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NATIONAL PRECAST CONCRETE ASSOCIATION AUSTRALIA

PRESIDENT'S COLUMN

PRECAST IN THE NINETIES

As the current recession yields to an eventual upturn there will be unprecedented opportunities for manufacturers and their clients to take advantage of the potential of precast concrete. All the signs are favourable.

A major selling point for precast concrete has always been the high quality available with controlled factory production. The problem with this is always price – higher quality is generally associated with increased cost. In the 90s, however, quality standards will be increasingly client driven and price put into a different perspective. On this basis precast will win every time.

> There is hardly anything in the world that some men cannot make a little worse and sell a little cheaper, and the people who consider price only are these men's lawful prey.
>
> *John Ruskin*

It seems clear that the main agenda for the unions will shift from pay rates and demonstrations of militancy to training, productivity and long-term employment security. The rationalisation of the union movement into fewer bigger unions will bring stability and responsibility. If precasters are allowed to send their specialist factory staff onto sites to carry out installation and other work, then great efficiencies will result.

Growing environmental awareness will result in revised building standards such as those recently adopted by the City of Sydney which clearly favour masonry over curtain-wall construction. Precast railway sleepers and utility poles will be used more as our timber resources are conserved. Demands for better water quality in our streams and oceans will drive massive infrastructure expenditure.

The spread of hollow core walling machines will bring the same revolution to industrial and other low-rise building as has already happened in Perth and Sydney. Clients will insist on top quality, speed with dependability, and capital appreciation.

Precast flooring – either hollow core, permanent formwork or customised designs will take enormous market share as the users overcome their resistance to a new method. Should the builders regain control of their tower cranes from the unions then this process will accelerate.

The acceptance of totally precast buildings will increase as our clients gain confidence in the process and take advantage of structural products with architectural finishes.

Polished and honed architectural products will continue to gain acceptance because of the sophistication of these finishes and the power they give to architects who wish to design in masonry. Most mainstream architectural precasters will develop GRC capability as the technical problems previously associated with it are resolved.

The use of precast drainage and utility products will increase as the time, cost and quality aspects of forming and pouring pits and other structures are compared to simply dropping in a high-quality precast product. More-sophisticated production equipment will bring higher quality and lower costs.

All these opportunities and more will be available for us and for our clients. It remains to be seen how well we can market them and how willing the market will be to accept that there is a better way.

JOHN BURKE

GLASS REINFORCED CONCRETE

The Glass Reinforced Cement Association of Australia has been disbanded with members electing to join the National Precast Concrete Association Australia. These Members will develop a GRC Industry Group within NPCAA much along the lines of the existing Architectural, Structural, Hollow Core and Drainage Groups. It follows that GRC-manufacturing members will also have significant involvement in the work of some of these existing groups, particularly the Architectural and Drainage Groups.

The Directors and other Members of NPCAA welcome the new members from this growing industry. Work currently in hand by the group includes a new code of practice for the manufacture of GRC and a standard specification. ■

THE ANCIENT AND MODERN FACES OF GRC

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PRECAST SERVICE CORES

DEFINITIONS

Service Cores *– the walls enclosing a single or group of motorised lifts.*

Stairwells *– stair walls, stair flights including landings; all the above cast in a precast factory, delivered to site for erection and fixing in place.*

A major concern of builders is to avoid risk. Such risk may develop through construction time, construction quality, site safety together with a myriad of less-obvious concerns.

A number of recent Australian projects have demonstrated advantages in the use of precast service cores and stairwells not the least of these advantages being the ability to remove such elements from the critical path of the construction programme.

Other features which may be of interest to the builder include:

- reduction in site activities;
- parallel precast manufacture with site preparation;
- quick, safe access between floors;
- guaranteed accuracy of units and, in the case of stairflights, the elimination of the need to 'top' stair treads;
- delivery of the units at the builder's request.

This list of advantages is very imposing; on the other side of the coin, concerns which must be resolved early in the design programme include:

- availability, size and access requirements for on-site or mobile crane;
- transportation and access for unloading;
- the structural interaction of the service cores and stairwells within the overall structure;
- the builder's construction programme;
- any architectural treatment envisaged to the external surfaces of the service core or stairwell units.

Of the above, the lifting capacity of the crane is likely to be the most dominant issue in determining the size, shape and configuration of the units.

Shape possibilities include:

- flat panels;
- flat panels but with short return walls to aid stability during erection;
- L-, U- or box-shaped units.

