# APPLICATION OF NEG ARG FIBRE

Ref. No. 017 SEPTEMBER 1996

Nippon Electric Glass

NEG ARG Fibre, manufactured by Nippon Electric Glass Co., Ltd., is used throughout the world as a reinforcement for cement composites, including asbestos replacement products.

## GRC Dresses City Landmark in Australia

Overlooking Port Phillip Bay in Victoria, Australia, is the Landmark Corporate Centre, built to serve as a focal point in the central business district of Frankston, a city just south of Melbourne.

The strongly articulated elements of the development have been designed to step away from the Nepean Highway, and the new building successfully integrates into the low-rise character of development along the Nepean Highway. The upper level offices open to landscaped useable terraces which enjoy views of the foreshore and bay.

The entire facade of this shopping and office complex is clad with GRC (Glass Fibre Reinforced Concrete), using the steel stud frame system pioneered in Australia. This alkali-resistant glass fibre reinforced concrete is much in demand for the exterior walls of high-rise buildings particularly in Australia, the United States and Japan. The 42-story San Francisco Marriott Hotel is another striking example.

The features of GRC are its good bending strength, impact strength, toughness and cracking resistivity; its light weight due to thin forming; and it allows free design.

**Landmark Corporate Center**

| | |
|---|---|
| Location: | Frankston, Victoria, Australia |
| Owner: | Sol Sapir Pty. Ltd. |
| Design: | Sol Sapir Pty. Ltd. |
| Construction: | Entire Facade System GRC |
| Floor Area: | 6,388 $m^2$ |
| Manufacture and Installation of GRC: | Glenn Industries Pty. Ltd. Adelaide, South Australia |
| Completion: | 1994 |

## Smoke baffling cast into GRC

GRC panel was chosen as the exterior cladding for the building, owing to its ability to be moulded with the detail required by the architect, Sol Sapir Pty. Ltd., of Melbourne.

A particular feature of the Landmark Corporate Centre is the way the steel stud frame, because of the accuracy with which it was able to be placed within the panels, was used to support smoke baffling between floors. The frame also provided the fixing grounds for the internal fire rated walling system. This approach resulted in major cost savings since there was no need for an internal framework to carry the internal linings. It also provided more rent space in the building, hence a greater return on investment for the owner.

The smoke baffling system consisted of a 2 mm plate, integrally cast into the GRC which sealed the GRC to the steel stud frame. Following installation of the panel, the steel stud frame was sealed to the concrete floor beam to form an effective smoke seal between floors.

## Panels constructed 900 km away

The external appearance of the five-story building is one of large square windows, with detailed vertical rebated panels and fine detailed horizontal panels between. The panels were designed, manufactured and installed by Glenn Industries, located 900 km away in Adelaide, South Australia. Mario Quici, Glenn Industries Sales Manager, says that transportation of the finished panels to the site was a significant consideration: "A column and spandrel panel system was ideally suited in this case, as it allowed easy packaging, easy truck loading and unloading and economical loads."

He explains how the panels were constructed to incorporate the smoke baffling system: "A 10 mm GRC 'skin' was sprayed into the mould of the desired shape. Immediately, an engineered steel stud frame was jigged into the mould and attached to the skin by means of steel rods, known as 'L-flex' anchors, on approximately 600 mm grid centres. The stud frame was the means by which the panel was handled through the factory processes, and handled and hoisted on site. It was also the way by which the panels were attached to the building.

The L-flex anchors (10 mm rod) were designed to allow the skin to move independently of the stud frame and so accommodate thermal movement and moisture movement differentials between the GRC and steel stud frame."

## Facade design is modular

In creating the facade design, column panels were attached to the concrete floor beams/floors of the building. The column panels typically span from the window sill level on one floor to the window sill level on the floor above.

The vertical edges of the column panels formed the window mullion mounting points.

The steel stud frames are attached to the building by means of steel plates connected to the floors using cast in ferrules. The weight of the panel is taken on these plates. Packers are adjusted between these plates and the stud frame to give correct height positioning. Plates on the bottom of the column panel stud frame attach to plates on the top of the stud frame of the panel below, and by the use of packers are aligned with the panel below.

