

## 3 Merchant Square, Paddington, London: GRC residential façade case study

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### Abstract

This energy efficient 21 story residential Building designed by RPP, providing 201 apartments of different sizes and mixed tenure, is the perfect example of the renewed interest in GRC by Architects and developers. The façade has been composed as a series of layers; full height glass, recessed bronze anodized aluminum, all of which is framed by an outer layer of GRC panels. The layered façade provides a degree of privacy and shelter to both internal spaces and balconies alike. The end result is a beautifully constructed envelope to the building, which appears effortless and composed. The façade of 3 Merchant Square has an architectural language of solidity, provided by the GRC, contrasting with recessed layers of glass and bronze aluminium which achieves a delicate balance which is both elegant and entirely appropriate for a residential building. This paper discusses the project.

### MERCHANT SQUARE

Merchant Square is the final part of the Masterplan for the wider development of the Paddington Basin in Westminster, Central London.

Merchant Square offered the chance to design four buildings and their setting as one coherent piece of urban design. The buildings all look onto the new garden square at the heart of the 4 acre site bounded by the Harrow Road to the north and the Grand Union Canal at Paddington Basin to the south.



**Figure 1.**

The location is highly desirable for urban living, located beside The Grand Union canal and being only a short walk from both Hyde Park and the vibrancy of life in London's west end. The area has excellent amenities and transport links and so commands high

values for residential real estate. The developer, European Land & Property, has developed the canal-side over the last decade with high specification buildings with a real focus on the quality of the public realm and on how this area can become a new hub for working and living within Westminster.



**Figure 2.**

Robin Partington & Partners as architects for the Merchant Square Masterplan, secured planning permission in 2012 for the 4 buildings of the Masterplan including the 42 storey 1 Merchant Square, which will stand as the tallest building in the area and marks a point of arrival in London as the major arterial route, from the west, touches down to ground level to the north of the site. The development is highly visible and plays a significant role within the wider context of Westminster and London as a whole. It is a new address for London, a gateway for the capital and the focus at the heart of a vibrant community. The sense of quality in both design and materiality were prime drivers that were debated during the planning process. All 4 buildings have unique characters yet have a common design thread running through them.



**Figure 3.**

Materials were chosen that were engaging to the senses, yet durable. The materials must work when viewed at a distance on the city's skyline, yet they must also engage with people when viewed up close within the new public realm, where the surface and the details can be scrutinised. The desire was to use materials that stimulate the senses - providing visual interest, responding to ever changing daylight conditions, providing tactility by dropping to ground level and inviting human touch and conveying a sense of permanence and quality.

When carefully detailed and constructed, GRC has proven to be an entirely appropriate material to achieve these aspirations.

### 3 MERCHANT SQUARE

3 Merchant Square was the first of the 4 building of the Masterplan to be constructed and was completed in August 2014.

The building contains 201 apartments, of which 50 are 'affordable' with a mix of social rented and shared ownership types. The brief from the developer was to raise the level of quality above that of the previous buildings that had been completed along the canal side.

The building is 'tenure blind' with the external elevations carefully considered so that the designation of tenure is not evident in the articulation of the facades. This allows the building to be democratic and balanced whilst obviously conveying a sense of quality to all elevations that address the public realm.



**Figure 4.**

Merchant Square is the focal point of the Paddington Basin, providing a new garden square, amphitheater and dynamic new bridge – all of which contribute to make a new and attractive destination. The buildings that frame this square dictate the quality of the experience and hold the key to its success in the same way that all great squares are created with appropriate building blocks, an architecture of gravitas, solidity and permanence.

As the designs of all 4 buildings were progressed the drive was to use appropriate materials and an architectural language that would imbue the new square with a sense of timelessness and elegance.



**Figure 5.**

## GRC FAÇADE DESIGN TO 3 MERCHANT SQUARE

The design of 3 Merchant Square thus sought to embody these core values established for the Masterplan – which in turn influenced all of the material choices throughout the building, including the use of GRC on the elevations.



**Figure 6**



**Figure 7**

The building was simultaneously designed from the inside out and also from the outside in.

From the inside, careful attention to detail, high quality materials and thoughtful design simplify and enhance apartment living. A “place for everything and everything in its place” was a design mantra from the outset, ensuring a considered approach for users of the apartments, creating clever storage solutions and flexible living spaces... a home.



