



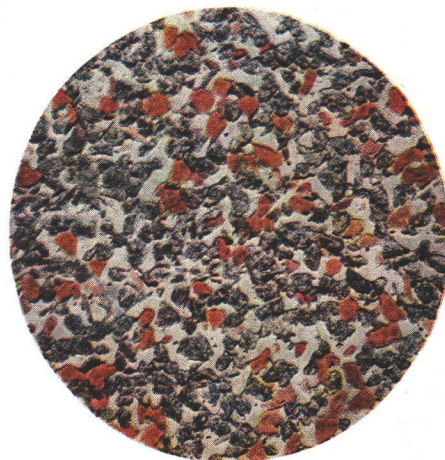
COLOR and

in Architectural Concrete by Aggregate Transfer

TEXTURE

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Liberal use of color is featured in the exterior walls of Le Bonheur Children's Hospital, Memphis, Tenn. Colored aggregates, ranging from deep buff to light pink and embedded in concrete to which yellow pigment was added, give a warm buff surface at the entrance to the Education and Research wing. All aggregate-transfer surfaces were ground smooth.

J. Frazer Smith & Associates, Memphis, Tenn.—architect-engineer. Harmon Construction Co., Memphis, Tenn., and Oklahoma City, Okla.—contractor.



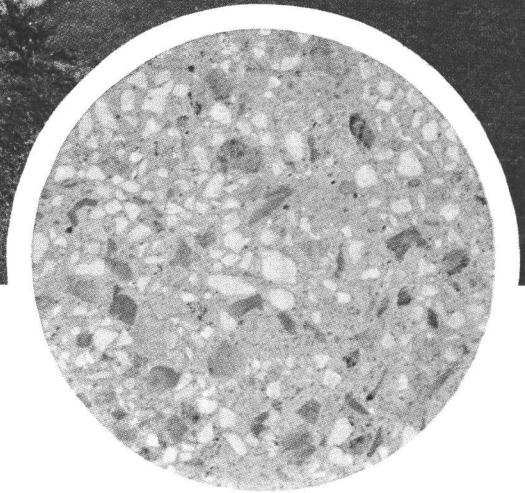
COVER

At West Point, Neb., the architectural concrete Cuming County Court House has approximately 1,700 sq.ft. of aggregate-transfer wall areas. These surfaces are covered with a mixture of 65 per cent dark cedar grey and 35 per cent alpine red marble chips and contrast with the grout-cleaned exposed concrete walls.

Backlund & Jackson, Omaha, Neb.—architect-engineer. Parsons Construction Co., Omaha, Neb.—contractor.

Portland Cement Association
33 West Grand Avenue
Chicago 10, Illinois

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The activities of the Portland Cement Association, a national organization, are limited to scientific research, the development of new or improved products and methods, technical service, promotion and educational effort (including safety work), and are primarily designed to improve and extend the uses of portland cement and concrete. The manifold program of the Association and its varied services to cement users are made possible by the financial support of over 70 member companies in the United States and Canada, engaged in the manufacture and sale of a very large proportion of all portland cement used in these two countries. A current list of member companies will be furnished on request.

COLOR and TEXTURE

IN ARCHITECTURAL CONCRETE BY AGGREGATE TRANSFER

Aggregate transfer is a method of obtaining color and texture in cast-in-place architectural concrete by embedding special, selected colored aggregates in the exposed surface. It is practicable for either small decorative areas or all exposed surfaces of a structure. Since by this method the more expensive special aggregates are confined to a thin surface layer of the concrete, an attractive color treatment is obtained economically.

Briefly, the aggregate-transfer method of surface treatment is as follows: The special aggregates are held in an adhesive on form liners; the liners are installed in the forms; concrete is placed and cured; and, finally, forms and liners are removed. The aggregates become embedded in and bonded to the concrete to such an extent that they are transferred from the liners to the concrete, creating a durable colored surface. An aggregate-transfer surface is attractive whether it is left untreated or given a special surface finish, and in either case requires practically no maintenance.

In addition, special textures may be achieved by using different methods of preparing the liners or by giving the exposed surface various treatments after the liners are removed. This manual presents recommended construction procedures for the aggregate-transfer method.

LINER LAYOUT

Form liners, specially prepared with selected aggregates, are required. Before the liners are coated with aggregate, they should be laid out according to the same principles that apply to form liners in general when they are used in the building of architectural concrete walls.* Although the joints between liner panels will be inconspicuous, the layout should be symmetrical so that the joints are in keep-

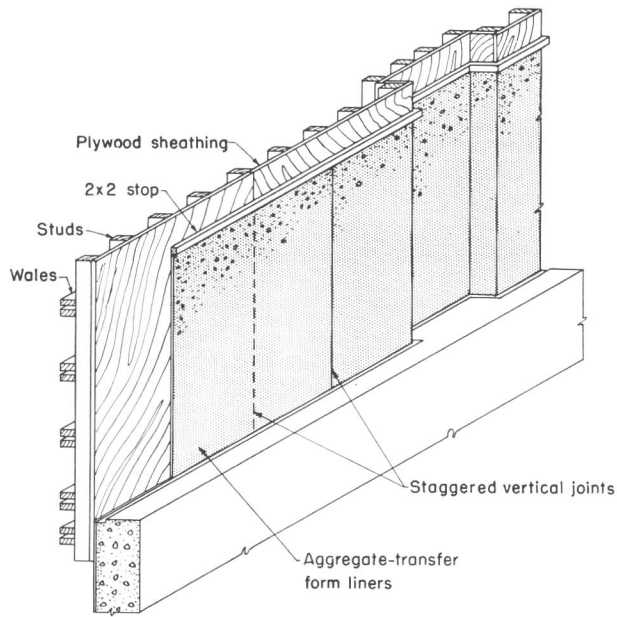
*See *Forms for Architectural Concrete*, available free only in the United States and Canada on request to the Portland Cement Association.

ing with the main architectural features of the building or of the surface under consideration. Vertical joints between panels should be staggered with the vertical joints in the form sheathing, as shown in Fig. 1. Horizontal construction joints in a concrete wall are planned in advance to coincide with the horizontal edges of liner panels.

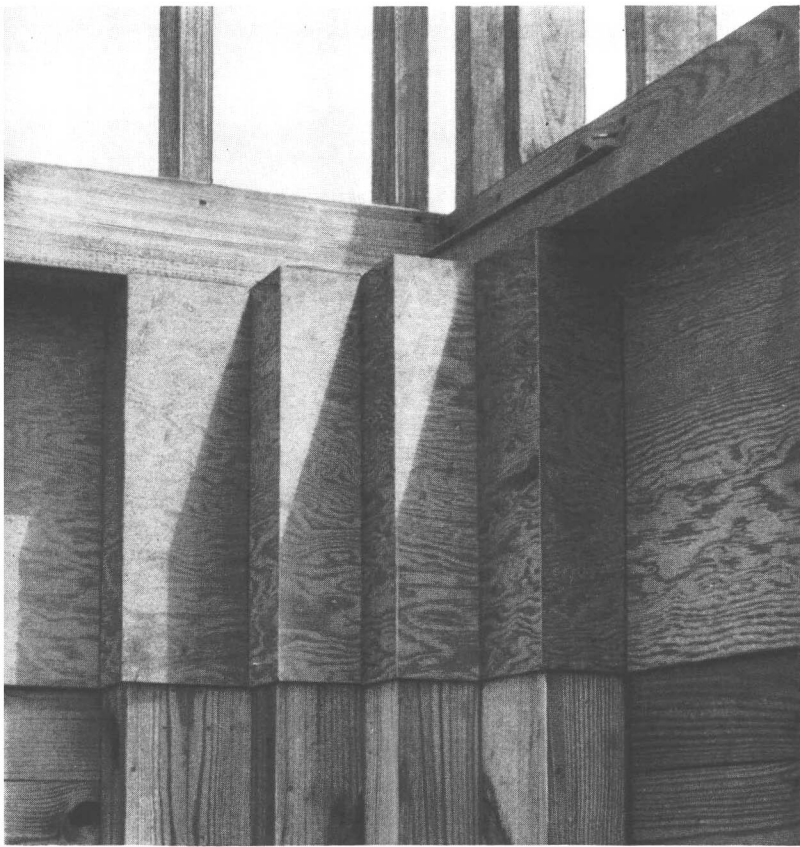
The outer wall forms are erected first and carefully aligned and braced. Plywood is preferred for form sheathing but accurately fitted dressed lumber may be used. The sheathing must provide a solid backing for the liners; open sheathing may result in bulging of the liners and give an uneven wall surface.

