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Designing and Planning of a Hospital Building.

Mrs. E. Malathi[1], Mr. P. Raghupathi[2], R. Manoj Kumar[3], P. Saikrishna[4], B. Sampath[5], K. Mohan[6]
Christu Jyothi Institute of Technology and Science, Jangaon, Telangana, India
Jewarlal Nerhru Technological University, Hyderabad, Telangana

Abstract: *Sub-health centers, as the first point of contact between the community and the primary health care system, require adequate physical infrastructure to function effectively. According to the Indian Public Health Standards (IPHS), each sub-center should have a designated building within the village, equipped with basic amenities such as electricity, water supply, and sanitation facilities. The building should include separate spaces for consultation, immunization, and storage of medical supplies. Adequate furniture and equipment are essential to ensure the smooth delivery of health services. Despite these guidelines, many sub-centers face challenges such as inadequate infrastructure and lack of continuous utilities, which hinder their ability to provide quality care.*

Keywords: Focused on materials, testing methods, cost estimation processes, and Optimization of cost

I. INTRODUCTION

The development of sub-health centers plays a crucial role in providing primary healthcare services to underserved and remote populations. In many regions, particularly in rural and semi-urban areas, the availability of medical facilities is limited, leading to inadequate healthcare access for local communities. Civil engineering plays a pivotal role in designing, constructing, and maintaining these vital healthcare structures to ensure they meet the necessary standards for safety, accessibility, and functionality.

Fig. 1 Sub Health Centre

Project Overview
Name of the Project: health sub centre building
Location: Wadlakonda, Jangaon (M), Telangana State
Administrative Authority: MPP Jangaon
Sanctioned Budget: Rs. 20,00,000 Lakhs

II. PURPOSE OF THE PROJECT

The project aims to improve road infrastructure by laying a durable and long-lasting cement concrete (CC) road in Pemberthi. The new road will:

- Improve connectivity and transport efficiency within the area.
- Enhance durability compared to conventional bituminous roads.
- Ensure better load-bearing capacity for vehicular traffic.
- Reduce maintenance costs over time.

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III. SCOPE OF WORK

the construction of the sub-health center building covers all activities required to design, construct, and complete the facility in accordance with applicable standards and regulations. This scope includes both preliminary and detailed phases of the project, from site assessment to the final handover of the building to the healthcare authorities.

Site Preparation and Surveying

- Site Evaluation: Conducting geotechnical and topographical surveys to assess soil conditions, site topography, and environmental factors that may influence the design and construction process.
- Clearing and Excavation: Clearing the site of any vegetation, debris, or existing structures and performing excavation for foundation works, including trenching for utilities (water, sewer, electrical, etc.).
- Leveling and Grading: Ensuring that the site is properly leveled and graded for effective drainage and foundation support.

Design and Engineering

- Architectural Design: Development of architectural plans that include floor layouts, elevations, and space planning for different functional areas such as patient care rooms, administrative offices, utility areas, and common spaces. The design must ensure accessibility and compliance with building codes.
- Structural Design: Detailed design of structural elements, including foundations, superstructure, and roof systems, to ensure the building's safety, stability, and compliance with local seismic, wind, and safety regulations.
- Electrical and Plumbing Systems Design: Designing power, lighting, and wiring systems, as well as plumbing systems for water supply, waste management, and drainage. This includes selecting energy-efficient solutions for lighting and HVAC systems.
- Sustainability Integration: Incorporating energy efficient design principles such as natural lighting, passive solar heating, and the use of renewable energy sources

Construction and Fabrication

- Foundation Work: Excavation and construction of reinforced concrete or masonry foundation, including formwork, reinforcement, and concrete pouring as per the approved design.
- Superstructure Construction: Erection of the structural framework, including columns, beams, slabs, and walls. This may involve the use of reinforced concrete, steel, or a combination of materials based on the design specifications.
- Roofing: Construction of the roof structure, which may include reinforced concrete slabs or metal roofing,

The following technical specifications are designed to ensure the successful construction and performance of a sub-health center building, focusing on structural integrity, safety, energy efficiency, and sustainability. These specifications incorporate industry standards, local building codes, and materials best suited for healthcare facilities in rural and semi-urban regions.

Foundation and Structural Systems

Depending on the design, with insulation and waterproofing. Wall and Partition Construction: Erection of exterior and interior walls, including brick or block masonry, as well as lightweight partitions for flexible internal spaces.

IV. MATERIALS AND METHOD

The research methodology for this paper involves a combination of literature review, case study analysis, and design analysis to explore the materials, techniques, and design considerations involved in constructing subhealth center buildings. The methods were selected to assess the various aspects of civil engineering that directly impact the functionality, sustainability, and cost-effectiveness of healthcare facilities in rural or underserved regions.

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LITERATURE REVIEW

comprehensive literature review was conducted to gather existing information on the design and construction of healthcare facilities, with a focus on subhealth centers. The review covered topics such as building codes, regulations, material choices, structural design, and energy-efficient practices in healthcare facility construction. Sources included peer-reviewed journal articles, government publications, case studies, and best practice guidelines from health organizations and civil engineering bodies.

TECHNICAL SPECIFICATIONS

To ensure the successful construction and performance of a sub-health center building, focusing on structural integrity, safety, energy efficiency, and sustainability. These specifications incorporate industry standards, local building codes, and materials best suited for healthcare facilities in rural and semi-urban regions

Foundation Type: Reinforced concrete slab-on-grade or shallow foundation, depending on soil conditions (as per geotechnical survey recommendations).

