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LEAN RCC MIXTURE DESIGN & QUALITY CONTROL AT FILIATRINOS DAM

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Filiatrinos Dam

Lean Rcc of filiatrinos dam ıs a mixture with low cement content. The percent of cementitious material range from 58 kgr/m3 (51 Cement & 7 Flying Ash) to 74 kgr/m3 (51 cement & 23 Flying Ash)

Lean RCC a mix of:

1. Cementitious Materials

Cement. *Flying Ash.*

2. Aggregates

Products of quarry.

3. Water

Flying Ash

Flying Ash is supplied from Megalopolis power station

Chemical composition of Megalopolis Flying Ash

Oxide	Raw Fly ash of Megalopolis (%)
SiO_2	40-45
Al_2O_3	15-20
Fe_20_3	7-8
CaO	10-15
CaO_f	0
MgO	2
SO_3	1,5-2,5
K_2O	1,5-2
Na_2O	0,5
Loss of ignition	2

Design Requirements for Filiatrinos Dam

- **Compressive strength of lean Rcc at 90 days should be greater than 4 Mpa**

$$R_{c90} \geq 4{,}0 \text{ MPa}.$$

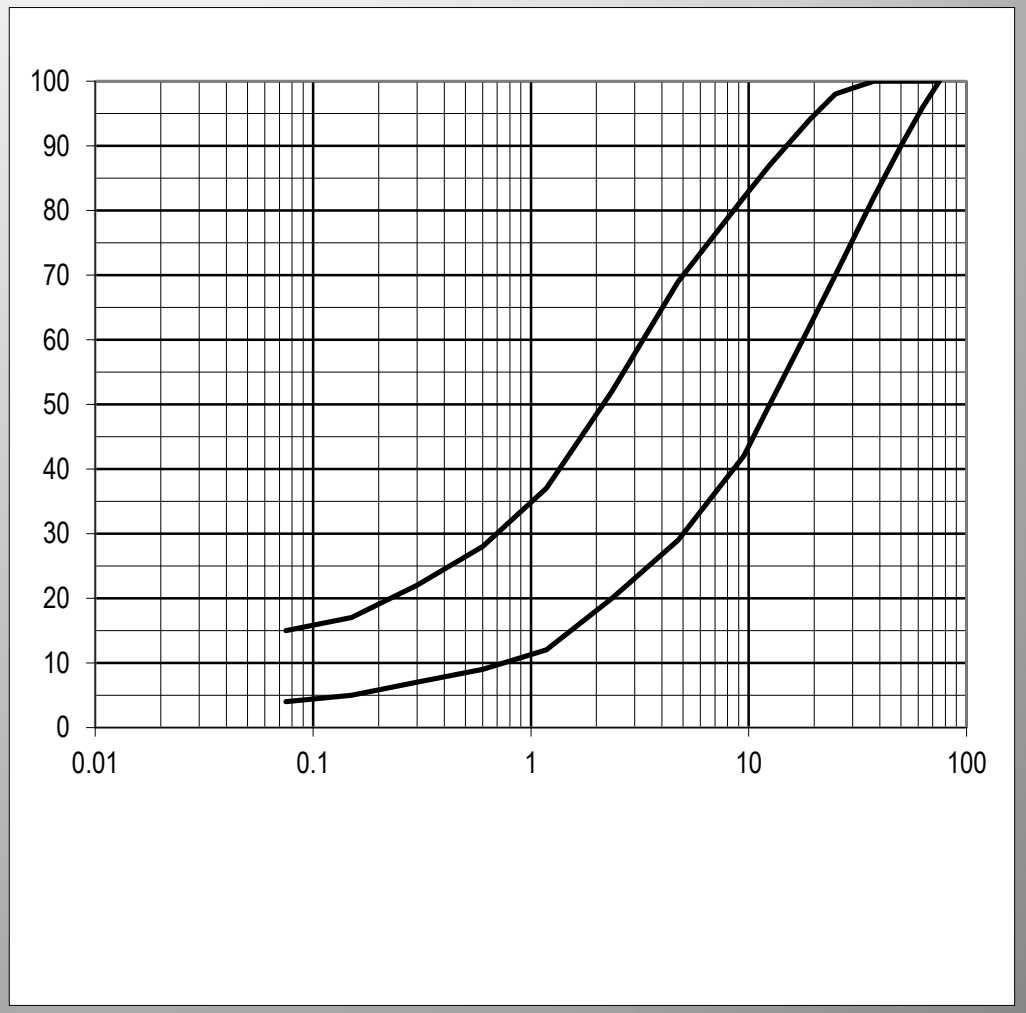
- **Dry Unit Weigth should greater than 20,0 KN/m3**

