CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

CONCRETE ON THE FARM

Replacing Bulletin No. 23.
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Bulletin. CHRISTCHURCH, JUNE, 1948. No. 227.

Bulletin No. 225 briefly described how to make good concrete. This bulletin deals with special concretes, and describes how to carry out several farm concreting jobs. Other jobs will be described in later bulletins.

Vibrated Concrete:

The process of vibrating concrete is well established as a means of obtaining very strong dense concrete. The idea is to apply rapid vibrations to the concrete for a short period immediately after placing. This removes air pockets and makes the concrete very dense and strong, and does away with the laborious tamping that is usually necessary, particularly with highly reinforced work. It also allows a drier mix than normal, thus giving concrete of greater strength. Alternatively a weaker mix can be used to give the same strength as the normal mix. The drier mix is well compacted into the forms by the vibrations.

Vibrators, electric motor driven, are on the market, but are very expensive, and a simple vibrator is readily made by mounting a light shaft in bearings on a baseboard and mounting an eccentric weight on the shaft. The shaft is then driven at high speed, up to 3000 r.p.m., by a belt drive from an electric motor or petrol engine. The vibrator is clamped to the forms, and allowed to run until the air bubbles stop rising to the surface of the concrete, which usually takes only a few minutes. Over-prolonged vibration, particularly until water rises to the surface, is harmful to the concrete. Vibration can be carried out merely by bolting a small petrol engine to the formwork, or connecting the formwork by a stay to a tractor, and idling the engine fast.

Vibration is particularly valuable for repetition jobs such as fence posts. A wooden platform about 8 to 10 feet square is usually constructed, the vibrator is bolted to this platform, and the fence post moulds placed on the platform, filled, and vibrated. In this way, several fence posts can be vibrated at once.

Dry Mix Concrete:

This is a method of making concrete building blocks, fence posts, and similar precast jobs, so that they can be turned out of the forms or moulds immediately. This greatly speeds up production. The concrete is mixed very dry, and rammed or heavily vibrated very tightly into the mould. The mould is then removed, and the concrete, if sufficiently dry, stands up by itself, just like the moist sand is turned out of a bucket by a child at the beach. The concrete, having insufficient mixing water, is considerably weaker when hardened than ordinery wet mix concrete, but quite strong enough for reinforced fence posts and building blocks. As the concrete is turned out immediately, the mould can be refilled straight away, and a large number of blocks or posts made in a day with only one mould. Considerable skill and patience are required to gauge by trial the correct amount of water to use so that the concrete will not slump down when the mould is removed, and yet will not be too dry and crumbly. For building blocks a 1 cement, 2 sand, 6 gravel mix has been found very satisfactory, using gravel screened through a ⅜" mesh sieve. It gives an attractive surface finish, and as it does not contain much sand, it does not absorb moisture readily. Sand concrete, composed of 1 cement, 5 sand, is also used. The surface of the block is very smooth, but it absorbs moisture readily. For fence posts, dry mix is commonly 1 cement, 2 sand,

3 gravel. Ordinary vibrators are not of much use for dry mix, but special vibrators giving a very heavy jolting action have been used satisfactorily. It is most important to compact the concrete thoroughly in the mould, either by thorough ramming or by heavy vibration.

Sawdust Concrete:

On account of its good heat insulating properties, concrete made of sawdust and cement has been used successfully for such work as piggery floors and walls. Common mixes are 1 cement, 4 sawdust for walls, and 1 cement, 2 sawdust for floors, but it would be necessary to experiment on a small scale with any particular sawdust before carrying out a large job, as failures have occurred with sawdust concrete. Sawdust of soft woods such as pinus radiata have been found most satisfactory.

Soil-Cement Concrete:

Concrete made from soil and cement has been used for many years in U.S.A. for air strips, roads and paths. The soil should be somewhat sandy and fairly low in humus and should not contain more than about 20 per cent of clay. This method of construction is still experimental, and trials with different soils and mixes would be desirable before attempting large-scale work. An experimental soil-cement wall recently constructed at the School of Engineering, Canterbury College, and consisting of 1 part cement to 10 parts Cashmere Hills loess is very promising, and indicates the possibility of using soil-cement for the walls of buildings. Building blocks could be constructed of similar material.

Light Aggregate Concrete:

Concretes composed of cement with cinders, pumice, scoria and similar materials are light, and have good heat insulating properties, although the concrete is not as strong as ordinary concrete. It is used for buildings to house stock, such as piggeries. The usual mix is 1 part cement to 4½ parts light aggregate. Walls and floors of these materials are much warmer than those of ordinary concrete. A chemical product recently developed overseas, when included with the mix, aerates concrete and makes it much lighter, besides giving it good heat insulating properties.

