The Material as a Stimulus for Designing Action: the GRC as a model in contemporary Iraqi practice

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Abstract. The architectural field has always represented an area where the potential of the materials that simulate the spirit of its time based on the architect designer’s understanding of these materials, their precise properties and their characteristics that influenced the making of creative architectural modules, the latest one known as GRC. The research problem specified as “The Lack of clear conception about what the GRC material is and its effect on the designing action both in its intellectual and applicable aspects in the development of the contemporary architecture”. The goal of the research is to define the aspects of the GRC and to bring into view their indicators and level of influence on contemporary architecture. The research defined its method of work by examining the concept of G.R.C and its practical applications in the global practice to build the theoretical frame then tests it on selected Iraqi samples. The research concludes that the local experiment proved the architect understands of the GRC conception and its applicable methods on developing contemporary designing methods aimed at renovation and to stay clear of stereotypical and traditional patterns especially those related to designing the facades but the influence was directed at most towards implementing the aesthetic considerations at the expense of functional and performance considerations.

1. Introduction
The responsibility of the contemporary architect is to blend in with the spirit of the age and the technical modern methods and to stay up-to-date with the latest that science has come up with in the field of architecture such as modern construction and coating materials tailored to the local architecture spirit without creating a huge gap between them, directed by his cultural, social, economic and environmental reality. And from this approach, the research focuses on what is known as GRC and its influence on the architectural design in general and on the local contemporary facades specifically. The architect does not miss the technological development and its influence on the architectural product in addition to the roles of these techniques in rejuvenating the methods of design taking into account all the other designing aspects especially in the architectural facades that reflect our modern architecture as a witness to our present in the future. The research defined its approach by extrapolation of GRC concept and its implementing applications on a global level showing the levels of its implementation and their effect on
the designing of the theoretical frame then test selected samples chosen from the local reality to reach results that produced a decline in the local experiment on certain levels so the research concludes that the local experiment has proven that the architectural understanding of the GRC concept as a method to rejuvenating facades and to deviate from stereotypical and traditional pattern As well as awareness of its executive methods related to the creating facades on the aesthetic level.

2. Investigation of construction materials used in architecture throughout their history

(Antoiades) considers construction materials as the meat and bone of architecture. After the industrial revolution, architects started to study the materials and organize them geometrically transforming the material from being merely a means of building into means of thinking and working together to allow the architects more capabilities because the material and its work techniques modify the architectural product and contribute in designing it in addition to other architectural considerations such as location, climate, time, traditions and personal taste of the one doing the work (Ahmad, 2001, p. 42), and so the Crystal palace a product of glass material and the development of glass permitted the innovation of environmental systems or what is known as “world class” or “transparent architecture” that are possible to build anywhere and under any climate (Michelle and Schodek, 2005) and the architectural shapes were freed after the innovation of the structural systems due to the materials characteristics such as colour, texture, performance so the architecture’s implementation and technical characteristics guides the innovative formation that coexist with the environment and with society and give the architect the feelings to express whatever he wants (Mahfood, 2014, p. 55).

It can be indicated that the materials represent stimuli for the designing act after the human interacts with it to show its potential and to show off his abilities in bringing out its characteristics for they help him in choosing certain patterns and ideas to create new Cosmetic formations to embody the form of external architecture and its internal space through construction capabilities for it is the separator between the inside and outside.

3. The designing capabilities of the contemporary building materials

The characteristics of construction material affects the formational, environmental, structural, expressional, philosophical, technical, implementation and design characteristics, many of the manufacturing companies around the world conduct studies about their modern products from different aspect and work on incorporating specialists from different fields in order to achieve their subjective goals as well as aesthetic, textural and sensational values related to color, feel, shine… etc. in regards to the formational characteristics, the formational flexibility of the modern materials is evident compared to the old and traditional materials, for the ease of working with these new products in terms of formational aspects, for they are known for their light weight, precise production, thin thickness and durability in construction, Represented by the possibilities of connectivity between the pieces of type and shape and each of the size, shape and form represent aspects that the accumulated human expertise has been subjected to, for they have a main role in the process of designing the materials and producing it in the architecture’s art field (Mahfood, 2014, p. 69). The relation to the structural capabilities represented by the material’s behavior to transfer weights directed at it and the amount of these weights, they force the architect to follow certain structural system and in relation to the implementation capabilities, the material’s characteristics are determined such as transport of material to the work site, assembly and construction methods, the number and precision of the workers responsible for using it, the architect has design methods by adhering to the dimensions and weight and the extent of cohesion and expansion and the effects of the weather and other factors (Shahbander, 2004, p. 58).