- **Maximum percentage of fines passing No. 200 (0.075 mm) Sieve : 15% (by weigth) of the mixture**

- **Maximum Plasticity index of fine aggregates (passing No. 200 sieve (0.075 mm) : 15**

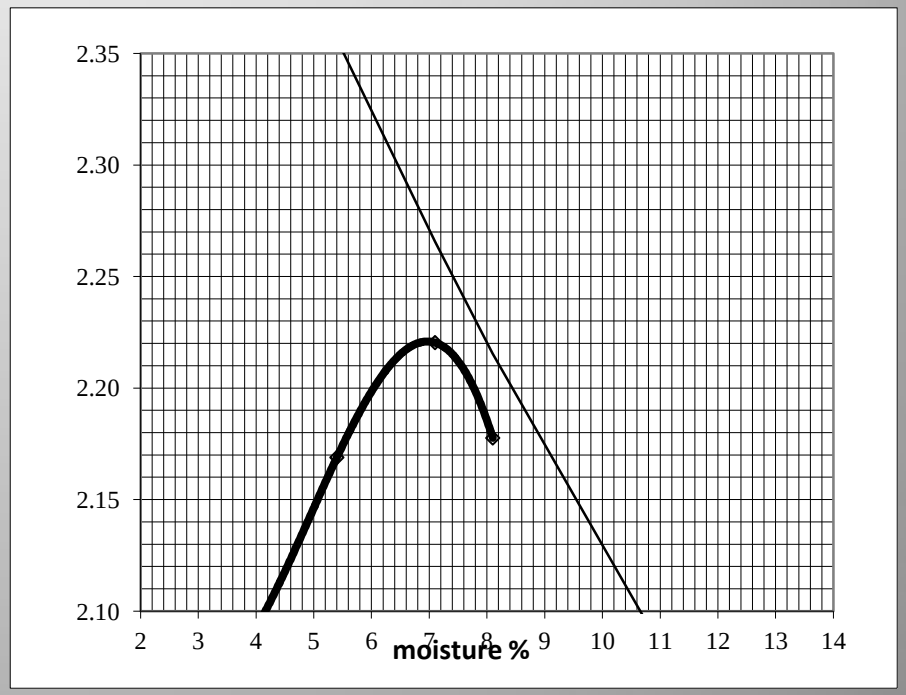
Aggregates Gradation Limits

Sieve number	diameter (mm)	Aggregates limits L. R.C.C (%)	
3"	75	**100**	**100**
$2^{1/2}$ "	63	**96**	**100**
2"	50	**90**	**100**
$1^{1/2}$ "	37,5	**82**	**100**
1"	25	**70**	**98**
3/4"	19	**62**	**94**
1/2"	12,5	**50**	**87**
3/8"	9,5	**42**	**82**
No 4	4,75	**29**	**69**
No 8	2,36	**20**	**52**
No 16	1,18	**12**	**37**
No 30	0,6	**9**	**28**
No 50	0,3	**7**	**22**
No 100	0,15	**5**	**17**
No 200	0,075	**4**	**15**



Lean Rcc Mix Design

At filiatrinos Dam the “soils” approach is followed in which the mixture is designed using a moisture/density relationship.



Lean Rcc method is intended to produce quality concrete suitable for roller compaction.