Units may be full-storey (floor to floor) height or half-storey – note that horizontal joints need not occur at floor level; their positions in two recently completed structures are shown in **Figures 1** and **2.**

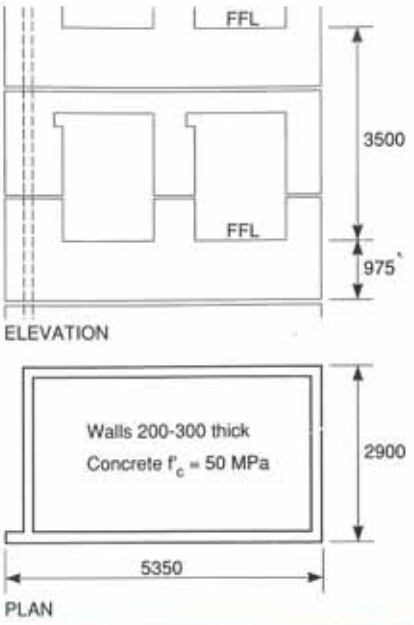


FIGURE 1 LIFTSHAFT WALL UNITS FOR 51 DRUITT STREET, SYDNEY

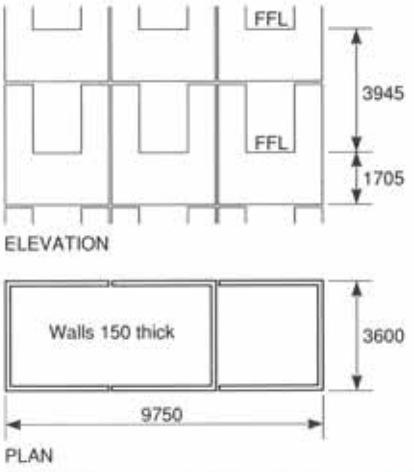


FIGURE 2 WALL UNITS FOR THE SOUTHERN LIFTSHAFT IN THE ST GEORGE HOSPITAL PROJECT, KOGARAH, NSW

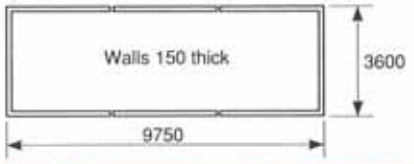


FIGURE 3 WALL UNITS FOR THE NORTHERN LIFTSHAFT IN THE ST GEORGE HOSPITAL PROJECT

Flat panels, whilst reducing crane loads naturally require on-site connections, temporary propping, and joint sealing.

The number and position of vertical joints in a service core will generally be determined by:

- the number of lifts in the group;
- whether or not fire separation walls are required between lifts (**Figures 2** and **3**, plan view);
- weight limitations;
- stability of the structure during erection;
- size and weight restrictions for transporting to site.

Again, it is the weight limitation for craneage which is likely to be the dominant factor.

The reduction of vertical joints provides for greater ease of construction by reducing or eliminating the need to 'match' horizontal and vertical dowels simultaneously during placement of the units.

Similarly, the number of dowels should be minimised to reduce the construction time and minimise any potential for mismatch of dowel holes. This may be achieved by the use of larger diameter bars which may require handling by crane.

Centrally located dowels are generally used to provide mechanical continuity from one unit to the next. The number of dowels and their position are based on the lateral and vertical loads.

However, precast units commonly have dowels at their corners or extremities. The load path within the unit should be simple. For vertical continuity it is suggested that dowels are carried through the unit, instead of using short dowels and transferring the load from the dowels to the wall reinforcement and back to the dowels again.

Vertical prestressing, such as Macalloy bars connected with couplers at each joint, should also be considered when the lateral loads applied to the liftshaft become high or the rotation of the horizontal joints is restricted.

The speed of erection of the liftshaft and stairwell units depends on the strength and lateral stability of the structure during construction. In order to achieve these requirements, the design of the vertical and horizontal dowel joints should allow the simple installation of dry-pack mortar or grout.

The designer should consider the construction process during the design of the connections. Typically, the vertical cores are grouted followed by the installation of dry-pack mortar to the horizontal joints. The spacing of the dowel holes for lapped bars should allow for a 30-mm-wide gasket to ensure grout does not flow into the horizontal joint.

