

CASTING CONCRETE AGAINST TEXTURED RUBBER

This brochure is the seventh in a series designed to provide architects, builders and owners with up-to-date information on the uses of natural rubber in building. It deals with the application of figured rubber sheeting to the surface of concrete to give it a decorative finish as well as covering briefly its established use for making "keys" in a concrete surface. This is one of a number of growing uses for rubber in concrete construction, all of which are described in recent publications of the Board (see list on inside back cover).

INTRODUCTION

Concrete for use in building or civil engineering structures may be rough-finished from the mould, or it may be brought to a suitable standard of finish in the moulding operation and so require no further finishing treatment. The following notes show that rubber can be used with advantage whichever of these two procedures is followed.

As a result of the development work carried out jointly by the Cement and Concrete Association and the Natural Rubber Development Board the architect now has at his disposal tested techniques for finishing concrete by means of rubber sheeting and a varied range of patterns suitable for the job. All of these patterns are applicable to both pre-cast units and concrete cast *in situ*.

The positioning and fixing of rubber in the mould, the lubrication of the rubber, the concrete mix and its placing in the mould, the stripping of the rubber, the care and selection of the rubber and the choice of patterns have all come within the scope of the development programme. The investigations have also included weathering tests and there are on

view at the Wexham Springs Station of the Cement and Concrete Association some panels, in satisfactory condition, which were cast in 1949 and have been exposed to the weather continuously since then. Some of these castings are illustrated on pages 6 and 7.

First news of commercial development on any scale came in 1953 when Christiani and Nielsen in Copenhagen made use of chequered rubber sheeting to decorate concrete while, simultaneously, some British firms also applied it successfully to various new buildings and structures. Since then many enquiries have been received regarding the castings on display at Wexham Springs and these have led to more concerns trying out the techniques.

Though very successful results have been obtained experimentally and commercially, development work, to improve still further methods and means, continues. Information and comments from architects and contractors who may, unknown to the Board, have experience of casting concrete against rubber will therefore be welcomed.

The technique is applicable to both in situ (left) and pre-cast work (right).



TEXTURING PRECAST CONCRETE

Textured rubber has been used in some very interesting projects where the concrete units have been manufactured in the factory and transported to the building site. An example is the factory of the Pressed Steel Co. Ltd., at Stratton St. Margaret (opposite), where slabs 20 ft. x 3 ft. 4 in. were cast against a special form of sheet rubber having a crepe-like texture. The textured slabs show white in the photograph and are arranged to alternate with slabs having an exposed aggregate of Rubislaw granite.

FIXING THE RUBBER IN POSITION

At Stratton St. Margaret, the rubber was stuck to the face of the mould with rubber cement. Several pieces of rubber were joined together to produce sheets of the required size.

For smaller castings it has been found unnecessary to stick the rubber to the mould. In such instances the rubber sheet is placed in the bottom of the mould and the concrete cast against it; on stripping the mould the rubber is peeled from the face of the concrete leaving a textured finish.

LUBRICATING THE RUBBER

Lubrication is of importance particularly for large pourings and, since rubber is prone to deteriorate after repeated contact with mineral oil, a vegetable oil should be used. Lanolin and castor oil are suitable but as they are both viscous the spreading operation should not be hurried. If too much is used the grooves or other depressions in the rubber may be flooded resulting in staining of the concrete. This is, however, a minor problem and will not present any difficulty if reasonable care is taken.

Experiments with lime-wash as a lubricant are now in hand. Other types of parting agents such as linseed oil, glycerine, silicones and sodium algenates have been regarded as too expensive for commercial use.

Not all contractors use lubricating agents and indeed where the pattern of the rubber is shallow these are unnecessary. But it is usual in these cases to allow the concrete 48 hours in the mould to set well and so avoid the plucking of green concrete when stripping.

THE CONCRETE MIX

It is unnecessary to use a special fine mix at the surface next to the rubber unless compaction is by hand. The more usual method of mechanical vibration ensures that, with ordinary mixes, the texture of the rubber will be faithfully reproduced.

