



Architectural Design Process: A Technical Review of a Five Bedroom Duplex Designed for a Client in Anambra State, Nigeria

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ABSTRACT: Architects play a critical role in combating climate change by designing energy-efficient, sustainable buildings that reduce carbon emissions and promote the use of renewable energy sources, which makes technical review essential for any architectural design. However, Players in the building industry have over the years found it unnecessary to review the processes they encountered during the pre-contract, contract and post contract stages of their projects. Some of reasons that has led to this pitfall include; ignorance, unwillingness, and financial incapacity of stakeholders in the industry as regards the need for a review as well as the leadership lapses in the part of the architect to properly coordinate the design team and produce all necessary deliverables required in a project. Hence, this paper provides a technical review on a five bedroom duplex designed for a client in Anambra State, Nigeria encapsulated in the comprehensive report on the architectural design for the project which was carried out by the integrated approach in resolving design issues and challenges laden with the provision of recommendations that will shape future occurrences of such challenges at every stage of the design process. More so, a comprehensive rundown of all the deliverables encountered in the brief taking, concept development, design development, budget estimate, construction documentation stages, specification writing and tendering in this selected project. On a final note, this review will bring to the conscious mind of the players in building industry to always ensure a complete documentation of all building design deliverables tailored towards improving project execution and future designs.

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A technical review can be used to improve product reliability during New Product Introduction (NPI) (Araujo EB, 2021). Architects need to foresee potential defects and recommend actions to eliminate or mitigate them, including what tests need to be carried out, as well as actions to evaluate building projects, architectural design processes, and specifications. The early identification of potential defects and matching appropriate actions to address them will improve contract administration, project delivery and reduce wastages / costs associated with design of buildings (Araujo EB, 2021).The

performance of every project is subject to the processes undertaken in carrying out the architectural design stages. This paper reviews the architectural design process for a residential development (A Five Bedroom Duplex) located at Aguleri, Anambra East in Nigeria for a particular client. The physical development is a duplex on one suspended floor creatively arranged to accommodate 3 bedrooms (including the guest bedroom) a sizeable lounge, dining, spacious kitchen, portable laundry with other ancillary spaces on the ground floor while the first floor contains two spacious deluxe bedrooms, one

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family study room and a private lounge. The audience of this technical review constitutes policy makers, city officials, and home builders who wish to build or renovate building facilities. The case study is a simple, functional building design with a unique architectural character for a family size of 4, and the objective of this paper is to review the architectural design process of the case study - a five bedroom duplex designed for a client in Anambra State, Nigeria.

cognizance of that a day slated to take the brief from the client. During the Brief taking process a harmonized brief was developed by the architect based on discussions with the Client. After the design brief, the architect drew out plans to visit the proposed site location for (preliminary) survey and feasibility studies.

Inception: On the 28th of November, 2017, the architect was commissioned by the client to design a building for him. After discussing with the client, the design brief was taken on the 30th November, 2017 by the architect giving rise to the commencement of the design process. On the 30th, November 2017 the client was able to bring all necessary documentations requested by the architect such as an Engagement letter and Survey plan for the commencement of the design process.

Report on Preliminary Survey and Feasibility Studies: As required of the project, the architect left to Anambra for this purpose. In the proposed site location, the architect confirmed the beacon numbers as indicated on the survey plan as well as the area / parameter of the proposed site area. The site was further analysed taking cognizance of the orientation, surface soil conditions, topography, drainage, adjoining properties, and right of way. More so, this review process also captures deductions of the architect’s engagement with the building regulation authority within the Anambra East Local Government Area to find out their planning and building regulations/ ordinances.

Brief taking

Briefing Process: Design briefs affect the creativity of design outcomes (Nilanjan, R et al, 2019). Taking