The issue of materials development and their programming by computers as a bridge between the architects and the rest of the engineers for the exchange of information and ideas, has contributed in the development of the designing solution, starting from the generation processes and ending with the finish, to the point where the designer’s role is to make decisions regarding the main axles that define the shape then unleashing the program to execute the computer operations that result in the final shape,
achieving the aesthetics of digital tectonic (Leach, 2004, p.37) after the digital design process or the technical design properties of the material became focused on real structural determines to re-create the shape in the architectural and engineering aspects and that led to the change in the role of the architect to become in control on the design process and to convert the architectural concept from being an act of (doing the thinking to thinking of doing) (Collett, 2013, p.93)

It can be indicated that the modern materials’ design capabilities are represented by the architect’s use of the material’s physical properties and their technical effects in a way that achieves the physical architecture’s characteristics (functional) and moral (aesthetic), and the change in the modern construction materials after the digital. the design module (modified module) represents the achievement result of the programmed characteristics of the materials (material’s act) then the designer will modify the module according to his Determinants and not a result of the designer’s development of a concept or a previous idea.

4. The effects of the construction materials on the architecture’s characteristics

The potential of the construction materials represented the middle knot in the Vitruvian Triad Virtues of Architecture (Function – construction – beauty) since the fact that architecture is “the scientific beauty to construct buildings” and the availability of height, durability, beauty and economic in addition to determining methods to address the lumps and architectural surfaces by integrating the impact of all design elements and to achieve a successful relation between the man and the architectural work, like providing light for seeing and its visual effect represented by the resulted visual impressions that are in alignment with function. (Khalaf, 2005, P.8). and after reaching what is known as smart materials resulted by the development of construction materials science, these materials’ characteristics became adjustable in a way that fits the design that the architect suggest, the smart materials will provide in the end the solutions to adapt the architectural designs to continue to meet the various performance demands on a larger and more effective scale. For example the photochromic materials that changes colour according to their exposure to the light, the brighter the light the more dark they became and vice versa, creating a colour balance that is easy on the human eye (Michelle & Schodek, 2005, P.13). The architectural formation and the arrangements resulted from the materials’ architectural formation in terms of colour and colour gradient, the texture and shapes and what is attached to the architectural shape such as symbols, meanings and implications that awakens emotions in him and cause him to admire and enjoy by just looking at it and make him think of the intellectual content of the architectural shape and its implications, for the materials help the architect in embodying his ideas and to achieve a connection with the receiver by bringing out the beauty effect of the modern construction materials’ potentials and to invest them into creating the expressive and phenotypic qualities of the shape by relying on their physical , visual, sound, touch and sometimes smell properties (Dibes & Zett, 2009, P.12) (Al Shareef, 2017, P. 48)

It is clear from what was previously stated that the construction materials in general and the contemporary materials in particular represent a fundamental pillar for enrich the design characteristics achieved for the architecture as a whole and for its ability to plot aesthetics and functional considerations according to the constructional material’s potentials and so, the problem of the research “The Lack of clear conception about what the GRC material is and its effect on the designing action both in its intellectual and applicable aspects in the development of the contemporary architecture” since the GRC material is one of the most prominent modern construction materials.