**Figure 8**

From the outside the building was designed so that the internal spaces mesh intrinsically with the external spaces of balconies, winter gardens and terraces with the same attention to detail.

The challenge with a 21 storey residential building is to create a composition that appears residential. The question is then how to distil the essence of what makes a building appear residential. In this case what are the characteristics that create a successful residential building in the context of being located in the UK and in London in particular. For a sophisticated 20 storey building this obviously cannot mean literal and direct reference to motifs from past centuries. The question is about understanding what is appropriate for a modern building and understanding the psychology of what a home is - what the needs of the residents are in order to feel secure and comfortable.



**Figure 9**

We work closely with property agents Jones Lang LaSalle to understand the ever shifting desires of the market. In this location and at this price point it has proven to be that many of the purchasers are from overseas and a high proportion of the apartments have been purchased as second homes and London bases for families, not merely investments, but having a more personal significance for the owners.

Interestingly there is an emerging perception that when buying in London, many purchasers have a clear insight into British culture and therefore desire products that are aligned to the positive associations that they have with Europe and London in particular. The property agents find that this can, almost surprisingly, manifest itself in the rejection of the shiny steel and glass constructions that may be the norm in Hong Kong, Singapore and numerous other locations.

Instead there appears to be an understanding of the ancient sentiment expressed by Sir Edward Coke in the 16th century that:

***'an Englishman's home is his castle',***

The statement is said to derive from English law for which Edward Coke helped shape as Chief of Justice in the 16th Century: The Institutes of the Laws of England, 1628 record:

***"For a man's house is his castle.....and each man's home is his safest refuge."***

Regardless of the origins of the phrase, its inference is clear – the home is a safe place that provides security as well as shelter. Security has different connotations – first as protection from the vagaries of everyday life and secondly as an assurance against financial hardship i.e. property, and in particular the domestic home, has typically been considered a secure investment.



**Figures 10 & 11.**

We are discovering that there are investors in the London market who prefer to avoid buildings that are clad in the same materials as new cars - presumably fearful that their home or investment will fade in the same way a shiny metal car does - and instead gravitate towards the traditions of 'bricks and mortar' or the very stone from which an Englishman's Castle would have been made.



**Figure 12.**

This view point is aligned to the values we have as an architectural practice, we want to create buildings that will stand the test of time, this is a corner stone for sustainability.



**Figure 13.**

## THE DECISION TO USE GRC

3 Merchant Square uses GRC in a way that alludes to stone at many levels, yet is truthful to the nature of GRC itself and does not attempt to replicate the typical scale of traditional blocks of Portland stone that were used to construct many of London's most prestigious addresses.



**Figure 14**

The building could have been clad with natural stone rather than GRC, however GRC has proven to be a more appropriate material :

- Stone would have been overly complex and generally a much heavier material to use and importantly could not have been so readily incorporated into unitised cladding panels. At Merchant Square the end product is 200 residential apartments that must be considered to be relatively expensive by most standards, however they are not at the highest end of the market and the strategy was to have a certain economy of means. The aim was to achieve an understated elegance rather than opulence. In other words - the use of appropriate materials, not lavish or ostentatious, but very importantly the detailing must be beautifully executed. This was something that we achieved working closely with Loveld and Permasteelisa who jointly manufactured the cladding for this building. The additional weight associated with solid stone would have led to an inefficient and costly cladding system, with significant implications for the structural frame of the building.
- The use of solid stone at the proposed depth on the layered facade would not have been practical nor affordable in its own right.
- Other options including stone veneer applied to substrates of either aluminum honeycomb or precast concrete were also explored. The jointing of the material and the interfaces become increasingly challenging with these approaches and this direction also strayed from our desire to have a sense of truth to the materials being used.
- In many instances real stone would have to be sub-divided into smaller panels and the decision to use GRC enabled a simpler and more elegant solution of full height panels providing a direct expression of the floor to floor dimension, giving the building a scale that responds to the occupation of the spaces inside.

## THE BENEFITS OF USING GRC ON A RESIDENTIAL PROJECT

A gently curved frame of GRC defines the east and west elevations, creating a sense of order, scale and elegance, an inhabited framework with richly articulated layers of bronze panels and framing to the windows adding depth and solidity, embracing balconies and terraces so that residents feel safe and secure, balanced by stunning views.



