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Drying of Modular Bricks

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Introduction

WORK on the drying of modular bricks was initiated at the instance of Indian Standards Institution and aimed to determine the difference in drying time between modular and standard sized bricks.

Drying time for both types of bricks were recorded under different conditions of drying. The results obtained indicate that the drying time of modular bricks was likely to be less and not more than that of bricks at present commonly used.

The present study pertains to the alluvial soils of the Indo-Gangetic plains and the results obtained are applicable to such types of soils only.

Laboratory Investigations.

Two soils from Roorkee brick fields were used for the present investigations. The soil from brick field 'A' contains 23.3% clay and 42.15% silt and soil from the brick field 'B' contains 17.8% clay and 26.8% silt.

The bricks were moulded and dried in the normal manner. The modular bricks were moulded in a 21.2 cm. × 10.7 cm. × 9.7 cm. mould and the standard sized bricks in a 25.9 cm. × 13.0 × 7.6 cm. mould. In order to observe the effect of the slight increase in dimensions on the drying time of modular bricks, some bricks were moulded in a 22.9 cm. × 11.5 cm. × 10.9 cm. (referred to as big modular).

The dimensions of all these bricks after drying and firing are given in table II.

The effect of the depth of the frog on the drying time of modular bricks was also investigated. The volume and dimensions of the frog in different bricks are given in table. III. Modular bricks with 1, 2, 3 cm. frogs and standard sized bricks with normal frogs were dried together under the same conditions of temperature, humidity and air flow. In order to vary drying conditions bricks were dried in the shade as well as in the sun. Readings were taken on six bricks of each type and the mean value of these is reported. (see tables I and Ia). In these experiments it was assumed that bricks containing 4 to 6% moisture could be loaded in the kiln, and the drying time of each set of bricks was calculated on this basis.

Results

It is clear from the results that :

(1) The rate of drying of bricks in the shade is practically half of that in the sun.

(2) As the depth of the frog in modular bricks increases the drying time decreases.

(3) The drying time of modular bricks made from the two soils is lower than that of the standard sized bricks, irrespective of the conditions of drying. This is expected to be so, as during the early stages of drying when the bricks are laid on flat surfaces, the brick surface exposed for drying is more in the case of modular bricks than in the case of standard sized bricks.

(4) Modular bricks moulded in the 'big' mould take longer time to dry than the bricks

TABLE I

Showing the Moisture percentage in the Bricks at Various Intervals when they were dried in the Shade and Sun

SOIL USED	Type of Bricks	Frog Depth (cms)	Moulding Moisture %	SHADE-DRYING									Time in days reqd. to reduce M. %		Average Temp. & R. Humidity	
				Moisture in bricks after various intervals (in alternative days)												
				1	3	5	7	9	11	13	15	17	6%	4%	Temp. °C	R.H. %
BRICK FIELD (A)	Common	1.5	33.96	29.31	24.88	20.51	15.21	9.14	6.73	4.85	—	—	11.38	13.00	Max. 28.2°C & Min. 11.8°C	Max. 88.2% and Min. 21.3%
	Modular	1.0	33.52	28.76	23.05	18.09	12.37	6.87	5.37	3.79	—	—	9.70	12.73		
	,,	2.0	33.65	28.87	22.84	17.73	11.96	6.86	5.70	4.07	—	—	9.76	13.00		
	,,	3.0	33.50	28.75	22.34	16.98	10.85	6.10	5.22	3.70	—	—	9.11	12.63		
BRICK FIELD (B)	Common	1.5	23.06	21.16	18.52	15.40	12.39	9.15	5.90	4.30	3.59	3.35	10.93	13.94	Max 23.6°C and Min. 86°C.	Max. 79.7% and Min. 30.5%.
	Modular	1.0	24.21	21.87	17.84	13.53	10.57	7.31	4.97	4.08	3.57	3.14	10.10	13.34		
	,,	2.0	23.81	21.29	17.29	13.13	10.09	6.91	4.39	3.72	3.19	2.85	9.79	12.10		
	,,	3.0	23.85	21.24	16.99	12.44	9.41	6.47	4.65	4.01	3.53	3.23	9.61	13.10		

TABLE I—(*Contd.*)

Moulding Moisture %	SUN DRYING									Time in days required to reduce M.P. to		Average Temp. and R. Humidity	
	Moisture in bricks after various intervals (in days)												
	1	2	3	4	5	6	7	8	9	6%	4%	Temp. °C	R.H. %
34.26	26.59	19.74	13.89	9.86	7.44	6.21	5.23	4.58	3.86	6.21	8.80	Max. 28.6°C and Min. 9.8°C	Max. 87.4% and Min. 21.4%.
32.98	25.17	17.74	11.71	8.32	6.22	5.34	4.45	3.96	3.10	5.25	7.91		
34.37	25.29	17.05	10.97	7.69	5.80	4.96	4.23	3.56	2.84	4.88	7.34		
34.68	25.28	17.31	11.09	7.69	5.94	5.32	4.42	3.96	3.17	4.69	7.91		
24.87	19.51	13.78	9.69	6.59	5.52	4.74	4.13	3.68	3.64	4.55	7.29	Max. 23.6°C and Min. 8.6°C.	Max. 79.7% and Min. 30.5%.
24.43	18.69	12.20	7.87	5.43	4.68	3.84	3.56	2.90	2.98	3.76	5.80		
23.94	17.87	11.36	6.99	4.76	3.98	3.40	2.98	2.72	2.52	3.44	4.96		
23.04	17.16	11.03	6.07	3.84	3.35	2.77	2.19	1.89	1.99	3.03	3.93		

