Modern Green Hospital Design In the Context of Local Cultural Environment
—— The Case of Levy Mwanawasa University Teaching Hospital (LMUTH), Zambia

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Thursday, June 5th, 2025

IPPR's construction projects of medical and health facilities in globally

République du Niger

Ethiopia Hospital

Levy Mwanawasa University Teaching Hospital

Masaka Hospital, Rwanda

Victoria Hospital, Mauritius

Mahoso General Hospital, Laos

Cambodia-China Friendship Preah Kossamak Hospital

Kampong Thom Provincial Hospital

The Medical Center for Children with Disabilities, Ulaanbaatar, Mongolia

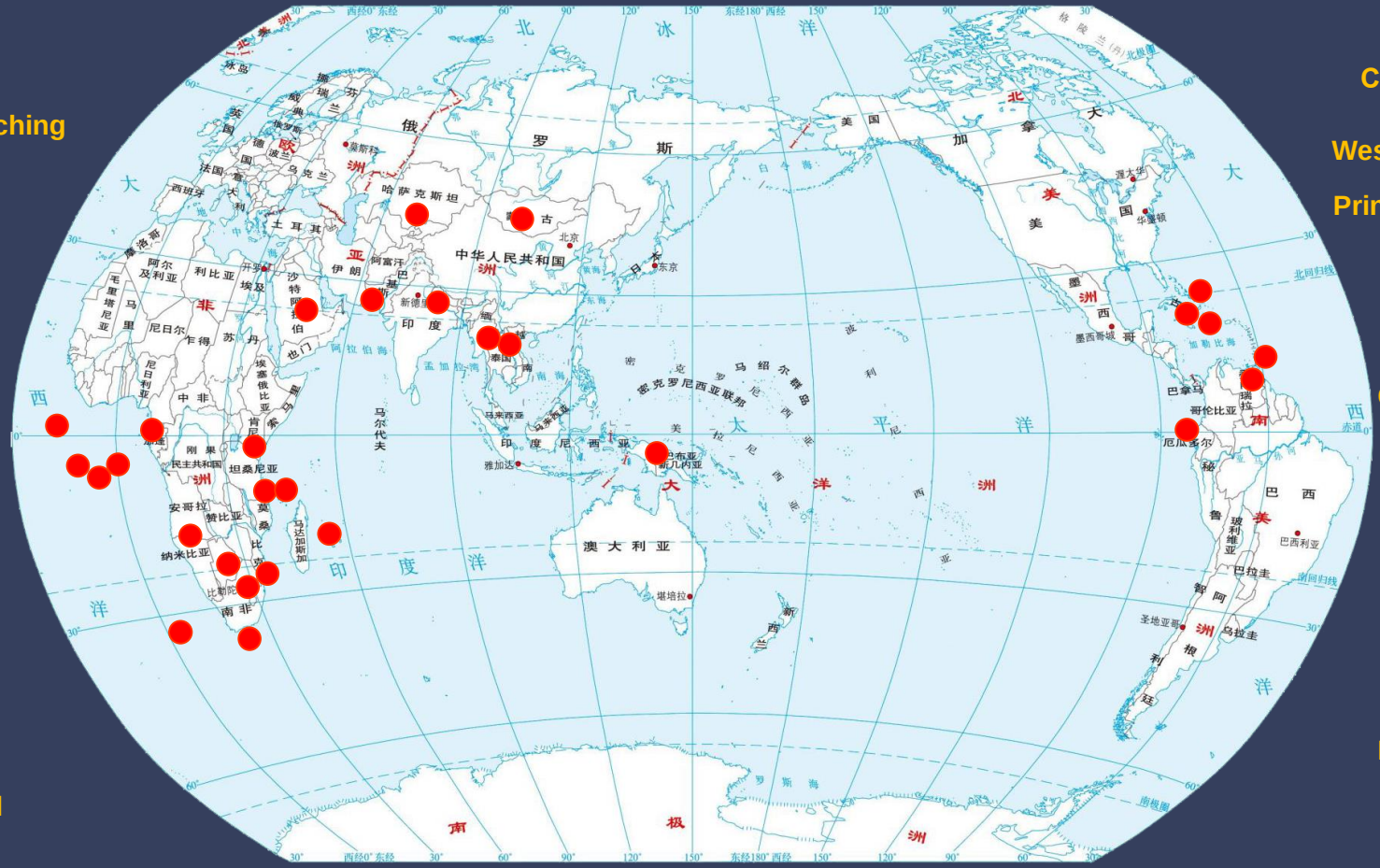
Shymkent University Hospital, Kazakhstan

Cabo Verde Hospital

Nepalese Civil Servant Hospital

Hospital in Papua New Guinea

Saudi Arabia Domda Hospital



Military Hospital of Guinea - Bissau

Cartundo Hospital, Kenya

China - Guinea Friendship Hospital (Guinea)

Western Children's Hospital in Jamaica

Princess Margaret Hospital in Dominica

Jone Hospital in Ecuador

Namibian Hospital

General Hospital in Katanga Province, DRC

Sveti Apostol Luka General Hospital in Doboj

Regional hospitals in Guyana

Abdulla Mzee Hospital

Hospital Geral da Beira

Pak–China Friendship Hospital

Mzuzu Central Hospita

Mahusekwa Hospital, Zimbabwe

Maseru District Hospital in Lesotho

Inrtoduction

Project：
Levy Mwanawasa University Teaching Hospital (LMUTH)

Project Nature:
China-aided Construction

Construction content:
New construction & reconstruction

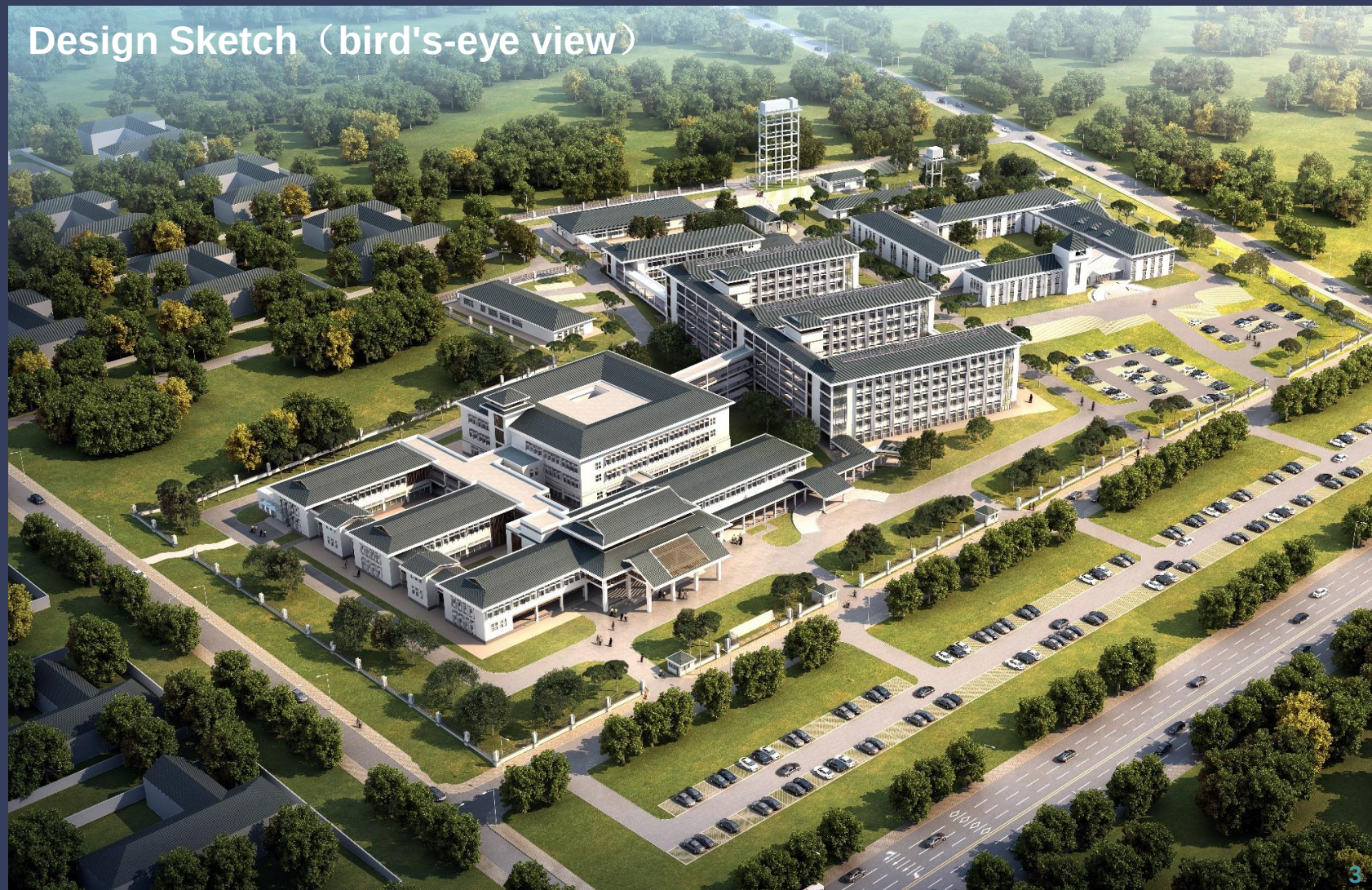
Construction requirements:
Build the largest and highest-level comprehensive hospital in Africa with China's aid.

Land area: 6.4 hectares

Floor area: 42,471.59 m²

Construction location:
Lusaka, the capital city of Zambia.

Number of beds: 826 beds (690 new beds, 136 renovated beds)



Built Real Scene (bird's-eye view)

Design Sketch of the Outpatient Main Entrance

Built Real Scene of the Outpatient Main Entrance

Design Sketch of Main Entrance for Inpatients

Built Real Scene of Main Entrance for Inpatients

Design Sketch of Inner Corridor at Main Entrance of the Outpatient Department

Built Real Scene of Inner Corridor at Main Entrance of the Outpatient Department

Preliminary Research and Planning on Early Stage

Current situation of the Healthcare System in Zambia

The healthcare service system in Zambia implements a universal free healthcare system, providing government-funded medical services to all citizens.

The hospital system is divided into three tiers, where patients first receive treatment at lower-level facilities and can be referred upward to higher-level hospitals upon approval by the attending physician at their current level.

Hospital Setup in Lusaka Province:

Tertiary Hospitals（3）：

UTH (General Hospital, 1,905 beds)、

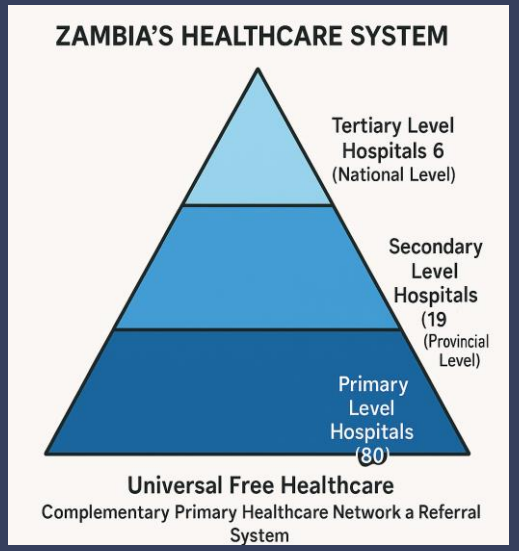
Cancer Diseases Hospital (Specialty Hospital)、Chainama Hills

Secondary Hospitals (None):

the China-aided Lusaka Hospital provides secondary-level services

Grassroots Facilities (279):

Health Centers (HCs) and Health Posts (HPs).



Aims of Project

1. To **enhance** the level of medical services by building the new facilities;
2. To establish secondary-level hospital in Lusaka Province to **supply the lack** of local healthcare system;
3. To construct a **high-level modern general hospital** achieved to the fullest extend standard as Class III, Grade A according to Chinese classification of hospitals;
4. To build an advanced, distinctive, harmonize, economical, sustainable, and resilient building.