Mix Design

Compressive strength tests are conducted in the design phase to determine mixture proportion requirements, and to optimize combinations of cementitious materials, water and aggregates

Modified Proctor method

aggregates

Electrical mixer

Molding lean rcc in cylindrical mold with a vibrating hammer

Curing room

Compressive strength tests

Compaction of cylinder specimens

Each mixture is compacted in cylindrical molds (15 cm x 30 cm) with a standard effort using a vibrating hammer.

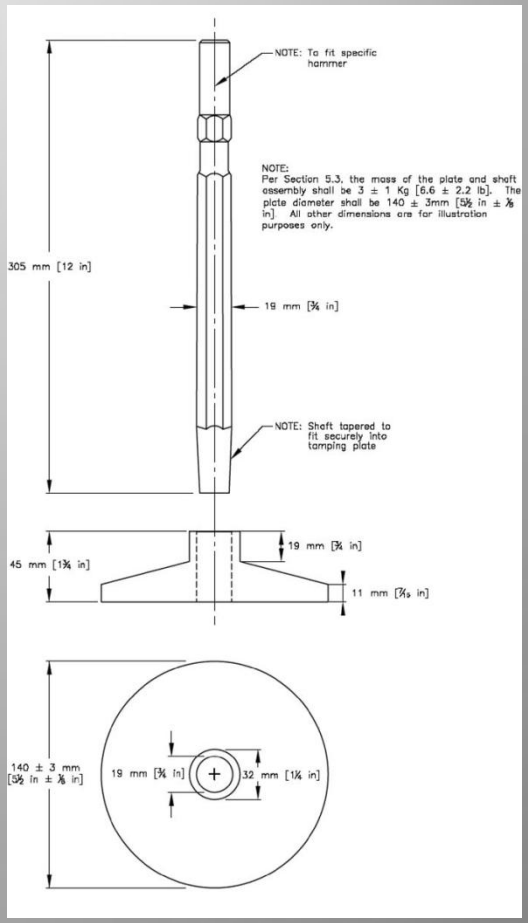
A correlation of modified proctor energy with the number of layers and vibrating time for compacting each layer was conducted in design phase

Specimens are compacted approximately to 96% of modified proctor maximum dry density

This is achieved when place lean rcc in four layers in the mold and compacting 1 minute each layer with the vibrating hammer