The size of the dowel hole should be 20 to 25 mm greater than the bar diameter to

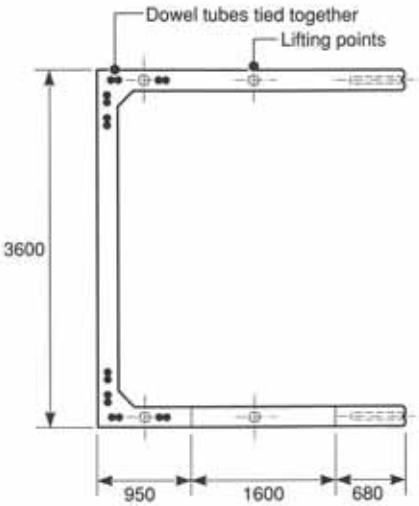


FIGURE 4 TYPICAL HORIZONTAL JOINT DETAIL USED IN THE ST GEORGE HOSPITAL PROJECT

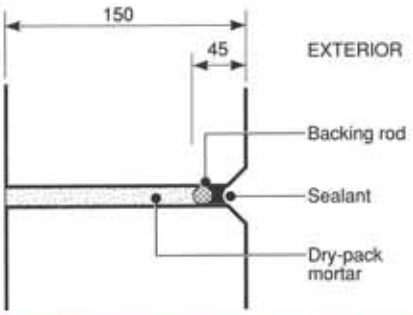


FIGURE 5 EXTERNAL HORIZONTAL JOINT FOR STAIRWELL WALLS

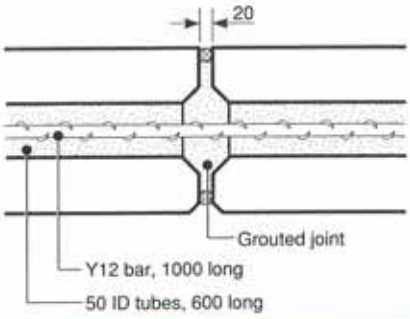


FIGURE 6 VERTICAL JOINT USING DOWELS OVERLAPPING BARS

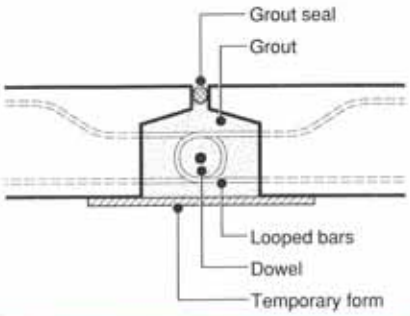


FIGURE 7 VERTICAL JOINT USING OVERLAPPING BARS

allow greater manoeuvrability of the unit during erection. The detail shown in **Figure 4** was used for the St George Hospital project with success. It is generally considered easier to install the vertical bars into the lower unit such that they do not protrude above the surface and result in the potential complex task of 'feeding' several bars into the lowering unit. Vertical joints may be formed by dowelling, overlapping hooped reinforcement locked by a vertical bar, or by welding – although the latter method is often not acceptable to the builder due to increased safety requirements, involvement of a further trade and access **Figures 6, 7** and **8**.

A copy of a comprehensive paper entitled *Precast Concrete Liftshafts and Stairwells – Further Developments* is available upon request from NPCAA. The paper – by G Vorobieff BE MEngSc MIEAust CPEng – was delivered by the author at a Conference *Innovation and Economics in Building* Brisbane, September 1991. ■