5. The GRC and its physical characteristics

In this section, the basic research hypothesis is The GRC is considered a revolution in the world of construction, design, manufacture and technology of modern structure and the go to for many designers. Scientists from the British construction Research Foundation invented the G.R.C and it abridgement for Glass fibre Reinforced Concrete and it’s a type of fibre that can be fused chemically in an Alkaline

1 https://grc2020.com/2009/11/05/76grc-reference-architecture-enterprise-data-architecture-framework/
medium, and so it can be used in reinforcing the cement medium and the concrete is called Glass fiber reinforced concrete or GFRP and is a unique construction material of great strength and ingenuity (Corning, 2011). The architectural GRC (for facades, walls, ornaments and art) is distinguished by a much higher flexibility factor that other raw materials that uses Polypropylene polyester fiber and can reach up to 10 times bigger and a tensile strength 3-4 times stronger than steel, in addition to the high Alkaline resistance through the use of zirconium dioxide in the forging of glass, that why GRC combines between compression strength with high emotional impact and fibers' tensile strength (Rajeshkumar, 2010, p. 26). In addition to it being a very hard material and is completely friction and breakage-resistant, it is pollution-resistant because of the ability to implement it with very smooth roofs and pose no harm to the health. It is a light material; GRC can be forged with thin sections from 6-12 mm to be much lighter than weight of the conventional stones similar to it in size. It is an easy material to make and form to produce shapes and minute details and give the desired texture for final surfaces with best quality. It is a practical material for the reproduction and restoration and is of high aesthetic quality and environmental friendly, reduces load on buildings and foundations can be colored with paints and dyes are can be treated just like cement surfaces. It is the realization of the most ambition designs for it offers many opportunities to create modern and futuristic designs and it represents the ideal solution for replicating the old features and to renovate within the renovation projects (Corning, 2011). The importance of GRC-made architectural products and elements are fully intertwined with their surroundings to form an integrated aesthetic unit. In addition to that, they are particularly resistant to unfavorable external factors, including low temperatures, sunlight and all forms of corrosion of concrete. They are ideal for use in modern industrial environments in both residential and urban areas.

It can be indicated that The GRC possess a variety of physical properties that can alternate between traditional, modern and futuristic and they achieve features that provide designers with opportunities to create architectural designs in addition to the technical properties such as durability and strength to enrich the architectural practice.

6. The GRC as a cover to embody modern architectural formations

The functional design of the external cover is linked to addressing a set of factors such as social factors (thinking method and beliefs) for the buildings facades to reflect the culture and beliefs of its inhabitants and environmental factors that determined the general formation of the façade represented by (distribution of openings and their dimensions, height and direction) for the GRC cover plates provide the appropriate lighting in addition to the aesthetics of light to improve the appearance of the building. The architectural designer must decide the GRC element in an early stage of the design to meet the performance requirements, for his choice of GRC is closely linked to the method of production and the style of determining the shape of GRC panels which are like an architectural skin, so he determines its structure for architectural application represented by (shape, thickness, size, pattern formation, installation method and its relation to the structure) (Mr Glyn, 2018, p. 32). The external cover reflects the environment and general climate through the harmony of the openings and their dimensions and the colors of the covers’ materials as well as the possibility of expressing the function of the building and the symbolic aspects (Khuzam, 2012, p. 47).

From an aesthetic aspect, the complete set of the natural and applied finishes combined with the freedom of design that the GRC panels permits, allows for diverse solutions that meets various architectural requirements that are recognized international specifications that were put forth and tested by the Glass fibre Reinforced Cement Association (GRCA) as the basis for all good designs. The RCMP design and installation is considered a very crucial matter for a long term service life and must be

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2 https://grcdelhincr.com/what-is-grc-meaning-in-construction/
3 https://grcdelhincr.com/what-is-grc-meaning-in-construction/
4 https://www.sukarart.com/%D8%A7%D9%84%D8%AE%D8%AF%D9%85%D8%A7%D8%AA/grp/
5 http://iraq-grc.com/our-products/grc-precast/
6 https://grcdelhincr.com/grc-cladding-panels/
supported by the use of specialized engineering practices. High aesthetic standards achievement that lies in the architectural facades that generates emotional relief due to surfaces, spaces, color spaces and the harmonized protuberances consisting with the cladding materials being used.

It is clear that the GRC facades combine both functional and aesthetic aspects to produce strong and modern buildings, has achieved and through their capabilities, various levels within the facades to reach a contemporary design. Some came on a visual level, other on an environmental-economic level (Sustainability) and other on an identity and local heritage level to satisfy the demand of various functional and aesthetic needs.