Project Feasibility Study Phase (March 2014 - April 2015)

Engagement with the Zambian Working Group

Site Survey

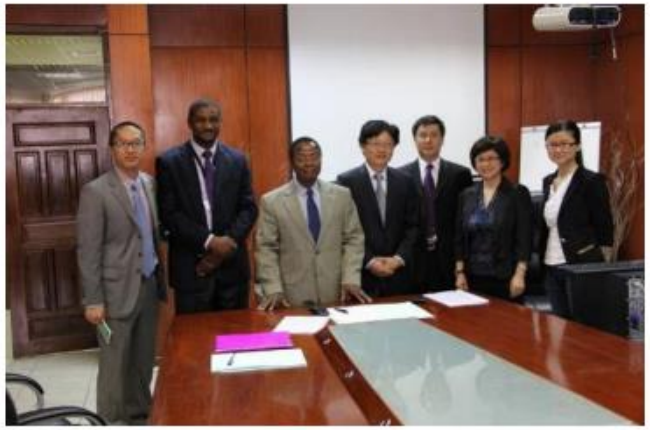
Collaborating with Zambian Engineers

Collaboration with Zambian Medical Equipment Specialists

Communication with Hospital Physicians

Communication with Hospital Clients

Requirements and Scale



Signing the Meeting Minutes

Pre-Considerations

- Geographic & Climatic Conditions
- Local economic developing level
- Functional mechanism of the healthcare system
- Lifestyle and cultural habits
- Potential of future development



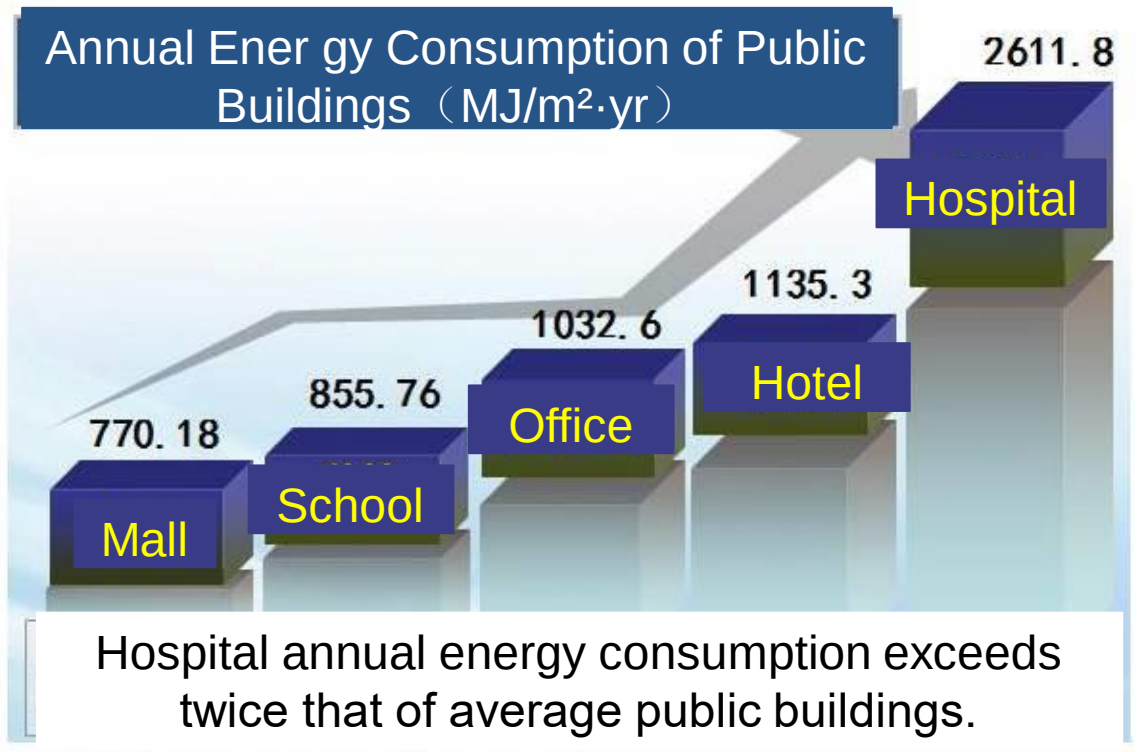
Reference Construction Codes

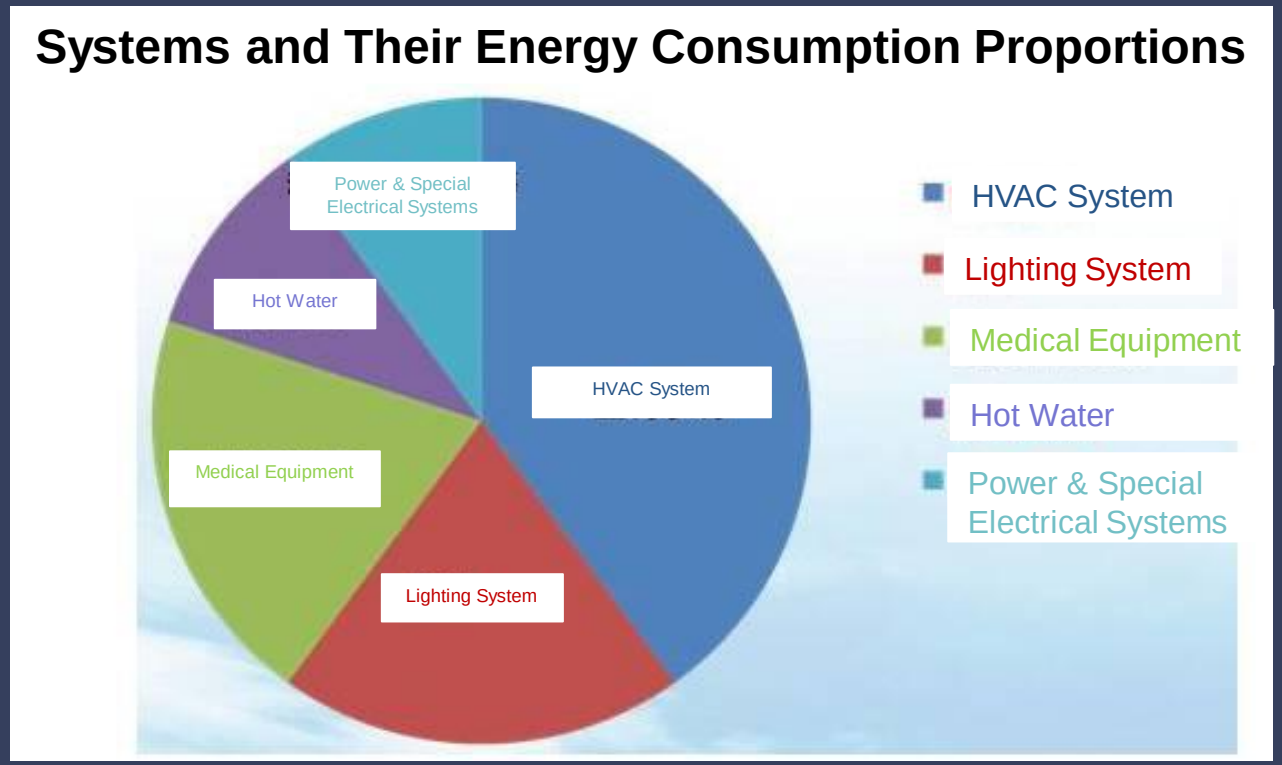
- LEED for Healthcare (2010, USA) - LEED v5 at present
- GB/T 51153 Green Hospital Building Evaluation Standard (China)

Key Considerations:

Sustainable Sites | Water Efficiency | Energy & Atmosphere | Materials & Resources | Indoor Environmental Quality | Operational Excellence | Maintenance Durability | Innovation & Regional Priority

Comparative Analysis of Hospital Energy Consumption in China（2010~2015）



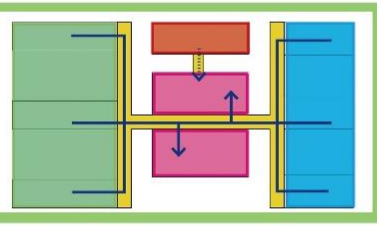
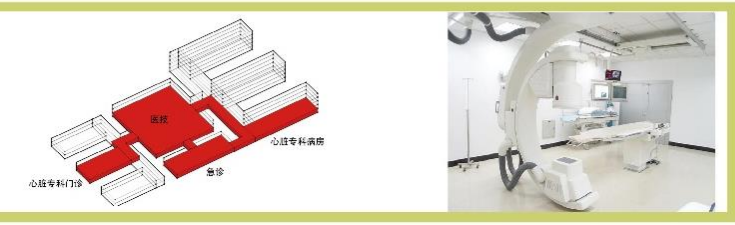


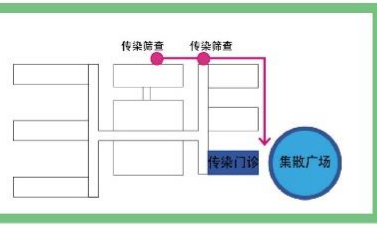
Sustainable hospital development should lay more emphasis on **clinical efficiency**, **HVAC energy consumption**, **lighting energy use**, **and medical equipment energy demand**.

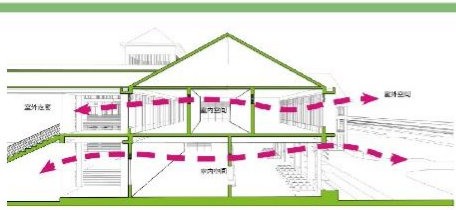
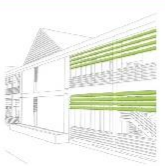
For Zambia, however, implementing context-appropriate technical solutions—such as climate-responsive building layouts, passive ventilation strategies, daylight optimization, and adaptive shading systems—proves more impactful.

Design Concepts

1. Integrating the medical function between old and new buildings; keep the scope of the renovation project within the 20% of the original;
2. Planning a simple medical functional framework with high efficiency performance;
3. The Cardiology Specialty Unit and the integrated healthcare system achieve synergistic resource sharing;
4. Design a separated infected diseases unit with hygienic security;
5. The architectural layout should encourage the integration of the inner space and the natural environment;
6. The green strategies responses the regional and cultural characteristics.