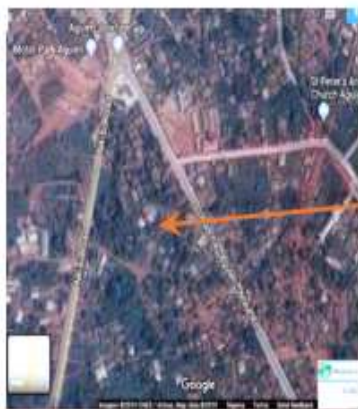
Map of The World Locating Africa



Map of Africa Locating Nigeria



Map of Nigeria Locating Anambra State



Aguleri Map Showing the Location Of The 5 Bedroom Duplex



Map of Anambra East Locating Aguleri



Map of Anambra State Locating Anambra East

Fig. 1: Maps showing flow to project location

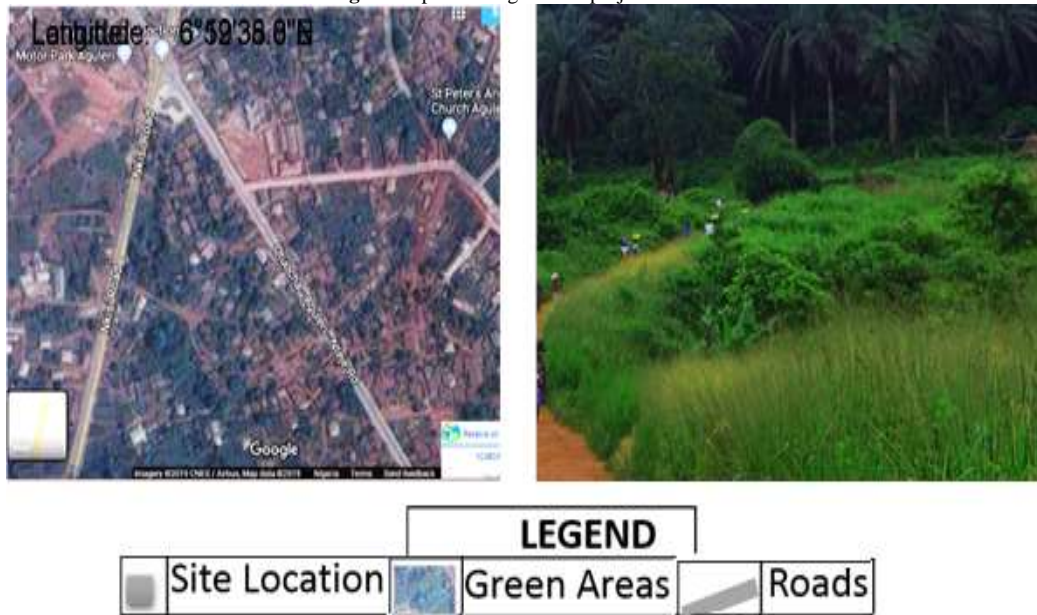


Fig. 2: Google map and photograph of the proposed site area and location

Deductions: - Studies from the preliminary visit to the building site shows that there is no restriction on the building height within that zone.- Minimum setbacks for the sides of the building is 2metres while for the rear of the building should be a minimum of 3metres and that of the forecourt is minimum of 5metres.

Project scope: Design (Stage 1, 2); Tendering and Award of Contract

Spatial requirement:

Ground Floor:

- Family lounge - Dining - Kitchen - Bedrooms (3)
- Store -Laundry - Entrance Porch/ Sit-out

First Floor: Private lounge -Dining - Bedrooms (2) - Balconies (2); Study room - Conveniences

Consultants Required: Architect; Quantity Surveyor; Structural engineer; Mechanical engineer; Electrical engineer

Concept Design

Project concept design: To respond to and translate the desires of the client into a functional mass, the client signed off for the development of the design concept for the proposed five (5) bedroom duplex. On the floor plan a simple, free-flowing design that will allow comfort of all the users in the provided spaces was evolved ensuring privacy of the main occupants of the building.

Site Planning Relationships:

Site Components: - Gate House – Parking; - Main building - On-site facilities
 Linear Relationships:



Fig. 3: The relationship between the site components

For the facade: All the sides of the building was designed to portray a stable and unique architectural character majorly composed of vertical elements such as columns.To move to the next stage (design stage) the building concepts were signed off by the client having met his requirements.

How a concept design sign off process should have been carried out to improve the process:

-Prior to the concept development, a Request For more Information (RFIs) should be given to the client to get more details about a proposed project.

- In lieu of using computer aided sketches which can still be printed out for proper sign-off, the use of freehand sketches should be greatly used to communicate with the client at this stage.

