

**Class 3 mortar coverage
assessment**

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Executive Summary

BRE was commissioned by Mr Stewart McGregor, of CPI Mortars Limited, to undertake observations and report on the relative coverage of a cement:sand mortar and cement:lime:sand mortar. Both mortars were described as Class 3 mortars by CPI.

The test work was observed by BRE on single trial mixes of cement:sand and cement:lime:sand mortars at CPI's production plant at Coatbridge. Weights of the mix components and the physical properties of the mortar mixes were also recorded by BRE.

The mixing of the mortars was carried out by CPI staff and block-work walls were constructed with the mortar mixes by an external brick/blockwork contractor. Measurements and photographs were taken by BRE on completion of the walls. Coverage of the mortars was determined from the amount of blocks used and area of walls completed and from weights of mortar left over from the wall construction.

The following points are concluded from this investigation:

- The Class 3 cement:sand mortar without the inclusion of hydrated lime has a higher coverage rate as it has a lower density than a Class 3 cement:lime:sand.
- The Class 3 cement:lime sand required a greater amount of material per square metre of blockwork than the cement:sand mortar.

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1 Introduction

BRE was commissioned by Mr Stewart McGregor, of CPI Mortars Limited, to undertake observations and report on the relative coverage of a cement:sand mortar and cement:lime:sand mortar. Both mortars were described as Class 3 mortars by CPI.

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2 Description of the project

The test work observed by BRE involved the production by CPI of two mortars to compare the coverage rate of the mortar material in the joints of blockwork walls. Both mortars were described by CPI as being Class 3 mortars.

2.1 CPI Class 3 mortars

The two mortars for coverage rate comparison were as follows:

- Class 3 cement:sand mortar with water retention and air entrainment additives.
- Class 3 cement:lime:sand mortar with water retention and air entrainment additives.

The weights of the materials were noted by BRE from a screen on the computerised system used by CPI to weigh batch mortar materials.

2.1.1 Physical properties of mortar mixes

A sample was removed from each of the two mixes, in the presence of BRE, to determine the following physical properties of the mixes:

- Flow (mm).
- Air entrainment (%).
- Bulk density of the wet mortar (kg/m^3).
- Moisture content (%).

Table 1 gives the recorded values for the properties of both mixes.

Table 1: Physical properties of mortar mixes

Property	Value of property for CPI Class 3 mortar	Value of property for CPI Class 3 lime mortar
Flow	177 mm	193 mm
Air entrainment	21 %	19 %
Bulk density (wet mortar)	1620 kg/m^3	1699 kg/m^3
Moisture content	15.85 %	17.2 %

2.2 Determination of mortar coverage

2.2.1 Construction of blockwork walls

The weight of each mortar made available for wall construction was recorded and is shown in table 2. The weights were recorded on the weigh bridge at CPI.

Table 2: Quantity of mix available for wall building

	Weight of CPI Class 3 mortar	Weight of CPI Class 3 lime mortar
Wt of empty tub + forklift	3940 kg	3940 kg
Wt of full tub + forklift	4360 kg	4420 kg
Weight of mortar	420 kg	480 kg

Wall construction commenced with the Class 3 cement:sand mortar. Three walls were constructed with the following dimensions:

- First wall – 26 blocks long by 5 courses high (total number of blocks used 130). Dimensions of the wall were 11.74 m long by 1.13 m high. (Area of wall 13.266 m²).
- Second wall – 19 blocks long by 3 courses high (total number of blocks used 57). Dimensions of the wall were 8.57 m long by 0.685 m high. (Area of wall 5.870 m²).
- Third wall – 19 blocks long by 3 courses high (total number of blocks used 57). Dimensions of the wall were 8.525 m long by 0.685 m high. (Area of wall 5.840 m²).
- Additional blocks on second wall – (total number of blocks was 4.5 and the area of the wall was 0.5 m²).

A photograph of the walls is shown in figure 1 in appendix A.