Rigidity between floors is ensured as the panels are physically attached to each floor.

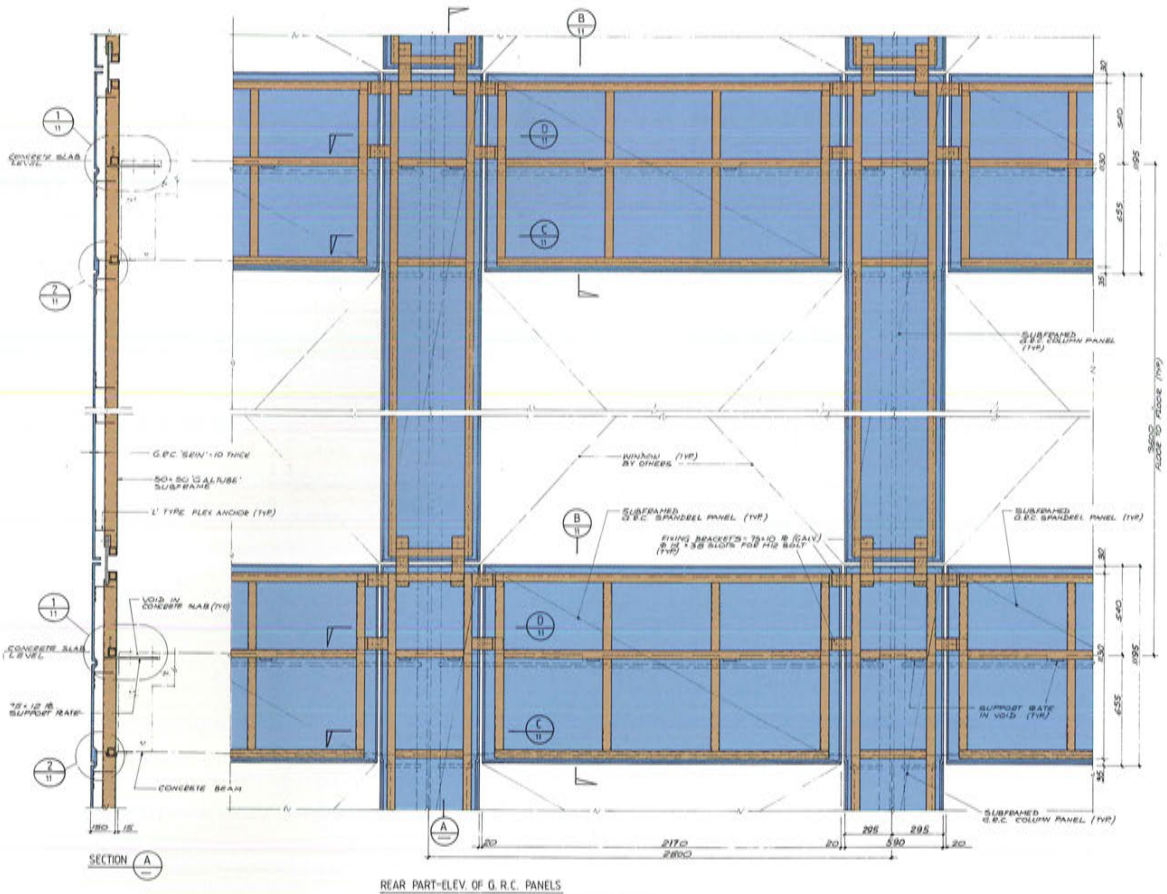
Spandrel panels are attached to both the concrete floors/floor beams and the adjacent column panels. The spandrel panels span horizontally between the column panels and form the window head of one floor and the window sill of the floor above.

The steel plates which attach the panel steel stud frame to the building take the weight of the panels. To ensure rotational rigidity the four corners of the steel stud frames are fixed to the column panel by steel plates and bolts. Packers are used between the plates to obtain correct panel alignment.

Corner panels are attached in the same manner as the column panels, that is, each panel "sits" on the floor and attaches to the panel below. Corner panels span window sill to window sill and are basically two column panels cast integrally at 90 degrees to each other to form the corner. The big advantage of this method is the absence of a vertical mitered joint and associated alignment and sealing problems that would occur if two column panels were used.