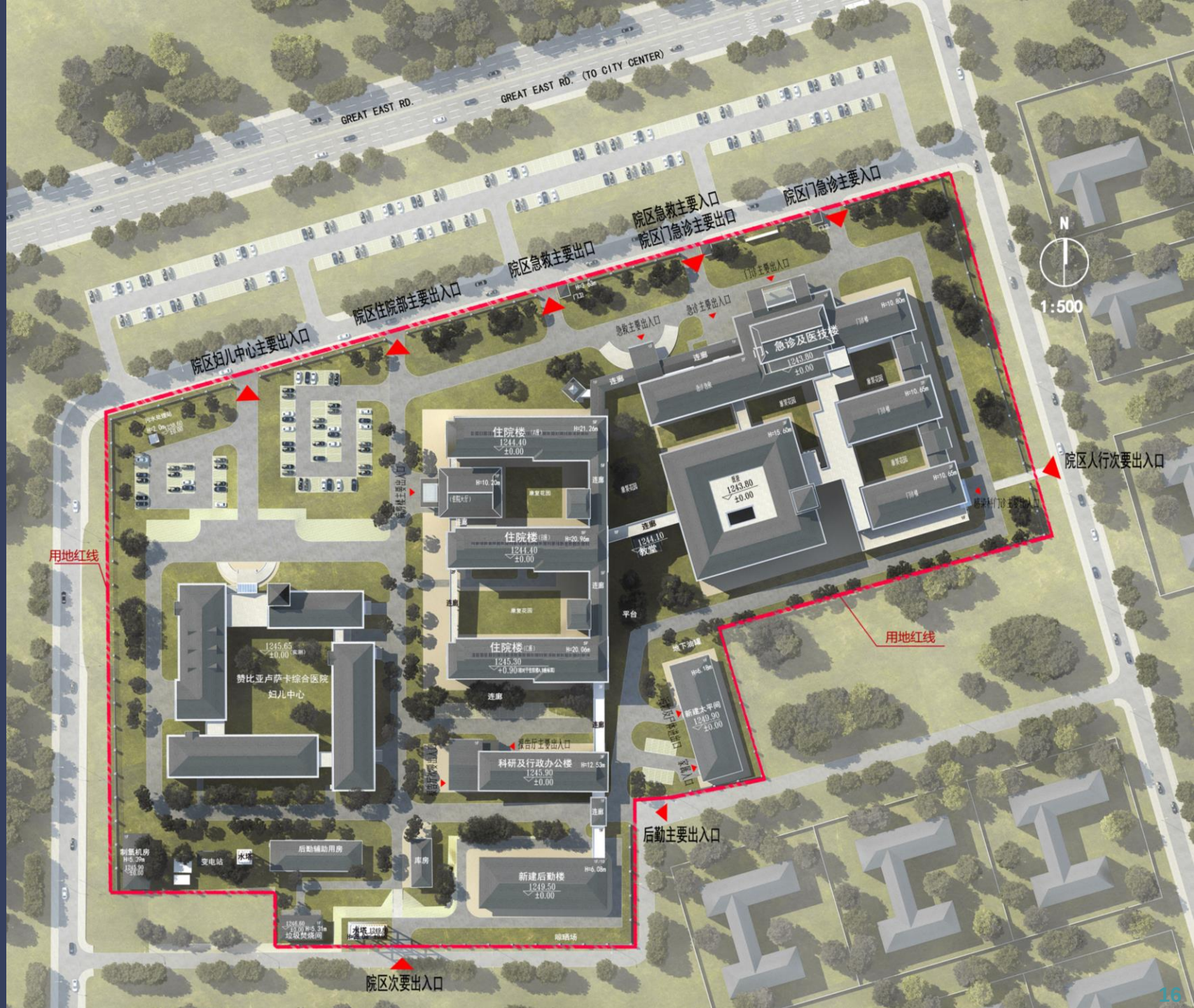






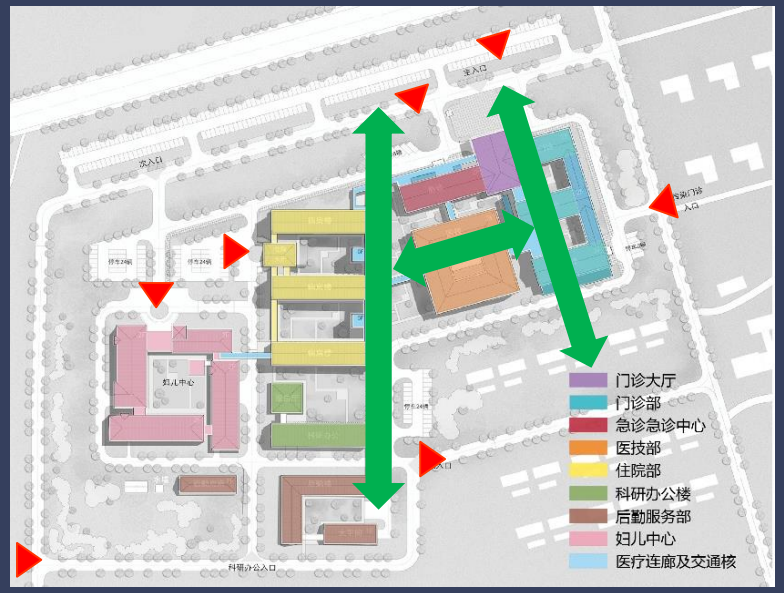





Master Planning

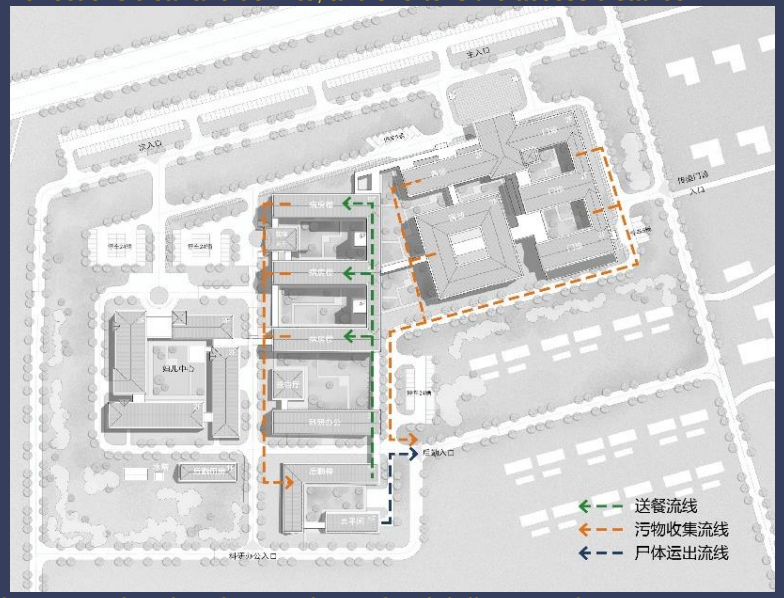
Economic & Technical Indicators	Specifications
Total Planning Area	70,300 m²
Total Floor Area	42,471.59 m²
- New Construction	35,000 m²
- Renovation	7,471.59 m²
Floor Area Ratio (FAR)	0.6
Green Space Ratio	34.2%
Parking Capacity	
- Motor Vehicles	346
- Bicycles	250
Bed Capacity	826 beds
- New Construction	690 beds
- Maternal & Child Center	136 beds



Layout & Medical Processing

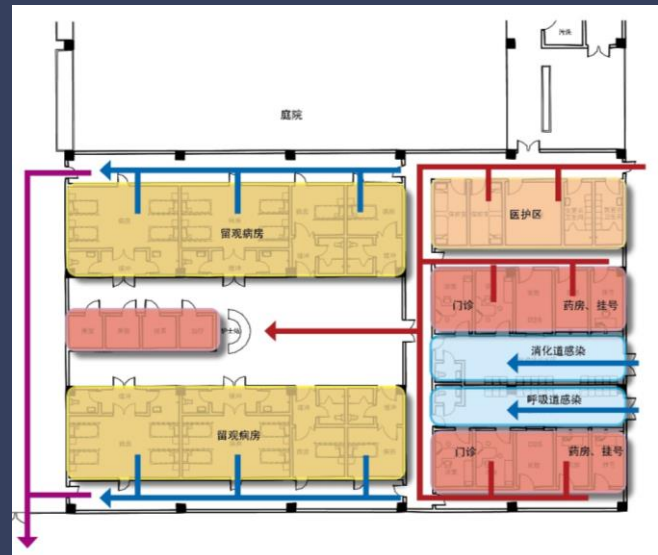


Each type of personnel has its own entrance.The H-shaped medical main street structure form makes the functions compact and concentrated, the directions clear and definite, and shortens the access distance.

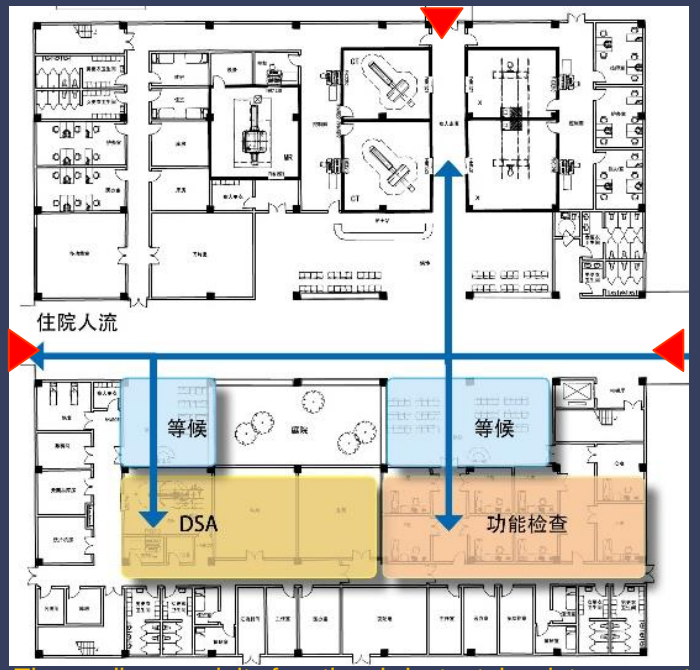


The routes for cleaning products, food delivery and waste transportation are all independent of each other.

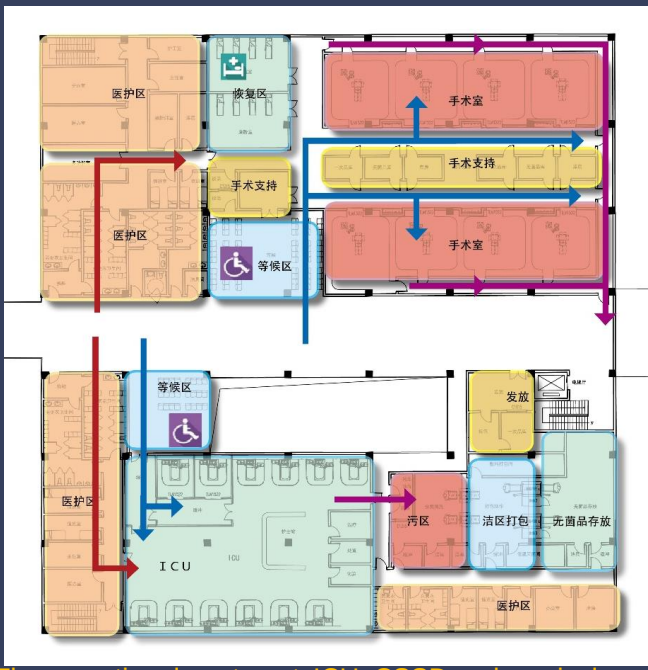
The Medical Technology Department is located in the central area and is directly connected to the outpatient department, emergency department and inpatient department in different directions without interfering with each other



The Department of Infectious Diseases is relatively independent in the corner of the overall layout and does not interfere with other functions. Medical staff and patients are separated and diverted to avoid cross-infection



The cardiac specialty functional cluster takes into account the common use of emergency, outpatient and inpatient departments, sharing resources



The operating department, ICU, CSSD and surgical wards are arranged adjacent to each other, forming a complete functional cluster

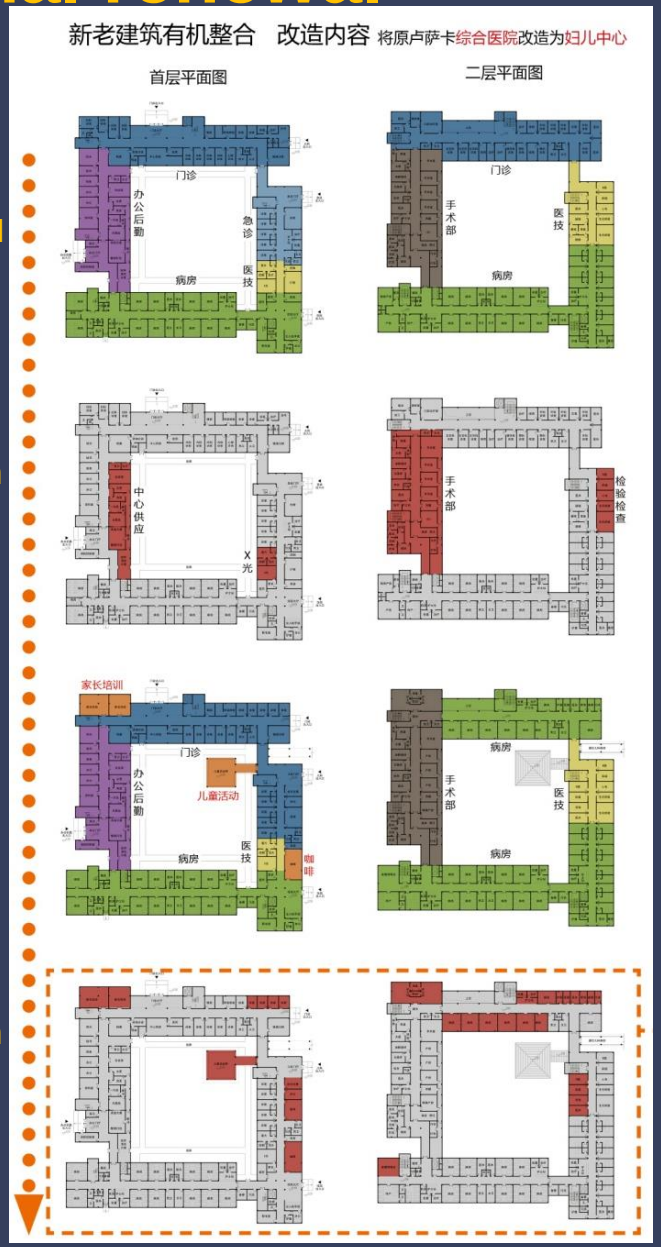
The renovation rate of existing hospitals is less than 20% to achieve functional renewal

