Veneer Construction

Commonwealth Bank Building, Sydney – an example of a high quality, durable veneered facade

The practice of veneer construction, (also known as two-layer casting), has been a proven technique for producing an aesthetic and durable surface finish for architectural facade panels in high-and medium-rise construction,both in Australia and overseas for as long as precast concrete has been manufactured.

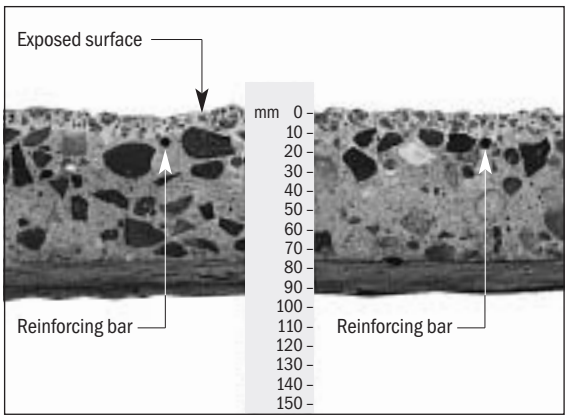
Veneering in this case refers to the process of casting concrete in two layers rather than to any process akin to applying timber veneers or the like. It is similar to casting concrete in layers as is done for larger structures or to the topping of insitu floors and bridge decks. In practice, the second layer in the pour of an architectural panel is usually carried out within an hour of pouring the first layer.

It is, as in all technical processes, possible to induce failure by the use of bad practice. There has been, however, an exaggerated reaction to a handful of apparent failures of veneer in precast construction which has led to veneering being banned by some specifiers. This has been wasteful and has demonstrated a lack of understanding of the basic technical criteria. The precast concrete industry has marvelled at the violent reaction to veneering from many quarters which has been unsubstantiated by any application of science.

In order to provide a technical resolution the NPCAA, in 1999, commissioned Mahaffey Associates to undertake research into the technology and history of veneering in precast concrete applications.

The research was carried out in two stages:

- To determine the general condition of facade concrete of 14 major buildings constructed with veneered panels over more than 35 years.
- To carry out testing to demonstrate that veneering is a safe procedure.



Reinforcement in perfect condition after being cut out of an acid-etched veneered precast unit exposed to a marine environment for over 25 years. There is no delamination.

Precast data 4

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AMP Centre (Tower and St James Building), Melbourne – an example of a veneered facade from the 1960's

The study was completed in December 2000, and the findings have now been published. In summary these are:

Stage 1 The review was limited to some 14 NSW commercial high-rise buildings ranging from 15 to 36 years of age, where maintenance records were available.

Key Findings:

- Any problems with these buildings were not related to the failure of the bond between the veneer and the backing concrete.
- In all cases where repairs were required, the problems were the result of poorly conceived or executed construction techniques or of the choice of alkali reactive aggregates – not the result of veneering.

Stage 2 The testing was carried out at the factory of an established precast manufacturer, and trials completed under normal factory conditions. Trial 600 x 600 mm units were cast face-down, ie the architectural concrete was poured first and the backing concrete (the second layer) was poured later at predetermined intervals viz 1.25, 2.5, 3.5 and 4.5 hours.

Three types of testing was carried out:

- Compressive strength (veneer and backing)
- Drying Shrinkage (veneer and backing)
- Adhesion testing (veneer pull-off test) *refer Figure 1.*

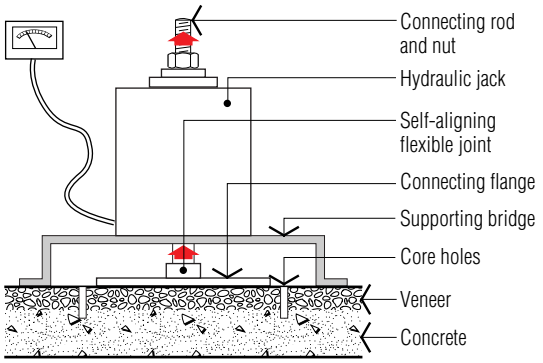

Figure 1 *Schematic diagram showing the bond test set-up*

Key Findings

- Veneering of precast concrete panels, carried out in accordance with good practice, results in a composite material with a perfect bond between the veneer and the backing concrete. Pull-off testing showed that no failure occurred in panels at the interface with delays of up to 31/2 hours of casting of the backing surface.
- The interval between casting of veneer and backing concrete affects the development of bond at interface.
- The bond between the backing concrete and veneer is sufficient to resist failure at the interface for delays of up to 2.5 hours.
- While the tests were able to induce interface failure in some cases with delays of over 2.5 hours it seems clear that appropriate surface treatment to promote bond would prevent interface failure following any length of delay between pouring the layers of concrete.

The overall conclusion of this research study is that the technique of veneering precast concrete facade panels is technically sound, and produces a high quality and durable product. Should you require more comprehensive details on this research study, please contact the NPCAA office.

In conclusion, it is worth noting that independent overseas research on bond strength achieved between unreinforced interfaces supports the findings of the Mahaffey study. For further reading on this research, please refer to BFT 4/2001 Pages 64–69, *Shear Strength – unreinforced interfaces: precast concrete elements and in-situ topping*.