7. The G.R.C capabilities in the modern facades

7.1 First: Characteristics related to the architectural formation and external aesthetics

The GRC is considered a practical material for reproduction and restoration and has aesthetic qualities. Due to the ease of molding, manufacturing, tempering and production, it was possible to produce various shapes and fine details and with coloring and texture effects for the final surfaces and with best quality to achieve the finishing aesthetics. Since they are molded like a traditional concrete but perfect in terms of its materials, it was possible to create details and complex designs and architectural projects with a wide set of colors, shapes and Consistency (Morrison, 2010, p.7). It is possible to manufacture all marble designs and in all shapes and sizes and details and also the ability to form precise details in the external surfaces of the buildings to give an attractive architectural product because of its ability to produce certain architectural pattern (Mr Glyn, 2018, p.21). Thanks to its physical properties, the GRC is highly flexible in working and implementation of all designs especially the ones that contain Islamic geometric shapes or patterned motifs and all the exterior decorations that are somewhat heavy, like the type that used to make cornices, outer frames and decoration pillars of special design and also the windows and frames especially those that contain patterns or ornamental decorations that are very difficult to implement manually.

7.2 Second: Characteristics related to the structural aspects

Being light weight, it characterized by ease of transport and installation as well as its role in increasing the safety factors for large and huge structures due to light weight as it reduces loads on buildings with foundations and huge structures (Mr Glyn, 2018, p.21), although that GRC has a similar density of concrete, its weight is several times lighter due to the small thickness used from 10-15 mm to be weighing 40 - 50 kg / m2 compared to the use of concrete (Precast), which reaches 100 mm thickness to weigh 240 kg / m2, which is five times less weight and can be carried by hand as well as reducing loads on buildings contribute to significant reductions in the cost of foundations. GRC products can be formed with thin parts of 6-12 mm thickness to be considerably less than the weight of conventional pre-made concrete products (Benton) of similar size, and because of G.R.C resistant to rust where it does not contain any metal components (iron) as well as being a weak permeability compared to conventional concrete, it is not affected by UV rays significantly resist chemical conditions and hot dry, corrosion and freezing for this it is suitable for all conditions as well as being stable material for long periods under dry conditions and does not lose its strength in wet conditions for long periods under dry conditions and does not lose its strength in wet conditions, for the stability of its characteristics such as the final curvature and tensile strength, which makes it responsive to design pressures (Mr Glyn, 2018, p.31).

7.3 Third: Features related to sustainability considerations (environmental-economic):

7 http://www.bcmgrc.co.uk/architectural-grc/
8 http://iraq-grc.com/our-products/grc-precast/
9 https://www.moqawelservice.com/single
10 http://iraq-grc.com/our-products/grc-precast/
11 https://deskgram.net/explore/tags
GRC materials are the same as environmental materials, glass elements are reclaimed or recycled materials and GRC contains materials taken from the soil that have no negative impact on the environment, but it consumes volatile ash and plant emissions as (pozzolans) and waste for recycling (Morrison, 2010, p.7) (Vahidi, 2010, p.6). GRC today contributes to the realization of green architecture and is known as (GRCi system), although GRC is not in green colour because of the high proportion of cement, which is a dense material and has high emissions of carbon dioxide, and cement kilns are a source of toxic mercury emissions, but G.R.C has been improved by careful selection of raw materials, appropriate design and more advanced production techniques to justify it as a building material in green color. GRC is a low material in structural and basic costs with low maintenance, good chemical resistance, corrosion resistance and carbonization due to the lack of mild steel in it, it has high sound absorption capacity and the dispersion of its falling waves which is why it possesses the characteristics of sound insulation as well as its quality in thermal insulation (Mr Glyn, 2018, p.21-p.24), as well as being a sustainable material in its nature and environmentally friendly as it reduces the harmful environmental effects of its advantages in all stages: In the pre-manufacturing stage: the natural raw materials available in most countries of the world (pure sand, cement and potable water) are the basis of making CRG, in the manufacturing stage: reinforcing steel is used completely and consumes only 20% of cement and sand used in traditional buildings which means eliminating the of CO2 emitted from the manufacture of iron and reducing the effect of percentage CO2 emitted by cement manufacturing by 80%, besides the fiber that used has no harm to human health, which the fiber that used in the manufacture of system C.R.G-i has a thickness of 14 microns while the fiber that harm to human health has a thickness of 3 microns which makes it non-inhalable during manufacturing process, as for the installation stage: it does not produce waste because there are no raw materials mixed or poured, besides there is no need for paint to complete the work in the sites which reduces the proportion of CO2 emissions by 90% of the concrete ready because of the light weight of walls manufactured from the system C.R.G-i which is why it reduces fuel consumption during the process of transportation and installation. And by reaching to the stage of using the building: it's a non-flammable material and does not result in toxic fumes contribute to the reduction of the proportion of CO2 and its shelf life is long-term due to their non-shrinking and non-stretching characteristics and because it contains fiber glass instead of iron and this reduces of repairing, replacing and repainting processes beside of being an anti-insect and rodent where it uses as a substitute for timber which contributes to the reduction of emissions of toxic pesticides, thanks to G.R.C for manufacturing a product at an economical cost since maintenance requirements are low (Dent & Shen, 2014, p.10) and