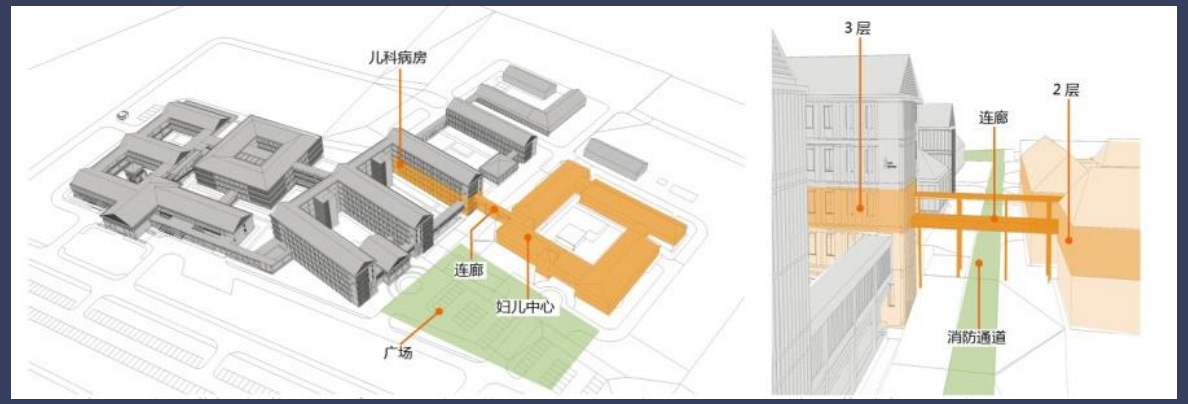
Original functional layout

Identify and retain key areas

Functional layout after renovation

Scope of renovation

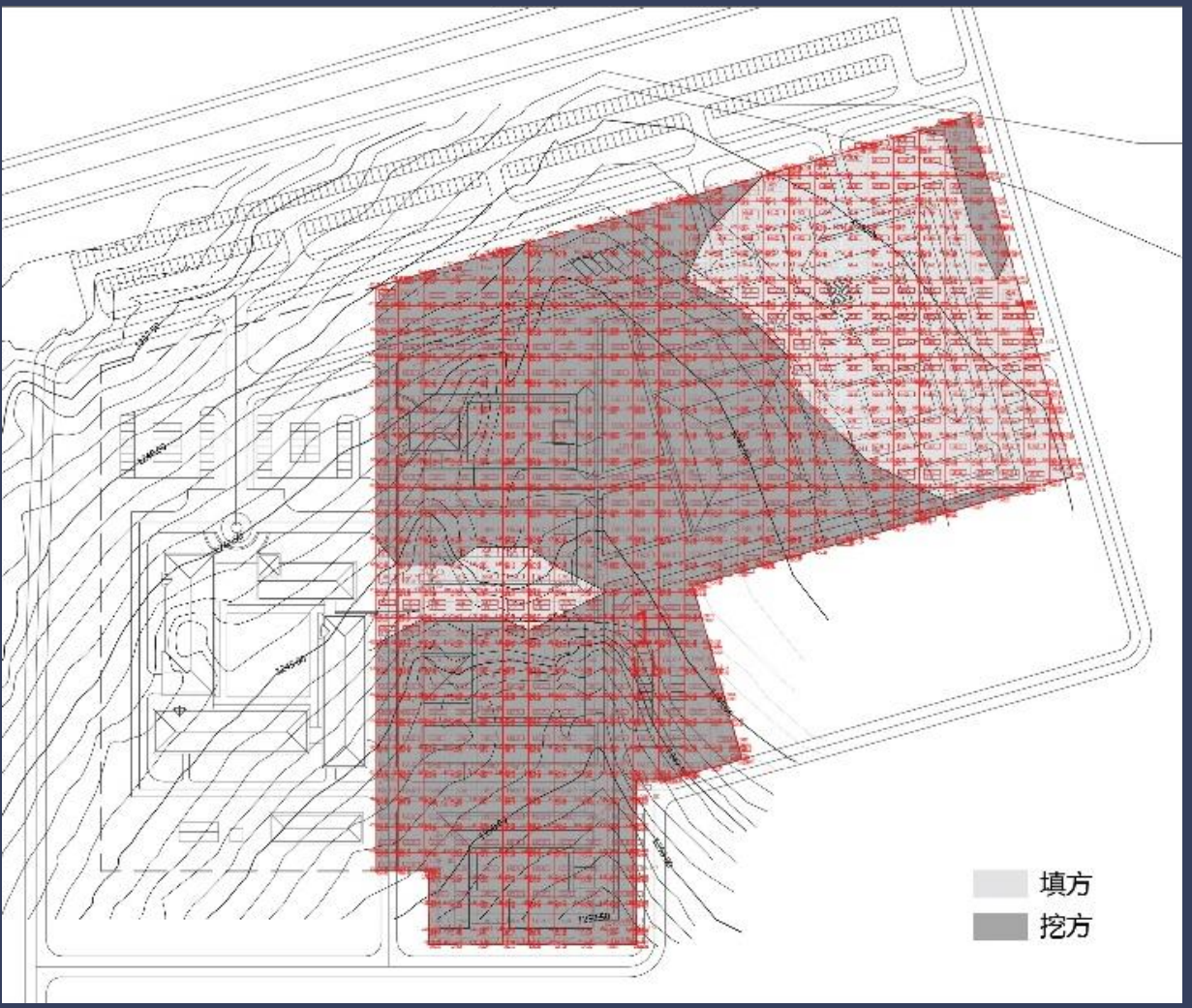




Elevated corridors are established between the newly built and retained buildings, with their functions closely integrated

The continuous update of the medical functions of new and retained buildings

Future-Adaptive Hospital Design Framework



Reasonably determine the building elevation of the site to achieve the optimal balance of earthwork volume on the site and establish an unobstructed passage environment

The H-shaped transportation system has an open port on the south side, enabling the outpatient department, medical technology department and inpatient department to be expanded in an orderly manner in the future

Computer-aided software is used for the performance analysis and optimization of light and air flow

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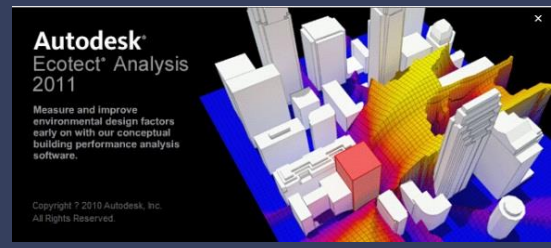
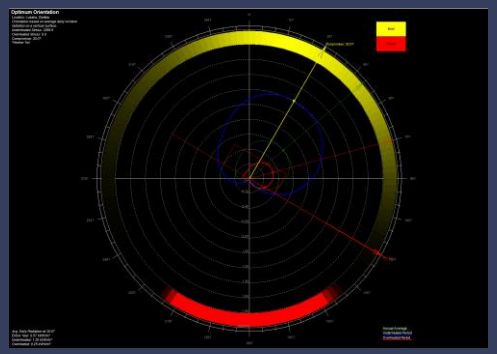


- Collaborative sunlight and shading analysis using REVIT and ECOTECT
- Deduce the design of shading components using Ecotect
- The influence of solar radiation on building sites

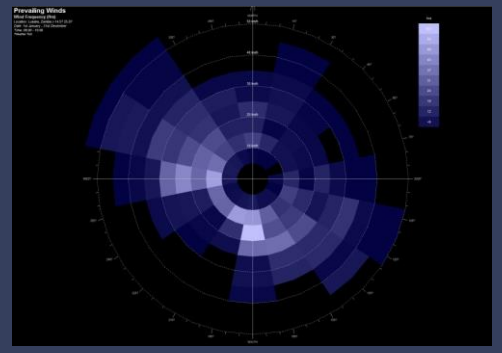
- The original site and the new site

- Dominate the wind direction at different times

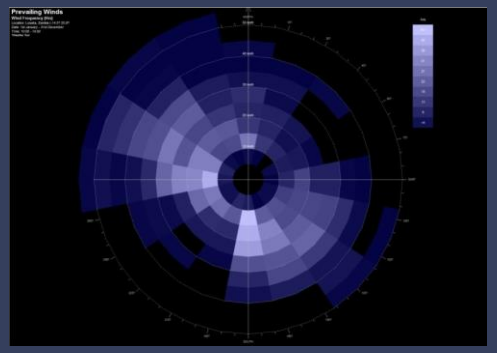
The best orientation for local buildings is 30 degrees east of north.



