18/08	7:04:35	7:07:55	0:03:20	1000.00	825.32	600.73	55.19				1.422
04/18/08	7:07:55	7:11:24	0:03:29	1000.00	837.15	617.83	41.51				1.422
04/18/08	7:11:24	7:14:43	0:03:19	1000.00	816.55	592.92	41.51				1.417
04/18/08	7:14:44	7:18:52	0:04:08	1000.00	840.58	596.34	51.77				1.412
04/18/08	7:18:53	7:23:13	0:04:20	1000.00	824.18	607.08	39.56				1.421
04/18/08	7:23:13	7:35:57	0:12:44	1000.00	834.10	596.34	45.91				1.413
04/18/08	7:35:57	7:40:46	0:04:49	1000.00	827.61	607.08	47.86				1.422
04/18/08	7:40:47	7:46:35	0:05:48	1000.00	835.24	589.99	42.00				1.408
04/18/08	7:46:35	7:52:14	0:05:39	1000.00	823.41	615.39	45.91				1.427
04/18/08	7:52:14	7:57:52	0:05:38	1000.00	833.33	596.34	42.00				1.412
04/18/08	7:57:52	8:03:16	0:05:24	1000.00	834.10	595.85	51.77				1.415
04/18/08	8:03:17	8:08:11	0:04:54	1000.00	824.56	601.22	34.68				1.416
04/18/08	8:08:11	8:14:09	0:05:58	1000.00	829.14	600.24	49.82				1.418
04/18/08	8:14:10	8:19:30	0:05:20	1000.00	832.95	604.64	40.05				1.416
04/18/08	8:19:30	8:24:40	0:05:10	1000.00	829.90	589.50	45.91				1.411
04/18/08	8:24:40	8:29:56	0:05:16	1000.00	827.23	600.24	45.42				1.418
04/18/08	8:29:56	8:35:34	0:05:38	1000.00	829.90	604.64	53.72				1.422
04/18/08	8:35:34	8:43:16	0:07:42	1000.00	829.14	609.04	40.54				1.420
04/18/08	8:43:16	8:46:40	0:03:24	1000.00	836.39	601.22	41.03				1.413
04/18/08	8:46:40	8:49:50	0:03:10	1000.00	824.18	591.94	49.33				1.416
04/18/08	8:49:50	8:52:55	0:03:05	1000.00	837.53	598.29	38.58				1.410
04/18/08	8:52:56	8:56:33	0:03:37	1000.00	820.74	600.73	50.79				1.422
04/18/08	8:56:33	9:00:50	0:04:17	1000.00	836.39	613.43	41.51				1.420
04/18/08	9:00:50	9:05:54	0:05:04	1000.00	824.56	588.03	42.00				1.411
04/18/08	9:05:54	9:11:10	0:05:16	1000.00	836.00	606.59	50.79				1.419

PRODUCTION LOG, MIP

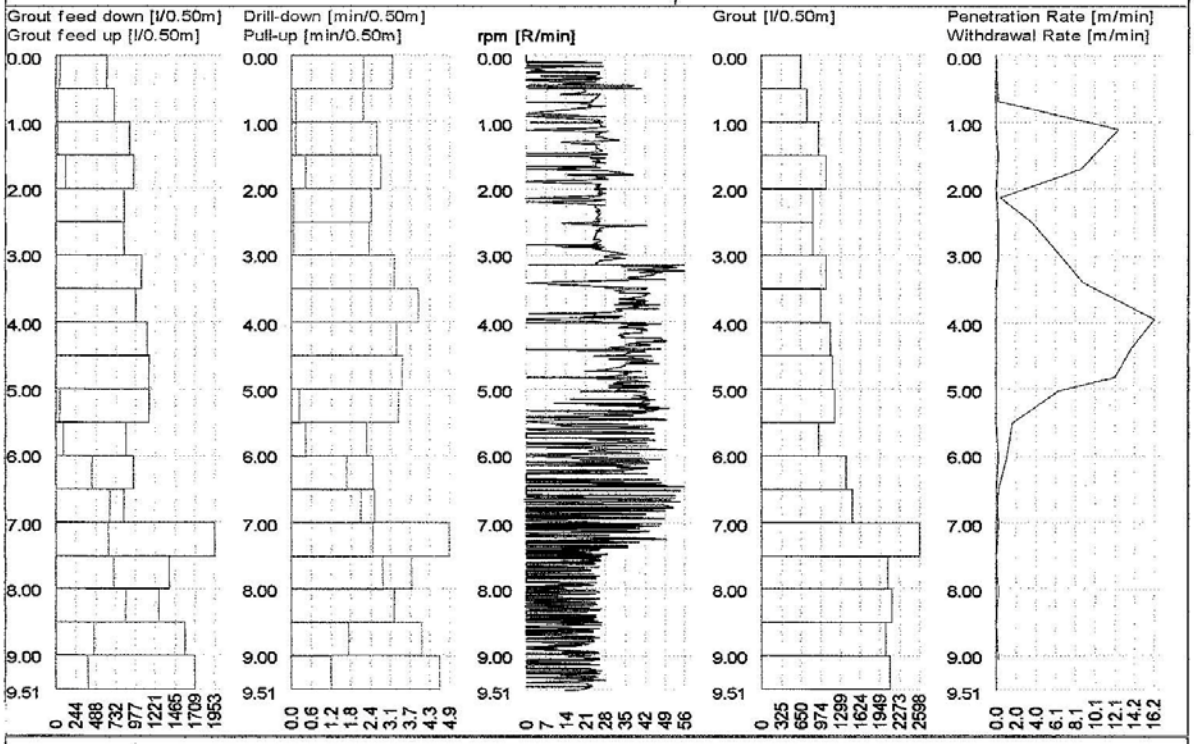
Jobsite:	Oakland Airport		
Client:	OFFC	Project No.:	07 08 001
Operator:	BILL	Cut:	ob1
Drilling Rig:	RG-23	Date:	Jul 14, 2009
I-No.:		Wall thickness/Dia.:	m
		Width of cut:	m
		Drilled depth:	9.51 m
		Column length:	9.51 m
		Ø deviation X:	0.00 mm
		Ø deviation Y:	0.00 mm



Additives

Quantity:
Grout density:-

Start:	9:30:57 AM	Nom. grout consu...	0.00 m³
End:	10:51:53 AM	Actual. grout con...	25.833 m³
Total time:	01:20:55		



supervisor: Client:

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