It can be indicated that the continuous features of GRC from the pre-manufacturing stage to the stage of completion the implementation and using the building and for the achieved architecture by provided a set of features including the design associated with the formation and architectural composition including construction to convert designs into a building and sustainability associated with achieving a successful relationship between the achieved building and its surroundings.

8. Applied capabilities of the interfaces of G.R.C in the architectural experiences globally and Arabic

8.1 Employment of G.R.C to achieve functional and symbolic considerations:
The architectural designer employed the material in the renovation of the mosque (THE ALTUNIZADE MOSQUE), and the length of the panels reached 8 m by employing a modern concept of architecture as the modern lines of the mosque are designed to prepare a special template for the units that used in the minarets characterized by a special scheme to be employed as sun cover in the section of balconies and enriched the facade of the building through fibro-light sun screens came with symbolic specificity as a

12 bttps: www.concreenetwok corn GFRC
cladding at the main entrance as well as performing the functional aspect by crossing the light to the chapel\textsuperscript{13} as shown (Figure 1).

The effect of GRC material was reflected in the design act by modifying the design of the mosque that enhanced the environmental functional aspect in the plan of the mosque as well as enriching the symbolic aspect in the facades of the mosque block and its external mass as a whole.

8.2 Employed G.R.C for achieve sustainability:
The International Center in Iran (INTERNATIONAL PUBLIC GATHERINGS CENTER, ISFAHAN, IRAN) project is based on the main constituents of GRC material represented by natural earth oxides which are used in cement and fiberglass industry to reduce the environmental impact as they are not considered as pollutants as well as low GRC weight compared to steel despite it performs the same function\textsuperscript{14} as shown (Figure 2).

The effect of G.R.C in the design act was reflected in a sustainable way by enhancing the economic aspect by adopting natural resources as well as achieving a positive relationship with the environment by reducing the level of pollution.

8.3 Employed G.R.C in the revival of heritage:
In London, the (CREDIT LYONNAIS CANNON) project relied on the G.R.C panels for recognition of English heritage and the building was placed second on the list of Victorian English heritage because of its stylistic Victorian associations. The light weight of the GRC panels with a hollow section enabled the architect to slide the walls out and still remains a historic building with English heritage\textsuperscript{15} as illustrated (Figure 3).

The effect of GRC was reflected in the design act by modifying the cover of the design model according to the Victorian heritage determinants as well as enhancing the functional and environmental aspect of being a two-tier as well as structural and aesthetic aspects.

8.4 Employed G.R.C to achieve identity and local character:
The GRC material was employed for a variety of considerations in Masdar City Sustainable a self-shading facade has been developed using a series of techniques to determine the final shape of the building. Its curved shapes came with oblique views directed down narrow streets in order to deal with the desert environment while maintaining privacy by developing "Mashrabiya patterns" as a screen and avoiding monotony by casting the possibilities of GRC with elements and plates thickness of 25 to 30 mm, which developed an architectural style that contributed to the modern interpretation of the traditional Mashrabiya to creativity "Mashrabiya screen" as a kind of windows that provide lighting, shadow and privacy and reflect the Arab Islamic identity (Palmer,2011) as shown (Figure 4).

The effect of GRC was reflected in the design act by modifying the cover of the design model according to the determinants of identity and environmental specificity of the Arab Islamic region as well as aesthetic aspects.