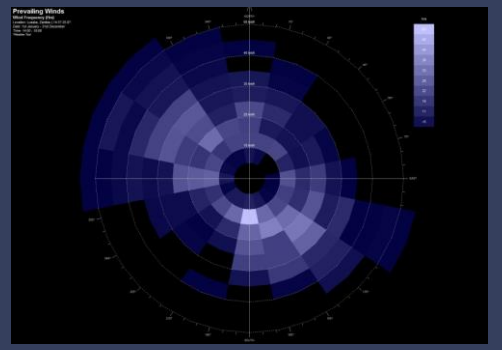
- morning



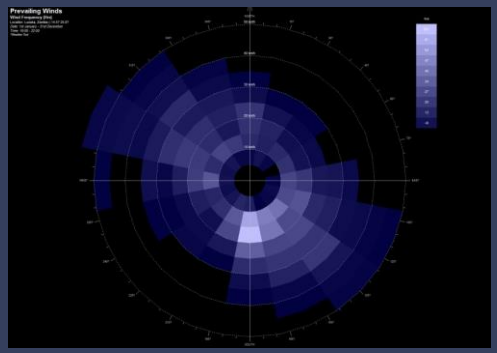
- at noon



- afternoon

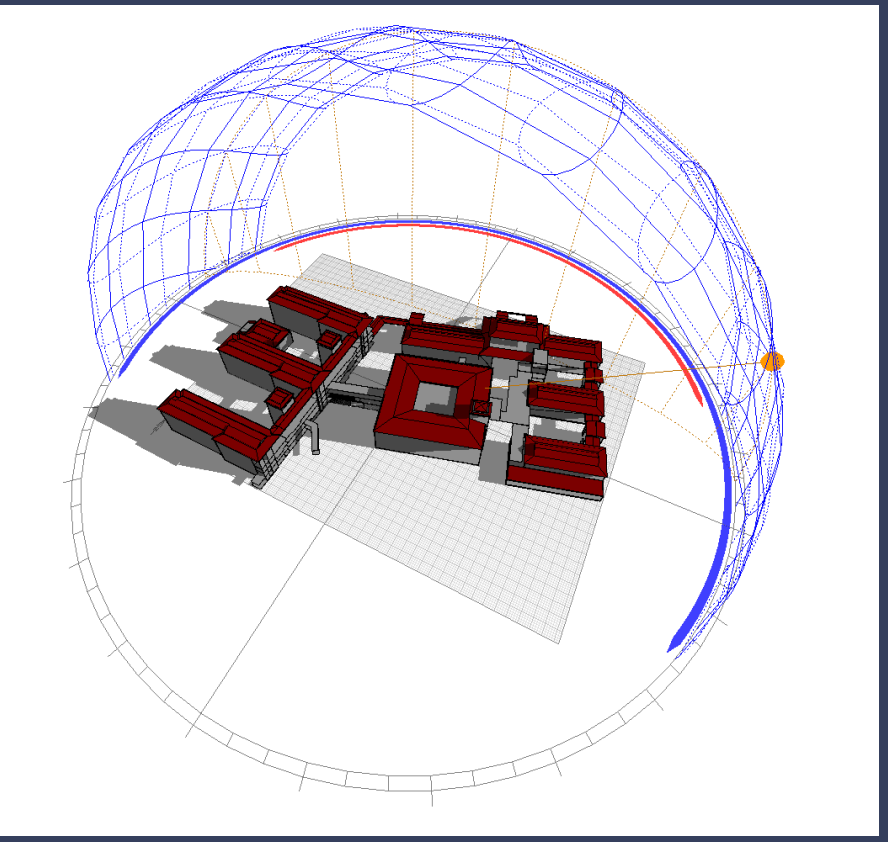


- at night

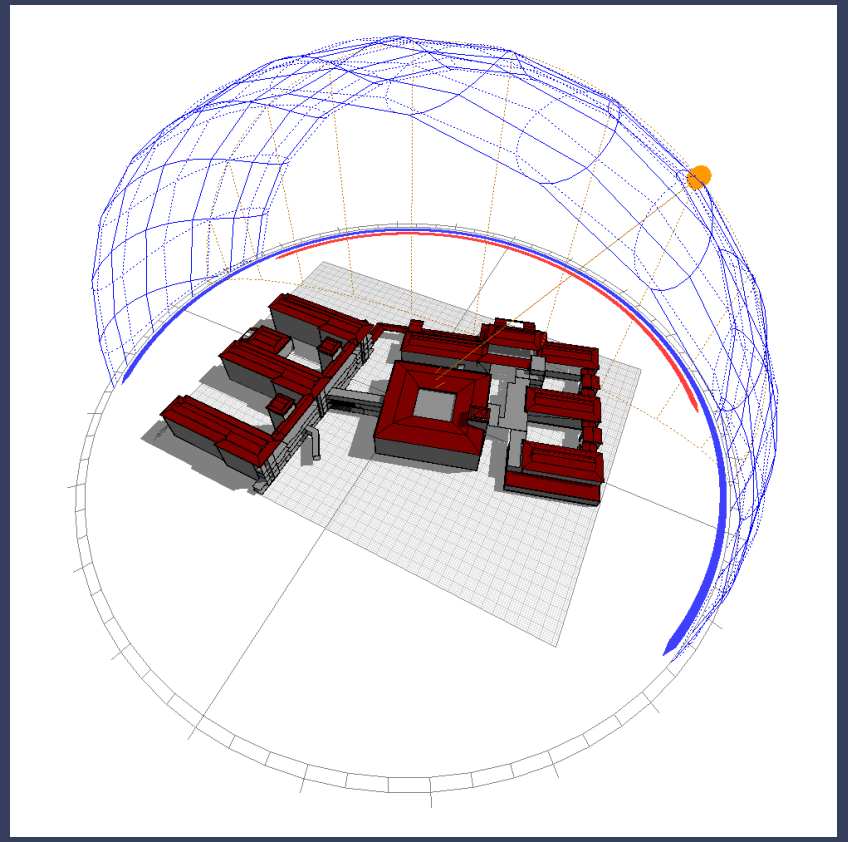


Analysis of Sunlight Shading and Shadow Coverage of Buildings

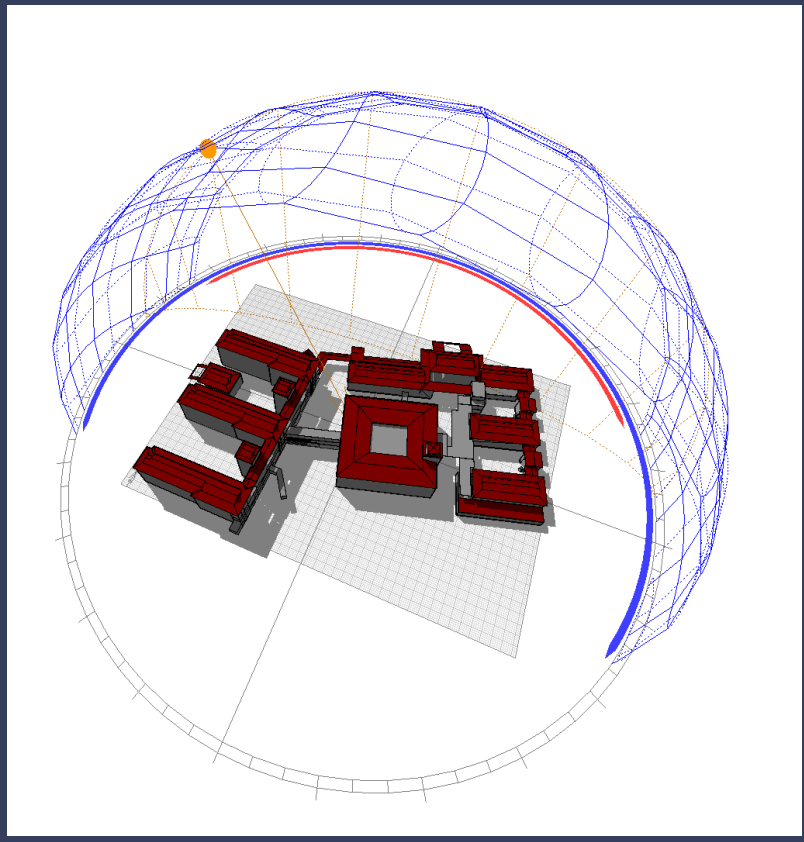
- The multi-story decentralized building layout ensures efficient and compact medical processes and sufficient sunlight spacing between buildings
- The architectural shadows form effective shading, creating a relatively favorable microclimate environment for the natural courtyard Spaces between buildings



- 8am



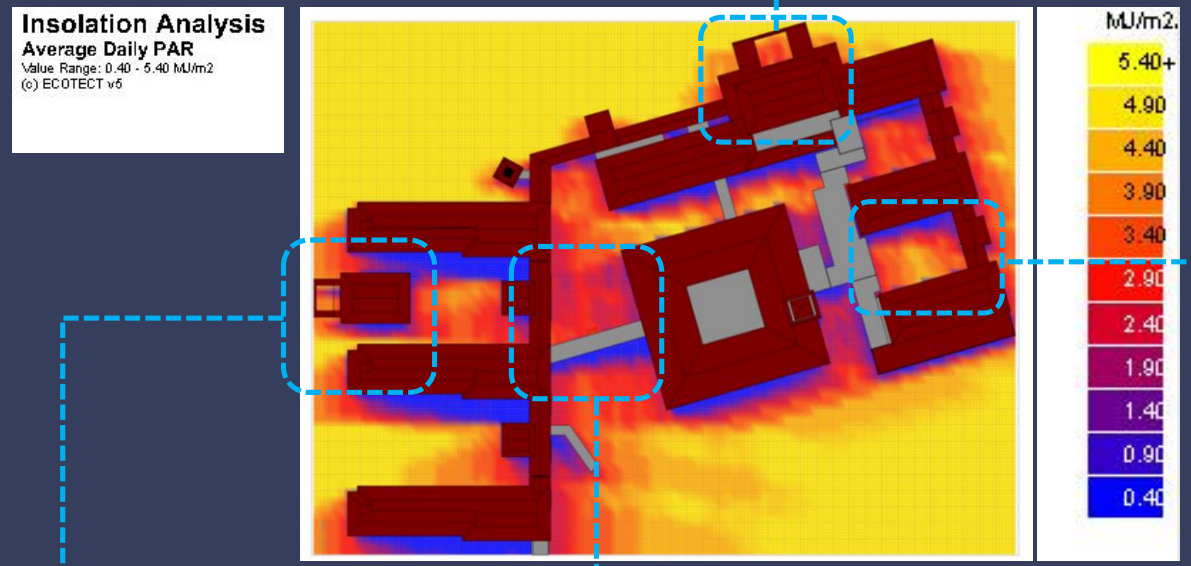
- 10am

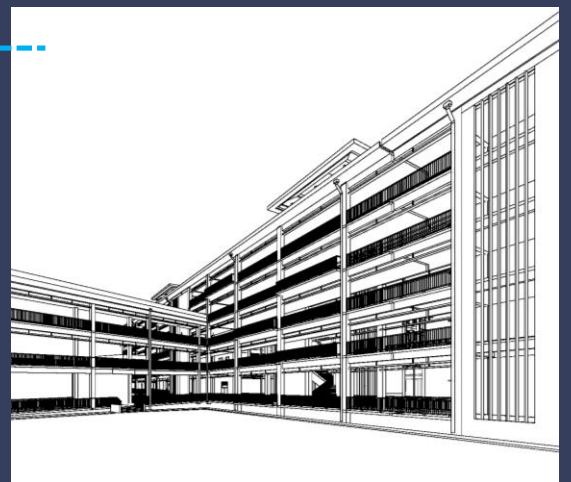


- 4pm

The influence of solar radiation on construction sites

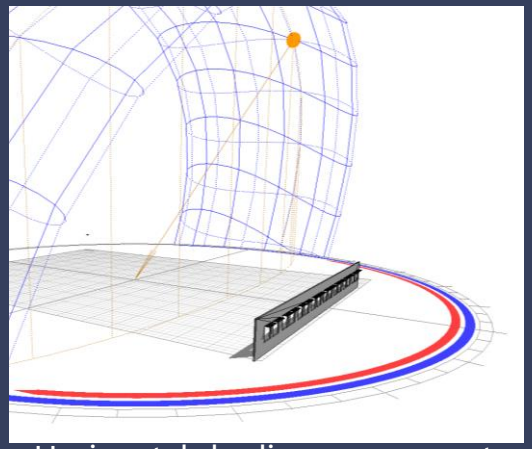
- The intensity of solar radiation on the building site affects the comfort of outdoor Spaces, especially areas with frequent human activities.
- Computational simulation shows that the solar radiation intensity in the entrance Spaces of the outpatient and emergency departments and inpatient departments, as well as in each courtyard space, is relatively small. Combined with shading facilities, it meets the requirements of comfort.



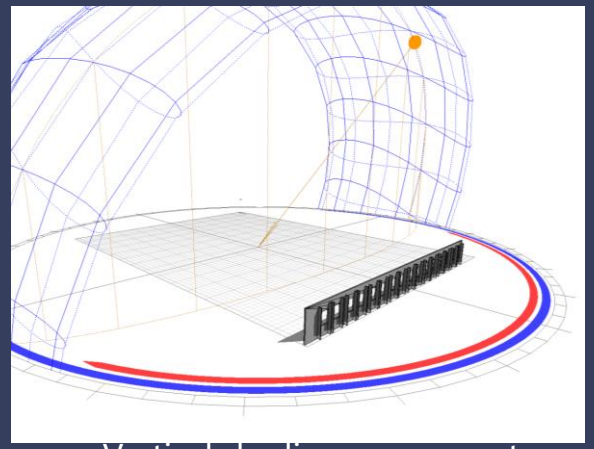


All-round shading system design

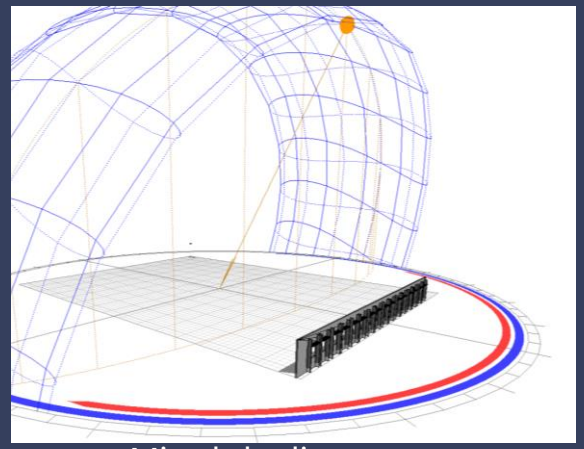
- **Appropriate shading methods can help allow sunlight to enter the room in cold season and prevent excessive sunlight from entering in hot season. With the help of auxiliary measures, the combined shading components have the highest shading efficiency in the north-facing wards**
- **The open pitched roof provides shading and heat insulation for the roof**



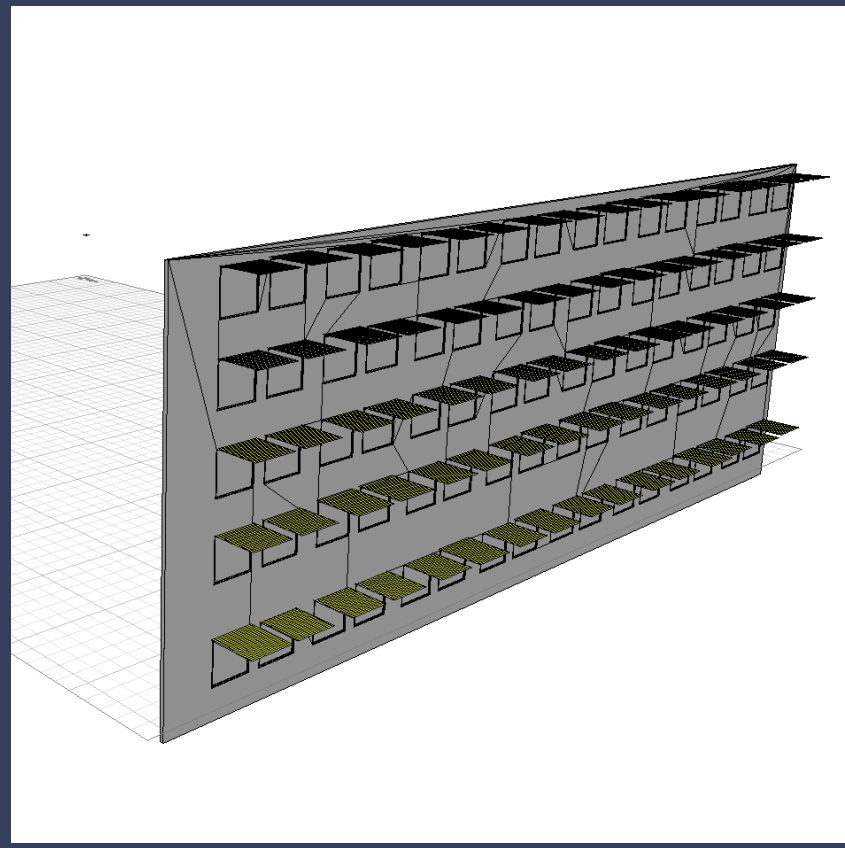
Horizontal shading components



Vertical shading components



Mixed shading system



Formed Sunshade component

Shading facade of the outpatient building

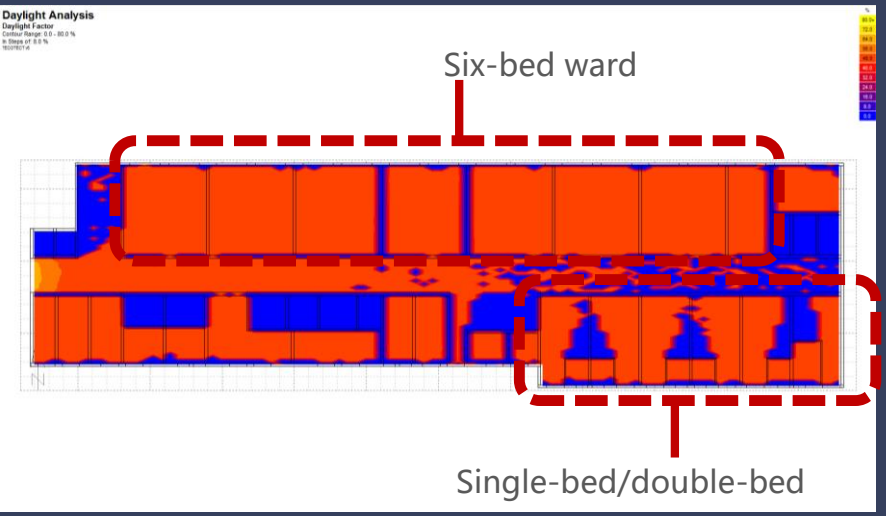
Shading system for corridor facades

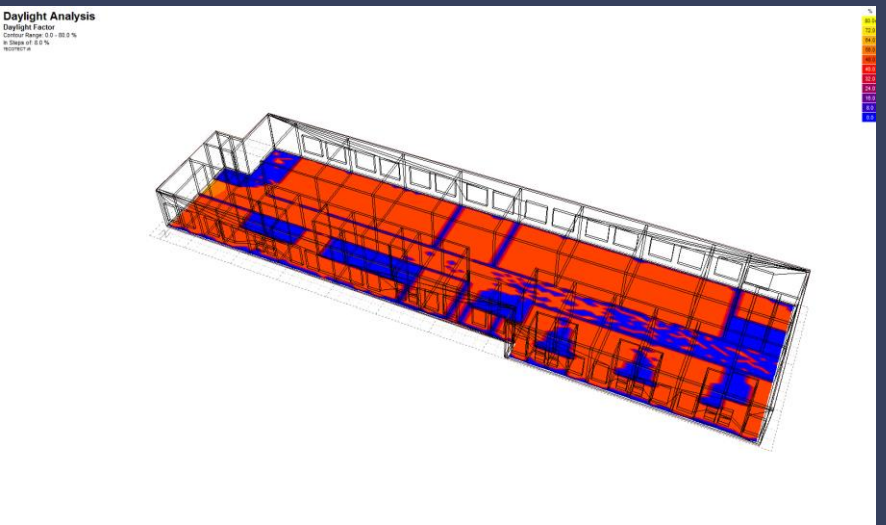
Shading system for the facade

Open slope roof shading and heat insulation system

Analysis of indoor light environment

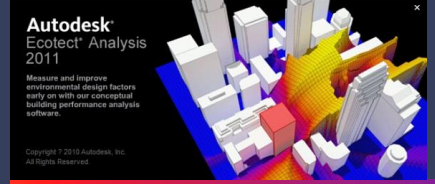
- "The area with a daylight factor greater than 2% must account for over 75% of the total area." Simulation analysis shows that all wards meet this requirement.
- Based on the results, the size, height, and position of ward windows satisfy natural lighting needs.
- Even on cloudy days, sufficient natural light is achieved indoors, reducing reliance on artificial lighting and lowering energy consumption.