Plywood $\frac{1}{4}$ in. thick is a satisfactory liner material, although sheet metal, cardboard or heavy waterproofed paper may be used for special conditions such as the forming of curved surfaces. Plywood liners are rigid enough to permit a panel to be handled and erected without disturbing the aggregate placed on its surface. With reasonable care plywood liners may be used several times, which will help to reduce unit costs. A liner panel should not be larger than 4x8 ft., the maximum size that can be conveniently handled by two men when the panel has been covered with aggregate.

Since a liner panel cannot be cut readily once the aggregate is placed, it should be accurately cut and properly fitted in the forms beforehand. The amount of cutting and fitting will depend on the number of intersecting walls and the conditions at the corners. Fig. 2 illustrates a corner condition that would require much cutting and fitting. On large, unbroken wall surfaces, if intermediate panels are cut to proper sizes, only the end panels must be prefitted. Individual panels or a discontinuous series need not be prefitted. Between panels, joints, which should be no wider than $\frac{1}{32}$ in., should be filled with gun-grade calking compound. To obtain true, straight edges and tight joints, it is highly desirable to cut the liners with a bench saw.



1 Aggregate-transfer form liners are shown in place. Note staggered joints.



2 Liner panels are cut and prefitted at a corner before the aggregate is placed.

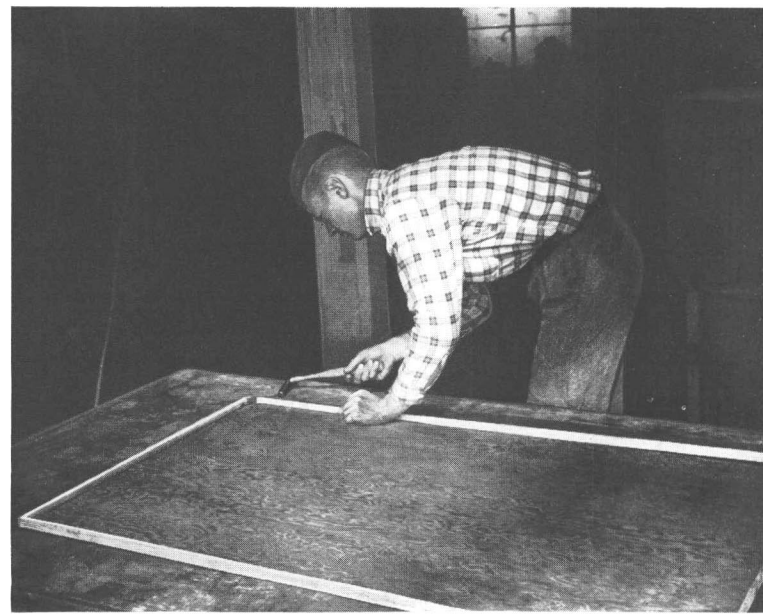
PRELIMINARY PREPARATION OF LINERS

After the liners have been cut and fitted, the working surface should be oiled lightly with a No. 10 motor oil or any good grade of form oil. Some of the water-resistant adhesive* that is used to attach aggregates to liners should be thinned to the consistency of lacquer (about 50 per cent adhesive and 50 per cent thinner), brushed on the liners and allowed to dry for 24 hours. This treatment will protect the surface.

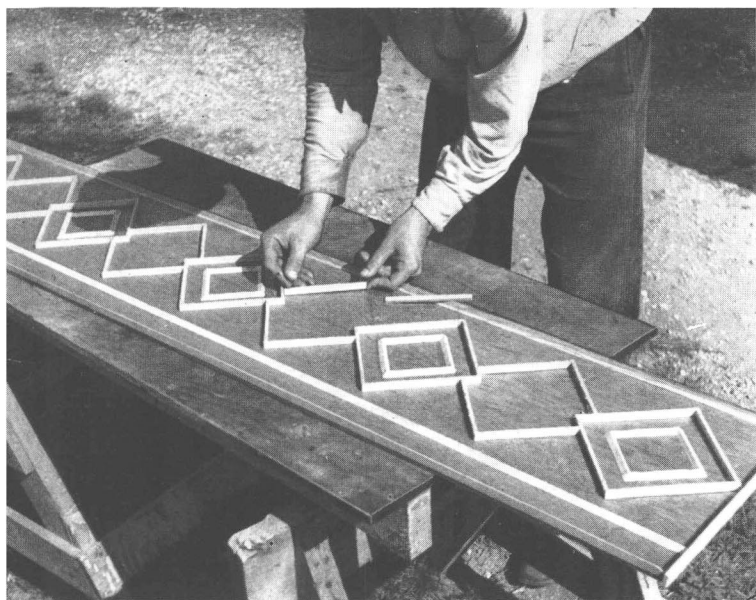
Strips of wood or plywood $\frac{1}{4}$ in. thick and $\frac{3}{4}$ in. wide are fastened to the edges of each panel with staples or $\frac{5}{8}$ -in. brads spaced every 6 in. (see Fig. 3). These edge strips hold the aggregates to a sharp line, assure good aggregate coverage at joints and protect the aggregates along the edges when panels are handled. Before they are fastened to the edges of the panels the strips should be coated with paraffin to prevent aggregate particles from adhering to them. For curved edges or other special conditions strips of waxed heavy cardboard may be used.

Rustication strips or other incised forming, such as shown in Fig. 4, are also attached to liners at this time. If heavy strips or molds are used they should be lightly tacked in position and then firmly nailed or screwed from the back of the liner. Before liners are removed from the

*Special adhesive (362B cement) made by Allied Finishing Specialties Co., 2639 West Grand Ave., Chicago, Ill., or equal.



3 Waxed strips to protect aggregate along the edges are attached to a liner panel.



4 V-groove strips attached to a liner panel separate the colors in a patterned design.

hardened concrete, these nails or screws should be taken out so that the heavy pattern framework will be left in the concrete until the wood has dried thoroughly; then the strips or molds can be pulled away easily without breaking the edges of the concrete.

APPLICATION OF ADHESIVE

The prepared liners are now fastened to a vibrating table and spread with the special adhesive (see Fig. 5). The adhesive should be water-resistant so that it will not be softened by wet concrete or by rain. It should be strong enough that aggregate particles will not be dislodged when liners are handled or concrete is placed, but it should not be so strong that it will damage liners when they are stripped from the concrete, thus preventing their re-use. The most successful adhesive consists of nitro-cellulose, dammar gum and acetate. The thickness of adhesive will vary depending on the size of the aggregate to be used and the type of finish desired.

Aggregates must be applied immediately after the adhesive has been spread because of its tendency to "skin over" in 20 minutes or less. During extremely hot weather, especially with low humidity, the adhesive may skin over very quickly, making it impossible to apply aggregates properly. To overcome this difficulty the work should be done under a shelter or early in the day when temperatures are lower. Another means of delaying skinning is to add a small amount of retarder to the adhesive.



5 A special adhesive is spread to a uniform depth on a liner panel with toothed trowels.

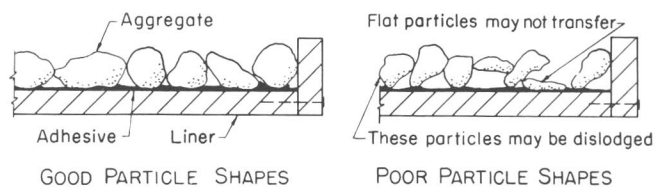
SPREADING OF AGGREGATES

Aggregates must be uniform in size— $\frac{1}{4}$ to $\frac{3}{8}$ in., $\frac{3}{8}$ to $\frac{1}{2}$ in., or $\frac{1}{2}$ to $\frac{5}{8}$ in.—surface-dry and well shaped for adequate embedment in the concrete. Crushed aggregates should be as nearly cubical as possible; thin, flat pieces or slivers will not transfer satisfactorily. Fig. 6 illustrates the difference between good and poor particle shapes.