DESIGN OF THE MOULD

The presence of the rubber sheet does not involve any departure from normal practice. Care must be taken to prevent any escape of mortar between the textured rubber and the side of the mould.

One designer is at present working on a system whereby concrete elements are made in batches on edge, the pouring taking place from above. The rubber mats are arranged in series and in a vertical position in the composite moulding frame.

STRIPPING THE RUBBER

When the concrete is set the slab is parted from the mould and set aside to cure. The interposing layer of rubber does not impede this operation. If the rubber is secured to the mould it is released at the same time, otherwise it is peeled off separately.

ACTUAL AND PROJECTED USES

These are some concrete elements which have been cast against rubber:

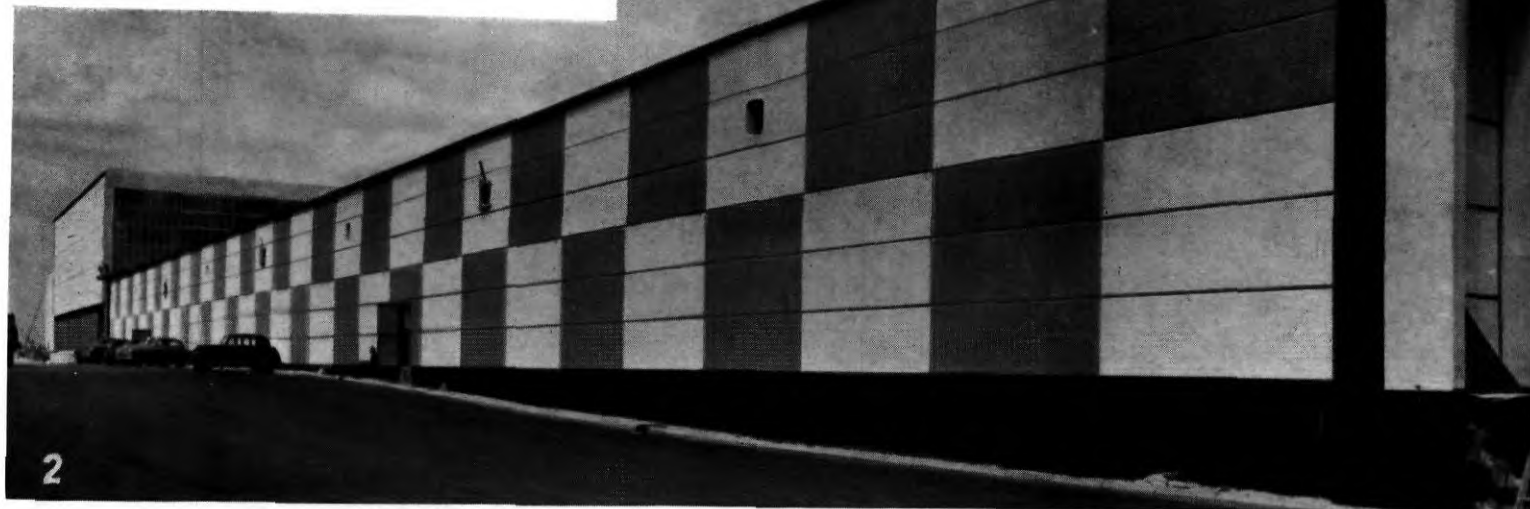
Precast facing slabs for use as exterior facings.
Precast concrete beams where the soffits have been textured to provide a key for rendering.
Complete wall sections 20 ft. x 9 ft. with openings left for windows and doors.

Key to illustrations
opposite.

1 and 2. Textured rubber was used to impart a crepe finish to pre-cast walling slabs for the factory of the Pressed Steel Co. Ltd., at Stratton St. Margaret, nr. Swindon. (Architect — Bertram Carter, F.R.I.B.A.)

3. A pattern of vertical grooves made by casting against ribbed rubber decorates the horizontal strip between the windows of the accounts block of John Laing & Son Ltd., at Mill Hill, London.

4 and 5. Concrete used on the exterior of the Falconercentret building in Copenhagen was decorated by casting against square studded rubber. The building was designed and built by Christiani and Nielsen Ltd.