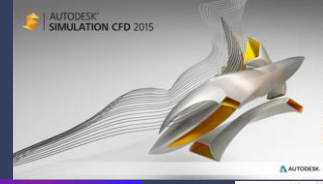


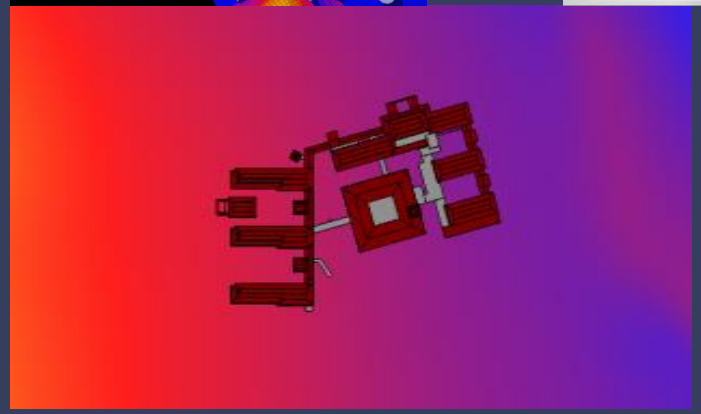


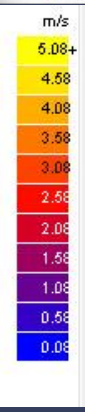
Indoor Air Environment Simulation Analysis

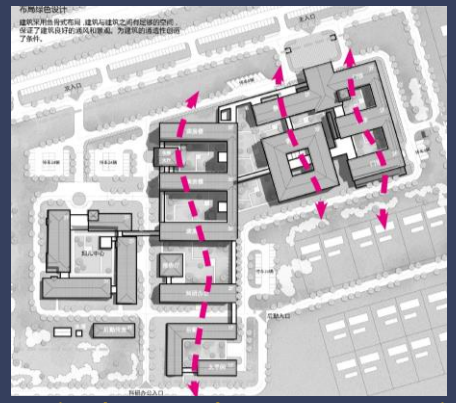
- Simulation results indicate that wind speeds exceed 5 m/s across most areas of the site.
- Functional spaces incorporate louvers to enhance natural ventilation, reduce indoor temperatures, and meet comfort requirements.
- Ventilation louvers are installed above doors connecting to semi-open corridors to improve airflow convection within rooms.



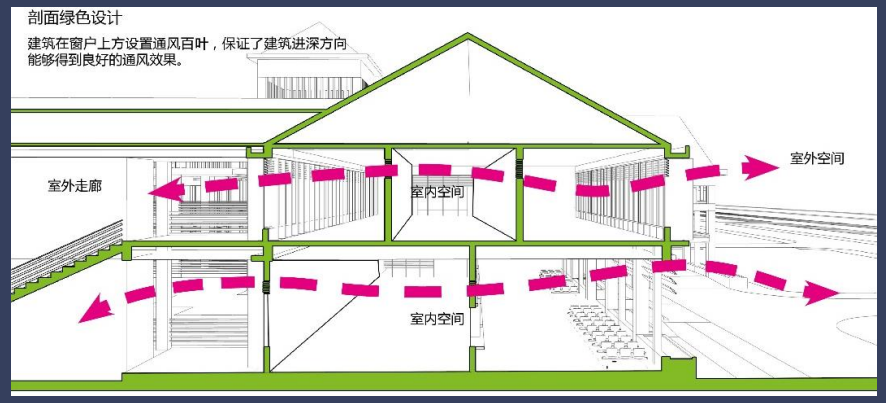






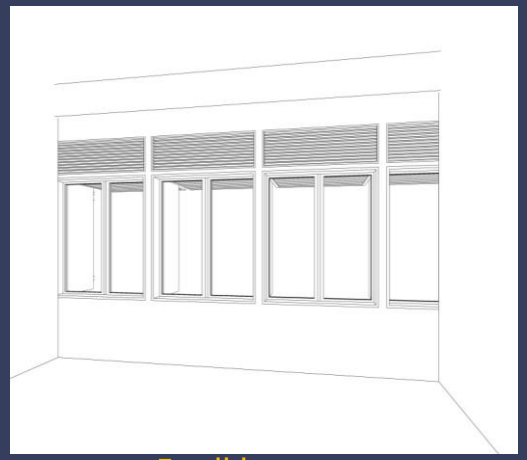


Community layout that promotes air flow

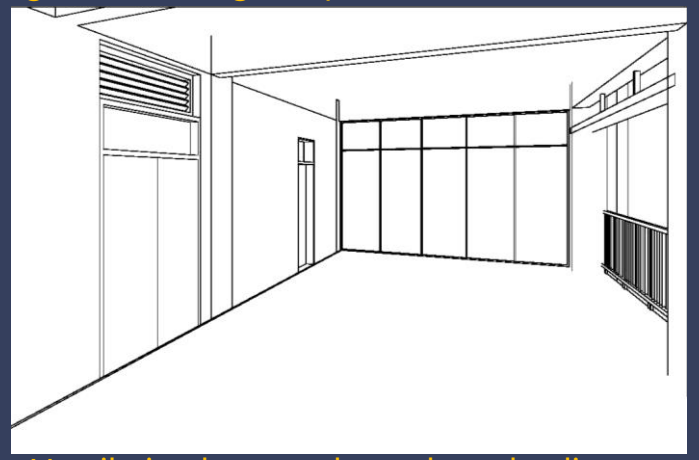


The airflow runs through the building complex

Ward exterior wall louvers



Ewall louvers

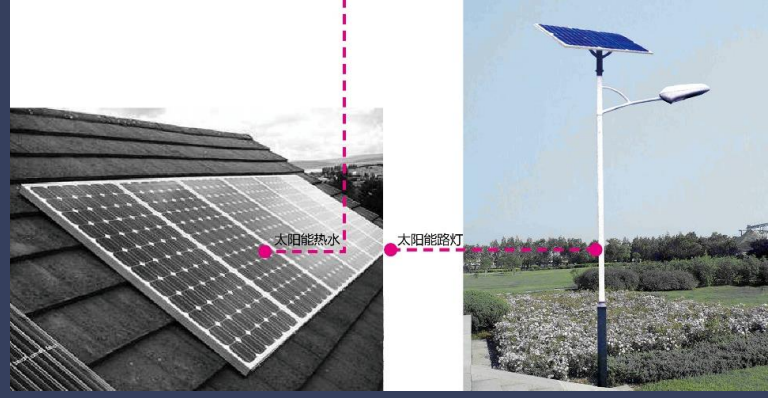


Ventilation louvers above doors leading to semi-open corridors

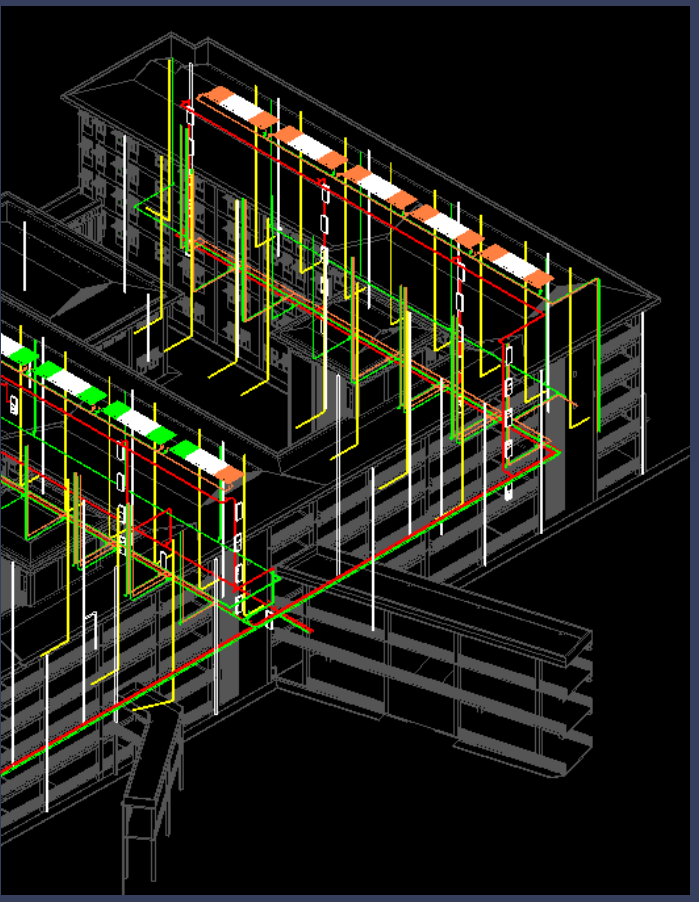
Waiting area open to the natural courtyard

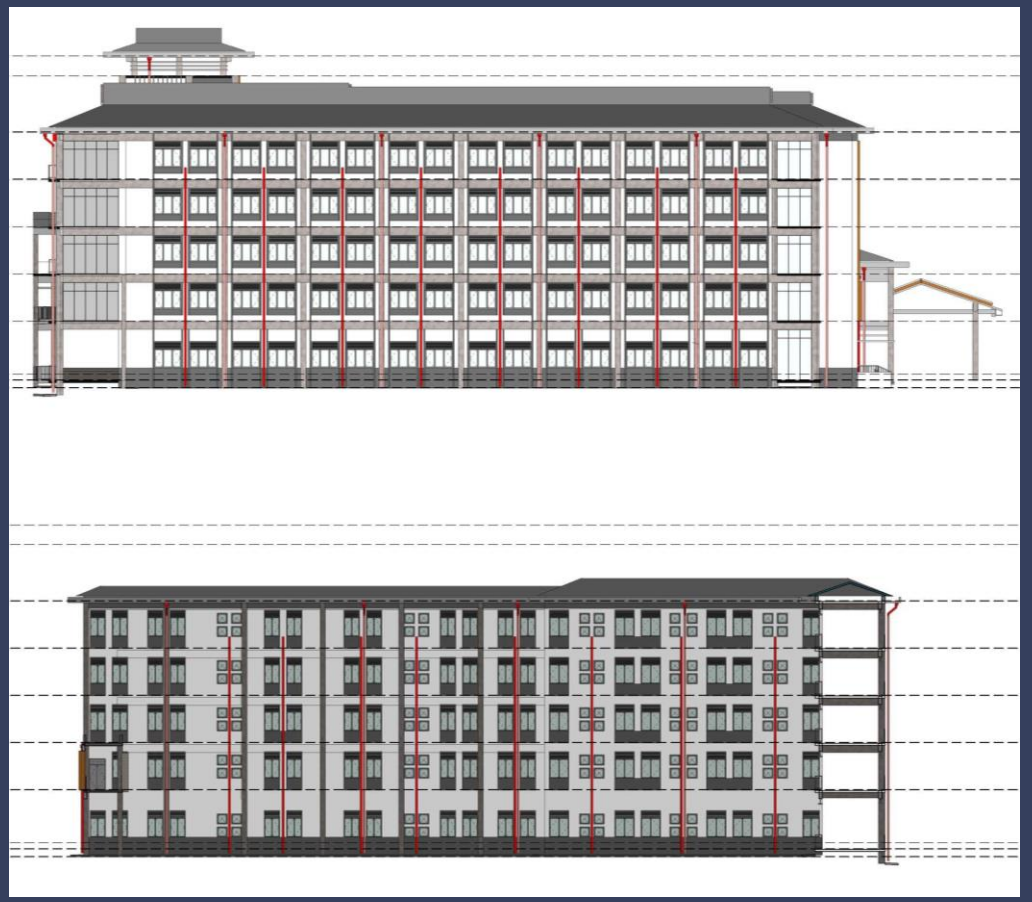
Appropriate green building technical measures

- Set up sunken green Spaces in combination with the courtyards between buildings to control the total annual runoff of the site and maintain the balance of groundwater.
- The Lusaka district is rich in solar energy resources. Each inpatient building is equipped with an 80-square-meter solar water heater on its roof, which generates hot water for showers.
- The street lamps in the hospital area adopt solar energy to save electricity.
- There are numerous termites in Lusaka. The foundation and wooden components have all undergone anti-corrosion and termite control treatments to maintain the firmness and durability of the buildings.
- All building and mechanical and electrical equipment are mainly applied to products that are locally produced and have subsequent maintenance services in the country.
- The main medical technology departments and important energy-consuming load electromechanical facilities are located at the center of the building layout, shortening the connection distance and reducing the transmission loss.
- The architectural form is simple and plain, with an integrated design of decoration and function. No decorative components without functional effects are designed.
- The materials used are reusable materials such as steel structures and aluminum alloy doors and Windows. The exterior walls are coated with inorganic coatings that are elastic, crack-resistant and weather-resistant for a long time.