"No Fines" Concrete:

Walls of buildings made of ordinary concrete are inclined to allow dampness from rain to pass through the wall by capillary action. It has been found that if the sand is omitted from the concrete mix, capillary action does not occur, and the walls keep drier and warmer than with ordinary concrete. No-fines (i.e. no sand) concrete is now being used for walls of dwelling houses and farm structures.

Cement Paint:

Special cement paints in powder form are mixed with water and used for painting concrete and all forms of masonry. They are superior to the ordinary cement washes, being far more durable and waterproof. Two coats should be used, the first mixed to a fairly thin consistency, and the second much thicker. If brushed on, they are applied with a fibre-bristled bannister brush and scrubbed and dabbed vigorously into the wall surface. They are excellent for finishing and waterproofing the special concretes mentioned previously. They are made in a variety of colours. Cement paints are now used frequently instead of the more laborious and expensive plastering of walls with mortar.

Rubbing-down Concrete:

When the forms are removed from such jobs as walls of buildings, tanks and troughs, unsightly marks, caused by joints between the timber and the grain of the timber, are often seen. These can be removed, if the concrete is still "green," by rubbing the surface with a wooden plasterer's float kept wet.

Plastering:

Walls and floors of concrete are frequently plastered or "rendered" with a coat of mortar composed of 2 or 3 parts sand to 1 cement, to give a pleasing finish and to assist with waterproofing. Plastering requires considerable practice and patience to make a good job. It is rubbed on to the concrete with a wooden float, and for a very smooth finsh can be rubbed over with a steel float. Important points in plastering are:—first scratch the concrete wall thoroughly, while still "green," with a pointed steel trowel, wet the wall thoroughly, and do not attempt to plaster more than ⅜" thick. Waterproofed cement can be used when plastering water tanks.

Concrete Fence Posts:

The 6ft by 6in by 5in reinforced concrete intermediate fence posts

that are a feature of the College farm are made in the following manner. The 6-inch dimension is at right angles to the fence. The reinforcement consists of four ⅜" diameter mild steel rods. These rods are formed into a framework with No. 12 wire stirrups. To make a stirrup, fix four studs ⅜" diameter in a board at the corners of a rectangle with 4" by 3" sides so that 1" of stud projects above the surface of the board. No. 12 wire is bent around these studs to form a loop at each corner starting and finishing the wire with a loop. See figure 1. Four of these stirrups are used for each post. The rods are threaded through the loops of the four stirrups to form a framework. See figure 2. Incidentally, the stirrups are not absolutely essential, and many posts are made without them, by laying the rods in place in the concrete as it is placed in the moulds. The stirrups, however, help to locate the rods accurately.

Moulds are made by laying down a flat wooden board, and by fixing oregon timber side and end boards to it in the form of a box. For each post two side boards about 7ft long by 5in by 1½in, two end boards 6in by 5in by 1in and four battens 12in by 2in by 1in are required. The corners of the mould may be fitted with three-sided battens which will bevel the corners of the post. A batten with bevelled sides is also nailed to the middle of one side board to form a groove for bending down, at the back of the posts, the long wire staple fasteners that secure the fencing wires to the front of the post. See figure 3. If desired, the side boards may be lined with thin galvanised iron sheet to make them more durable and strip cleanly. The reinforcement is laid on the base board and the two side boards laid on edge on each side. These are secured in position by laying the battens across the top of the side boards and passing an 8inch pin through each batten and into the base board. The battens must be drilled for the pins so that the inside face of the boxing is 6 inches apart. The 6in by 5in end pieces are held in position by cleats nailed to the inside of the ends of the side boards. See figure 4. A curved piece of galvanised iron may be fitted inside the 6inch by 5inch end piece at the top of the post to form a curved top, but for simplicity this is not shown in figure 4.

The inside of the mould is brushed over with a wash composed of clay and water mixed to the consistency of thin cream, which helps the moulds to strip cleanly. The mould may now be filled, using the 1 cement, 2 sand, 3 gravel mix as specified in Table A of the previous bulletin, No. 225. Take care to tamp the concrete well, or alternatively use vibration. With vibration, the mix can be drier than normal, and thus about 25% less cement can be used and a good strong post obtained. The reinforcement should be lifted when filling the mould to keep the bottom rod about ¾inch above the bottom of the mould. Long No. 8 wire staple fasteners, bent down in a groove at the back of the post, are used to fix the fencing wires to the front of the post. See figure 6. ¾inch diameter holes to take these staples are cast into the post by pushing a piece of ¾inch rod, bent and welded as in figure 5, through holes previously drilled at correct spacings in the side moulds. A finished post with hole spacing is shown in figure 8. These rods should be greased for easy withdrawal.