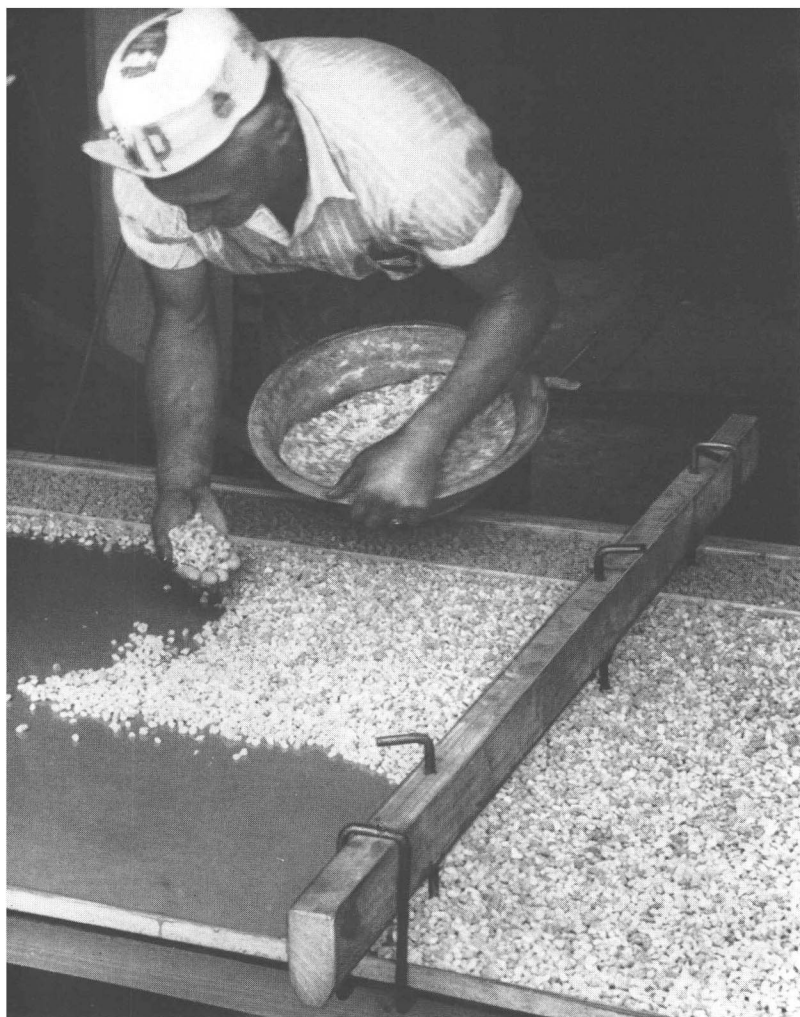
Although a variety of materials may be used for special facing aggregates, marble, granite and ceramics are most generally used.* It is often possible to obtain marble aggregates locally from a dealer in terrazzo supplies.** When these special materials are not readily available, local aggregate may be satisfactory, depending on its hardness,

*For a more complete discussion of special facing aggregates see page 11.

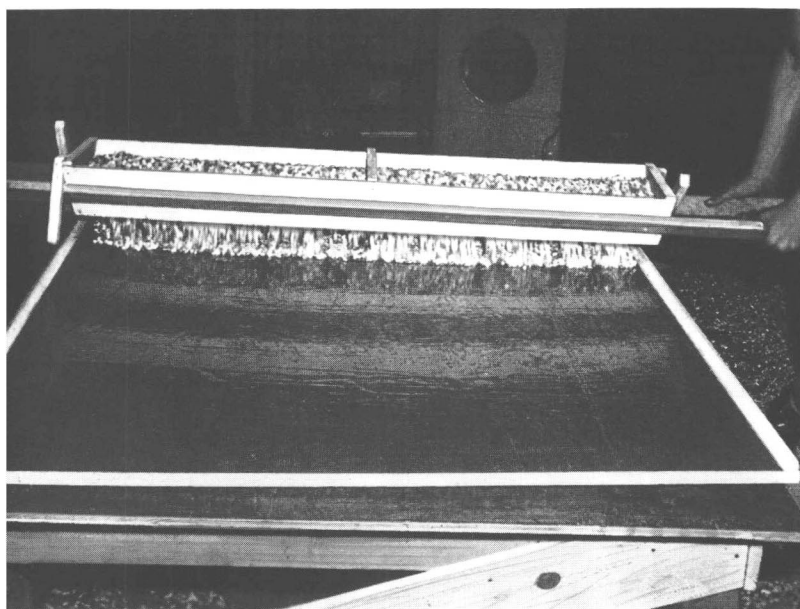
**A partial list of manufacturers of special facing aggregates is available from the Portland Cement Association, 33 West Grand Ave., Chicago 10, Ill.



6 Properly shaped aggregate particles are essential for good transfer from panel to concrete.



7 Aggregate is spread by hand when only small areas are to be covered.

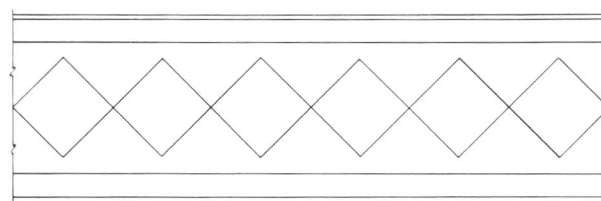


8 Aggregate is spread with a V-shaped hopper where large areas are involved.

shape and color. After being washed and screened, many gravels have suitable colors for aggregate transfer.

When two or more colored aggregates are to be combined, small quantities may be mixed by being placed on a piece of canvas and rolled back and forth several times by two men; large quantities may be placed on a platform or floor and mixed by shoveling.

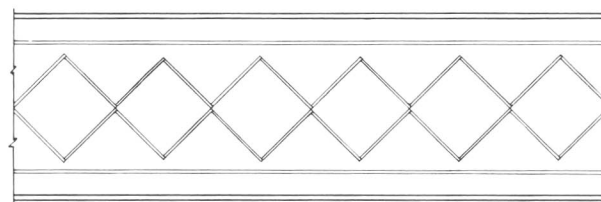
The method of placing aggregate on a liner depends on the size of the area to be covered. Small panels can be covered by sprinkling the aggregate by hand as shown in Fig. 7. For larger areas, such as 4x8-ft. panels, a small V-



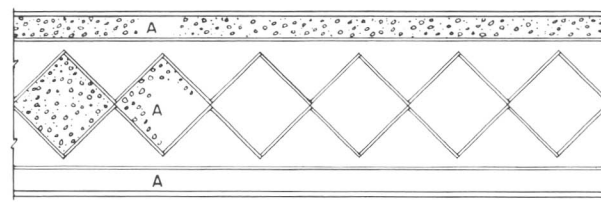
Step 1. Draw design layout on liner or transfer from stencil



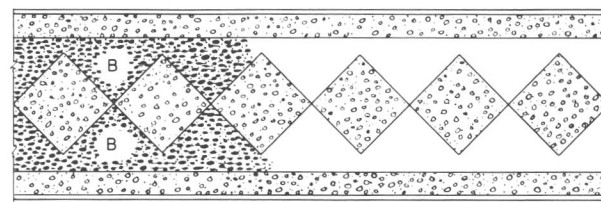
Step 2. Position $\frac{3}{16} \times \frac{1}{2}$ -in. fiberboard divider strips (waxed) with common pins



Step 3. Outline design with divider strips



Step 4. Apply adhesive and aggregate to areas A and allow adhesive to harden overnight



Step 5. Remove divider strips and apply adhesive and aggregate of different color to areas B. Vibrate and allow to harden.