## ● Typical Connection of Column – Spandrel Panels

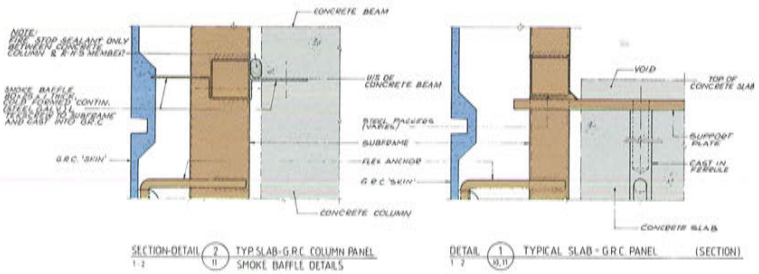
Unit: mm




REAR PART-ELEV. OF G.R.C. PANELS
TYPICAL CONNECTION OF COLUMN – SPANDREL PANELS

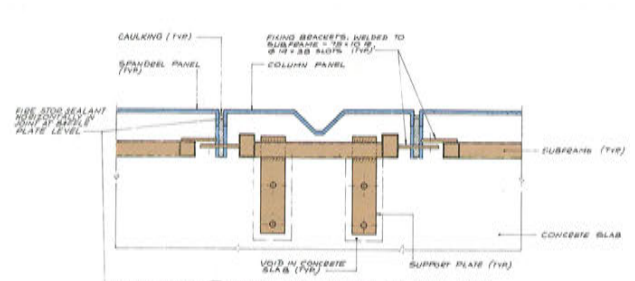
## ● Smoke Baffle Details and Sections

Unit: mm



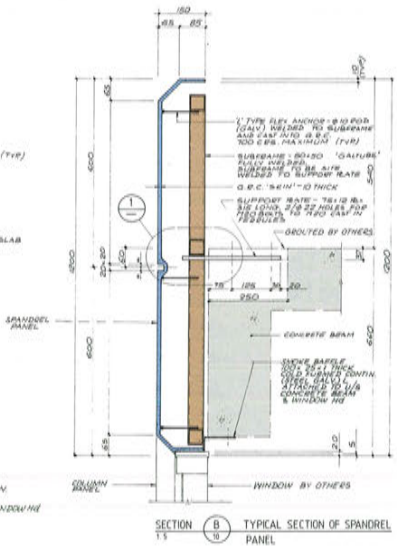

SECTION-DETAIL (2/11) 1:2 TYP. SLAB-G.R.C. COLUMN PANEL SMOKE BAFFLE DETAILS

DETAIL (1/B.11) 1:2 TYPICAL SLAB - G.R.C. PANEL (SECTION)




SECTION-DETAIL (0/10) 1:5 TYPICAL SLAB – G.R.C. PANEL SEAL DETAILS (PLAN)