TABLE I (a)

Moisture Percentage in the Bricks when they were Dried in the Shade and Sun at Various Intervals

SOIL USED	Type of Bricks	Frog Depth (cms)	Moulding Moisture %	SHADE–DRYING									Time in days required to reduce M.P.		Average Temp. and R. Humid.	
				Moisture in bricks after various intervals (in alternate days)												
				1	3	5	7	9	11	13	15	17	6%	4%	Temp. °C	R.H. %
BRICK FIELD (A)	Common	1.5	30.99	28.98	25.03	21.15	16.86	13.05	9.90	7.62	5.89	—	14.04	16.10	Max. 25.3°C and Min. 7.7°C	Max. 75.03% and Min. 34.6%
	Modular (big)	1.0	32.05	29.87	26.93	23.38	19.90	16.83	13.92	11.02	8.41	—	15.12	16.09		
	,,	2.0	31.42	29.38	25.99	21.88	18.04	14.70	11.17	8.69	6.58	—	15.23	16.00		
	,,	3.0	30.38	28.58	24.93	20.69	16.63	12.89	9.43	7.08	5.46	—	14.08	15.23		
BRICK FIELD (B)	Common	1.5	23.06	21.16	18.52	15.40	12.39	9.15	5.90	4.30	3.59	3.35	10.93	13.94	Max. 23.6°C and Min. 8.6°C	Max. 79.7% and Min. 30.5%
	Modular (big)	1.0	24.04	21.97	19.02	15.96	12.78	9.27	5 92	4.52	3.76	3.18	10.95	14.49		
	,,	2.0	23.64	21.70	18.06	14.87	11.24	8.18	5.12	3.93	3.29	3.06	10.30	12.85		
	,,	3.0	24.34	22.30	18.89	15.46	12.06	8.64	5.60	4.40	3.69	3.40	10.72	14.20		

TABLE I (a)—(*Contd.*)

Moulding Moisture %	SUN—DRYING									Time in days required to reduce M %		Average Temp. and R. Humidity.	
	Moisture in bricks after various intervals (in days)												
	1	2	3	4	5	6	7	8	9	6%	4%	Temp. °C.	R.H. %
34.47	27.22	17.25	10.18	5.93	3.88	3.77	—	—	—	4.0	4.45	Max. 33.4°C and Min. 22.3°C.	Max. 92.7% and Min. 45.2%.
33.96	26.55	17.62	11.53	6.79	4.91	4.52	—	—	—	4.6	5.23		
33.89	26.27	17.26	11.10	6.33	4.66	4.26	—	—	—	4.3	5.17		
—	—	—	—	—	—	—	—	—	—	—	—		
24.87	19.51	13.78	9.69	6.59	5.52	4.74	4.13	3.68	3.64	4.55	7.29	Max. 23.6°C and Min. 8.6°C.	Max. 79.7% and Min. 30.5%.
24.52	19.44	13.73	9.26	6.43	5.25	4.27	3.77	3.30	3.38	4.36	6.54		
24.07	18.62	13.25	8.29	5.58	4.55	3.71	3.27	2.87	2.79	3.84	5.65		
23.69	18.61	12.54	8.31	5.51	4.47	3.76	3.20	2.72	2.72	3.82	5.66		

TABLE II

Dimensions of the Dried and Fired Bricks*

		BRICK FIELD 'A'						BRICK FIELD 'B'					
		Dried Bricks Dimensions			Fired Bricks Dimensions			Dried bricks dimensions			Fired bricks dimensions		
		Common	Modular (big)	Modular	Common	Modular (big)	Modular	Common	Modular (big)	Modular	Common	Modular (big)	Modular
LENGTH	(Cms.)	24.0	21.0	19.3	22.4	20.4	19.0	24.5	21.8	20.4	24.3	21.6	20.0
BREADTH	(Cms.)	11.5	10.5	9.3	11.0	10.0	9.0	12.0	11.8	10.0	11.8	10.5	9.8
DEPTH	(Cms.)	7.3	10.5	9.1	7.0	10.2	8.9	7.6	9.5	9.0	7.6	9.2	9.0

(*Bricks were fired at a temperature of 1000°C)

TABLE III

Showing the dimensions and volume of frog in fired bricks.

	Common	Modular Bricks		
		1 cm.	2 cm.	3 cm.
Length (Cms)	13	10.5	10.5	10.5* 9.1
Breadth (cms)	5.4* 4.0	4.0	4.0	4.0* 3.0
Depth (cms.)	1.5	1.0	2.0	3.0
Volume (C. cms).	114.45	42.0	84.0	102.9

(*Tappared)

moulded in the normal modular mould.

(5) An increase of about 10% in the thickness and other dimensions of the modular bricks (moulded in the 'big' mould) results in an increase in the drying time of bricks made from the two soils. In bricks made from soil 'A' the the drying time is even more than that of the standard bricks made from the same soil. However, difference arises at later stages of drying and is very small which is not of much consequence in industrial practice when sun-drying is adopted. A 2 or 3 cm. frog in the modular bricks (with increased dimensions) reduces this difference.

Conclusions

1. The drying time of modular bricks is always less than that of the standard sized brick-irrespective of the clay content of the soil used and the drying conditions.

2. Bricks slightly thicker than 9 cm. and made from clayey soils takes longer time to dry than the conventional bricks. In such cases a 2 or 3 cm. deep frog would help in reducing the drying time nearly to the level of the standard sized bricks.

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