\textsuperscript{13} https://grca.org.uk/grc-projects/altunizade-mosque.php
\textsuperscript{14} https://www.grca.org.uk/grc-and-the-environment.php
\textsuperscript{15} https://grca.org.uk/grc-projects.
It turns out that the impact of the reflection of the material in the design act in a comprehensive starting from the stages of the generation of architectural forms to their interfaces achieved mass and composition as a whole through the creation of systems leather and covering included detailed considerations of the casing and what has achieved the external body and internal spaces with the fulfillment of various considerations (job-creation-beauty) as GRC provided high flexibility in innovation Contemporary designs which have been modified according to the architect's specification have been pushed into the material to achieve the final model and then implemented in high quality in reality, and organized in the theoretical framework (Table 1).

| Table 1. Employment of GRC in Design Act (Researchers) |
|--------------------------------------------------------|
| indicators                                             |
| Generating stage | Generate external shape | developing a traditional pattern as a cladding of panels reaching to a new pattern. - developing a structure that achieves a new shape - creating a cover of two or more layers that ends in a new shape |
| Physical properties | panels shape | Superficial - Polygon - Organic |
| | panels thickness | thick - Thin - very thin |
| | panels weight | Heavy - light - very light |
| Implementation stage | Production of design models | Insulation of panels - panels coupled with structures - overlapping series |
| Realized operational relationship | Independence-coupling-overlap within a single unit |
| Architectural composition - architectural style or pattern |
| Design capabilities achieved by modifying design models | Simplicity - complexity | Sustainability potential | Construction potential | Aesthetic potential | Expressive potential | Symbolic potential |
|-------------------------------------------------------|-------------------------|--------------------------|------------------------|-------------------|------------------|------------------|
| Design capabilities achieved by modifying design models | Simplicity - complexity | Sustainability potential | Construction potential | Aesthetic potential | Expressive potential | Symbolic potential |
| Formalism potential (Appearance) | composition aesthetics | Solidity - transparency | Unification - Diversification | Structural potential | Achieving interfaces or interior spaces | Achieving Environmental potential |
| Functional potential | structural potential | simplicity - complexity | solidity - transparency | Unification - Diversification | colour - one | Texture - Smooth - rough |
| Sustainable potential | Environmental | Achieving an appropriate level of illumination according to effectiveness - achieving acoustic insulation - achieving thermal insulation | Economic | Reduce the costs | Energy Saving - Easy implementation and maintenance - Recycling |
| Social | Repeat traditional features | Resistance to climatic conditions - reduction of pollution level - fire resistance | Reduce the amount of reinforcement - reduce heavy structural frames | Repeat traditional features | Elements - Embossed motifs - exterior decorations - cornices - external frames - columns - window frames and windows |
| Construction potential | Reduce the amount of reinforcement - reduce heavy structural frames | Achieved - not achieved | Achieved - not achieved | Achieved - not achieved | Achieved - not achieved | Achieved - not achieved |
| Aesthetic potential | Tectonic | Traditional - not traditional | Achieved - not achieved | Achieved - not achieved | Achieved - not achieved | Achieved - not achieved |
| Expressive potential | Producing visual elements | Subjective - objective | Achieved - not achieved | Achieved - not achieved | Achieved - not achieved | Achieved - not achieved |
| Symbolic potential | Production of historical features | Achieved - not Achieved | Achieved - not achieved | Achieved - not achieved | Achieved - not achieved | Achieved - not achieved |
| Highlight the elements of identity | Highlight local privacy | conservatism - restoration | conservatism - restoration | conservatism - restoration | conservatism - restoration | conservatism - restoration |
9. Applied side:

The application focuses on the analysis of models of the interfaces of GRC in Iraqi architectural experiments in different geographical areas of the sections of Iraq represented by the capital Baghdad and Najaf, for the sake of higher credibility and comprehensive conclusions at the local level as shown in (Figure 5)

9.1 First: The building of the Endoscopic surgery hospital in Najaf
The five-storey building is located in Najaf and has recently been completed and is still in use. GRC panels have been adopted as a building finish designed and as a contemporary architectural style to renew Islamic decoration as a local heritage in line with privacy and to emphasize the local identity of religious conservatism and to avoid imitation and copying. The architect developed an architectural style to renew the pattern of Islamic decoration and produce a contemporary style.