9 Drawings show the procedure for making panels with multicolor designs.

shaped hopper may be used to spread aggregate evenly as shown in Fig. 8. (Details for building such a hopper are given in Fig. 22.) After the aggregate is spread, the liner is vibrated, and any additional aggregate that is needed to obtain complete coverage is added by hand. To assure uniform surface coverage, a vibrating table should be used. Its impulses must be directed horizontally and so adjusted as to pack and settle the aggregate without causing the particles to roll or jump. If aggregate particles become coated with adhesive on the top or sides they will not bond with the concrete. (Details of a vibrating table are shown in Fig. 23.)

MULTICOLOR DESIGNS

Liners may be prepared with designs in two or more colors in a manner similar to that already described except that each color of aggregate is placed on the liners on a different day. Temporary divider strips should be used to separate the colors and outline the design. The adhesive is spread on those areas where one color is to appear, the aggregate is distributed and the liner panels allowed to set overnight. The next day excess aggregate is shaken off, divider strips are removed, and adhesive and aggregate are spread on areas that are to be of a different color. The process should be repeated for each color used. Fig. 9 illustrates a typical design carried out with two differently colored aggregates.

DRYING OF LINERS

After the aggregate has been placed, the adhesive should be allowed to dry for at least 24 hours before the liner is used; a longer drying period may be necessary if the atmosphere is cool or damp. During the time that the liners are drying they may be stacked, one above the other, on 2x4's separated by 2-in. blocks. Keeping the liners apart, as shown in Fig. 10, protects them from damage and permits air to circulate for adequate drying. Properly stacked liners may be stored indefinitely.

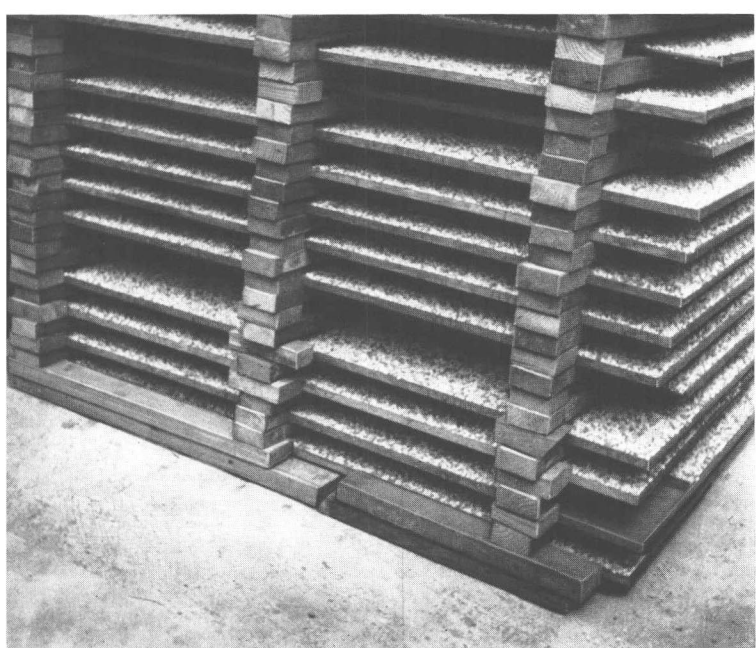
Liners that are allowed to dry for a week or two before they are needed will usually be easier to strip from the concrete. After the adhesive has hardened, liner panels should be tilted on edge so that excess aggregate will fall off. They should be inspected for uniform and complete aggregate coverage and, where necessary, additional aggregate should be applied according to the method suggested for patching liners (see page 10).

SURFACE TEXTURES

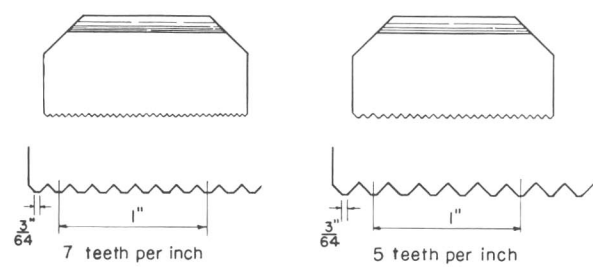
Several different surface textures that require very little or no surface finishing may be produced by varying the manner in which adhesives and aggregates are placed on the liners. (See photographs of aggregate-transfer panels on back cover for typical results.)

1. **Trowel reveal (light).** Adhesive is applied to a liner with a toothed trowel having seven points per inch (see drawing on the left in Fig. 11). This results in a layer of adhesive suitable for aggregate $\frac{1}{4}$ to $\frac{3}{8}$ in. in size. Before the adhesive is applied it should be thinned with approximately 15 per cent by volume of lacquer thinner. The aggregate reveal obtained by this liner treatment is very uniform and requires no surface finishing.

2. **Trowel reveal (heavy).** This method is similar to the previous one. Aggregate $\frac{3}{8}$ to $\frac{1}{2}$ in. or $\frac{1}{2}$ to $\frac{5}{8}$ in. is used and the adhesive is applied with a trowel having five points per inch (drawing on the right in Fig. 11). Less thinner is required in the adhesive as the aggregate becomes larger; no thinner is necessary with $\frac{5}{8}$ -in. aggregate.



10 Liner panels are stacked to permit air circulation for proper drying.



11 Trowels for producing (left) light reveal or (right) heavy reveal.

3. Rough reveal. A rough texture can be produced by using a built-up adhesive such as a mixture of 50 per cent plaster-grade perlite and 50 per cent adhesive by volume. Because the perlite will absorb some of the adhesive, a thinner must be added to keep the material from becoming too viscous. This mixture should be spread to a uniform thickness by screeding it with a $\frac{3}{8}$ x $\frac{1}{4}$ -in. steel bar equipped with projecting adjustable pegs near each end to control the required thickness of adhesive. To aid in leveling the mixture to a uniform depth the liner should be vibrated. For $\frac{1}{4}$ - to $\frac{3}{8}$ -in. aggregate the adhesive layer should be $\frac{3}{32}$ to $\frac{1}{8}$ in.; for $\frac{3}{8}$ - to $\frac{1}{2}$ -in. aggregate it should be $\frac{5}{32}$ to $\frac{3}{16}$ in. When liners are removed the surface of the concrete is wire-brushed to remove excess adhesive (see page 10).

4. Veined finish. Adhesive and aggregate are applied as in method 1. Then a mixture of 10 parts of perlite to 1 part of molding plaster and enough water for a stiff consistency is troweled or dashed on the aggregate-coated liner to produce a veined effect or, if desired, a definite pattern. When liners are removed the weak plaster-and-perlite mixture is easily wire-brushed from the surface to produce the desired effect.

5. Sand finish. Adhesive should be thinned to the consistency of flat wall paint and carefully brushed out on the liners in the same manner in which an interior wall is painted. This must be done during cool weather or in a cooled room because the thin coating of adhesive dries rapidly in higher temperatures. Sand passing a No. 20 screen and retained on a No. 30 screen is used as the liner aggregate. The sand particles, being very small, give such dense coverage that no further surface treatment is necessary when the liners are removed.

PLACING LINERS IN FORMS

Aggregate-coated liners weigh from 2 to 2 $\frac{1}{2}$ psf. A panel as large as 4x8 ft. should be handled by two men. Even though properly placed aggregate is not easily dislodged, rough handling should be avoided.