**Figure 15**

The articulation of the façade to 3 Merchant Square contributes towards the legibility of the proposal as a whole, reinforcing its residential character. The overall form of the building is broken down by the expression of a two story module to the primary structure, where the warmth of the stone-like GRC combines with the inner layers of bronze cladding and glazing to provide visual interest and a human scale.



**Figure 16**

The use of recessed external balconies, 'Juliette' balconies and winter gardens further enhance this residential character, reinforcing the integrity of the building.



**Figure 17**

Our homes protect us from the elements but they also are vessels that contain a multitude of other issues, things that resonate with us on a deep and symbolic level; our homes become a physical manifestation of all our hopes and fears. In a multi-storey residential building that enjoys extensive glazing and panoramic views over London, our fears can be anything from a sense of vertigo as we stand next to full height windows and balconies, to feelings of being on show and concerns regards privacy.

Our use of monolithic GRC panels attempts to address these issues by offering reassurance and conveying a sense of solidity. Windows are set back 300mm within the GRC frame work thereby avoiding vertiginous views down the cliff face of the façade.



**Figure 18**

Broad GRC columns are suggestive of the structural stability of the building and can be seen from within the apartments. Windows are at times cradled and over sailed by the GRC to further emphasize the sense of containment and protection that we desire in our homes.

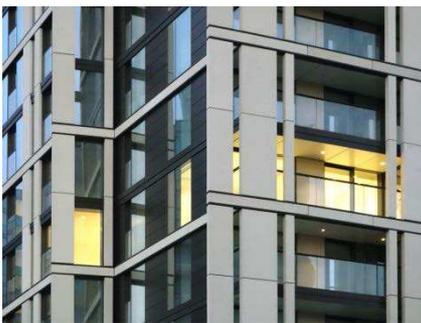
Balconies are also overlapped with wide planes of GRC to provide sheltered and private outdoor spaces.



**Figure 19**

In these instances the GRC is no longer a mere cladding panel that is viewed from the outside; the material becomes a familiar element that is experienced as an intrinsic part of the home and part of the tapestry that forms the panoramic views over London. Over time its proximity invites casual scrutiny and the intricacy of the detailing, its monolithic nature and the flicker of sunlight sparkling off the carefully selected aggregates all help to create a detailed visual memory of the building for the resident. The GRC material appears almost as if sitting patiently waiting to be appreciated in the same way that the subtlety of a brushstroke on a favourite painting may be discovered and savoured.

Inside and outside spaces are woven together with GRC panels flanking the balconies, providing shelter and privacy – in essence shaping and supporting the spaces and providing comfort to the residents within.



**Figures 20, 21 & 22**

The GRC is subtly elevated to play a vitally important and integrated role in defining the very nature of this building from the outside but also from the inside. The quality of finish and detailing was of course key to the success of this.

We collaborate with contractors and their suppliers to make the best use of their skills and abilities, delivering buildable details. Using models and mock-ups, we are able to refine our concepts, embracing their input and suggestions to deliver outstanding interiors that reinforce the spirit and character of the building as a whole.

Loveld worked tirelessly to explore how to achieve such a high quality of surface finish, tight construction tolerances and all with the use of complex folding moulds to create deceptively simple looking monolithic panels.



**Figure 23**

The success of the façade design is that it appears elegant and effortless which belies the complexity of the apartments it houses and the care that has been taken over the façade construction.



**Figure 24**

## **TECHNICAL SOLUTIONS / CONSIDERATIONS**

Loveld NV as GRC manufacturer worked in close cooperation with the Architect, the Developer and our direct client Permasteelisa who was the contractor for the entire façade works of this project. The GRC cladding on this project is designed as an open jointed rainscreen system fixed to a unitised curtain wall façade. Early on we were involved in producing samples and mock-ups to help the design team to better understand the possibilities of the material.

From the first meetings it was clear for us that the Architect and the developer wanted to push the possibilities of the material to its limits to create a building with a sense of solidity, where the GRC panels would read as monolithic stone like piers.