9.2 Second: Commercial building Karrada Street 62 in Baghdad
The building dates back to the eighties of the last century and the designer aspired to renovate in 2018 due to the commercial importance of the site and consists of three phases and adopted GRC panels to renovate its architectural facades and achieve the style. The street is of significance within the capital Baghdad locally called restaurants Street which included the construction of many restaurant buildings to show a contemporary identity and the renovation of the building came as a facade by the adoption of the designer GRC slabs which took an unusual pictorial pattern but retained the symbolism of the local facades represented by the Baghdadi arch to come out with a block that communicates with The architectural identity on the one hand emphasizes the individuality of the designer by creating a new style.

9.3 Third commercial building on 42nd Street in Baghdad:
GRC panels are designed with the conditions of providing natural lighting and ventilation and pass to the original openings of the upper floors of the building taking into account the levels and height of the opening and its proportion to the hardness in line with the commercial context of the street. The installation was done by the work of an iron frame installed on the previous facade and adjusts the joints between the panels leaving a space for thermal expansion.

9.4 Fourth: a residential building in Palestine Street behind Al Nakheel Mall in Baghdad
The building represents a luxurious two-storey residential house that is still under construction, the GRC panels are designed to highlight luxury as a prominent figure providing privacy for the dwelling in line with the residential context and local identity by updating Mashrabiya as a private residential building to provide privacy as well as functional considerations to provide light and natural ventilation with modernizing the Islamic style of Mashrabiya, as well as providing panels to update the elements. The architectural heritage is represented by the Islamic arch, friezes and columns with contemporary tangible influences.
10. Method of measurement
For the indicators of the first item and for the purpose of arriving at the values, an analytical description of the samples was adopted, as the items are related to the physical properties of GRC. Research depends on the extent of verification of the indicator. For measuring the values of the indicators of the second item in the table which relates to the recipient, a questionnaire was conducted and distributed by 50 forms on a specialized sample represented by the architects of the academic field and professional practice. As shown in Table 2 which include values of indicators as follow:
0=non inquiring value, 1=min. inquiring, 2=med inquiring, 3=max. Inquiring, as shown in (Table 2)

11. The results of inquiry
The results showed that the local experience has declined at certain levels and not at other levels, both on Creating contemporary design models & Design capabilities achieved by modifying design models indicators. The research depend on frequency of indicators as Statistical method which show ratios of inquiry as show in (Chart 1), (Chart 2)
### Table 2. Employment of GRC in Design Act (Researchers)

| indicators | Sample 1 | Sample 2 | Sample 3 | Sample 4 |
|------------|----------|----------|----------|----------|
| **Creating contemporary design models** | | | | |
| Generation stage | Generate external shape | developing a traditional pattern as a cladding of panels reaching to a new pattern. - developing a structure that achieves a new shape - creating a cover of two or more layers that ends in a new shape | 1 | 3 | 1 | 1 |
| | Physical properties | | | | |
| | panels shape | Superficial - Polygon - Organic | 1 | 2 | 1 | 1 |
| | panels thickness | thick - Thin - very thin | 3 | 1 | 2 | 3 |
| | panels Weight | Heavy - light - very light | 3 | 1 | 2 | 3 |
| | panels size | For one or two floors - multiple floors | 2 | 2 | 1 | 1 |
| **Implementation stage** | Production of design models | | | | |
| | Insulation of panels - panels coupled with structures - overlapping series | | | | |
| | Realized operational relationship | Independence-coupling-overlap within a single unit | 2 | 3 | 2 | 2 |
| **Formalism potential (Appearance)** | Architectural composition - architectural style or pattern | 2 | 1 | 2 | 2 |
| | composition aesthetics | Simplicity - complexity | 2 | 2 | 2 | 1 |
| | | solidity - transparency | 2 | 1 | 2 | 1 |
| | Unification - Diversification colour | One - more than one | 1 | 1 | 1 | 1 |
| | Texture | Smooth - rough | 1 | 1 | 1 | 1 |
| **Functional potential** | achieving - not achieved | 2 | 2 | 2 | 2 |
| | achieving - not achieved | 2 | 1 | 2 | 2 |
| **Environmental** | Achieving an appropriate level of illumination according to effectiveness - achieving acoustic insulation - achieving thermal insulation | 1 | 3 | 1 | 3 |
| Design Models                      | Sustainable Potential                      | Energy Saving                  | Easy implementation and maintenance | Recycling |
|-----------------------------------|-------------------------------------------|--------------------------------|--------------------------------------|------------|
|                                   | Economic                                  | Reduce the costs               |                                      |            |
|                                   | Social                                    | Repeat traditional features    | Elements                            |            |
|                                   | safety and security potential             | Resistance to climatic conditions - reduction of pollution level - fire resistance | 1 1 1 1 123 |            |
|                                   | Constructive potential                    | Reduce the amount of reinforcement - reduce heavy structural frames | 1 1 1 2 |            |
|                                   | Aesthetic potential                       | Tectonic                       | Traditional - not traditional        | 1 2 2 1 |            |
|                                   | Expressive potential                      | Producing visual elements      | Subjective - objective               | 2 1 2 2 |            |
|                                   | Symbolic potential                        | Production of historical features | Achieved - not Achieved              | 2 0 2 2 |            |
|                                   |                                           | Highlight the elements of identity | conservatism - restoration           | 2 0 2 2 |            |
|                                   |                                           | Highlight local privacy         | conservatism - restoration           | 2 0 2 2 |            |
|                                   |                                           | Heritage revival               | conservatism - restoration           | 2 0 2 2 |            |
Chart 1. Analyses of Creating contemporary design models (researchers)