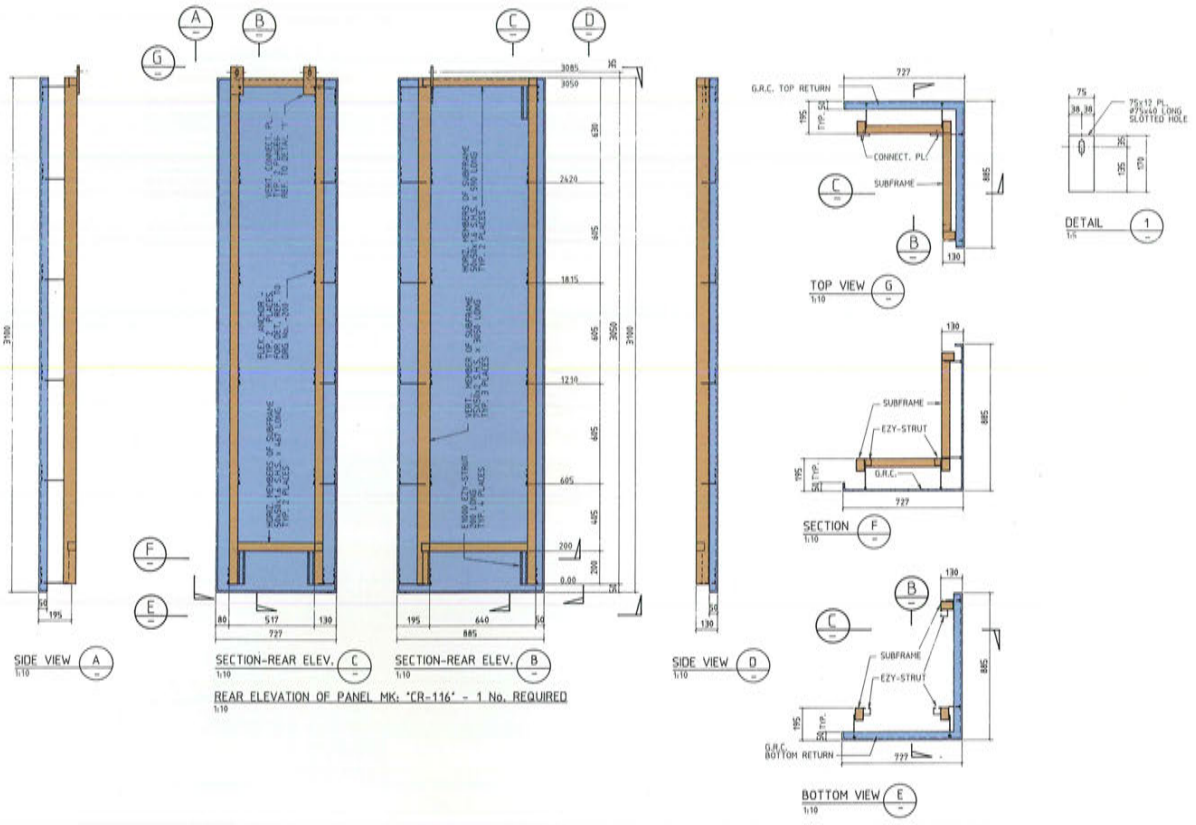
SECTION-DETAIL (C/11) 1:5 TYPICAL COLUMN PANEL SMOKE BAFFLE DETAILS




SECTION (B/10) 1:5 TYPICAL SECTION OF SPANDREL PANEL

## ● Corner Panels

Unit: mm




### All coatings applied in factory

The coating system chosen for this project was a textured acrylic finish incorporating an anti-graffiti/dirt retention glaze coat.

After wet curing for seven days, the panels are etched and high-pressure rinsed. This process removes all laitance from the surface and opens up the high-density face to obtain maximum coating penetration and maximum adhesion. The panels are then dried to reduce the moisture content to less than 7%.

The coating process begins with a clear acrylic deep-penetrating sealer to achieve maximum adhesion. This is followed by a 250-micron base colour coat of high-build acrylic. To this base coat a texture finish is applied. The coating system is allowed to cure before the application of the glaze coat. The whole coating system is applied in Quality Controlled factory conditions and arrive on site in completely finished condition.

### Savings in erection options

Ferrules for attaching mounting plates were cast integrally with the floor. The panels arrived on site, fully coated and ready to erect. Column panels are positioned and attached first and then the spandrels are fitted. The building can be erected level by level, or elevation at a time, which gives maximum flexibility to the construction program without the need for external scaffolding. Owing to careful consideration during the conceptual design stage, cost savings were made by incorporating internal wall framing and smoke baffling into the GRC panel design. Further savings were made by coordinating the design of the GRC panels with the window manufacturer as all windows were installed from within the building.

### *Advantages of GRC*

- Light weight
- Flexibility of design
- Factory pre-finished unit
  - range of finishes and colours
  - design can be incorporated in window frame installation support and waterproofing
  - stud frame to which internal lining can be fixed providing greater rentable space
  - smoke baffling integrally cast
- Reduction in site handling time
- Speed of site erection
- Erection of system independent of construction crane
- Factory quality control
- Immediate floor-by-floor safety barrier provided by system
- Reduction in use of external scaffolding
- Reduction in overall weight resulting in significant savings in the foundation cost
- Notable reduction in the number of site deliveries for a given sum of panels compared to pre-cast concrete

**Nippon Electric Glass Co.,Ltd.**
1-14, Miyahara 4-chome, Yodogawa-ku, Osaka 532-0003, Japan

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