TEXTURING CONCRETE *IN SITU*

The use of rubber sheets in shuttering for concrete to be poured on the site presents some interesting problems, because the rubber is usually employed in a vertical position. This is not to deny the excellence of the method for the treatment of soffits but, in this case, the technique approximates to that of the casting table.

FIXING THE RUBBER

In vertical positions the rubber sheet may be stuck or otherwise secured to the shuttering. The choice of method will of course be influenced by the size of the rubber sheet, its thickness and its weight. In wood shuttering, light tacking is often enough because the lateral thrust of the concrete will usually expel all air between rubber and shuttering.

The rubber lining does not affect the concreting operations whether placing and compaction are by hand or mechanical. When the internal method of vibration is used there is a smaller risk of damage to the rubber lining from the poker than if other materials were used in that position.

CONSTRUCTION JOINTS

Construction joints require some forethought on the part of the designer, particularly for large areas of wall surface. For the construction of dams and retaining walls it may be reasonable to employ a butt joint, but for other works where the joints are to be a design feature, shaped battens or fillets are included in the shuttering in predetermined positions.

In the bridge abutment shown below, concrete was

made to simulate stone masonry by nailing $\frac{3}{4}$ in. vee-fillets at the edges of rubber sheets of 2 ft. x 1 ft. 4 in.

LUBRICATION

The same considerations apply as for precast work (see section "Lubrication", page 2).

CONCRETE MIX AND PLACING

Normal mixes are used. Naturally it is very important that the concrete should be properly compacted to obtain a good overall surface effect. Bad results follow from under-vibrating or over-vibrating and repairs to the surface are not easy to perform. This of course applies wherever concrete is left direct "from the forms" and need not present any undue worry when the work is in the hands of an experienced firm.

In *in situ* work it may be found that the bottom section of the first lift is unsatisfactory, due to fines having leaked out of the mix. This is a common experience and is due to loss of fines in the mixer. This is overcome in practice by discarding the first mix and putting in the second, or by mixing the first and second together before placing in the formwork.

STRIPPING THE RUBBER

The operation of striking the formwork is easy and is probably facilitated by the rubber in most instances. The life of the forms is extended due to the protective rubber lining.

Note: No lubrication was used at Blaenau Ffestiniog, where small panels were used.

Bridge abutment at Blaenau Ffestiniog in Wales where the in situ concrete was made to resemble stonework by casting it against textured rubber used in conjunction with vee fillets.



THE RUBBER

SOURCES OF SUPPLY

Owing to the great range of sizes, thicknesses and patterns employed, it has been found impracticable to include specific details and prices in this brochure but the Board will be pleased to send to enquirers a list of rubber sheeting manufacturers who will provide all the more detailed information required.

SELECTION, MAINTENANCE, JOINING

Pattern, Size and Thickness

The patterns illustrated are those which have proved successful in use. They are of standard sheets available from manufacturer's stocks. These may be used in alternating patterns to increase the scope of textures, etc. It is recommended that intricate or close patterns be avoided as difficulty may be found in expelling air from between the face of the concrete and the rubber, and bubbles or honeycombing occur to spoil the face of the set concrete.

The particular design which has aroused considerable interest in recent years is the large square-studded pattern, familiar for its use on the platforms of buses. This was used in the construction of the building (illustrated on page 3) in Copenhagen (Christiani and Nielsen). It has been found that large scale patterns of this sort give excellent results, the figuring being discernible at some distance from the building.

Designers are likely to call for new patterns, and this is a matter which should be discussed with a rubber manufacturer. Normally, the capital cost of putting down a new mould is considerable, and may not be an economic proposition in the absence of a large demand. Where only small amounts of sheeting are required, an economical answer is likely to be found in the latex casting process, which is also suitable for the production of prototypes. The Board will be pleased to provide names of companies which use the latex casting process.

It will be readily appreciated that, normally, the depth of the texturing is dependent on the thickness of the rubber and that rubber more than $\frac{1}{2}$ inch thick will seldom be used. Where extra depth is required for its pattern value it may be obtained by making the joints deeper (as previously described) or by using special patterns.