Chart 2. Analyses of Design capabilities achieved by modifying design models (researchers)
12. Conclusions:
A. The materials are catalysts of the design act after the interaction of man with it to show its potential and energies by showing its characteristics as it helps him to take certain patterns and ideas to create new formal configurations to embody the external architecture and internal spaces through the possibilities of construction as the separation between the inside and outside.
B. The design model under contemporary construction materials is a "modified model" and represents an achievement result of the properties of programmed materials (material act), which enabled the architect to use the physical properties of the material and its technical effects, including the characteristics of physical architecture (functional) and moral (aesthetic).
C. The construction materials in general and contemporary ones in particular, especially G.R.C material is an essential pillar to enrich the design characteristics achieved for the architecture as a whole because it has a variety of physical properties that enable it to move between traditional and new and future in addition to its ability to crochet the functional and aesthetic considerations according to the possibilities of the construction material, achieving advantages give designers opportunities to create architectural designs as well as technical characteristics such as rigidity and durability to enrich the architectural practice.
D. The impact of G.R.C in the design act is comprehensive, from the stages of generating architectural forms to the interfaces achieved mass and composition as a whole, through the creation of systems, leather and cover included detailed considerations of the envelope and what has achieved the external body and internal spaces with the fulfillment of various considerations (job-creation-beauty) The G.R.C material allowed high flexibility in the creation of contemporary designs, which were modified according to the architect's specifications.
E. the GRC facades combine functionality and aesthetics to produce solid and modern buildings that have achieved, through their capabilities, various levels within the facades to reach a contemporary design. The impact of GRC in the design act has been reflected in several levels, some of which are on the plastic level and the other on the environmental-economic level (sustainability). Successful between the achieved architecture and its surroundings and enhance the economic aspect by adopting the natural resources as well as achieving a positive relationship with the environment by reducing the level of pollution. The other is at the level of local identity and heritage to meet various functional and aesthetic needs as well as enrich the symbolic aspect.
F. The research concluded that the local experience proved the architectural awareness of the concept of G.R.C and its executive methods for the development of contemporary design methods aimed at renewal and away from stereotypes and tradition, especially associated with the design of facades, but the impact is mostly directed towards the activation of aesthetic considerations at the expense of functional and performance considerations.

13. Recommendations
A. Renewal and a departure from stereotypes and imitation within the local experience can be through the adoption of design methods that focus on the capabilities of the material at the comprehensive, intellectual and detailed level of architectural design.
B. Digging deeper into understanding the potential of GRC as a contemporary material possesses considerations that are not limited to the aesthetic aspect but also include considerations related to the functional and performance aspect.
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