The plumbing and drainage system design integrates operational and maintenance requirements, ensuring user convenience and ease of inspection/component





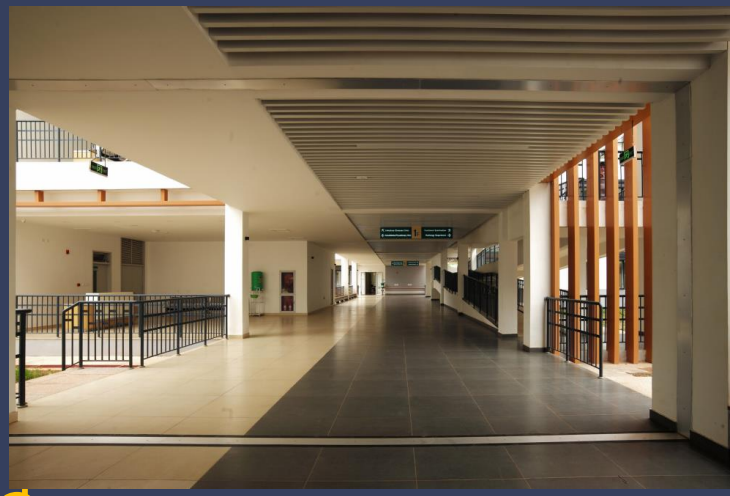
The water fixtures are arranged in clustered layouts to reduce vertical piping complexity, while ward drainage pipes are installed along exterior walls for easier maintenance and replacement.

Open public spaces that harmonize with the local climate and blend into the natural environment

Ground Floor Plan（首层）

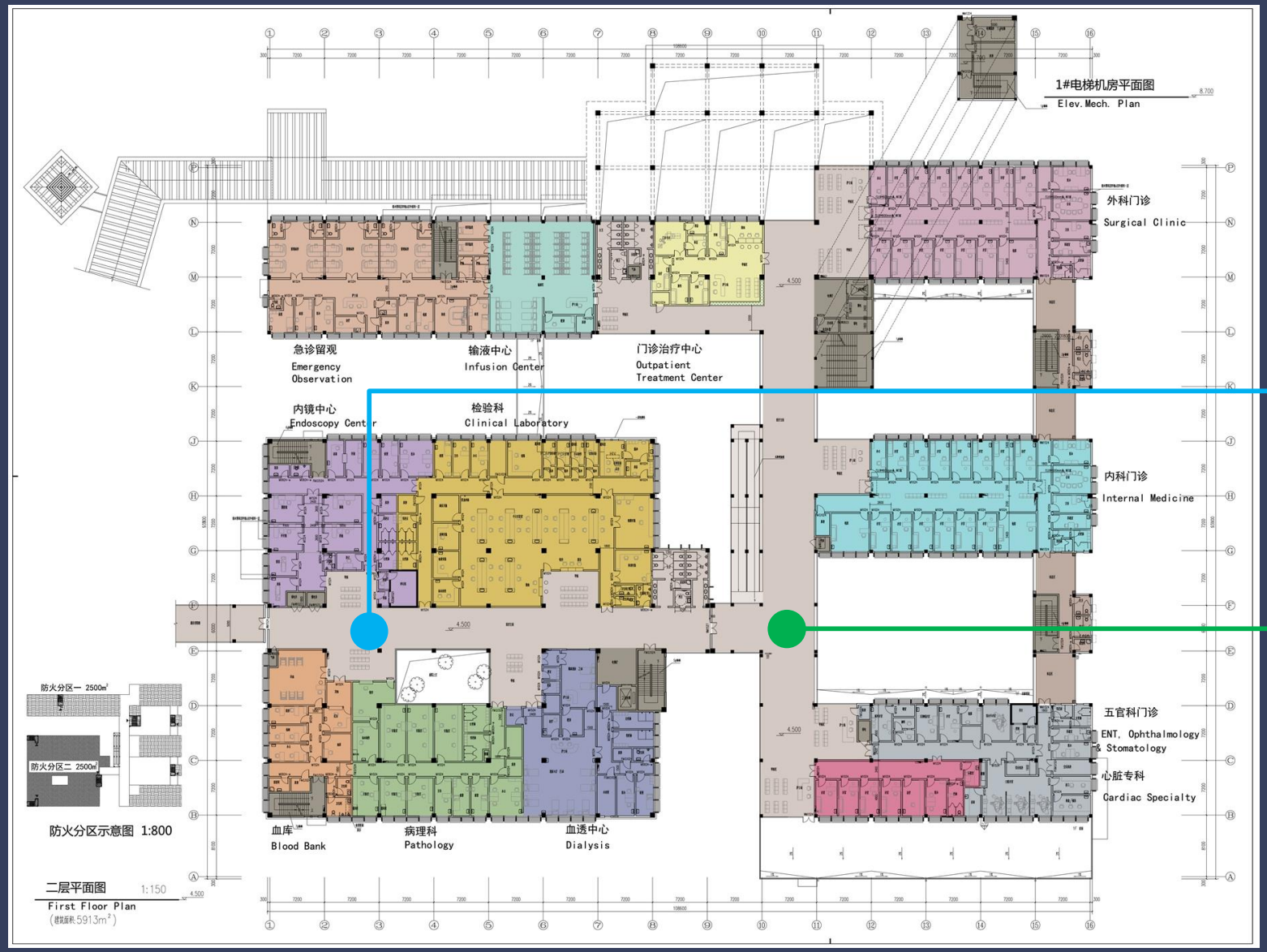
Outpatient Entrance Plaza

Outpatient Pharmacy Waiting Zone



Medical Street Integrated with Courtyards

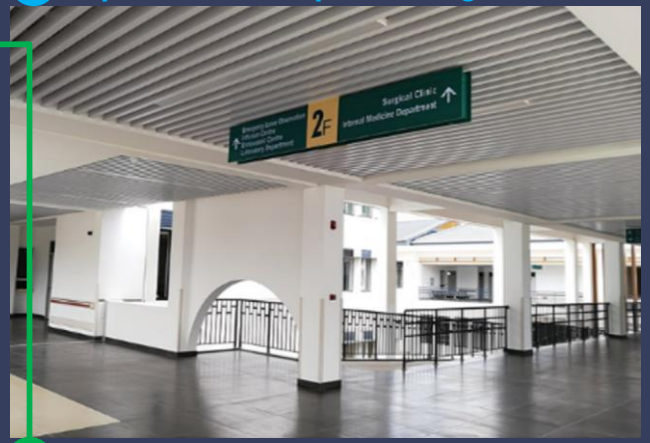
Biophilic Open Healthcare Spaces



First Floor Plan（二层）

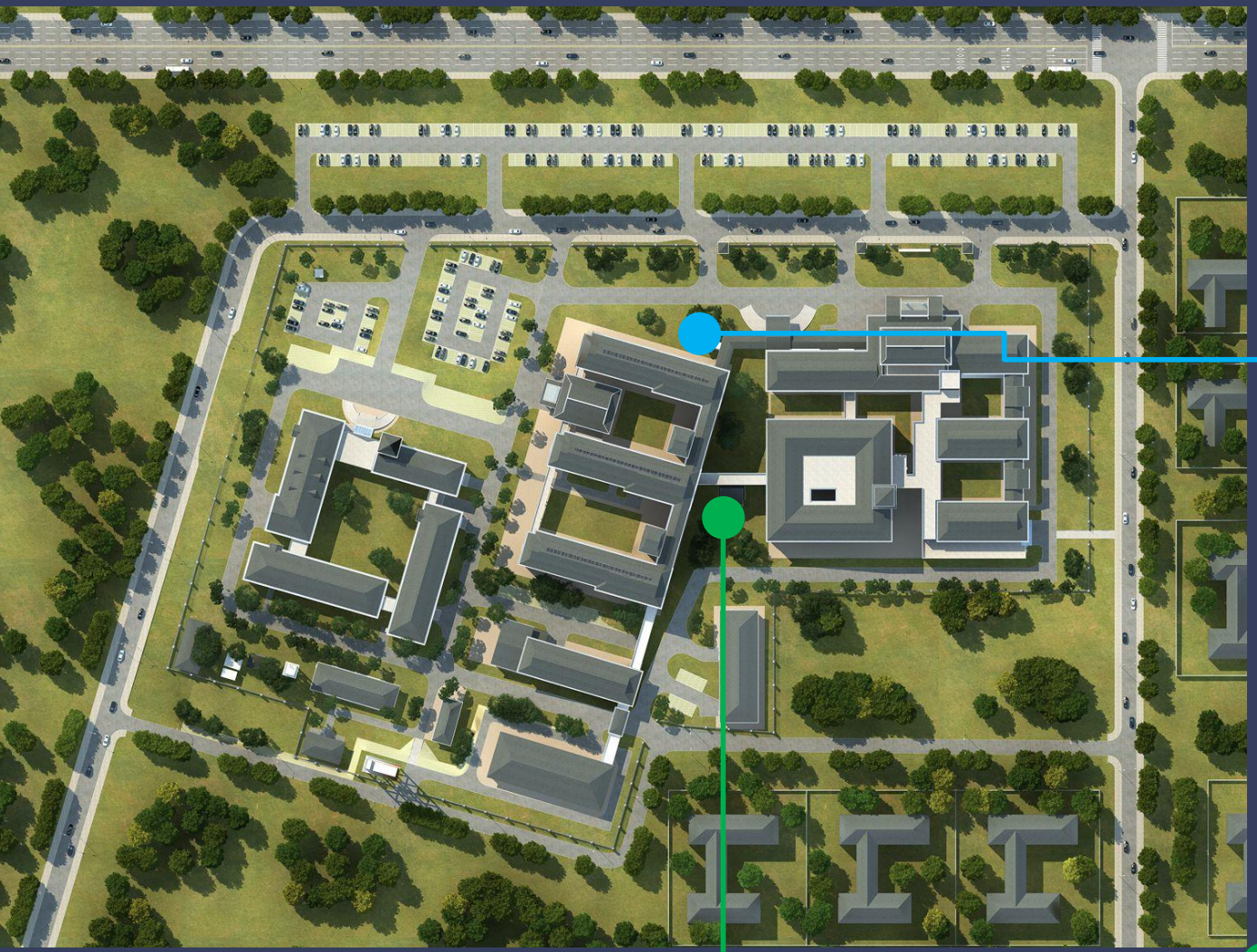
Academic Lecture Hall

Open Medical Spine - Diagnostic & Treatment Wing



Open Medical Spine - Outpatient Wing

Culturally-Adaptive Lounge & Social Space



Master Planning

Rest & Visitor Pavilion

Chapel Along Medical Street

Architectural Aesthetics

Highly Acclaimed:

"A harmonious fusion of Zambian national architectural aesthetics with classical Chinese elements."

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Global Best Projects

Best Project, Health Care: Levy Mwanawasa University Teaching Hospital

By Christine Kilpatrick

The Levy Mwanawasa University Teaching Hospital, which opened as the coronavirus pandemic struck, admitted 70% of Zambia's COVID-19 patients.
Photo by XU Weiliang

December 8, 2021

Levy Mwanawasa University Teaching Hospital

Lusaka, Zambia

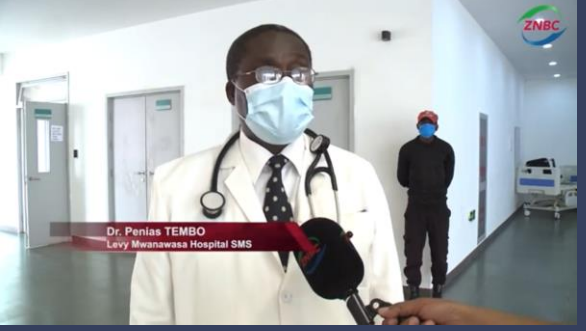
BEST PROJECT

OWNER: Ministry of Health

LEAD DESIGN FIRM; CIVIL, STRUCTURAL AND MEP ENGINEER: China IPPR International Engineering Co. Ltd.