The moulds may be removed the following day, or sooner if rapid hardening cement or calcium chloride has been used.

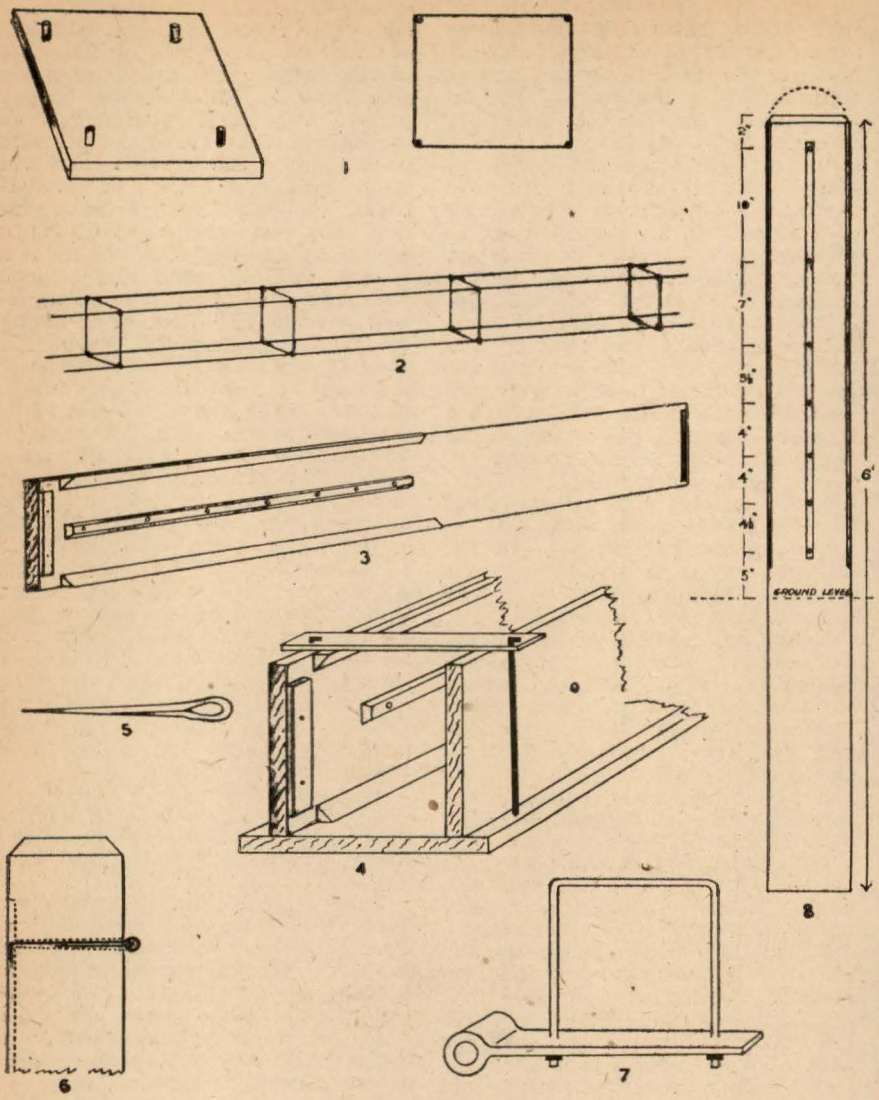
The posts are then rubbed down with a wooden float for a smooth finish, and carefully stacked and kept damp to cure them until they mature.

These College intermediate fence posts are extra large, and are spaced wide apart in the fences. 5/16inch reinforcing rods would be satisfactory for ordinary use, while many intermediate posts are made 4inch, by 4inch, reinforced with four ¼inch rods. Any size of posts could be made using moulds constructed in a similar manner to that described.

Special metal moulds are available for constructing fence posts in dry mix concrete thus enabling them to be made very rapidly in large numbers. Moulds for this method can also be readily constructed.

The College strainer and gate posts are made 8 inches by 8 inches, reinforced with four ½inch rods. They are made in a similar way to the intermediates, except that no holes are cast through the posts, and a wedge shaped piece of wood is fitted to the mould to leave recess for the stay. When used as gate posts, hinges are not cast in but attached to the posts in the manner shown in figure 7.