There are limitations to the size of rubber mats, due to the manufacturing process. It is possible, however, to use several pieces in conjunction either by butting them loosely in the mould, or by making permanent joints in the rubber. With some types of rubber this is done by cutting from their thickness and sticking a piece of thin rubber in the rebates so formed, to maintain equal thickness throughout. The advice of the manufacturer of the particular rubber used should be obtained in this matter.

Quality

Though to the layman most figured rubber sheeting appears similar, some advice is necessary on the different types of rubber in order to make a judicious selection. Some types of rubber are, for instance, more liable to deterioration caused by sunlight and ozone, while others, if of unsuitable composition, are liable to tear or become deformed when being stripped from the concrete. Generally a higher quality sheet should be selected though poorer quality may be suitable for small runs.

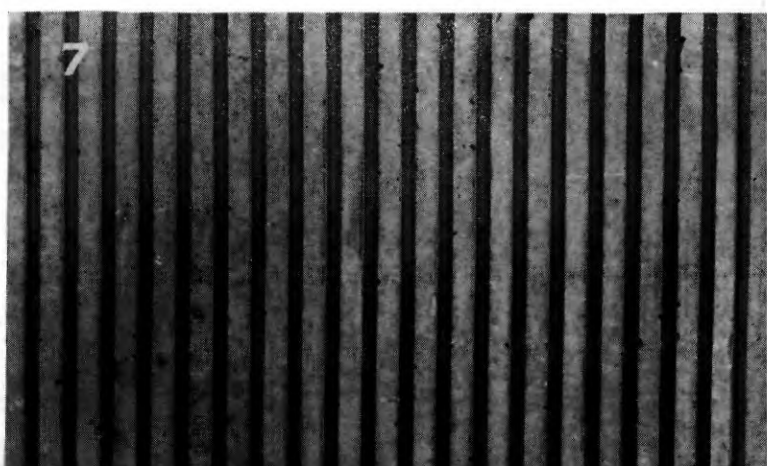
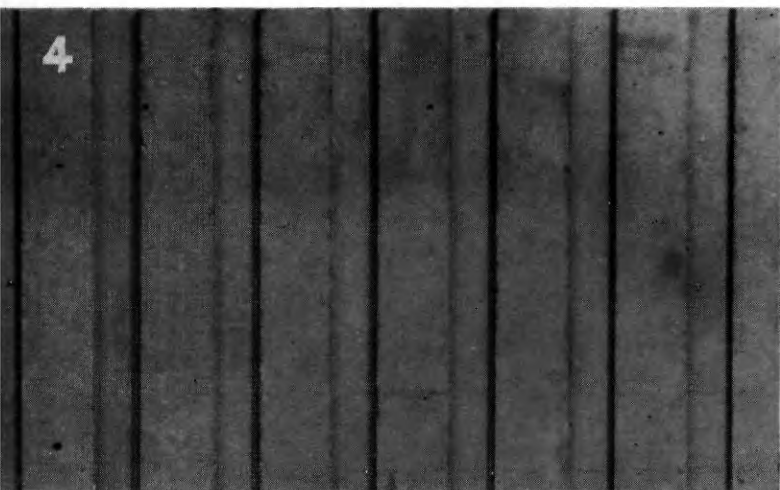
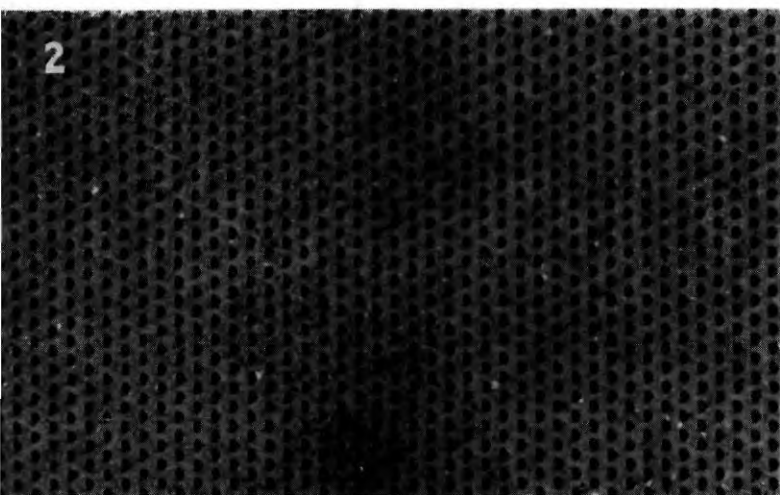
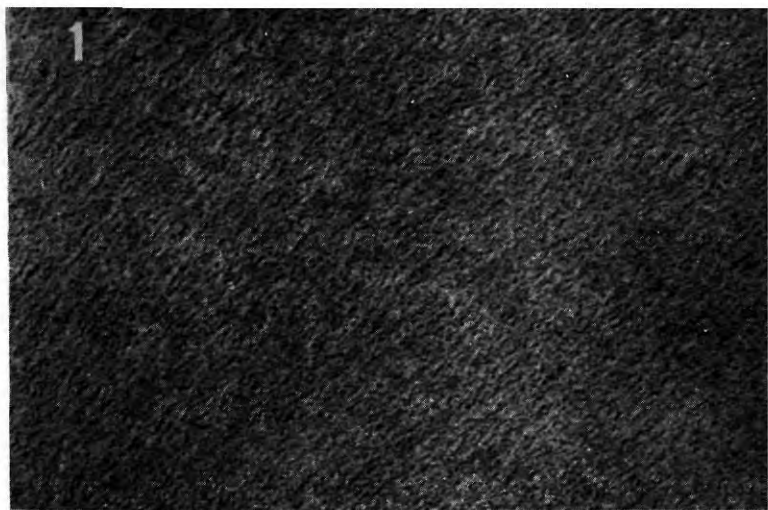