LEAD CONTRACTOR: Shanxi Construction Investment Group Co. Ltd.

When the Levy Mwanawasa University Teaching Hospital opened in the Zambian capital of Lusaka in spring 2020, the expanded and upgraded facility was more than a successful project; it was a salvation for the African nation. The facility admitted Zambia's first coronavirus patients in March and soon became the center of its response. Throughout the pandemic, the team says the hospital admitted over 70% of total COVID-19 patients in Zambia.



The hospital was completed and operational in early 2020, immediately joining Zambia's fight against the COVID-19 pandemic upon commissioning. It has made outstanding contributions to improving the country's healthcare standards while significantly advancing local medical education, employment, and long-term economic development.

In recognition of these achievements, the Zambian Ministry of Health has officially designated the facility as the Levy Mwanawasa University Teaching Hospital.

Post-Commissioning Evaluation

- **Integrated Healthcare Delivery**
  "Synergizing advanced medical technologies with traditional practices through complementary hardware-software systems and dual-focused training programs."
- **Medical Team Performance**
  "Chinese medical aid teams operate with exceptional efficiency in this culturally-adapted environment, achieving both clinical excellence and knowledge transfer."








Green Hospital in Symbiosis with the Environment

——The Case of PLA Hospital Hainan Hospital

- Semi-Enclosed Layout
- Integrated Solar Shading & Thermal Insulation System
- Flow Integration System
- Optimal Daylight Utilization
- Smart Hospital Operation System
- Comprehensive Disaster Resilience System
- Environmentally Responsible Technical Measures

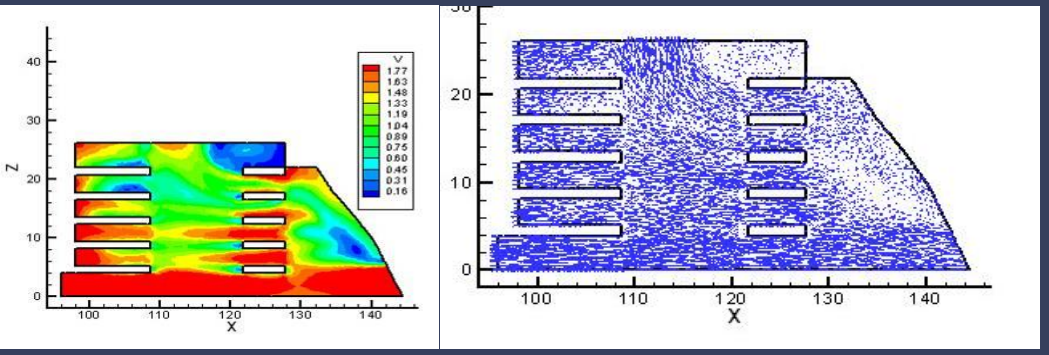
Building Scale: 160,000 sqm

Bed Capacity: 680 beds

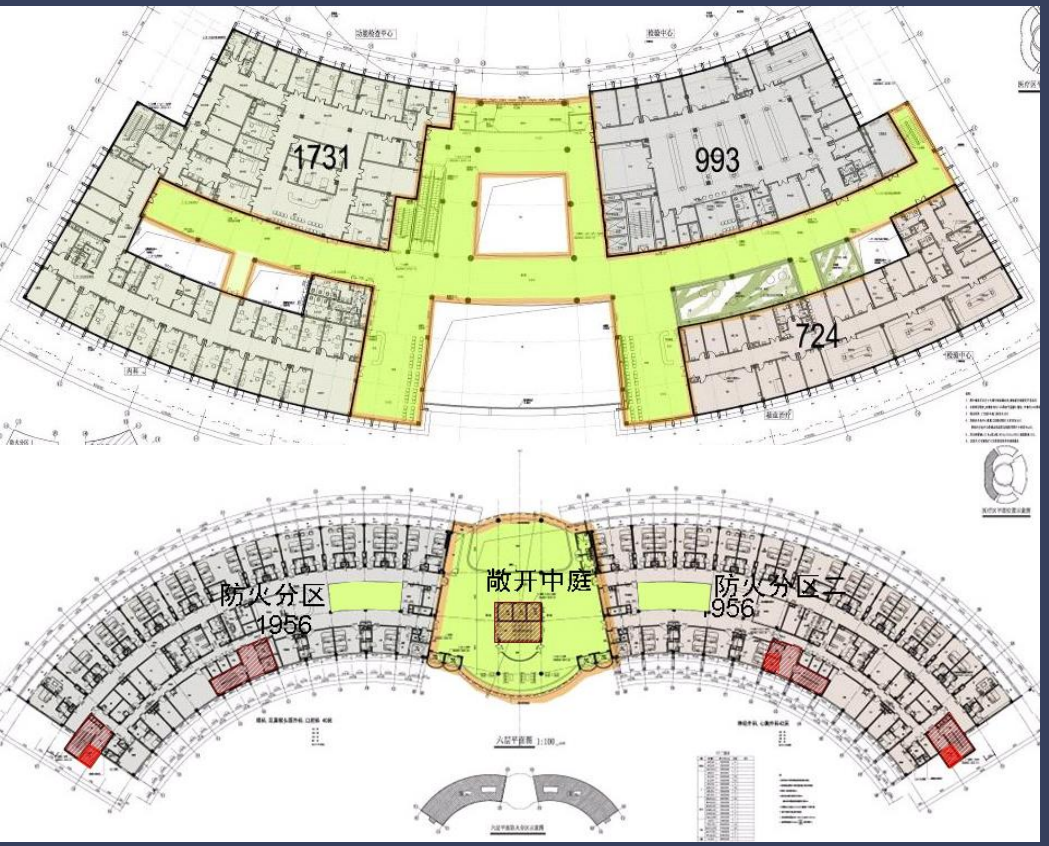
Location: Sanya City, Hainan Province, China

Construction Period: 2010–2012

Achieve 15% Annual Operational Energy Reduction (via Integrated Hospital Energy Monitoring Platform)



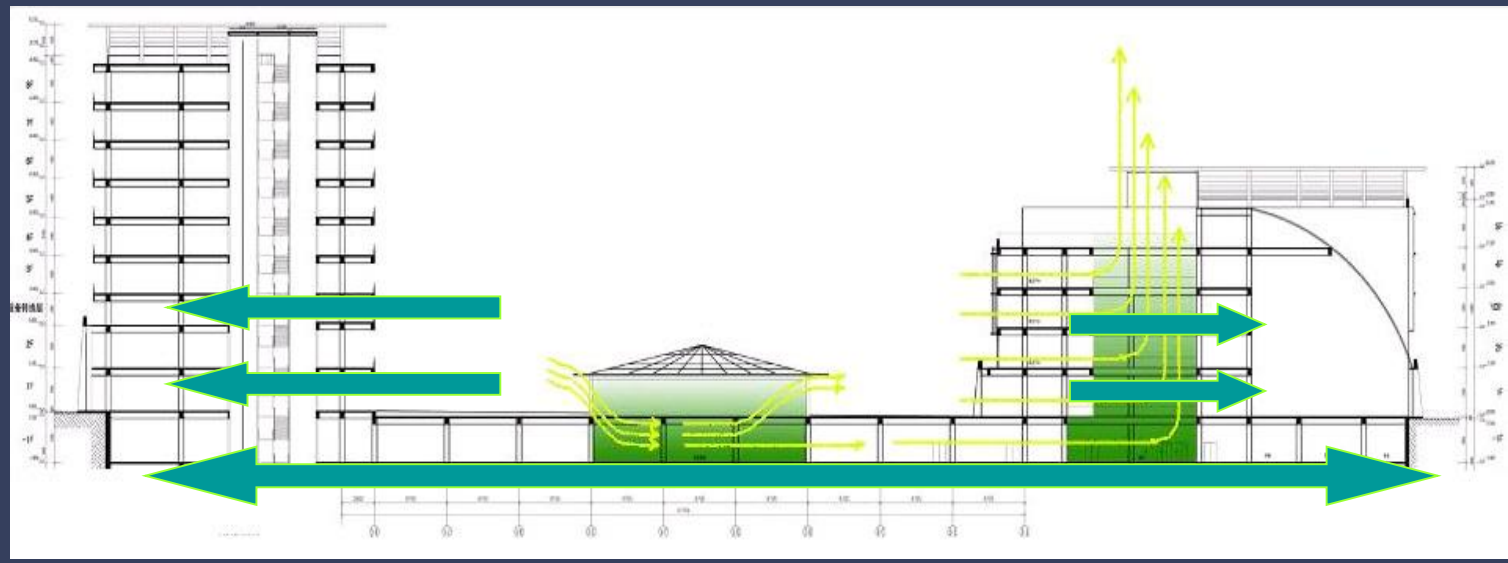
Computer simulation of the air flow direction in the outpatient hall



An indoor space open to the natural environment

Medical Street with Courtyard in Outpatient Department

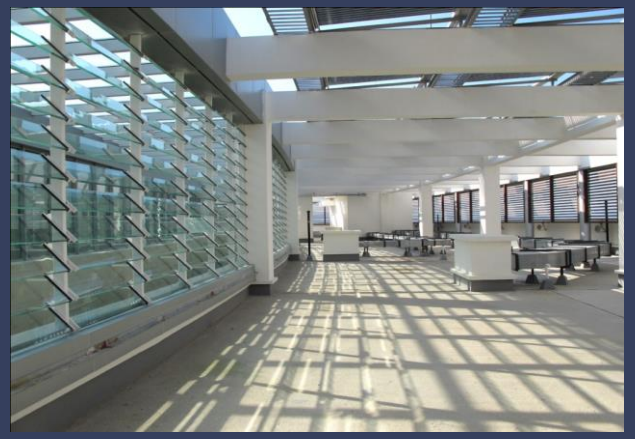
Clinic Courtyard Overhead Ventilated Glass Louvers

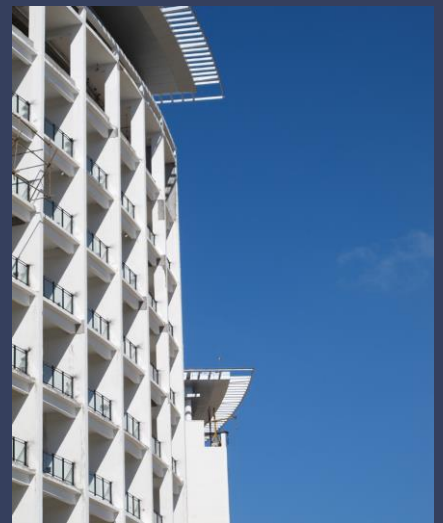


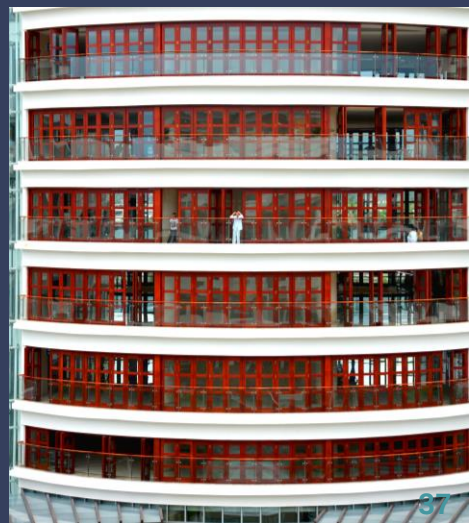
The natural airflow running through the building complex

Sunshading System Architecturally Integrated into Building Facade

- Integrated Facade Sunshading System
- Cantilevered Patient Ward Balconies
- Elevated Roof Canopy for Thermal Insulation
- Clinic Lobby Water Curtain & Fabric Shading
- Petals-Inspired Shading Fabric in Sunken Courtyard
- Ceramic-Fritted Glass Walkways







Re-visit the hospital on May 16, 2025

Conclusion

For green hospital design in different countries:

1. The **core value** of the sustainable healthcare facilities lies in its ability to **economically** and **efficiently** deliver high quality medical services over the **long term**.
2. In regions with varying development levels, fully utilizing **natural conditions** can play a crucial role in achieving sustainable development.
3. For countries like Zambia, being in the process of modernization may, in a sense, provide greater **advantages** for sustainable development.
4. Resilient and enduring sustainable development goals rely on the **synergistic application** of diverse green technologies.
5. **Sharing best practices** in sustainable hospital infrastructure development among nations can significantly advance global green healthcare initiatives.

THANKS !