**Figure 25**

The total quantity of GRC cladding on this project is 5.700 square meters, of which 700 square meters are spandrels and 5.000 square meters are columns. The total amount of individual units on the project is 1.906 units of which approximately 30% consist out of 2 number off-site assembled pieces. Although the façade appears simple from the outside there were 380 different unit types required on the whole building. This implies that there is an average repetition of approximately 5 units on the project.



**Figure 26**

The GRC cladding on this project can be subdivided into 7 main types:

1. Single storey high columns, 3-sided finish with 3 different widths: 300mm, 800mm and 1200mm.
2. Single storey high columns, 4-sided finish with 3 different widths: 300mm, 800mm and 1200mm. These columns were installed in front of glazing or terraces and are also visible from inside the apartment or terrace.
3. Single storey high corner columns cantilevering out of the main façade, 800mm wide.
4. 2-storey high corner columns, 4-sided finish, 800mm wide
5. Ground floor column units
6. Slightly curved spandrel panels to be integrated into a unitised curtain wall unit.
7. Straight spandrel panels to be integrated into a unitised curtain wall unit.

The process of starting and developing the GRC system design was greatly influenced by the Architectural design intent and the developer's requirement of this building. The key requirements and their influence on the GRC design were the following:

1. The GRC face required a certain finesse from up close because the panels were visible and tactile from both ground floor and the terraces of the apartments. The aggregates/sand particles needed to be as large as possible and the desire from the design team was to have some natural sparkle in the face. Very early in the process various combinations of aggregates were tested and sample boards prepared to find an optimum mix for the face coat of this project. Finally a combination of aggregates made from crushed Jasberg granite and Cavaillon granite with natural mica sparkles, size 0-3mm created the right colour combination and stone like appearance, required for this project. A light grit blasting process after the panels were cured revealed the beauty of the aggregates.
2. The architectural design required the GRC panels to read as solid monolithic panels and not as thin 20mm GRC skin. It was therefore important to create thicker edges on all sides of the panels to give the material gravitas and strength of character. On the 4-sided columns, where a separate manufactured back plate was required, we developed a shadow gap detail to conceal the void and secondary structure inside the columns from views from the apartments. To further enhance the detailing and quality of the panels and to reduce damages to the edges, a 5mm radiused corner was adopted for the entire project and each and every edge.
3. The reveals on all column shapes were not square but 85-degree acute angles. To achieve the desired face quality on all sides of the columns we opted to use folding moulds in the production process.
4. At the ground floor the developer found it very important that the GRC columns were not only reading as monolithic panels but also, when touched or knocked by pedestrians, did not sound hollow, emphasizing again a sense of the structure of the building which is often concealed behind the GRC panels. Therefore most ground floor columns were concrete filled GRC sections to maintain the same visual appearance as on the upper floors and providing the solid and structural requirements.
5. One of the key architectural features on the building are the 2-storey modules which are emphasized by a unitised aluminium spandrel with an integrated horizontal GRC strip. This spandrel is repeated every 2 floors and has a 300mm deep anodized aluminium cill and soffit which is direct visible from the inside of the apartments. During the mock-up testing period it was found that leaching from the GRC would likely cause staining of the aluminium cills. To minimize the leaching from the GRC and therefore minimize staining of the aluminium cills a hydrophobic sealer was applied on the GRC face. This required a thorough research of available products and their influence on the staining of the aluminium. This was a process executed by Sandberg in the UK on behalf of Permasteelisa.
6. An important requirement of the Architectural specification for the GRC cladding was the replacement strategy, which had to allow for every individual GRC unit to be replaced at any time in the future without having to demolish the adjacent cladding.
7. The many terraces on the building required the design of an integrated rainwater system. The ideal solution was to keep this rainwater system on the outside of the envelope and to integrate it within the voids of the GRC columns. The spaces inside these panels is constrained and the coordination required was intricate.
8. On the main expressed corners of the building there was a requirement for cantilevering GRC units and 2-storey high freestanding GRC columns with concealed structural elements. The design of these units and the integration of structural steels and substantial fixing brackets within very the slender GRC columns was a real challenge.