Table 1: Space requirements on the ground floor

| S/N | Spaces Provided | Unit | Average Area (M ²) |
|-----|----------------------|------|--------------------------------|
| 1 | Entrance Porch | 1 | 15.00 |
| 2 | Lounge | 1 | 24.30 |
| 3 | Dining | 1 | 15.60 |
| 4 | Bedroom | 3 | 10.90 |
| 5 | Verandah / Sit - out | 2 | 4.80 |
| 6 | Kitchen | 1 | 9.70 |
| 7 | Store | 1 | 2.50 |
| 8 | Laundry | 1 | 5.00 |
| 9 | Conveniences | 3 | 2.90 |
| 10 | Stair hall / Lobby | 1 | 26.00 |
| | TOTAL | 16 | 116.7 |

Table 2: Space requirements on the first floor

| S/N | Spaces Provided | Unit | Average Area (M ²) |
|-----|-----------------------|------|--------------------------------|
| 1 | Balconies | 2 | 5.50 |
| 2 | Lounge | 1 | 40.90 |
| 3 | Dining | 1 | 10.60 |
| 4 | Bedroom #4 (Madam's) | 1 | 14.90 |
| 5 | Bedroom #5 (Master's) | 1 | 19.50 |
| 6 | Family Study Room | 1 | 19.80 |
| 7 | Conveniences | 3 | 3.70 |
| 8 | Stair hall / Lobby | 1 | 26.00 |
| | TOTAL | 11 | 140.9 |

Consultants Selection and Coordination

Process for appointing consultants for this project and client involvement: In line with the conditions of engagement that the client should appoint the consultants based on the architect's recommendations. The electrical, mechanical and structural engineers consulted and selected by the architect were approved by the client.

How a proper process of appointing of consultants should be done:- Prior before this stage, the client should be pre-informed of the role of the architect to recommend and engage competent and diligent consultants for the client's approval. This will facilitate a better coordination between the architect and other selected consultants.

Design Development

Design Development Process: This stage saw the light after the client approved the concept development stage. In developing the design, the required design considerations to address the corresponding design

issues emanating from the concept stage were noted and harmonized to evolve a functional design. However, allowing inputs from the selected consultants stimulated a compact and holistic design whose aesthetics is made evident on the four vertical principal views of the building. One of the key considerations in the design of this building project is ventilation (Kim H, 2016) owing to the increasing temperature in the tropical climate. More so, the different consultants also brought their different designs which were presented to the client by the architect after perusal and modifications were made necessary.

How developed design was agreed with Client: The design stage was broken down into stages based on the components that constitute the building design. The client was made to understand the flow and interaction of the components of building site. More so, the floor plan design was physically related to the client and approved with minor modification. In conclusion, the façade designs and the three dimensional views of the proposed building was completed and described for the client with emphasis on the idea of ensuring that all the elevations of the building are characterized by appealing architectural character. All designs in this stage was done using ArchiCAD – version 18 and rendered with Atlantis studio - version 7. To conclude this stage the exterior perspectives of the building design were modeled and rendered in different views capturing the landscape and other constituting features with was signed off by the client to give way for the next stage which is the Architectural design stage II.

How a developed design sign off process should have been carried out to improve the process:

- In a scenario whereby the client is not conversant with interpretation of spaces sizes and organization among other drawings, the architect is expected to push further to aid the client in the having a convincing experience and understanding of his proposed project by using instruments or means such as; Building Information Modeling (BIM), Animation / Motion works, Print media, Mock-ups, Presentation modules, and Physical demonstration. This will further foster the smooth running of the architectural design stage.

- Developed design should be better relayed to the client in the best form of graphic language for clarity and to ensure well informed decisions by the client.



Fig. 4: Exterior and Interior Perspectives Generated During the Design Development Stage

Specification Writing:

A technical review should provide recommendations and discusses possible methods for improving specifications' usability in design and execution of built environment projects (Ahmed *et al.*, 2023).

How the specification was agreed with client:

Specifications for this project were in the form of Performance Specifications, and was accepted by the client after acquainting him with composite building materials, methods of construction. The specifications for this project was structured according to work packages mirroring the separation of the works into sections; 1. General requirements 2. Site preparation 3. Concrete construction 4. Timber construction 5. Block construction 6. Roofing 7. Doors and windows 8. Cladding and lining 9. Suspended ceilings 10. Rendering and plastering 11. Joinery and fixtures 12. Tiling 13. Painting 14. Floor coverings 15. Plumbing and drainage 16. Electrical installations 17. Mechanical installations 18. Fences 19. Paving 20. Landscape 21. Referenced standards 22. Acts, regulations, authorities and codes 23. Schedules. For the purpose of this paper a summarized portions of section 1 to 3 was discussed below.