A substitute for reinforcing rods



can be made by twisting two lengths of No. 8 gauge wire, galvanised or black, together, with a twist of about 6 turns per foot. Twisting in long lengths is easily done by rigging up some form of wheel or crank to which one end of the wires is attached. Two wires thus twisted is equivalent to a ¼inch diameter rod. Two of these twisted rods together would be stronger than one 5/16inch diameter rod.

Concrete Building Blocks:

Continuous concrete walls of buildings have to be reinforced to prevent cracking. Reinforcing can be greatly reduced or avoided, and drier, warmer walls made by using hollow concrete building blocks. Special moulds are on the market for constructing either solid or hollow blocks. Common sizes are 18 inches by 8 inches by 8 inches and 18 inches by 8 inches by 6 inches, with two oval shaped hollows cast vertically through each block. Moulds are also readily constructed in either wood or heavy sheet steel. Dry mix concrete is most commonly used, and the moulds stripped immediately. Any of the special concretes mentioned earlier in this bulletin could also be used.

Figure 9 shows a mould used at the College, and the type of 18inch by 8inch by 8 inch block made with

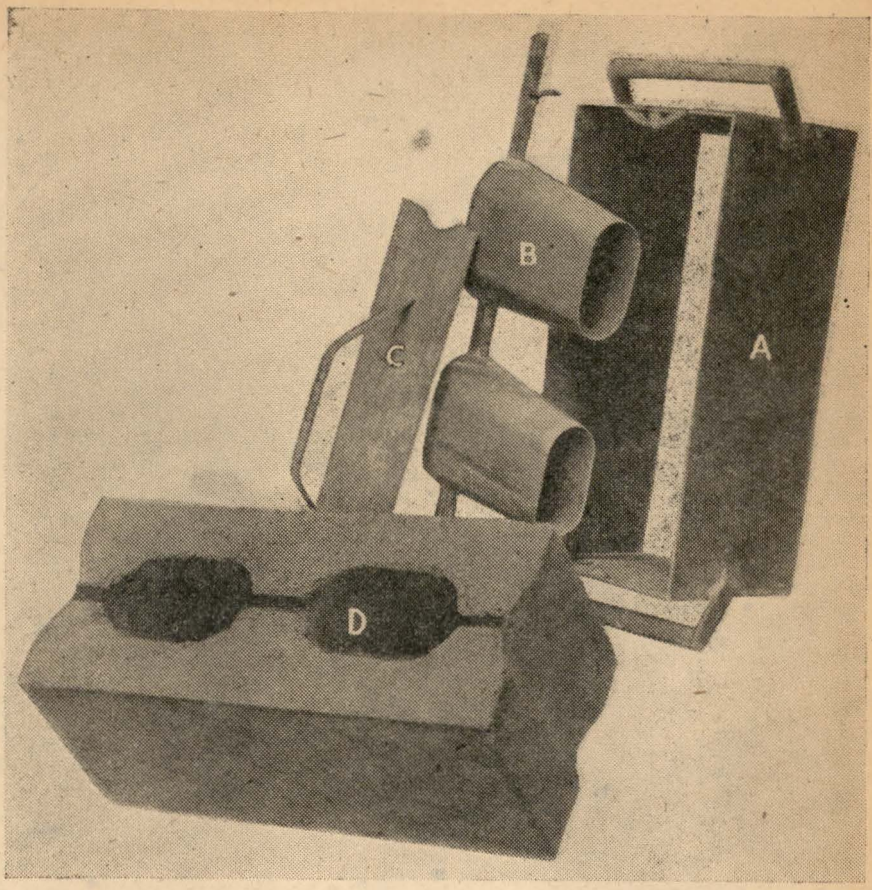


FIGURE 9

it. The outer rectangular sheet steel mould, figure 9(a), is stood on a strip of bituminous fabric on a concrete floor, and the inner mould, figure 9(b), placed in position. The space between inner and outer moulds is filled with dry mix concrete and thoroughly rammed. The inner mould is then removed. The plate with a handle, figure 9(c), is placed on top of the block, and held in place while the outer mould is removed, thus preventing lifting of the block, with the mould. To give easy removal, the bottom of the outer mould is made very slightly longer and wider than the top.

In normal temperatures, the blocks can be handled and stacked next day. They are kept damp for a few days, and after curing for about one month can be used.

Walls of buildings constructed of concrete blocks can be left plain, or finished by plastering or painting with cement paint.

Special blocks for corners, window frames, etc., can be made by fitting plates or wooden blocks in the mould.

Copies of this Bulletin may be obtained from the Secretary, Canterbury Chamber of Commerce, P.O. Box 187, Christchurch.

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