Selecting forming materials for architectural concrete

Primary considerations in selecting forms and form liners are whether they are absorbent or nonabsorbent, or whether absorbency will be uniform

In selecting a forming material, the first consideration is whether the material is absorbent or nonabsorbent. Absorbent forms remove water from the concrete and reduce the water-cement ratio in the concrete surface. The lower the water-cement ratio, the darker the concrete. If the absorption is not uniform, the concrete surface will vary in color. Nonabsorbent forms prevent moisture loss and result in finishes that are uniform in color but lighter than those cast in absorbent forms.

Construction of boarded forms may require care to avoid indentation of surface from grit or stone, as on these curved forms.

Plywood forms

B-B plywood, which is a construction-grade oil-impregnated plywood, does not produce acceptable architectural concrete finishes because of its nonuniform absorptive capacity. Concrete cast against this form reflects graining effects and boat patches. Variations in the water-cement ratio from nonuniform absorption also result in hard spots in the concrete, and abrasive blasting of such finishes leads to a nonuniform etch because the hard areas are better able to resist the blast.

Unpiled B-B grade plywood may be used for architectural concrete with certain modifications. The form surface can be made impervious to moisture absorption by the application of wood sealers or special coatings. When wood sealers are used, a minimum of two coats are normally needed to ensure proper protection. A well applied wood sealer usually will hold up for a maximum of five reuses. After that, forms must either be discarded or sanded and retreated with sealer.

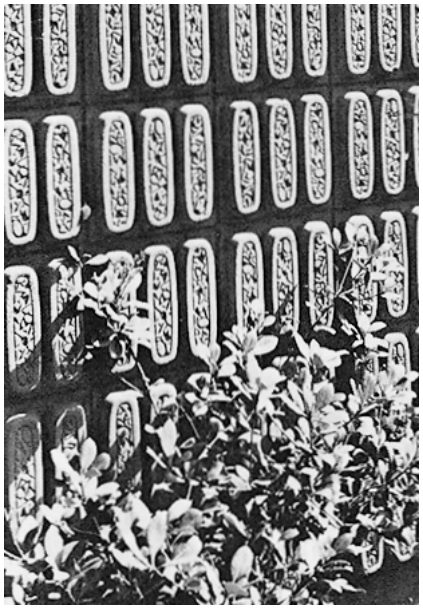
Regardless of whether wood sealer or special coatings are applied, B-B grade plywood should be tested by casting test sections to evaluate the effectiveness of the sealer. Some wood sealers will raise the grain of the plywood.

Another type of plywood that is effective for architectural concrete work is produced at the mill with an applied plastic overlay. Two grades are available, frequently referred to as medium density or high density, depending on the thickness of the overlay. The high density type has been found to be effective for as many as 10 reuses, or even more when the forms have been designed for easy stripping and have been handled with care. Problems sometimes encountered with this material include embrittlement of the overlay or development of a pink discoloration in concrete; both are from reaction of the overlay with the concrete. Usage of the material on a project mockup helps to determine whether or not these problems exist in the materials being considered.

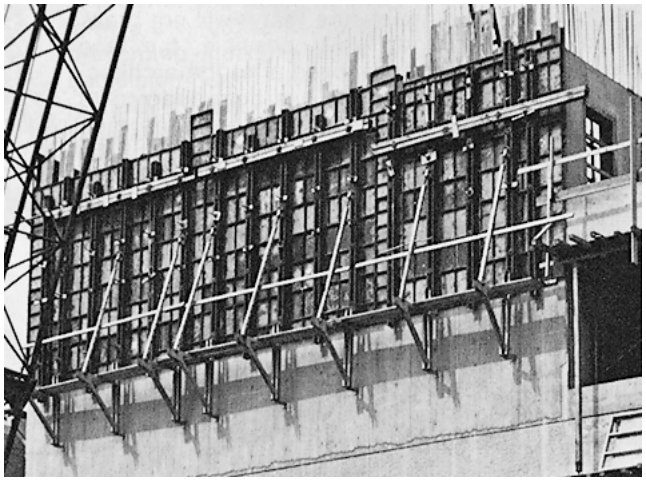
A further nonabsorbent material which is becoming increasingly popular for use in architectural concrete is the plastic-coated birch plywood produced in Finland. This is probably the finest grade of wood-based material available for architectural concrete construction. Its average reuse factor is better than the high density plywoods available and potential problems are minimal. Another feature is the availability of larger special sizes; these sizes can reduce the amount of butt joint treatment needed.

Steel forms

Where economically feasible, shop built steel forming systems are an ideal selection for achieving high quality architectural concrete finishes. The use of steel forms minimizes the jointing problems encountered in plywood systems. However, using steel units produced by different rolling techniques can produce a slight variation in color and texture, which may show up in an as-cast finish. In some cases it has been advisable to epoxy-coat the forms to prevent problems with



This wall was built with disposable form liners with an intricate pattern.
Photo courtesy of Labrado Forms



A reeded form liner is being used with a prefabricated forming system that normally would not be used alone for architectural concrete. The concrete below the wavy line at the bottom has been chiseled to produce a combination reeded and chiseled finish (shown in detail in the last picture of the article titled Mechanical Finishing of Hardened Concrete).

rust. Steel forms can normally be reused 50 to 100 times when properly handled.

Fiberglass-reinforced plastic forms

Fiberglass-reinforced plastic is being used increasingly as a forming material for architectural concrete. Like steel, it eliminates jointing problems common to plywood, but it is lighter in weight than steel. Normally it can be reused 20 to 30 times though there have been instances of up to 100 reuses.

Form liners

Liners applied to structural forms can produce varied and effective as-cast architectural concrete finishes. The most commonly used liners are made of lumber, fiberglass-reinforced plastic, polyvinyl chloride, or rubbers.

Rough-sawn lumber is often used for board surface textured finishes where concrete color variations are acceptable. Absorption can be minimized by coating the lumber with a wood sealer. To prevent bowing of the boards, all sides can be coated with wood sealer by painting or immersing. Even with a sealer, some types of lumber may absorb moisture from the concrete. In other cases, natural sugars found in the lumber may penetrate the sealer coating when concrete is cast against the form, retard the set of the cement at the surface, and cause a dusty, dark, blotchy effect. Fir is the preferred choice for boarded surface finishes due to its low sugar content. Pine has a high sugar content. Lumber has its highest sugar content if it has been cut in the spring. The weathering of the lumber also can affect the outcome of the concrete finish. If rough sawn lumber is being used it is important to cast samples to determine the effect the lumber will produce. The lumber selected should be purchased all at one time from one source to minimize the possibility of variations.

Polyvinyl chloride, fiberglass-reinforced plastics, or rubbers are not absorptive in nature and they produce uniform architectural concrete finishes. Normally 20 to 30 reuses can be expected from a good fiberglass-reinforced plastic form liner. In excess of 100 reuses have been obtained using polyvinyl chloride or rubber liners. The polyvinyl chloride and rubber liners offer the flexibility of producing almost any desired texture. Minimal amounts of release agent are required with the fiberglass-reinforced plastic or rubber liners and none is required with polyvinyl chloride.

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