General Requirements: Compatibility of Materials

Ensure materials which are used are compatible with all other materials which may be affected.

Making Good

Repair any damages caused during the execution of the works. Leave the works and the site of the works in a neat and clean state on completion of the works.

Site Preparation: Dust protection

Provide dust-proof screens, bulkheads and covers to protect existing finishes and the immediate environment from dust and debris.

Tree Protection

Protect from damage all trees which are required to remain. Do not remove topsoil from the area within the drip line of the trees and keep this area free of construction material and debris.

Concrete: Twice as much concrete is used in construction as all other building materials combined. Nevertheless, with such mass use of the material, drawing out any limitation of concrete or reinforced concrete will be of public concern particularly from the safety perspective (Colin RG, 2014). This key factor led to the detailed specification writing on the composition, mixture, batching, transporting, placement, vibration, and curing of concrete as partly summarized below.

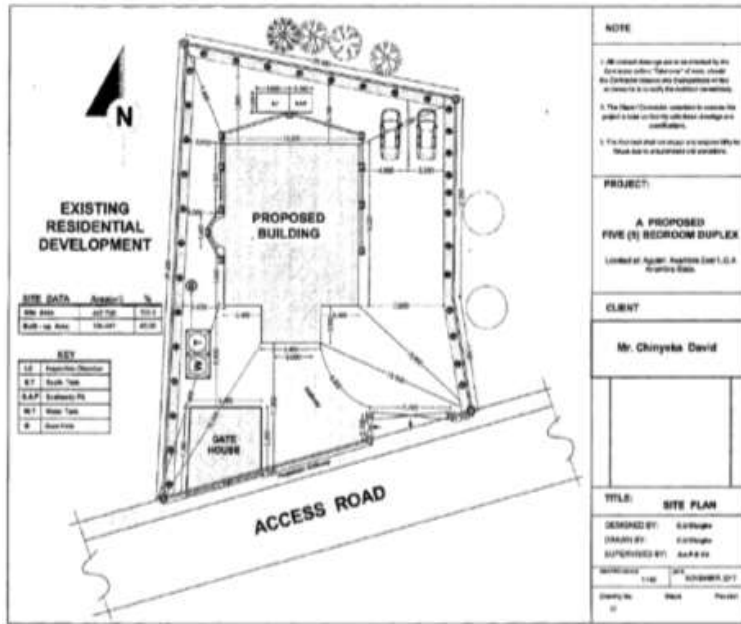


Fig. 5: Site plan of Case study

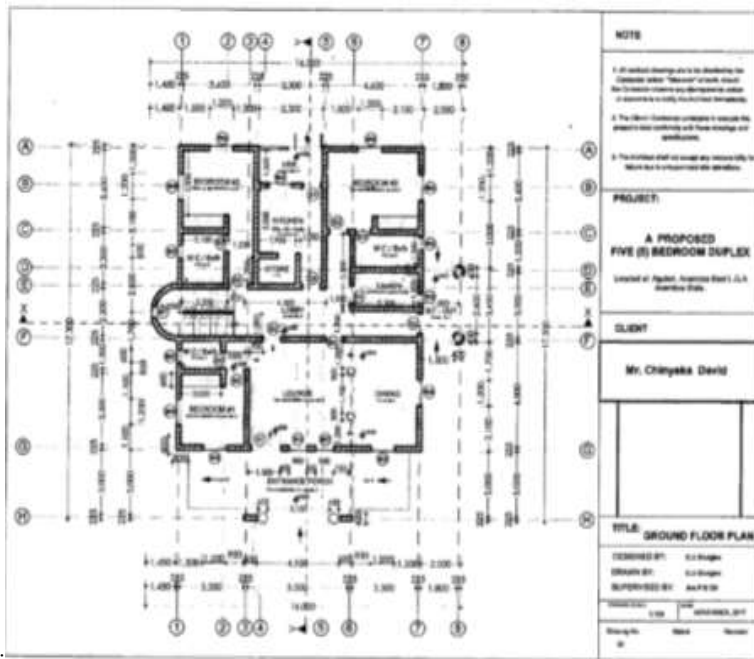


Fig. 6: Ground floor plan of Case study

Compaction: Vibrate concrete to remove entrapped air. **Vibrators:** Do not allow vibrators to contact set concrete, reinforcement or items including pipes and conduits embedded in concrete. Do not use vibrators to move concrete along the formwork. Avoid causing segregation by over-vibration in line with BS 1881-116 (1983).