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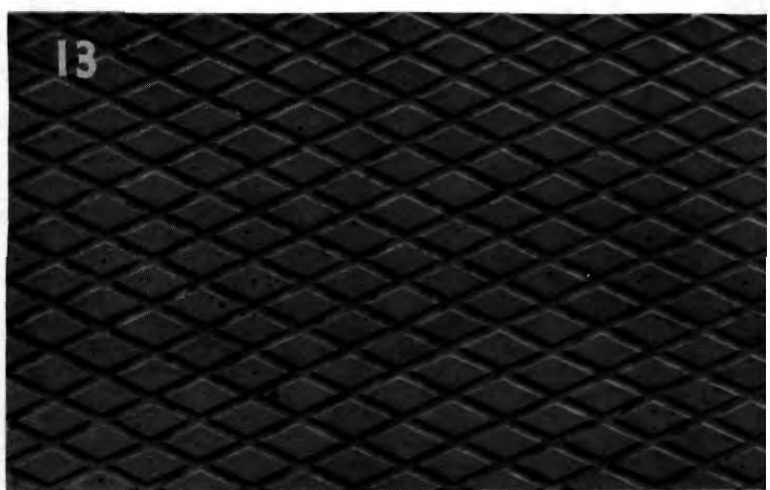
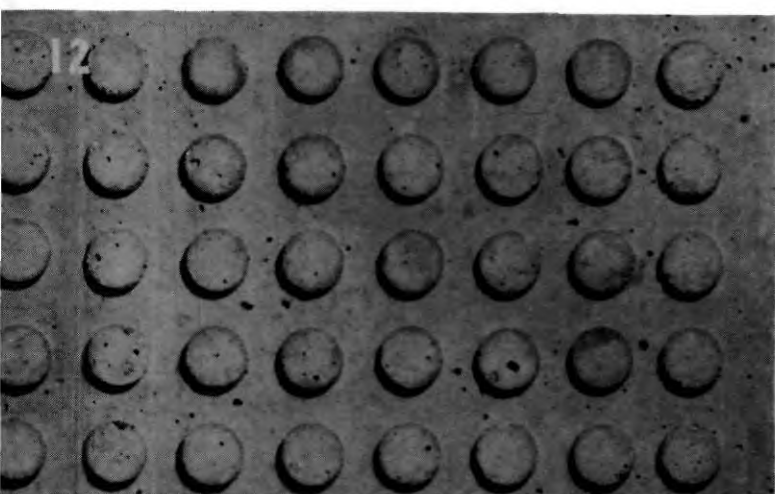
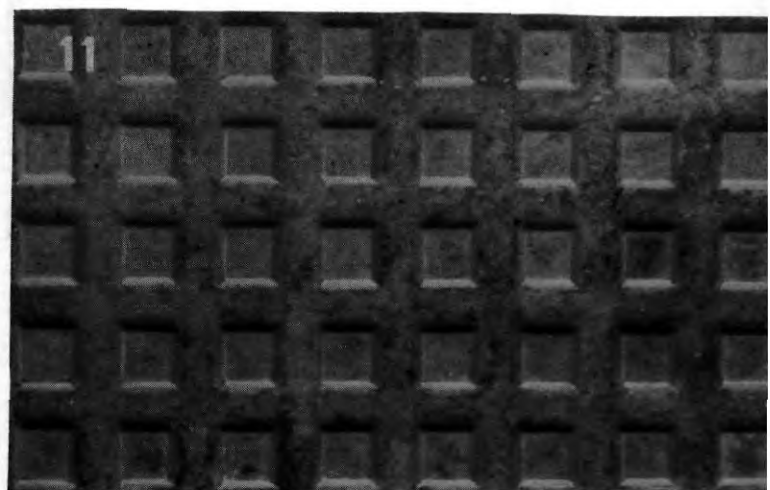
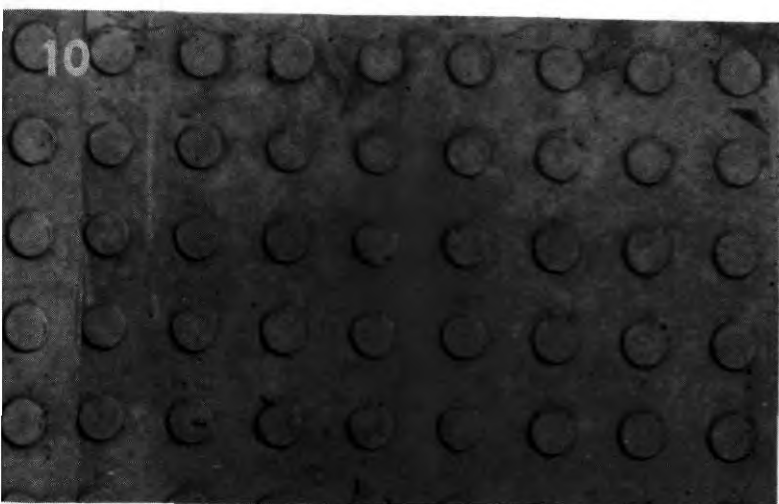
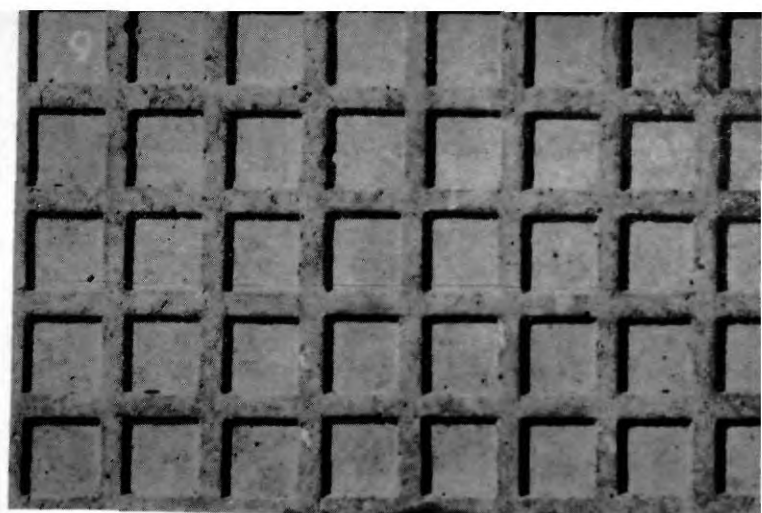
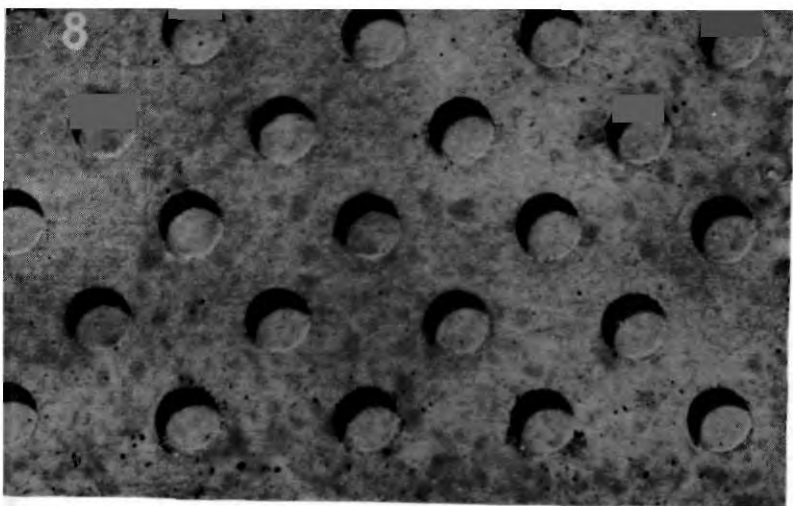
The rubber sheets should be protected from rough usage which might lead to distortion or damage. The sheet rubber keeps very clean in use but if a light film of cement dust should adhere this can be removed with ease by soft, dry brush or with water. Rubber should *not* be used in conjunction with mineral oil.