Flooring:

- Ground floor: Concrete floor with integral waterproofing.
- Upper floors: Reinforced concrete floors or precast concrete slabs.

Load-Bearing Structure:

- Superstructure: Reinforced concrete columns, beams, and slabs (RCC) designed to support the building loads, including occupancy, equipment, and emergency requirements.
- Frame System: Reinforced concrete frame or steel frame with bracing for lateral stability, designed to withstand seismic and wind loads based on local environmental conditions.
- Seismic Resistance: The structure will comply with relevant seismic design codes (e.g., IS 1893 for India, or equivalent) to ensure safety in earthquake-prone areas.

Building Envelope Walls:

- Exterior walls: Hollow concrete blocks or fired clay
- bricks, with a thickness of 200-300 mm for thermal insulation.
- Interior walls: Plasterboard or lightweight partitions (gypsum board) for interior rooms, providing flexibility for future reconfigurations.

Roof:

- Sloping roof with metal sheeting or reinforced concrete slab. The roofing will include thermal insulation material to maintain internal temperature.
- Roof will also include a rainwater harvesting system to collect runoff for non-potable uses.

Windows and Doors:

- Windows: Aluminum or uPVC frames with doubleglazed units to provide insulation and natural lighting while reducing energy consumption.
- Doors: Powder-coated steel or wooden doors with locking mechanisms designed for security and privacy in healthcare settings.

HVAC (Heating, Ventilation, and Air Conditioning)

- Ventilation: Natural ventilation through operable windows and vents; ceiling fans and exhaust fans in areas requiring enhanced airflow
- Air Conditioning: Split-type or window-type air conditioners in patient care areas and administrative offices, where cooling is necessary.

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- Heating: If required, electrical or solar water heaters for providing hot water to washrooms and healthcare facilities.

Electrical Systems

Main Power Supply: The building will be connected to the local electricity grid, with a backup power source (such as a diesel generator or solar power system) in case of grid failure.

Lighting:

- Energy-efficient LED lighting throughout the building, ensuring appropriate illumination in patient rooms, treatment areas, and common spaces. Emergency lighting to meet health and safety standards, ensuring proper illumination during power outages.
- Power Outlets: Sufficient power outlets in treatment rooms, offices, and common areas to support medical equipment and office appliances.
- Grounding and Earthing: Compliance with local electrical codes to ensure proper grounding and protection against electrical hazards.

Plumbing and Water Supply Water Supply System:

- Connection to the municipal water supply system or,
- where unavailable, a borewell or water storage tanks with filtration systems to ensure safe drinking water. Proper distribution of water to all healthcare rooms, restrooms, and kitchen areas.

Drainage:

- Separate drainage systems for wastewater, including rainwater, black water, and gray water.
- Wastewater treatment plants (if required) or septic tanks for remote locations without access to municipal sewage systems.

Sanitary Fittings:

- High-quality sanitary ware (toilets, wash basins, urinals) made of durable, non-porous materials. Automatic flush systems for toilets in patient and hightraffic areas to maintain hygiene.

Safety and Accessibility Features

Fire Safety:

- The building will comply with local fire safety codes (e.g., IS 3808 for India) and include fire extinguishers, fire alarms, emergency exits, and smoke detection systems.
- Fire-rated doors for critical areas such as the kitchen and utility rooms.

Accessibility:

- Barrier-free design with ramps, wide doors, and accessible restrooms for people with disabilities. Elevators (if multiple floors) for easy access to all areas of the building.

Emergency Systems:

Emergency exit signs, safety lighting, and evacuation plans to be displayed in all areas.
A public address (PA) system for emergency announcements.

Sustainability and Environmental Considerations

Energy Efficiency:

- Passive solar design principles to reduce the energy consumption for heating and cooling.

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- Use of energy-efficient appliances, LED lighting, and solar panels (if feasible) for generating renewable energy.

Materials:
Preference for locally sourced and sustainable materials to reduce carbon footprint and support local industries. Use of non-toxic paints, low-VOC materials, and durable finishes to improve indoor air quality.

Water Conservation:
Rainwater harvesting system to reduce dependency on external water sources.
Low-flow faucets, showerheads, and water-efficient toilets to minimize water usage.

V. CONCLUSION

the infrastructure of sub-health centers is pivotal to the effective delivery of primary health care services. Adequate and well-designed buildings enable these centers to serve as the first contact point between the rural community and the health care system. Each subcenter should be equipped with essential amenities such as electricity, water supply, and sanitation facilities, as specified by the Indian Public Health Standards (IPHS).
These centers should have designated spaces for patient consultation, immunization, and storage of medical supplies, along with sufficient furniture and medical equipment. However, many sub-health centers face challenges like inadequate infrastructure, intermittent utility services, and insufficient medical supplies, which impede their ability to provide quality care. Addressing these issues through targeted investments and policy interventions is critical. Upgrading the physical infrastructure of sub-health centers and ensuring a consistent supply of essential utilities and medical supplies will significantly enhance the quality of health care services in rural areas. By doing so, we can move closer to achieving the objectives set forth in the IPHS guidelines and improve the overall health and well-being of the rural population.

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