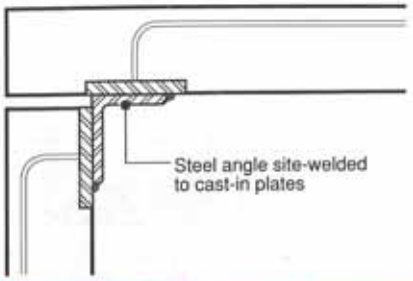


FIGURE 8 VERTICAL JOINT USING CAST-IN-PLACE PLATES

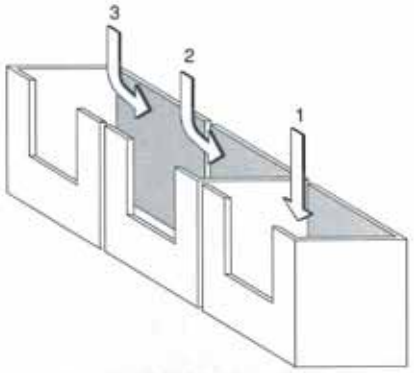


FIGURE 9 CONSTRUCTION SEQUENCE OF THE LIFTSHAFT IN THE ST GEORGE HOSPITAL PROJECT

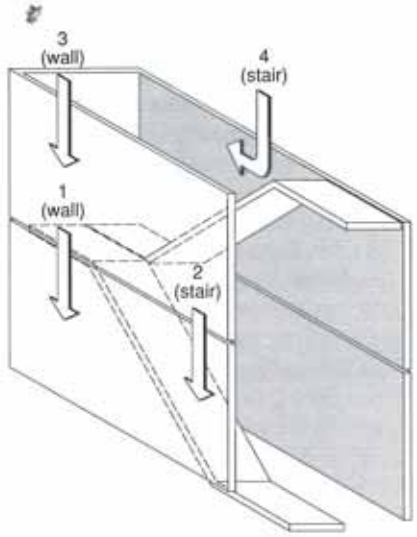


FIGURE 10 CONSTRUCTION SEQUENCE OF THE STAIRWELL IN THE ST GEORGE HOSPITAL PROJECT

NEWS FROM BEDROCK

HUSSEIN TAWANSI

This is the first in a series of three articles on decorative aggregates for precast concrete. Hussein, who is Managing Director of Australian Granite and Minerals, has a BSc in geology and is a Fellow of the Quarry Institute Australia.

The term 'granite' in the stone industry, is used to cover a multitude of igneous rocks of varying composition formed by the cooling process of liquid magma deep in the earth's crust. During the last decade the Australian stone industry has located numerous deposits of this very attractive rock within Australia, particularly in New South Wales and South Australia.

Due to the varying mineralogical composition of the granite and the nature of its cooling process at varying depths in the earth's crust, granites differ in colour and texture.

Granite is a fine-grained, crystalline rock and consequently has certain characteristics which make it a most desirable aggregate. It is strong, hard, abrasion resistant, has very low porosity and can be obtained in a range of colours. This makes it a superb material for use in building facades, particularly where honed or polished finishes are used. Its durability is unquestioned; besides its physical characteristics, it is chemically stable, being markedly resistant to acids – unlike that other decorative rock, marble, which is readily attacked by carbon dioxide and atmospheric moisture. The Pharaohs' granite statues at the Egyptian Museum in Cairo provide a superb example of the beauty and durability of this stone.

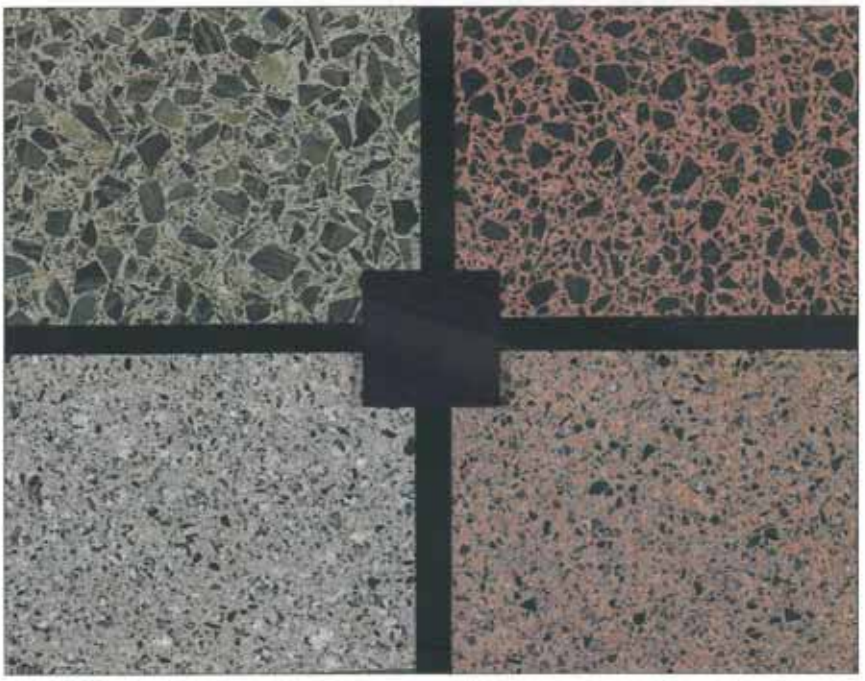
Australian granites offer a diverse range of colours, extending from off-white, light, medium and dark grey through to black. Other colours include pink, light red, deep red, brown, yellow, blue and green. Few countries in the world enjoy such a profusion of colour.