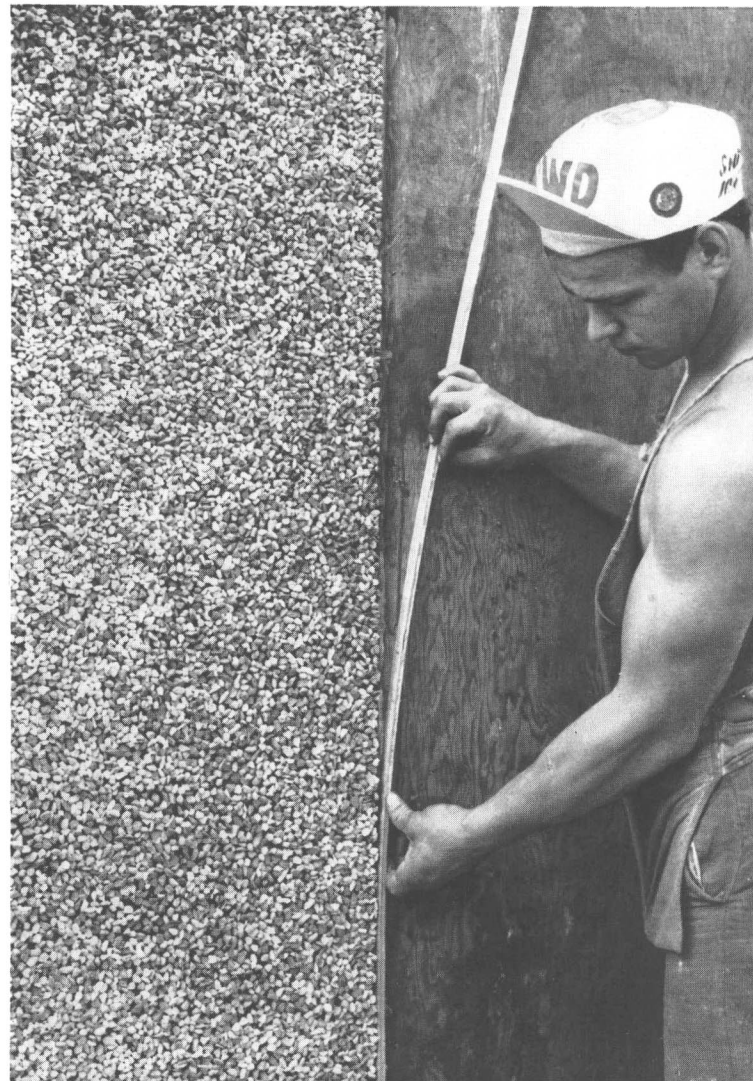
The edge strips (see page 2), which protect the aggregate on the panels where it is most vulnerable, should not be removed until necessary. The strips at the bottom and along the side adjoining the previously placed panel are removed just before the liner panel is positioned in the form. The edge strip along the other side is removed just before the next panel is set, as shown in Fig. 12. If the strip at the top coincides with a construction joint, it should remain on the liner until the concrete in the lift has been placed; it is removed at the same time that the liner is taken off. Strips are easily removed without tools and may be re-used.

Before liners are set and attached, the forms should be examined and any protruding nails or other irregularities removed so that the liners will fit tightly against the form sheathing. At abutting edges, liners must fit snugly and be exactly flush to avoid objectionable joint marks. To prevent leakage at the joints a narrow strip of suitable calking compound is applied to the edge of the previously placed panel, as shown in Fig. 13. An excess amount of calking compound should be avoided. If the next panel is shoved firmly against the one in place (see Fig. 14), a well-filled joint not more than $\frac{1}{32}$ in. wide will result.

When the liners are properly positioned they are fastened to the forms with $\frac{5}{8}$ -in. wire brads spaced about 6 in. on centers near the edges and on 16-in. centers intermediately. Loosening of aggregate particles can be avoided if the brads are driven carefully.

After the outer curtain of reinforcing bars is erected, liners should be checked for loosened panels and for areas where aggregate has been knocked off. Additional brads may be required to refasten panels and keep the joints

12 To prevent damage, protective edge strips are not removed until necessary.





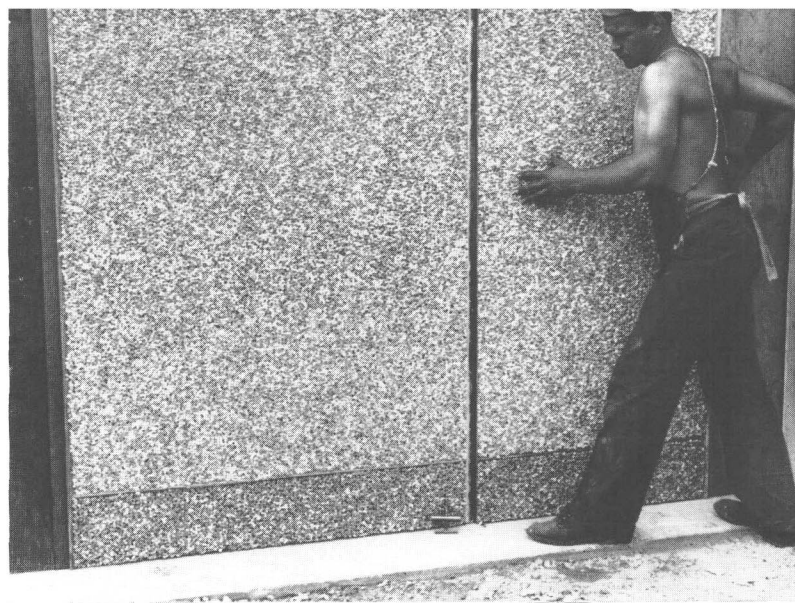
13 Caulking compound is used to seal joints between panels; an excess amount should be avoided.

flush. Those areas where aggregate has been knocked off are easily repaired by pressing aggregate into a fast-setting adhesive piece by piece. Generally, unless the liners have been greatly mishandled, little repair work needs to be done.

A 2 x 2 is nailed to the sheathing at the construction joint at the top edge of the liner (see Fig. 15) before the curtains of wall reinforcement are set. The 2 x 2 acts as a concrete stop to form a straight line at the construction joint and also holds the outer vertical reinforcing bars the proper distance away from the face of the liners to assure adequate concrete cover over the bars.

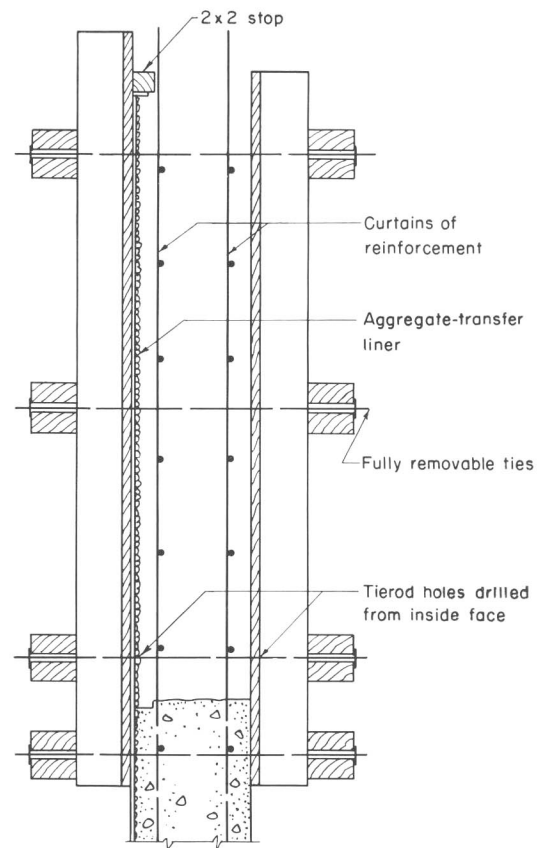
After the reinforcement is placed the inner form is erected. Tierod holes should be drilled from the inside face toward the outside in one operation with a long drill. An improvised drill may be made from a long steel rod that is flattened and beveled to a sharp edge at one end. Wales on both sides of the forms should be directly opposite each other.

Tierods should be fully removable and of the combination spreader-and-tie type that leaves no mark on the wall surface other than the hole itself. Only when absolutely necessary should inside spreaders be used, and then each



14 A liner panel is shoved firmly against a previously placed panel to form a tight joint.

should have a soft rubber pad that rests against the aggregate-transfer liner to protect the surface from damage. When tierods are removed they should be pulled out from the side of the form opposite the liner.



15 Wall section shows forms and curtains of reinforcement in place.

level. On the other hand, if it is placed at once to the full height of the spandrel, some of the concrete may flow into the floor and sag away from the exterior wall surface. The correct procedure is to place concrete to the floor level, or slightly above, and allow it to stiffen but not harden before resuming placement in the upturned portion.