**Figures 27 & 28**



**Figures 29, 30 & 31**

The key features of the eventual developed and adopted technical solutions for the GRC system of this project are the following:

1. For this project our company's desire from the outset was to investigate the use of sprayed premix instead of the traditional Hand spray. We worked closely with Smart Crosby, Powerspray and used also the expertise of Graham Gilbert to design and develop the technique for this project. Throughout the whole project a grade 10 sprayed premix has been used, which is an exception in the UK for these size of panels. To enhance the strength of the GRC and to provide an extra factor of safety for the deep reveals we have opted for the addition of a glass fibre reinforcing mesh. The advantages of a premix application method are a less complex production method and the realisation of a consistent quality and strength of the product; which is less dependent on the skill of the operatives. The premix design contains dry and graded silica sand, White Portland cement CEM 42.5 N, polymer and 13mm AR Glass fibre.
2. The use of galvanized sub frames was avoided for the majority of the project for reasons of durability. Due to the combination with the aluminium façade we opted to design and use an anodised aluminium sub-frame. These sub-frames enabled an easy solution for the distribution of the flex anchors with the GRC skin, the fixing of the integrated rainwater system and the main fixing of the GRC units back to the unitised curtain wall cladding. The use of the sub-frames allowed for the possibility to use the "grade 10 premix GRC" for this size of units. It also avoided the use of GRC reinforcing ribs which are always a concern for colour differences on the face. The use of flex anchors, in combination with the sub frames accommodates thermal movements of the GRC in relation to the backing structure which is a necessity for long term durability of

the GRC cladding. Only on the 2-storey high free standing columns were we required to use galvanised steel sub-frames to provide the structural integrity of these large panels. These galvanised steel frames were also powder coated to further extend the durability.

3. The main fixing back to the unitised curtain wall cladding were two aluminium plates bolted to the top of the sub-frame, which could be hooked on a standard Permasteelisa aluminium bracket, which reduced the fixing cost. At the bottom of the unit a spigot solution was adopted which was bolted to the top of the unit below. The fixing system allows the panels to move individually and also allows each panel to be replaced in the future if required.
4. All 4-sided column units consisted out of 2 GRC parts with each an aluminium sub-frame or on the smaller parts some sprayed in stainless steel brackets, which were pre-assembled off site together with the concealed integrated rainwater system. By pre-assembling these parts in factory conditions and with thorough quality control it was possible to minimise site works and to make the on-site installation more efficient.



**Figure 32.**

The adopted solutions and methods, together with a thorough focus on quality control during all stages of the manufacturing and installation process has resulted in a high quality, beautifully constructed and detailed envelope to the building, which appears effortless and simple.

The GRC elements provide the building with the solidity and the beauty of a natural stone based product seamlessly integrated and contrasting with the precisely manufactured bronze coloured curtain wall system.

To quote Alain de Botton:

***“Insofar as we appreciate order, it is when we perceive it as being accompanied by complexity, when we feel that a variety of elements has been brought to order—that windows, doors and other details have been knitted into a scheme that manages to be at once regular and intricate.”***

***...the truth of the maxim that beauty lies between the extremities of order and complexity.”***

This suggestion reads to us like a succinct summary for what we have striven to achieve at 3 Merchant Square.



**Figure 33.**

## **SUMMARY**

### **Residential façade – key facts**

- Large scale panels possible with GRC, giving the expressed frame a degree of prominence and an ability to act as a primary ordering device for the façade. Hinting at the grandness that is clear in buildings made of stone.
- The inherent flexibility of the material that allows for careful detailing to convey a sense of solidity and therefore high quality and the use of special folding moulds to achieve this
- GRC's ability to be incorporated into a unitised curtain walling system due to its light weight and strength. Use of composite panels with sub-frames. A prerequisite for efficiency of construction on taller buildings.
- Durability and longevity – it's mostly inert qualities that allow it to age gracefully
- Perception of being 'stone like' in appearance and therefore possessing many of the same desirable characteristics, cultural connotations that speak of quality, status and permanence
- Use of pre-mix to avoid the vagaries of operative skills and potential variations in appearance. Reduced risk of inconsistencies
- Use of hydrophobic sealer on the GRC to mitigate risk from leachates onto anodised aluminium adjacent to the panels
- Slenderness of panels and columns spanning 1 and 2 stories with integrated structural sub-frames
- Integration of rainwater drainage pipes form balconies, taking advantage of the hollow nature of the GRC panels to keep the drainage concealed yet outside of the weather line of the building.