Compaction with a vibrating hammer

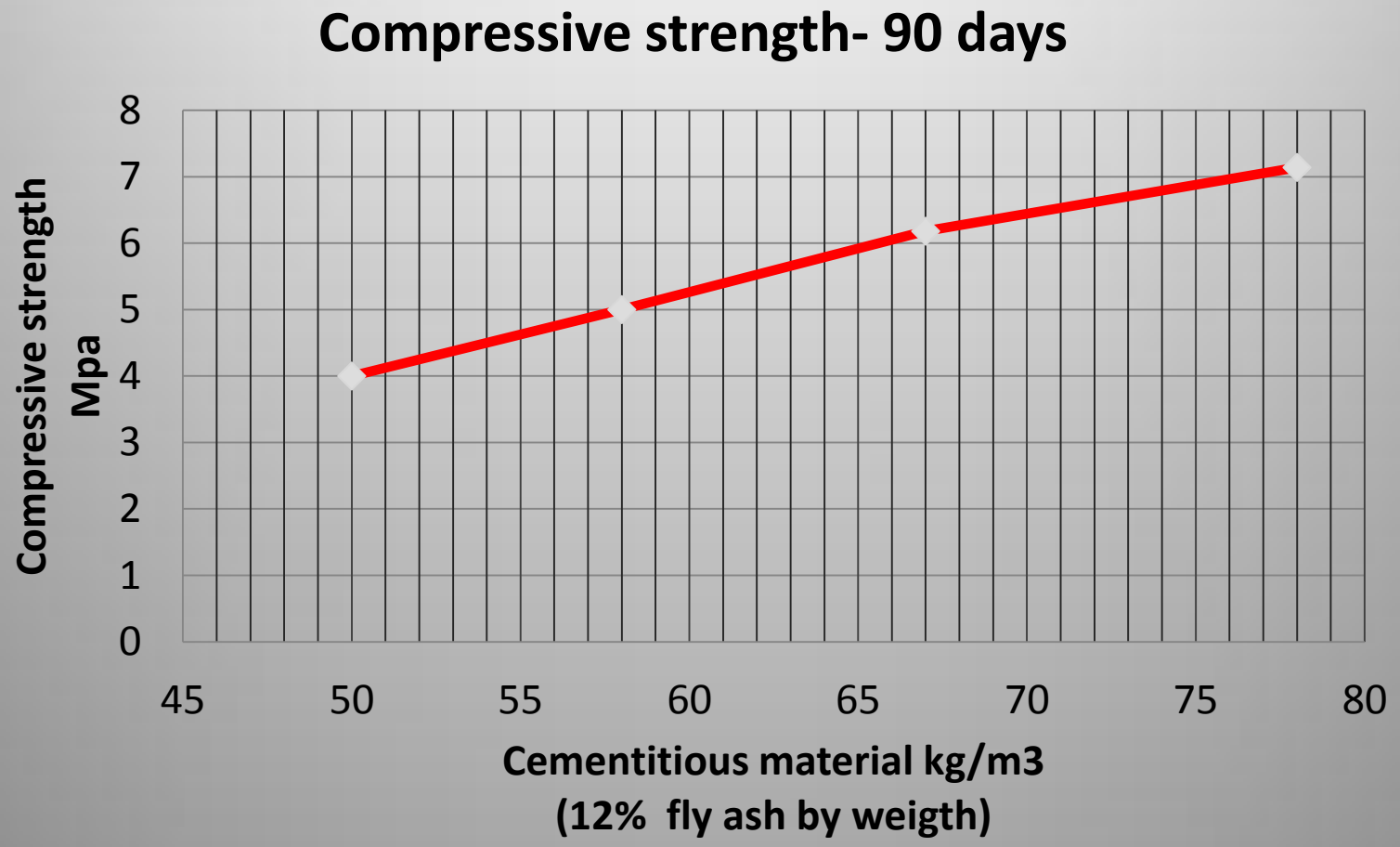
Molds with bond breaker for specimen removal



Circular Steel Tamping Plate and Metal Shaft (ASTM 1435/C)