REMOVING FORMS

When the concrete has hardened, forms are removed first and the aggregate-transfer liners are stripped from the walls later. This delay allows the concrete to harden enough that the facing aggregates will not be pulled off with the liner. Usually the liners can be taken off after 5 days, but it may be necessary to allow more delay in cool weather. If liners are not to be re-used, they may be left in place until the structure is nearly completed to aid in the curing process and to protect the surface of the wall during construction. Liner panels can be pried off with a beveled 2 x 4, starting at one corner as shown in Fig. 20. Once a start has been made at a corner, the rest of the panel will usually come off easily. In removing the liners, the use of sharp tools or other methods that will mar the surface should be avoided.

FINISHING

Pleasing surface textures can be obtained economically by the methods discussed in "Surface Textures," pages 5 and 6, with little or no further surface treatment.

In addition, a variety of textures, from moderately rough to polished, can be produced by various methods of surface finishing. Generally, the concrete should be cured at least 14 days before any surface treatment is started.

Rough textures may be obtained by several means. Bush-hammering produces a slightly roughened surface that has a pleasing appearance, but it is usually uneconomical except for small areas of special ornamental interest. A slightly rougher texture can be produced faster and more economically by sandblasting; an area of 300 to 400 sq.ft. can be treated per hour with one sandblast nozzle. Since, besides deeply revealing the aggregate, blasting etches it and changes its color, this effect must be taken into account when sandblasting is specified. Samples should be made and sandblasted before the method is used on a completed wall. This also affords a chance to select the proper sand for blasting and to determine the most satisfactory distance from nozzle to surface. With the usual nozzle velocity and sand used for sandblast cleaning satisfactory results are obtained when the nozzle is approximately 5 ft. from the surface.

A smooth, almost polished finish can be produced by dry-grinding the surface with a No. 8 grit resin-bonded

stone until the aggregate is well exposed. For greatest economy a high operating speed of 4,500 to 5,500 rpm is recommended. Wet-grinding produces satisfactory results but it is slower and less economical. After dry-grinding, any pits and holes in the surface should be filled with grout. To do this, the surface should first be flushed with water; then a stiff grout, consisting of 1 volume of blended white and grey portland cement to about 2½ volumes of sand passing the No. 8 sieve, should be applied with a fiber brush. The grout should be worked into the voids with a rolled-felt rubbing pad on a flexible shaft machine operating at the lowest speed; excess grout should be removed. The surface should be kept damp for 3 days or until the grout is hard enough for the final grinding operation, which consists of wet-grinding with a No. 80 grit stone. After the final grinding, the surface is scrubbed with a 15 per cent solution of muriatic acid to brighten the color of the aggregate and is then rinsed with water.

A smoothly ground surface has a quality appearance that is of greatest value at building entrances and other locations that are subject to close inspection. Grinding, like bush-hammering, is an expensive operation and is generally used only for small areas.

The surface obtained by the rough reveal method described on page 6 must be wire-brushed to bring out the coarse texture after liners are removed. The adhesive can be brushed away more readily after it has dried thoroughly for a week or more. Recommended for best results is a flexible-shaft power tool equipped with a rotating brush that has stiff wire bristles about 1 in. long and that is operated at the slowest speed. The concrete should be hard enough that aggregate particles are not dislodged by the action of the tool.

PATCHING

Any imperfections in surfaces that may occur can be patched and, if the work is done carefully, will be difficult to detect. The patch should be made before the surrounding areas are finished. The defective area is chipped out to a depth of ¾ to 1 in.; the edges are undercut if possible. It is then wetted and filled with mortar mixed to a stiff consistency with 1 part of cement and 2½ parts of sand. The mortar is placed in two layers, each ⅜ to ½ in. thick, on successive days. The second layer is struck off ⅛ in. below the wall surface and while the mortar is still soft, grout-coated particles of the matching aggregate are troweled in until an aggregate coverage like that on the surrounding areas is obtained. The grout-aggregate mix is made with 1 part cement, 2 parts sand and about 6 parts aggregate with only enough water to hold it together. After the special aggregate is in place the patch is compacted, floated level with the wall and then kept damp for

at least 5 days. The patch and surrounding surfaces should be given the same finishing treatment.

To match the color of the patch with the surrounding areas several trial mortar mixes should be made with different percentages of white and grey cement. A small pat of each trial mix should then be cured for 5 days and compared with the wall to determine which of the mixes most closely matches the existing color.

AGGREGATES

The special facing aggregates most commonly used in the aggregate-transfer method are:

1. **Marble aggregates.** Crushed marble is a very satisfactory material because it comes in many colors, breaks into desirable shapes, is available in most localities and is reasonable in cost. Marble aggregates come in either light or dark shades of green, yellow, red, pink, blue or grey, as well as in white or black.

2. **Granite aggregates.** Crushed granite is also a desirable material, especially since it is extremely durable, but its range of colors is limited and it is not as readily available as marble. Granite aggregates may be white, black, grey or pink.

3. **Ceramic aggregates.** Ceramic particles are manufactured in a wide range of bright colors and two or more colors may be combined to give almost any color or tone desired. Ceramics cost about four times as much as marble or granite aggregates and thus are generally used only for small surface areas or spot ornamentation.

EQUIPMENT

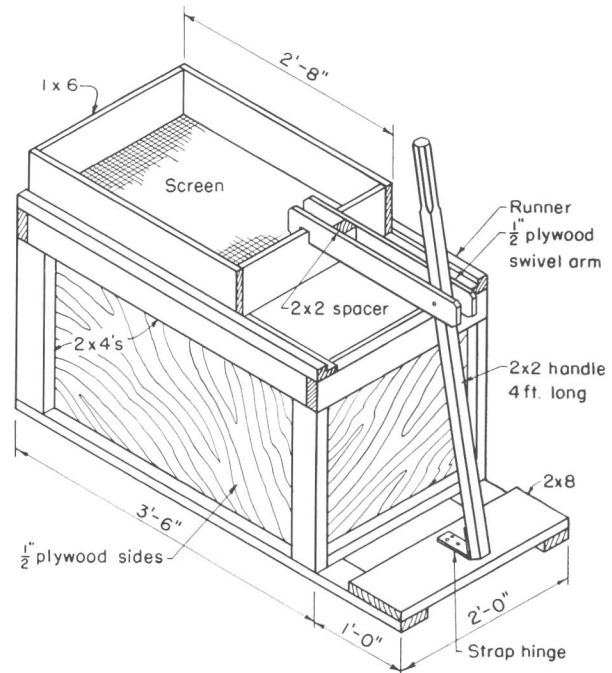
In addition to the usual tools found on a construction job, the aggregate-transfer method requires the following equipment:

1. **Aggregate shaker screen.** Aggregate is often available already screened to size. If not, it must be screened to obtain the correct sizes and to remove particles of dust. When the quantity to be screened is small, the work may be done with a hand-operated shaker screen, shown in Fig. 21. For large amounts of aggregate, a power-operated screen may be more economical.

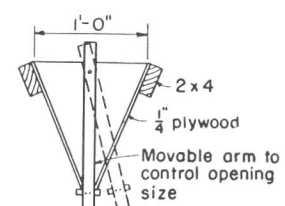
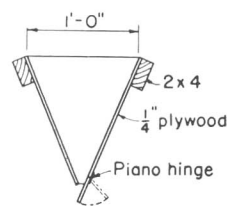
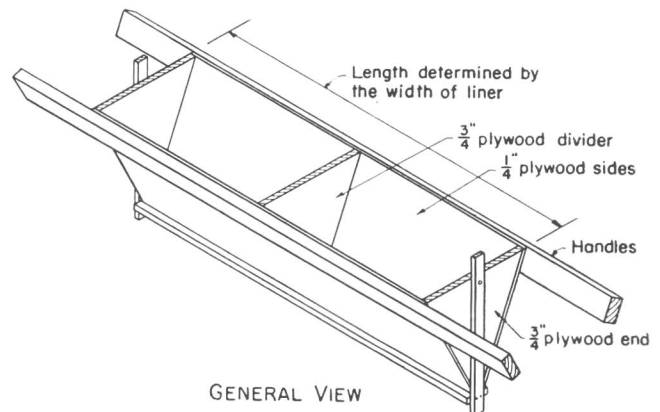
2. **Spreader hopper.** A small V-shaped hopper for spreading aggregate rapidly over the liner panels may be easily constructed of plywood, as shown in Fig. 22. Properly used, a hopper of sufficient capacity will give about 95 per cent aggregate coverage.