Wall construction then followed with the Class 3 cement:lime:sand mortar. Three walls were constructed with the following dimensions:

- First wall – 26 blocks long by 5 courses high (total number of blocks used 130). Dimensions of wall were 11.705 m long by 1.125 m high. (Area of wall 13.168 m²).
- Second wall – 19 blocks long by 4 courses high (total number of blocks used 76). Dimensions of wall were 8.54 m long by 0.91 m high. (Area of wall 7.771 m²).
- Third wall – 19 blocks long by 1 course high (total number of blocks used 19). Dimensions of wall were 8.55 m long by 0.225 m high. (Area of wall 1.924 m²).
- Additional blocks on third wall – (total number of blocks was 4.5 and the area of the wall was 0.5 m²).

A photograph of the walls is shown in figure 2 in appendix A.

2.2.2 Coverage

The coverage of the mortars was determined by constructing the blockwork walls using a known amount of each of the mortars. The number of blocks used to construct the walls, area of the wall construction and the amount of mortar mix left over, on completion of wall construction, were recorded by BRE.

The bricklayers constructing the walls were instructed to keep the mortar joints to 10 mm by CPI. The brick layers were observed by BRE to fill each of the joints around the blocks and the build quality was the same for each mortar mix.

3 Results

The results for the coverage tests are given in table 3.

Table 3: Number of blocks and square metres of block laid with mortar

	CPI Class 3 mortar	CPI Class 3 lime mortar
Number of blocks	248.5	229.5
Area of blockwork (square metres)	25.476 m ²	23.363 m ²
Quantity of mortar available for walls	420 kg	480 kg
Quantity of mortar left after wall construction	19.04 kg	52.92 kg
Quantity of mortar used for wall construction	400.96 kg (0.248 m ³ at density 1620 kg/m ³)	427.08 kg (0.251 m ³ at density 1699 kg/m ³)
Quantity of mortar used per block	1.614 kg/block	1.861 kg/block
Quantity of mortar used per square metre	15.739 kg/m ² 0.009735 m ³ /m ²	18.280 kg/m ² 0.010743 m ³ /m ²

The block used for wall construction was a 7N concrete block with nominal dimensions of 440 mm long, 215 mm depth and 100 mm wide.

4 Discussion

The tests for mortar coverage of the two Class 3 mortar mixes do not form a rigorous investigation into coverage rates of cement:sand versus cement:lime:sand mortar mixes. The coverage results from the two mortars, however, can give an indication of how two similar mixes can be assessed. When one of the mixes has a higher value for bulk density it will always provide a smaller volume when the same weights of mix are compared.

Mortar joints in a wall construction will naturally vary in width by small amounts, even when constructed by an expert brick layer. This will occur over both sets of walls constructed for each of the mortars. If all joints were exactly 10 mm in width there would be a defined volume for the mortar to fill. So, it would be that the mortar with the greatest volume per kg or tonne should have the greatest coverage.

The brick layers used to build the blockwork walls at CPI were observed by BRE to fill each of the joints around the blocks and the build quality was the same for both mortar mixes.

In the tests undertaken at the CPI production plant in Coatbridge the ratio of the number of blocks (or area of blocks) constructed against the weight (or volume) of mortar used was compared and the Class 3 cement:lime:sand mortar had less coverage than the Class 3 cement:sand mortar.

5 Conclusions

From weight recordings and observations made at CPI Mortars Limited, Coatbridge, of the coverage assessment of two Class 3 mortars the following points can be concluded:

- The Class 3 cement:sand mortar without the inclusion of hydrated lime has a higher coverage rate as it has a lower density than a Class 3 cement:lime:sand.
- The Class 3 cement:lime sand required a greater amount of material per square metre of blockwork than the cement:sand mortar.

Appendix A – Photographs



Figure 1: Walls built with Class 3 cement:sand mortar



Figure 2: Walls built with Class 3 cement:lime:sand mortar