The granite aggregates used in the manufacture of precast, reconstructed granite, extend the colour range even further, since a number of the rock sources, whilst unsuitable for use as dimensioned stone, can be readily crushed into aggregate sizes and are admirable for use in the manufacture of precast reconstructed granite.

The precast concrete industry can offer exciting finishes in the aforementioned colours or combinations of two or more aggregates. Add to these qualities of the stone, the effect of aggregate grading, the use of crusher fines, the effect of available cement colours – white, off-white or a variety of greys – together with the possible use of an oxide colour pigment, and a variety of surface finishes – such as honed or polished (either of which can be combined with etching) – then the variety of final appearance leaves our designers with an abundance of possible finishes, the envy of the world.

The aesthetic and physical properties and characteristics of this superb aggregate have undeniable applications in the building-facade and decorative-paving markets. ■

SOME EXAMPLES OF THE VERY WIDE RANGE OF COLOURS AND GRADINGS AVAILABLE USING RECONSTRUCTED GRANITE AGGREGATES



OUT AND ABOUT

The requirements for street furniture and paving are that they be:

- functional
- robust and durable
- aesthetically pleasing.

There are no priorities in this listing; all three are mandatory for success.

Improved mould technology and a greater understanding of colour and texture by the precast concrete manufacturer now allow precast concrete to adopt a more dominant position in the supply of urban street furniture. The ability of the manufacturer to provide complementary products such as paving with kerbing, tree surrounds and furniture items such as planter units, litter bins, and seating, allows for the 'total precast concept'.

PRECAST PAVING UNITS WITH COMPLEMENTARY SEATING ELEMENTS

Precast paving has the attributes of colour, texture and geometry. Colour may be achieved by the use of coloured aggregates such as the wide range of granites available, possibly using the fines from the crushing operation as the fine aggregate content of the mix. Certain natural, coloured sands provide an excellent colour base for light, creamy to buff shades when used with light coloured cements such as off-white.

Additionally or alternatively, colouring pigments may be added to the concrete mix. These range from the natural earth colours of blacks, browns, reds and ochres to the more delicate pastel shades.

Textures may vary from the ever-popular water-washed aggregate – generally a river-pebble material or crushed granite – to the sophisticated honed or polished finishes, these latter finishes often etched to provide a low-slip surface. Other textures can be achieved by the use of mould liners or other forms of post-casting finishing such as sand blasting.

As a general rule, paving units should be designed to minimise slipperiness, prevent surface abrasion and hence maintain true flat surfaces, and finally provide a dense surface thereby limiting staining – a problem so frequently seen from food, drink or oil spillage. Logically, the answer to these three concerns is to maximise the amount of coarse aggregate exposed at the surface of the paving unit.

PRECAST POLISHED PAVING UNITS WITH BRICK INFILL PANELS, WITH PRECAST WALL CAPPING USING A WHITE QUARTZ AGGREGATE AND LIGHT SANDBLASTED FINISH

TACTILE PAVING UNIT

CUSTOM-MADE PLANTER BOXES WITH COMPLEMENTARY DWARF WALL TO LEFT

The geometry of precast paving units is limited only by the capacity to transport and place the units. Simple mechanical-handling equipment often readily available allows for units of quite generous proportions to be placed.

Colour, texture and geometry can be used to great advantage in defining vehicular and pedestrian access, establishing proportion of an ill-defined area and assisting disabled persons, as with the use in a Perth pedestrian area of the 'tactile' paver designed to assist vision-impaired persons.

BOLLARDS WITH LIGHT SANDBLASTED FINISH, CENTENNIAL PARK/MOORE PARK TRUST

BOLLARDS WITH SIMULATED LIMESTONE FINISH, PERTH

One of the failings of other paving materials has been the manufacturer's apparent inability to provide a full range of complimentary units such as tree surrounds, kerbs, closing units around lighting standards, cable pits and the like. The greater flexibility offered by precasting makes the designer's imagination and cost the only constraints.

Street furniture – planter boxes, seating and waste bins to name the most widely used items – needs to be robust if only to deter vandalism. Whilst this often means solid looking and quite weighty units, it does not follow that the units have to be aesthetically displeasing. Again, the availability of colour as mentioned in the short discussion on paving, supplemented by a range of paint textures and colours together with concrete texture and good proportioning of the units guarantee visually pleasing elements.

The industry can supply a range of products to meet the client's purse; standard products such as the litter bin illustrated, a robust unit with an exposed aggregate finish to minimise staining. The industry can equally provide more-sophisticated, custom-made units, witness the items shown in the accompanying photographs.