3. **Vibrating table.** A high-speed motor with 3,450 rpm is necessary to obtain the correct type of horizontal vibration. Fig. 23 shows details of a vibrating table.

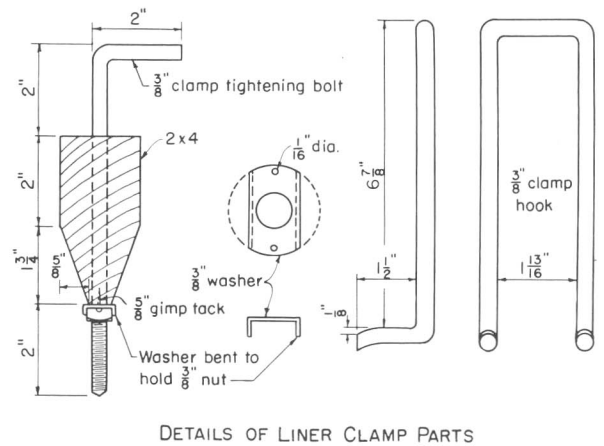
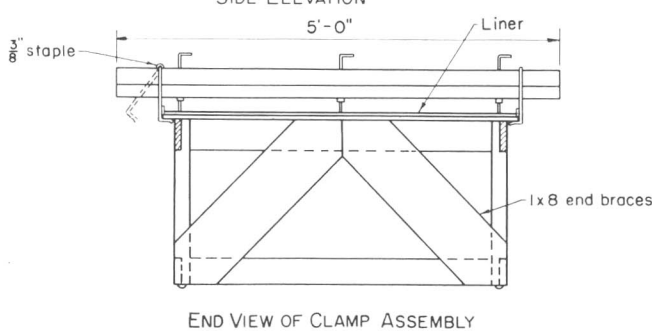
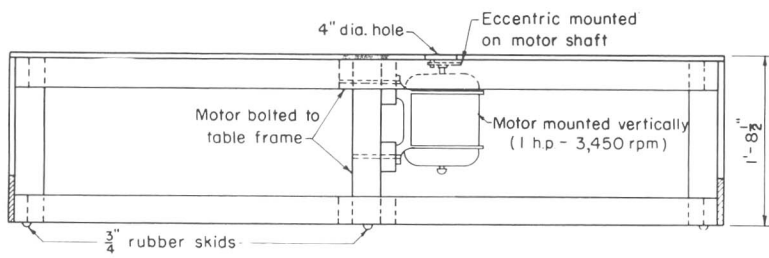
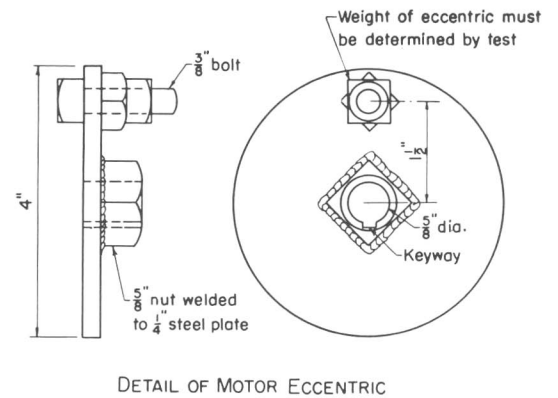
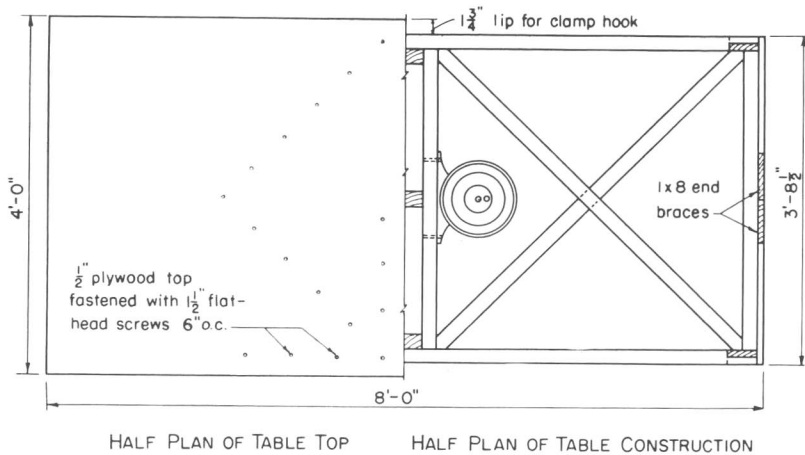
4. **Brad pusher.** Brads are driven with a magnetic brad pusher. If this is equipped with a slender nozzle,



21 Details of a hand-operated shaker screen for screening aggregates.



22 V-shaped hopper for spreading aggregate rapidly on large liner panels.



23 Details of a vibrating table.

brads can be inserted in the spaces between aggregate particles.

5. **Calking gun.** Calking compound should have the consistency of a heavy plastic paint and should be applied with a gun that has a small nozzle.

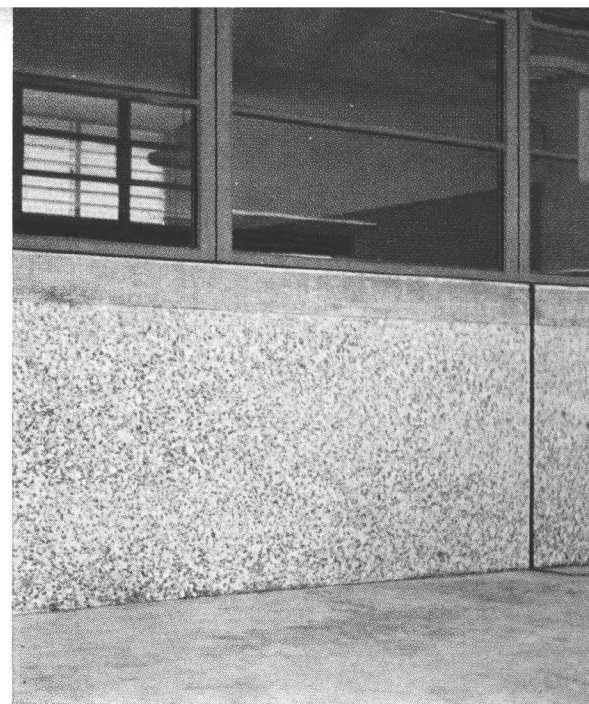
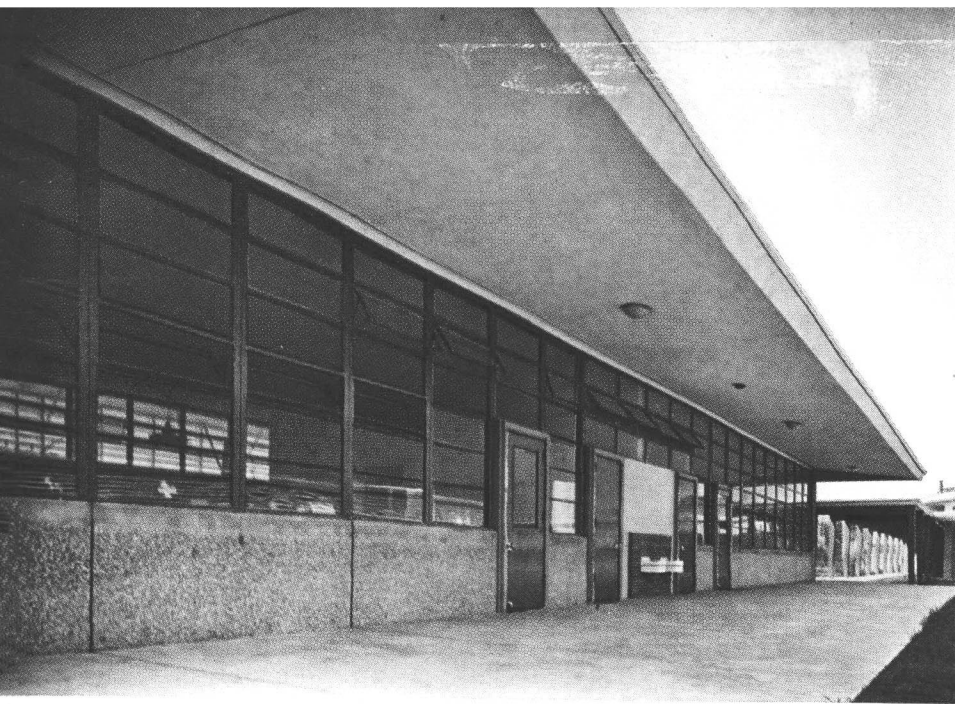
6. **Vibrator.** An internal vibrator with a small spud that will pass between reinforcing bars should be used. If possible, the vibrator should be electrically operated to