Construction joints

Joint preparation: Roughen and clean the hardened concrete joint surface, remove loose or soft material, free water, foreign matter and

laitance. Dampen the surface before placing the fresh concrete and coat with a neat cement slurry.

Challenges arising from lack of proper sign-off of design specification and how they were addressed: Incessant inputs from the Client. Intermittently, the client was engaged on the contents of the specifications to ensure comprehensive acquaintance of the project deliverables at this stage.

How it was addressed: After effecting all necessary modifications, a day was fixed when all inputs from the design team was fine-tuned leading to the adoption of the specifications for the proposed project.

Processes that will improve specification writing: - The architect is expected to be abreast of the nature, qualities, make-up, value and cost of any material / method of construction to be adopted. This should be done in line with current market trends, standard and applicable regulations. Also, to reduce the degree of discrepancies in the specification - sample, shop drawings, product / material schedule, installation / assembly drawings, and graphics should be made available to the client to ensure he understands, peruses and confirms all specified items.

Budget Estimates: Development of preliminary budgets: Having developed the design and details, the client demanded to know the bills of the quantities specified in the drawings. This was prepared by the quantity surveyor and checked by the architect to ensure the project is not over-run. At the end of the cost evaluation process, a cost estimate for the proposed project was communicated to the client into stages based on the proposed phases of construction.

