

# Controlled Low Strength Material, CLSM Consideration for the Use of Fly Ash in the Mix Design

9-12-2011

Fly Ash has been used in CLSM mixes for wall stabilization, pavement support, utility conduit trench backfill, and pipe bedding.

CLSM as a bedding material for clay pipe provides the necessary support for the pipe to obtain the required load factor and sets rapidly for earlier backfill.

Research by the National Clay Pipe Institute and member companies has determined that **the use of Fly Ash is not necessary and is not recommended.** (See attached calculations and chart).

**The use of Fly Ash retards the cure time of the CLSM.** The recommended CLSM slump measurement of 8 inches + - 1 inch and the 15% - 20% air entrainment provides adequate flowability for mix placement. The method of measuring CLSM slump is defined in ASTM D6103 and uses a cylinder six inches long and 3 inches in diameter.

Refer to the “Guidelines for Controlled Low Strength Material (CLSM) Mix Design, Placement and Testing For Use as a Bedding Material For Vitrified Clay Pipe”.

# Small Batch Testing to evaluate Fly Ash and Cement in the Optimum CLSM Mix

March 2, 2010

This test procedure is to evaluate the influence of various amounts of fly ash on the Optimum Test mix.

The test shall be performed using 12" x 12" x 4" deep plywood boxes.

Fill three boxes of each mix.

Measurements will be taken using a penetrometer having a 1 sq. in. foot to a depth of 1 inch.

Three penetrometer measurements shall be made in each test box at 30 minute intervals.

Measurements will continue until the penetrometer reaches 700 psi or a period of six hours has elapsed.

Each mix shall contain the following based on a one yard mix:

One Cylinder for 28 day compressive testing will be made from each mix.

	Materials per Cu. Ft.
2028 pounds of fine aggregate (sand).	75.0 pounds
507 pounds of course aggregate (3/8 inch).	18.8 pounds
375 pounds of water. (or necessary to obtain the slump).	10.2 pounds
4% accelerator.	2.8 ounces
15% to 20% air.	
Slump 9 inch +- 1 inch (3" dia. by 6" long cylinder).	

In addition to the above, to each mix will be added the following:

Mix #1	188 pounds of fly ash.	7.0 lbs
Mix #2	151 pounds of cement plus 37 pounds of fly ash.	5.6 lbs/1.4 lbs
Mix #3	188 pounds of cement	7.0 lbs
Mix #4	188 pounds of cement plus 37 pounds of fly ash.	7.0 lbs/1.4 lbs
Mix #5	188 pounds of cement plus 94 pounds of fly ash.	7.0 lbs/3.5 lbs
Mix #6	188 pounds of cement plus 188 pounds of fly ash	7.0 lbs/7.0 lbs

## Small Batch Testing to Evaluate Fly Ash and Cement in the Optimum Test Mix

8/12/2011

Penetrometer numbers are the average of six readings in three 12" x 12" x 4" deep boxes of each mix.

The mix headings are pounds of ***cement/flyash*** per yard of mix.

penetrometer readings (1 inch dia.)

Time (hours)	0/188	151/37	188/0	188/37	188/94	188/188
1/2 hr	0	0	0	0	0	0
1 hr	0	0	0	0	0	0
1 1/2 hr	0	0	25	20	20	40
2 hr	0	0	125	90	80	125
2 1/2 hr	0	0	315	215	175	330
3 hr	0	25	565	290	245	410
3 1/2 hr	0	90	700	375	315	535
4 hr	0	190		445	500	600
4 1/2 hr	0	280		565	600	690
5 hr	0	350		600	690	700
5 1/2 hr	40	400		690	700	
6 hr	80	480		700		
6 1/2 hr	120	550				
7 hr	250	600				
7 1/2 hr	320	700				
8 hr	490					
8 1/2 hr	600					