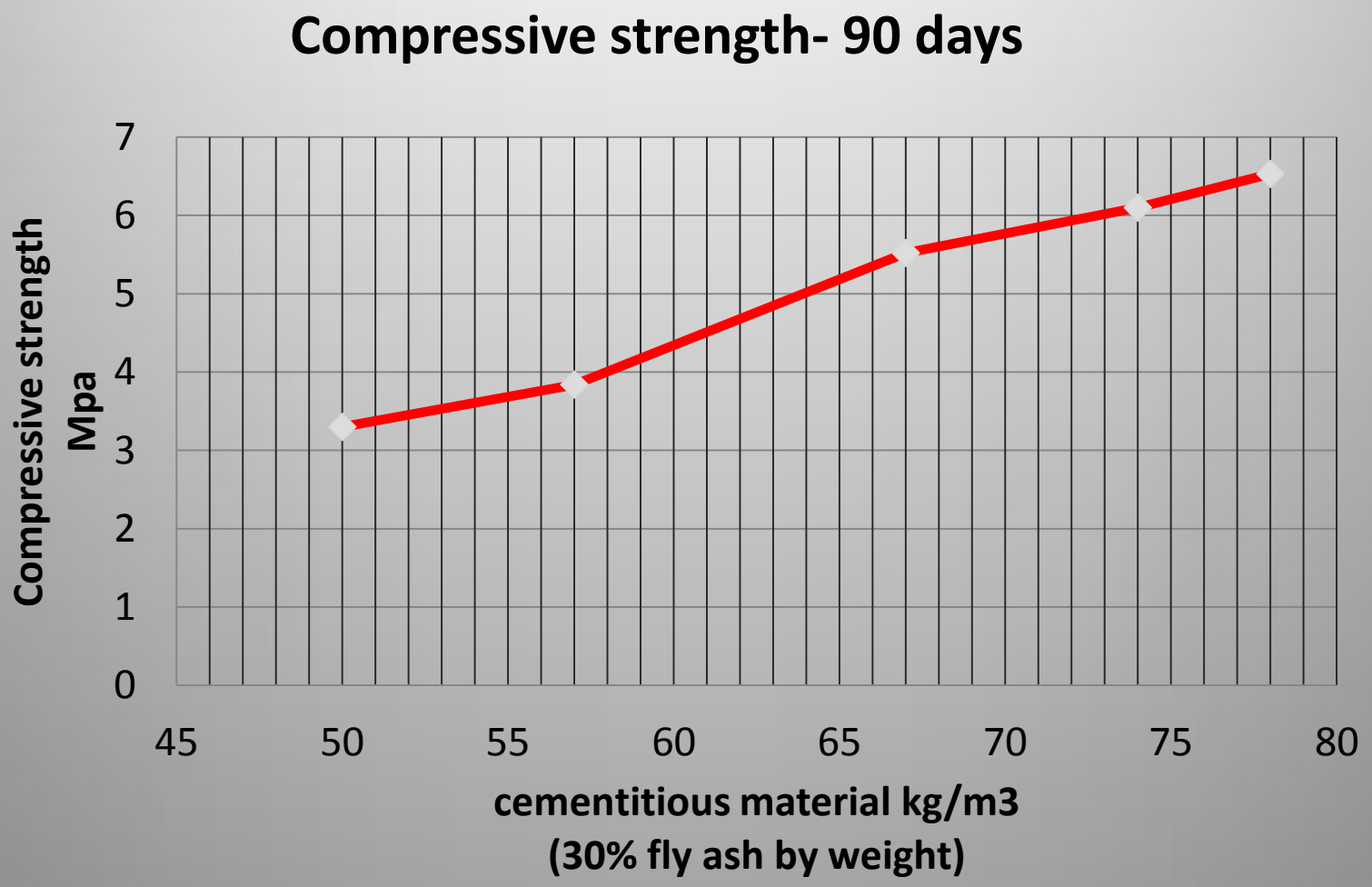
Laboratory Results

Relation of cementitious material content with compressive strength for aggregates with PI=NP and fines passing No. 200 sieve= 8%



Laboratory Results

Relation of cementitious material content with compressive strength for aggregates with PI=6 and fines passing No. 200 sieve =12%



TEST SECTION

a preliminary test section was completed at a convenient location to confirm RCC mixture proportion characteristics and to allow observation of placement and compaction characteristics of lean RCC.

- **Height of uncompacted layer :**
  40 cm uncompacted
  ↓
  35 cm Compacted

- **Passes of vibrated roller: 6**

- **Degree of Compaction:**
  98% of maximum dry density

- **Compressive Strength**

Compressive Strength

compressive strength tests are conducted in four cylinder specimens

- ✓**at an age of 90 days**

$$fc_{(90)} = 4MPa$$

$$\overline{X_4} \geq fc_{(90)} + 1.1s$$

$$X_{(i)} \geq fc_{(90)} - 0.5MPa$$

- ✓**at an early age of 7 days, as preliminary control**

Quality Control During Construction

The compressive strength of RCC is influenced by several factors including the water to cementitious materials ratio, quality and grading of aggregates, degree of compaction.

Routine minor adjustments in water content will be required daily or more often due primarily to changes in the aggregate moisture condition.

Quality Control During Construction

Daily Tests

1) Aggregates Grading 2) atterberg limits 3) Moisture content 4) Compressive strength 5) temperature

Samling of lean rcc

molding specimens

Curing specimens for 7 &90 days

Gradation test

Atterberg limits

Compressive strength tests

In situ inspection

layer height

Number of vibrator roller passes

Compaction degree using Sand & Cone method

Lift Joint treatment

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ΣΥΜΒΟΥΛΟΙ ΜΗΧΑΝΙΚΟΙ Α.Ε.

THANK FOR YOUR ATTENTION!