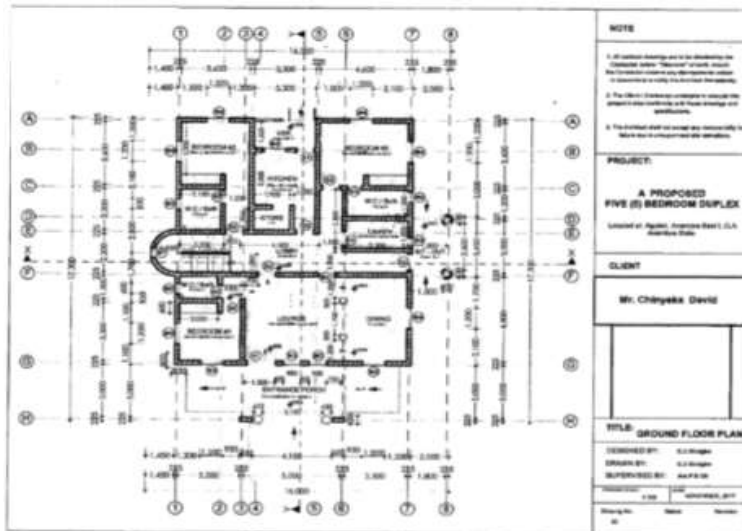


Fig. 7: First floor plan of Case study

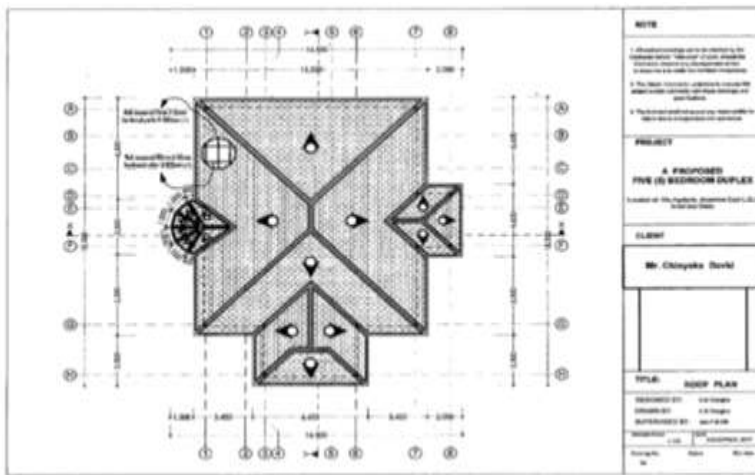


Fig. 8: Roof floor plan of Case study

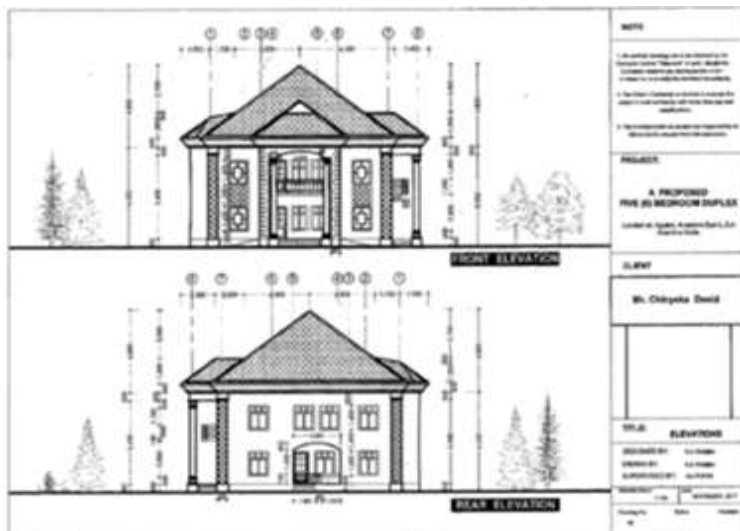


Fig. 9: Elevations of Case study

Presentation of these budgets estimates to the client: The prepared bill of quantities was accepted by the client after presentation with few sections he demanded the costs should be reviewed and reduced. Furthermore, the client inquired on minimum amount of money he can raise for the construction of the building project and was properly guided on the work plan thereof spelling out deliverables and cost laden with each of the work stages.

Construction Documentation: The Construction Documentation Process: Prior to this stage the client was informed to affirm all the modifications in the design development stage noting that after this construction development stage, the drawings will be printed out in four (4) sets of drawing and sent out for approval by the Local Government Physical Planning and Development Unit in Anambra East.

Building Systems: Foundation: Strip foundation is adopted for this framed structure. Strip foundations support columns (super structure) and transmit the loads to the soil evenly. Floor Component: The floor slab will be constructed of reinforced concrete and finished with different materials depending on the space involved.

- Wall component: Machine Molded Sandcrete Hollow Blocks is adopted for the masonry walls. They are to be rendered with mortar and laid in Stretcher bonding.

- Roof component: The roof truss system adopted is the Lattice Truss System (rising and falling struts with posts). To this regard, the drawings were completed based on the standard way of presentation, delivered to the client for records and sign off. Having fulfilled the design requirements for the proposed building project the client formally approved the construction drawings to be used as a working document for the erection of the proposed residential development

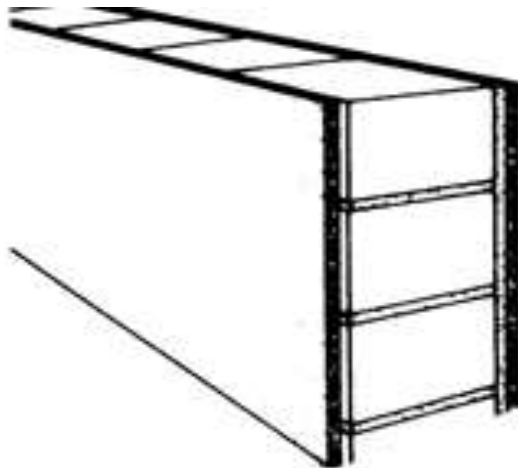


Fig. 10: A presentation of the specified brick bonding/laying & covering with mortar

