**CHAPTER II**

**COOLING AND HEATING LOAD CALCULATION**

This chapter presents the essential data required in establishing the appropriate air conditioning system to be used in the design proper. This includes the building components, material construction, heat load calculation, psychrometric calculation including the psychrometric chart plotting, and piping calculation.

The ground floor of the hospital has less than 70 spaces which primarily consists of work area, storage rooms, operating rooms, examination/ treatment area, emergency room, X-Ray room, OPD clinic medical rooms, administrative office, dark and control rooms, staff dining area, and canteen.

The second floor has also less than 70 spaces which primarily consists of bedwards for patients, isolation rooms, treatment rooms, dirty utility and clean linen, nurse station, conference room, delivery room, labor room, nurseries, breastfeeding room, operating rooms, supply and storage rooms.

The third floor of the hospital has less than 50 spaces which is actually the same rooms for the second room except there is a chapel.

**A. Building Components and Materials Construction**

This section presents the materials used and the composition of the building walls, roofs, doors, glass windows, and partitions.

**1. External Wall**

**Figure \_** Wall Construction

150 mm CHB sand and gravel

25 mm Cement Plaster

25mm Cement Plaster

Inside Air firms

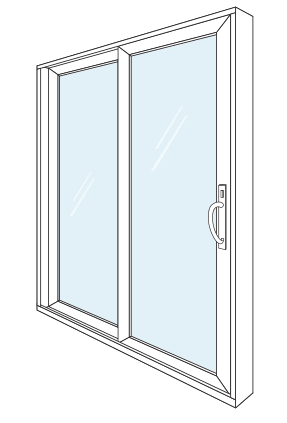
Outside Air Film

|  |  |  |
| --- | --- | --- |
|  | R, m2 ⁰K/Watt | ρS, Kg/m2 |
| outside air film | 0.0440 | --- |
| 25 cement plaster | 0.0347 | 39.95 |
| 150mm CHB sand and gravel | 0.1350 | 147 |
| 25 cement plaster | 0.0347 | 39.95 |
| inside air film | 0.12 | --- |
|  | RT = 1.2695 | ρST = 226 Kg/m2 |
|  | **UW = 2.7144 W/m2K** | **TYPE F** |

**Table 1.0** Properties of each Components of External Wall

This table presents the composition of external wall including the outside and inside surface resistance, 25 mm cement plaster and 150 mm CHB with their corresponding thermal resistivity and surface density. Moreover, the heat transfer coefficient, U, is obtained by getting the inverse of the summation of the resistances of the components. Therefore, use Type F Wall. The height of the wall is 3 meters with permanent light color. Since the total mass per unit area of wall is greater than 226 kg/m2, the type of wall to be used was type F. See Appendix B.

**2. Glass Portion**



**Figure \_** Glass Window

Single Glass, Regular Sheet, Light Venetian Blinds

Number of panels = one to four panels

Area = depends on the architectural plan

Height = 1.6 m

Heat Transfer Coefficient use U = 2.8211 W/m2K (fixed)

Heat Transfer Coefficient use U = 2.8722 W/m2K (awning, sliding)

Window Details

|  |  |
| --- | --- |
| **Ground Floor** | |
| **Dimension(m)** | **Description** |
|  | Fixed Window |
|  | Awning Window |
|  | Awning Window |
|  | Fixed Window |
|  | Awning Window |
|  | Fixed Window |
|  | Rotating Window |
|  | Fixed Window |
|  | Fixed Window |
|  | Fixed Window |
|  | Fixed Window |
|  | Fixed Window |
|  | Fixed Window |
|  | Fixed Window |
|  | Awning Window |
|  | Fixed Window |
|  | Awning Window |
|  | Fixed Window |
|  | Fixed Window |
|  | Fixed Window |
|  | Fixed Window |
|  | Fixed Window |

**Table \_** Ground Floor Window Schedule

This table shows the dimensions of the window included in the ground floor. The kinds of the window used in the first floor are the \_\_

|  |  |
| --- | --- |
| **Second Floor** | |
| **Dimension(m)** | **Description** |
|  | Fixed Window |
|  | Awning Window |
|  | Awning Window |
|  | Fixed Window |
|  | Awning Window |
|  | Fixed Window |
|  | Rotating Window |
|  | Fixed Window |
|  | Fixed Window |
|  | Fixed Window |
|  | Fixed Window |
|  | Fixed Window |
|  | Fixed Window |
|  | Fixed Window |
|  | Awning Window |
|  | Fixed Window |
|  | Awning Window |
|  | Fixed Window |
|  | Fixed Window |
|  | Fixed Window |
|  | Fixed Window |
|  | Fixed Window |

**Table \_** Second Floor Window Schedule

This table shows the dimensions of the window included in the second floor. The kinds of the window used in the second floor are the \_\_

|  |  |
| --- | --- |
| **Third Floor** | |
| **Dimension(m)** | **Description** |
|  | Fixed Window |
|  | Awning Window |
|  | Awning Window |
|  | Fixed Window |
|  | Awning Window |
|  | Fixed Window |
|  | Rotating Window |
|  | Fixed Window |
|  | Fixed Window |
|  | Fixed Window |
|  | Fixed Window |
|  | Fixed Window |
|  | Fixed Window |
|  | Fixed Window |
|  | Awning Window |
|  | Fixed Window |
|  | Awning Window |
|  | Fixed Window |
|  | Fixed Window |
|  | Fixed Window |
|  | Fixed Window |
|  | Fixed Window |

