UIA YEAR OF DESIGN FOR HEALTH

AN EMERGENCY APPROACH TO THE DESIGN AND CONSTRUCTION OF THE GHANA INFECTIONOUS DISEASE CENTRE IN THE TIME OF THE COVID-19 PANDEMIC

BY
Arc. Fiifi Y. Sam-Awortwi

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My name is Arc. Fiifi Yasebi Sam-Awortwi and I would be representing UIA – Region V(Africa) in this year’s design for health event.

I am the deputy Construction Project Manager and Member of the Design Team for the Ghana Infectious Disease Center (GIDC) situated at Kwabenya, a suburb of Accra, Capital of Ghana.

This facility is a 108 Bed infectious Disease Centre, designed and built within 3 months during the period of lockdown by the Built Environment Professionals and Private Sector players, with support from the Ghana Army and other Government Agencies.

This presentation is based on my personal experience and research whiles working on the project.
A little about my country Ghana……..

**Location** - West Africa

**Population** - 31 million

**Land Area** - 238,535 km²

**Capital City** - Accra

**Major Exports**

- Gold, Cocoa
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BRIEF OVERVIEW.....

Rapid Process of events . . .
Research, Design Process, Working Teams
Construction Process
The Project is private sector led and was initiated by a philanthropist, Senyo Hosi and his team of private sector leaders of industry through an SPV...

In the atmosphere of Patriotism and Volunteerism, the Ghana Institute of Architects offered its services as its Cooperate Social Responsibility and rallied allied professionals in the built environment to participate.

FIRST EVER PROJECT UNDERTAKEN JOINTLY BY THE BUILT ENVIRONMENT PROFESSIONAL ORGANISATIONS!
DESIGN BRIEF / OBJECTIVES

- QUICK CREATION OF A SPACE FOR CONTAINMENT (TEMPORAL STRUCTURES WERE UP FOR CONSIDERATION)

- MINIMISING THE RISK OF INFECTION TO HEALTHWORKERS

- DIGNIFYING PLACE FOR THE SICK
**APPROACH** – 2 PRONGED STRATEGY -“DESIGNING AND BUILDING”

**CORE DESIGN DELIVERY TEAM**

- Arc. Kofi Essel Appiah  
  PROJECT MANAGER

- Arc. Fifi Y. Sam-Awortwi  
  DEPUTY PROJECT MGR.

- Arc. Ruth-Anne Richardson  
  PROJECT ARCHITECT

- Arc. Richard Dadey  
  HEALTHCARE CONSULTANT

**CORE CONSTRUCTION DELIVERY TEAM**

- Lt. Col AB Tekyi  
  PROJECT MANAGER-ARC.

- Arc. Fifi Y. Sam-Awortwi  
  DEPUTY PROJECT MGR.

- Capt. KA Arthur  
  CIVIL ENG./OPERATIONS

- Lt.(GN) M Bampoe  
  CIVIL ENGINEER/SAFETY.

- Flt. Lt. INA Tetteh  
  PROJECT ARCHITECT

- Capt. FS Khako  
  ARCHITECT

**CONTRACTOR**

Mendanha and Sousa Construction Ltd.
CORE DELIVERY/ SUPPORT TEAM....
Many reference materials were sought, but with the urgent nature of this assignment, our main reference document was:

‘GUIDELINES FOR COVID-19 QUARANTINE AND TREATMENT CENTERS IN THE ETHIOPIAN CONTEXT’

Produced by the Association of Ethiopian Architects (AEA action against Covid-19 task force) as a recommendation to the Federal Ministry of Health.

Public Document shared on AUA social media handle
This document was readily useful at this moment due to the following reasons; **Summarised and straight to the point, addressed the basics.**

The Contents of this guideline largely covers the following areas:

- Nature of the Covid-19 Virus
- Review of existing local and international standards
- Case studies on Covid-19 Quarantine and Treatment Canters
- Spatial and Engineering requirements and recommendations for the physical structure for Covid-19 Quarantine and Treatment makeshift Hospital
Site Selection.