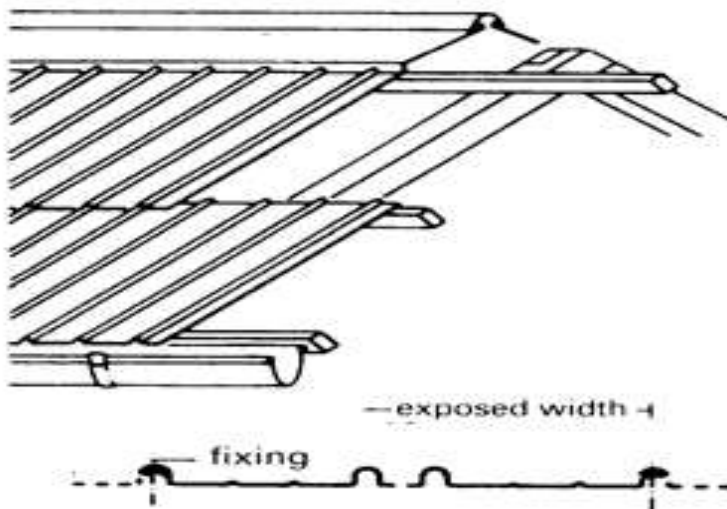


Fig. 11: Specified method for the placement of roof members

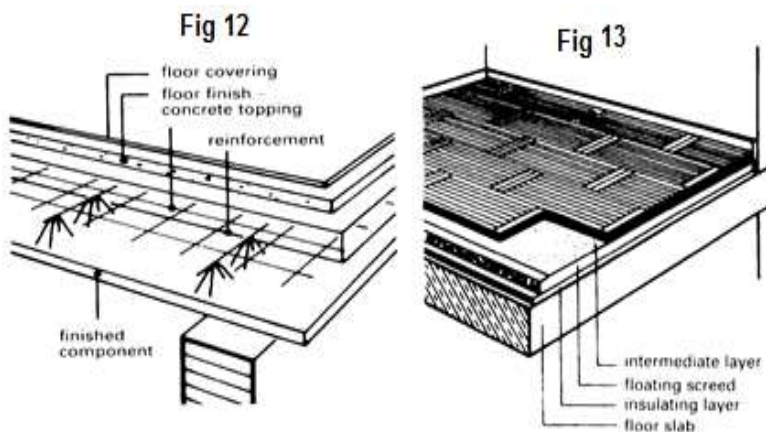


Fig. 12: Graphical Illustration showing how of the suspended floor members should be placed. Fig. 13: Graphical Illustration showing how the floor members of the kitchen on the ground floor will be placed

The stage was characterized by a comprehensive preparation of all the architectural working drawings/details and coordination of the structural, mechanical, electrical drawings from other consultants. At the completion of the required deliverables, the four (4) sets of construction drawings sent out to the Physical Planning and Development Unit of the proposed project Local Government Area were registered and approval was given authorizing the commencement of development. Finally, three (3) more copies of the approved drawings were made available with one (1) delivered to the client and the other two (2) retained by the architect for the subsequent stages.

Tender Process: The form of tender adopted for this proposed project during the contract stage is the Negotiated tendering. Based on certain factors such as; reliability and competence of contractor to be selected, the proximity of the contractor to the proposal project site, and lack of resources for the invitation of different contractors to bid for the project execution; an indigenous contractor based in Aguleri, Anambra State who has track records in constructing buildings was awarded the contract and the tender sum was negotiated with the contractor leading to the approval of the estimated total cost for the construction of the proposed five-bedroom duplex. This lump sum is scheduled to come in batches marking the different phases of the project. Phase I is to cover from foundation footing to the Damp Proof Course (DPC); Phase II is to take off from the DPC level to first floor slab; Phase III is covered from the first floor level to the roof level; Phase IV is the roofing of the structure in its entirety while Phase V is the fixing of doors / windows, and finishing works.

Finally, the construction documents were delivered to the client and later date was to be communicated to him for proper 'Take-over of the work' to execute.

Conclusion: This paper justifies the need to review the activities that characterize the architectural design stages from the inception stage of a project to tendering / contract award stage. The technical review process captures the deliverables that attributed the development of the design brief, the concept of the proposed residential development as well as the documentation of the construction drawings masked with the specifications and budget estimates. This paper was able to suggest solutions to some challenges that are attributed to architectural design stages.

REFERENCES

- Ahmed, MI; Mohammad, AH; Mohamed, HS (2023). Assessment of specifications' usability for engineering projects of the built environment. Research gate. Available online July 2023.
- Araujo EB (2021). The Importance of Engineering Technical Reviews to Improve the Product Reliability. 2021 Annual Reliability and Maintainability Symposium (RAMS), Orlando, FL, USA, 2021, pp. 1-5.
- BS 1881-116 (1983). Testing concrete: Method for determination of comprehensive strength of concrete cubes. British Standards Institute. London, United Kingdom.
- Colin RG (2014). Cement and concrete as an engineering material: An historic appraisal and case study analysis. The Open University, United Kingdom. Available online 28 February 2014.
- Kim H. (2016). Study on Integrated Design Workflow for Natural Ventilation Tropical Office Building Using CFD. *J Archit. Eng. Tech.* 5: 170.
- Nilanjan, R et al. (2019). An Empirical Study on the Impact of Design Brief Information on the Creativity of Design Outcomes with Consideration of Gender and Gender Diversity. *J. Mechanical Design.* 141(7):1