The rubber is easily stored since it can be rolled or, preferably, laid flat. The life of the rubber will be prolonged by keeping it stored in a moderate temperature away from sunlight.

When properly maintained the rubber should give several hundred uses.

Some of the Patterns Available . . .





The photographs show concrete panels cast against some of the types of rubber sheeting which are available. They were made at the Wexham Springs section of the Cement and Concrete Association. The illustrations are numbered for the convenience of enquirers.

SOME FURTHER NOTES

Weathering

The textured surface of the concrete has been shown to be satisfactory in its resistance to weathering (see page 1). The pattern of the selected rubber should *not* have undercut edges because this makes stripping difficult; it therefore follows that the face of the concrete will have no recesses to hold water. The textured surface of concrete has, in fact, increased resistance to weathering since texturing minimises the tendency for hair-cracks to form or spread. It also assists in breaking up the face of the wall and reduces the effects of staining or discoloration.

Tooling Concrete Surfaces

Concrete cast against the studded type of rubber mat is particularly suitable for further treatment. Some designers favour a tooling of the surface to expose the aggregate. The "high parts" of the patterns can be tooled to great effect, and incidentally, at less cost than tooling of the overall surface.

Painting Concrete

Concrete may be left untreated after being cast against rubber and will normally weather well and be quite satisfactory. Some users like to colour the concrete and this can be done by introducing a pigment into the concrete, or by applying external coatings. Pre-eminent in this field is chlorinated rubber paint which is unaffected by the lime present in concrete work. It is resistant to salt-laden or chemically laden atmosphere, and is available in a wide range of colours.

Curved Surfaces

Rubber, due to its flexibility, lends itself to casting on the curve, in shell roof construction, circular columns, and other types of shaped work.

Continuous Shuttering

The use of rubber in shuttering has given rise to projects for using an endless rubber belt in a metal frame with rollers at top and bottom.

Acoustical Surfaces

It is probable that concrete cast against rubber could have useful sound absorption characteristics, particularly in large concrete stores, warehouses and the like.

Pavings

Rubber is a useful casting medium in the manufacture of all types of concrete products, including paving slabs, kerbs, platform edgings, etc.

Keys in Concrete

The use of rubber mats for forming a roughened surface to set concrete is already well known. Surfaces of this type provide an overall key which enhances the bond of subsequent rendering coats. This is of particular importance where it is difficult to ensure adequate bond by normal means.

Strips of rubber of dovetailed shape may be inserted in concrete surfaces to provide, on withdrawal, channels or grooves for the insertion of fixing devices. By this means cladding systems of various types can be secured to the vertical or horizontal faces of concrete structures.