- Properly Zoned.
- Existing medical facilities to support the IDC.
- Medical staff here had already been trained to handle COVID-19.
TRANSLATING THE LITERATURE INTO ARCHITECTURE.... DESIGN CONCEPT

FACILITY USERS - HEALTHY PEOPLE AND INFECTED PEOPLE

NEED TO ZONE THE SPACES and create DEFINED CIRCULATION PATHS according to the HEALTH STATUS OF THE USER.
Building Foot Print = 3,870 Sqm
DESIGN/CONSTRUCTION REVIEW SESSION - WHOLE TEAM
COVID-19 Containment- AIRBORNE DISEASE CONTROL BY HVAC SYSTEMS

This portion of the research/Ref. material is by courtesy of Atlabach Consulting with its lead Consultant being Robert Bachynski P.Eng, a member of ASHRAE (American Society of Heating, Refrigeration and Air Conditioning Engineering)
AIRBORNE DISEASE CONTROL BY HVAC SYSTEMS

- Air Change Rate and Dilution

- Relative Humidity (RH)

- Computational Fluid Dynamics (CFD) Modelling
## Time to Provide 99% Dilution

<table>
<thead>
<tr>
<th>Air Changes Per Hour</th>
<th>Time Minutes</th>
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<tbody>
<tr>
<td>4</td>
<td>104</td>
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<tr>
<td>6</td>
<td>69</td>
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<td>8</td>
<td>52</td>
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<td>41</td>
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Optimum Humidity Range for Human Comfort and Health [ASHRAE]
CFD Modelling of an HVAC system (6ACH) Ceiling Return
AIRBORNE DISEASE CONTROL BY HVAC SYSTEMS
CFD Modelling of an HVAC system (6ACH) Floor Return
AIRBORNE DISEASE CONTROL BY HVAC SYSTEMS

UVC Lighting and Filtration

+ Radiation with wavelengths between 200 and 290 nm
+ Established to be able to kill the Corona Virus

Corona Virus’s Can be filtered and disinfected to 99.99% efficiency with the use of UVC lighting and Merv 15 filtration.

Applications....
HVAC Airborne Disease Control Trends

**Past**
- Occupancy Indoor Air Quality Complaints
- Air Sampling and Lab Testing
- HVAC Assessment and Recommendations

**Present**
- COVID-19 Pandemic
- ASHRAE COVID-19 Recommended Practices
- Installation of COVID-19 HVAC Controls

**Future**
- Unknown Potential Hazards
- Machine Learning Indoor Air Quality Algorisms
- Smart Buildings Proactively Protecting Occupants
LATE NIGHT WORKS. . . .
GHANA INFECTIOUS DISEASE CENTRE- CONSTRUCTION TECHNOLOGY

EVG 3D CONSTRUCTION SYSTEM
Expanded polystyrene sandwiched in wire mesh and finished with micro concrete

- Fast and Simple to erect
- Materials are recyclable
- No formwork needed
- Simple installation of utilities
- Elimination of additional beams and columns
- Less heavy components (easy handling)
- Provides Excellent thermal insulation
- Design flexibility
- Monolithic structure
- Better Earthquake resistance
- Lower Construction Costs
GHANA INFECTIOUS DISEASE CENTRE- CONSTRUCTION TECHNOLOGY

MATERIALS
Floor Slabs - In-Situ Reinforced Concrete Slab
Roof Construction - Concrete Filler Slab with Polystyrene
Roof Construction - Steel Sheets on Timber Rafters
Walls - 3-D Wire Panel with 'Shot-Crete' Both Sides
Flooring - Epoxy Flooring

ENERGY MEASURES
Insulation of Roof
Insulation of External Walls
Air Conditioning with Air Cooled Chiller
Energy-Saving Light Bulbs- Internal Spaces
GHANA INFECTIOUS DISEASE CENTRE - NOTABLE FEATURES

**Green Building- Edge Certified**
Exemplary Achievement in

- 23% Energy Savings
- 28% Water Savings
- 31% Less Embodied Element in Material

- Negative Pressure Within the Building
- One way traffic for Patients and for staff
- Antimicrobial paints
- Hands free sensor faucets and doors in certain areas.

**TOTAL PROJECT COST = $7,500,000.00 !!**
- Building Structure
- Medical Equipment
- All other running cost expenses.
GHANA INFECTIOUS DISEASE CENTRE
CONSTRUCTION MILESTONES

AERIAL VIEW-CONSTRUCTION PERIOD
GHANA INFECTIOUS DISEASE CENTRE
CONSTRUCTION MILESTONES

AERIAL VIEW-COMPLETED
CORRIDOR
FACTORS LEADING TO THE SUCCESS OF THE PROJECT...

- Exigencies of the time
- Leadership of the Private Sector
- Support of the Government
- Commitment of the Consultants
- Discipline and Consistency of the Military
- Benevolence of the Ghanaian People
CONCLUSION !!. . . .

With our **EMERGENCY APPROACH** to this project, we relied on the **Experience** of local health care facilities designers

inputs from health sector **Practitioners**.(Doctors, Lab technicians, Nurses, facilities managers etc.)

**Literature/research** on the subject matter.------which was our tool for the numerous review sessions during design and construction.
THANK YOU FOR YOUR ATTENTION.