Some comment is warranted on the arrangement of street furniture. There is a strong need to co-ordinate paving and furniture to achieve landscaping harmony. The placing of say, planter boxes, seating or litter bins in regimented lines and at intervals where each unit is viewed in isolation does little to create the visual impact that such units should provide. Seating and planter boxes in particular invariably benefit from groupings which provide greater visual impact. ■

WASTE/LITTER BIN

PURELY COMMERCIAL

Precast Concrete Pty Ltd, based in Brisbane, has acquired the hollow core operation of Quickfloor. The hollow core operation will trade under the name Quickfloor (a Division of Precast Concrete Pty Ltd).

Rescrete Industries Pty Ltd has acquired the Sydney operation of Transfloor Australia Pty Ltd, previously a Smorgon ARC subsidiary.

Transfloor is a partial precast, reinforced concrete flooring system for suspended floor slabs. ■

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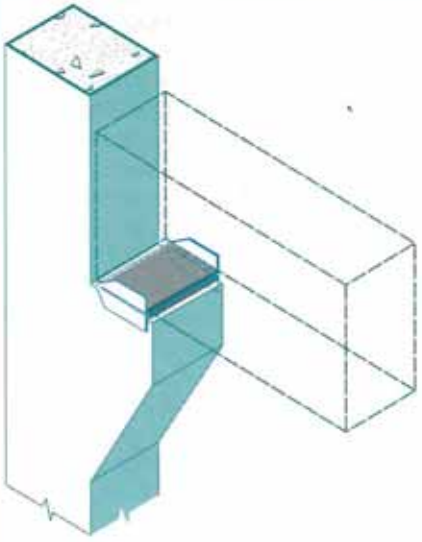
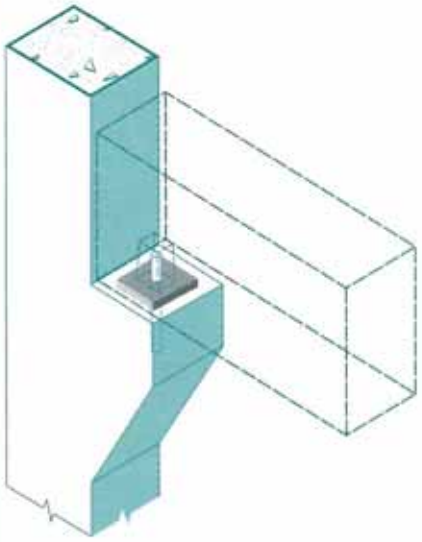
TYPICAL DETAIL

THIS ISSUE: BEAM TO COLUMN



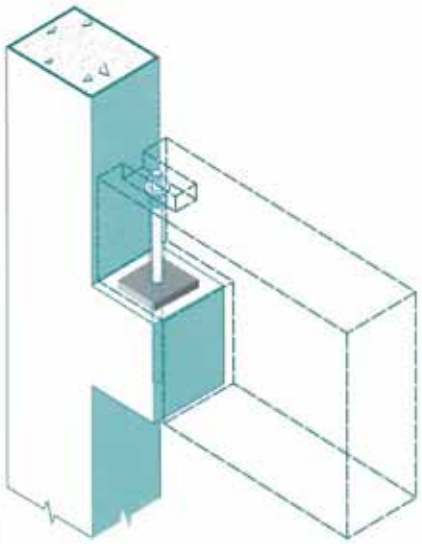
'SADDLE-PLATE' CONNECTION

- *Saddle folded from sheet metal and sandwiched between neoprene pads*
- *Prevents lateral movement*
- *Does not provide for longitudinal or vertical displacement*
- *Does not allow moment transfer*
- *Does allow for minor movements such as shrinkage and creep*



PLAIN-DOWEL CONNECTION

- *Block-out in beam to receive dowel, may be filled with mastic or with grout if the dowel is provided with a neoprene sleeve*
- *Controls lateral and longitudinal movement*
- *Does not provide for vertical displacement*
- *Does not allow moment transfer*
- *Does allow for minor movements such as shrinkage and creep*



THREADED-DOWEL CONNECTION

- *Cast-in threaded dowel with retaining nut and washer*
- *Controls lateral, longitudinal and vertical movement*
- *Does not allow moment transfer*
- *Does allow for minor movements such as shrinkage and creep*

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