provide better control of starting and stopping.

7. **Trowels.** Special toothed trowels (see Fig. 11) should be used to spread adhesive in a uniform layer. For thicker layers of adhesive a metal screed as described under "Rough reveal," page 6, should be used.

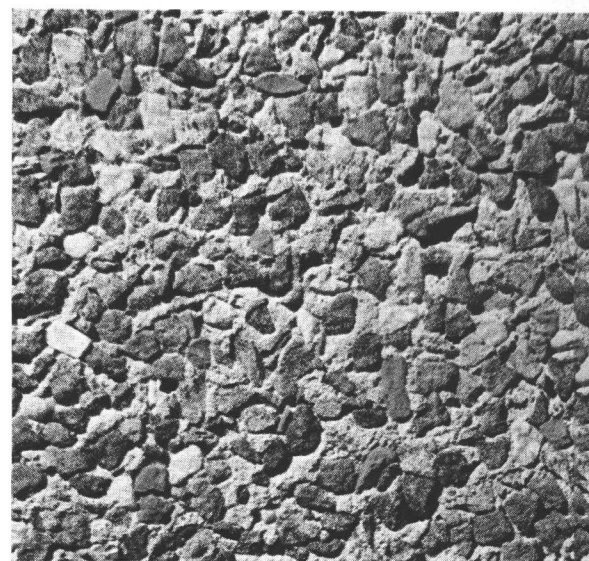
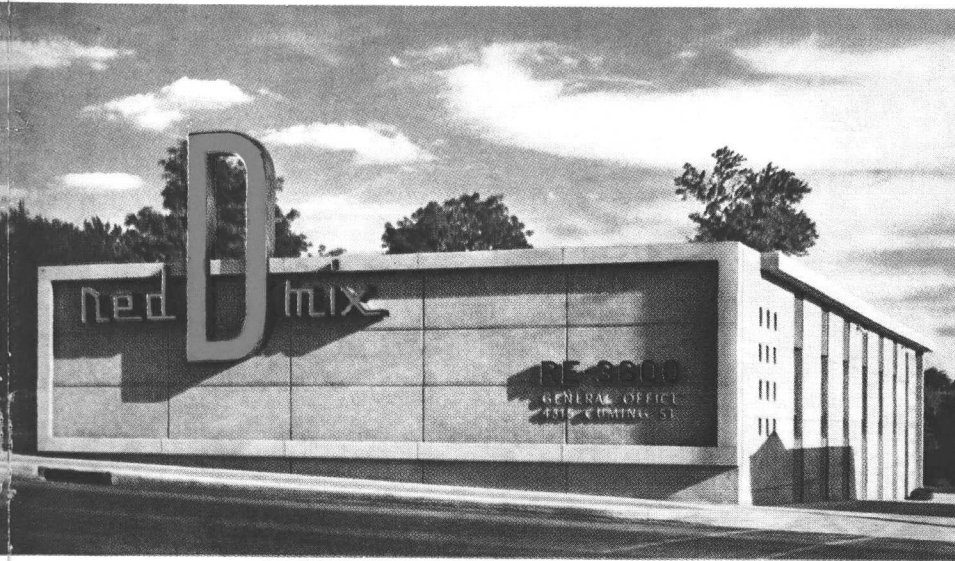
8. **Table saw.** Because aggregate-transfer liner panels must fit snugly, a power saw must be used to cut straight, true edges on the plywood panels.

The drawings in this publication are typical designs and should not be used as working drawings. They are intended to be helpful in the preparation of complete plans which should be adapted to local conditions and should conform with legal requirements. Working drawings should be prepared and approved by a qualified engineer or architect.



Sill-high walls on the Griswold School, Covina, Calif., have a rough-textured surface of exposed colored aggregate. School walls are often marked up by children but the rough surface of these walls, not susceptible to chalk or other marks, retains its attractive "built-in" appearance.

H. L. Gogerty, Los Angeles, Calif.—architect. D. Stewart Kerr, Los Angeles, Calif.—associate architect. William C. Crowell Co., Pasadena, Calif.—contractor.



For the remodeled and enlarged offices of the Red-D-Mix Concrete Co., Omaha, Neb., colored aggregate was used in the surfaces of this decorative end wall and of areas above and below the windows and at the main entrance. Marble chip aggregates, predominantly a medium green with some silver grey and alpine red, provide a distinctive color treatment that contrasts with the untreated architectural concrete walls.

Leo A. Daly Co., Omaha, Neb.—architect-engineer. Parsons Construction Co., Omaha, Neb.—contractor.

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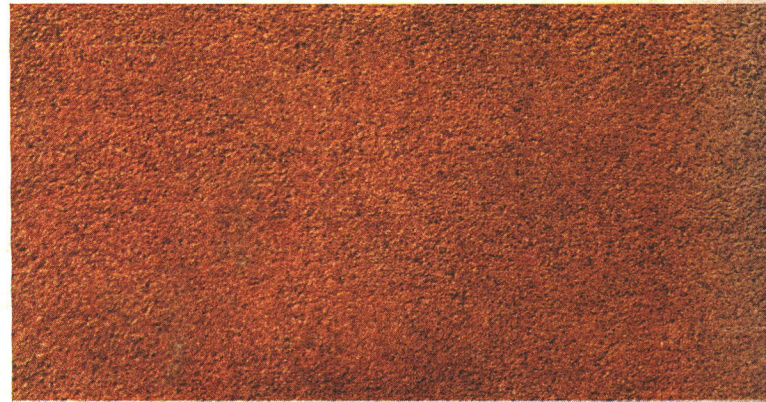


1. Ground surface with ceramic aggregates.



2. Sandblasted rough texture.

Aggregate-transfer panels:



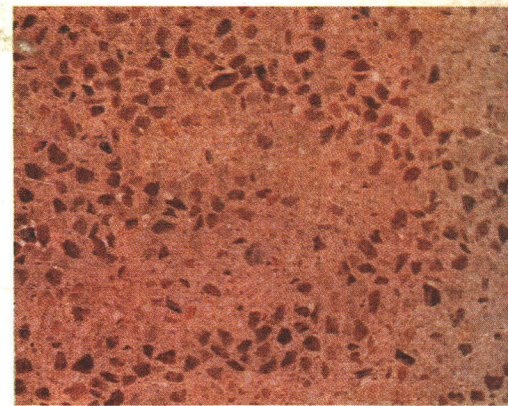
3. Sand finish.



4. Sandblasted rough texture.



5. Ground surface.



6. Colored mortar and ground surface.



7. Rough reveal.



8. Veined finish with color additive.

Marble aggregates were used in all panels except panels 1 and 3.

Panels 1, 2, 4, 5 and 7 had been continuously exposed to Chicago weather for nearly 18 years at the time the photographs were taken.