This table shows the dimensions of the window included in the third floor. The kinds of the window used in the third floor are the \_\_

3. **External Roof**

Outside Air Film

13 mm slag or stone

10 mm felt membrane

150 mm concrete

Inside air film

**Figure \_** Roof Construction

|  |  |  |
| --- | --- | --- |
|  | R, m2K/W | ρS, Kg/m2 |
| outside air film | 0.044 | --- |
| 13 mm slag or stone | 0.009 | 881 |
| 10 mm felt membrane | 0.05 | 1121 |
| 150 mm low density conrete | 0.88 | 641 |
| inside air film | 0.12 | --- |
|  | RT = 1.104 m2K/W | ρST = 2643 Kg/m2 |
|  | **UW = 0.9058 W/m2K** | **TYPE 6** roof with suspended ceiling |

**Table \_** Properties of each Components of External Roof

This table presents the composition of roof including the outside and inside surface resistance, 150 mm low-density concrete with 13 mm slag or stone as aggregate and 10 mm felt membrane with their corresponding thermal resistivity and surface density. Moreover, the heat transfer coefficient, U, is obtained by getting the inverse of the summation of the resistances of the components. Therefore, use Type 3 – Roof Terrace System with suspended ceilings.

4. **Partition**

4.1 Internal Wall Partition

Outside Air films

190 mm Concrete Exterior

150 mm CHB sand

and gravel

Inside Air films

15 mm cement plaster

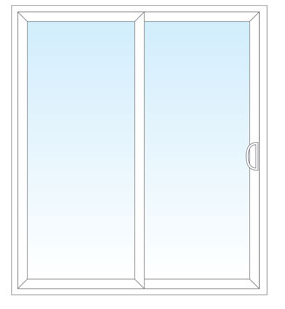
**Figure\_** Internal Wall Construction

|  |  |  |
| --- | --- | --- |
|  | R, m2 ⁰K/Watt | ρS, Kg/m2 |
| inside air film | 0.12 | --- |
| 15 mm cement plaster | 0.0208 | 23.97 |
| 120 mm CHB  sand and gravel | 0.1350 | 117.6 |
| 15 mm cement plaster | 0.0208 | 23.97 |
| inside air film | 0.12 | --- |
|  | RT = 0.3896 m2K/W | ρST = 165.54 Kg/m2 |
|  | **UW = 2.5667 W/m2K** | **TYPE F** |

**Table \_** Internal Wall Details

This table presents the composition of external wall including the outside and inside surface resistance, 15 mm cement plaster and 120 mm CHB with their corresponding thermal resistivity and surface density. Moreover, the heat transfer coefficient, U, is obtained by getting the inverse of the summation of the resistances of the components. The height of the wall is 4 meters with permanent light color. Since the total mass per unit area of wall is 165.54 kg/m2, the type of wall to be used was type F because this value is nearest to 200 kg/m2. See Appendix B.

**4.2 Partition Door**



**Figure \_** Glass Door

|  |  |
| --- | --- |
| **Dimension(m)** | **Description** |
|  | Single Panel Door |
|  | Double Panel Door |
|  | Single Panel Door |
|  | uPVC Panel Door |
|  | Double Panel Door |
|  | Sliding Door |
|  | Single Sliding Door |

**Table \_** Door Details

This table shows the dimensions of the door included in the hospital building. The kinds of the doors used in the hospital are\_

**5. Floor**

Outside Air Film

Vinyl tile 30 mm mm30mm

Insulating board

(concrete) 100 mm

50 mm sand blasting

**Figure \_** Floor Construction

|  |  |
| --- | --- |
|  | **R, m2 ⁰K/Watt** |
| outside air film | 0.12 |
| Vinyl tile 30 mm | 0.035 |
| Insulating board concrete 100mm | 0.088 |
| 50 mm Sand blasting | 0.3937 |
|  | RT = 0.0637 |
|  | **UW = 1.570598398 W/m2K** |

**Table \_** Floor Details

**Heat Load Calculation**

The heat load calculation is determined by a software Hourly Analysis Program (HAP). It is a computer tool which assists engineers in designing HVAC systems for commercial buildings in order to determine required sizes for HVAC system components. Ultimately, the program provides information needed for selecting and specifying equipment. Specifically, the program perform performs the following tasks:

* Calculates design cooling and heating loads for spaces, zones, and coils in the HVAC system.
* Determines required airflow rates for spaces, zones and the system.
* Sizes cooling and heating coils.
* Sizes air circulation fans.
* Sizes chillers and boilers.

Before energy simulations can be run, general information about the building, its environment, the types of HVAC and non-HVAC equipment, and its energy prices must be gathered. This step involves extracting data from building plans, evaluating building usage, studying HVAC system needs and acquiring utility rate schedules. Specific types of information needed include:

* Climate data for the building site.
* General information about building size, shape, layout and number of floors.
* General information about the type of wall, window and roof envelope construction to be used.
* General information about the space usage in the building which will affect occupant density and lighting and equipment usage levels.
* General information about the type of air-side systems, equipment and components to be considered.
* General information about prices for electric service and any fuel sources used in the building.

1. Weather Data

This information plays an important role in influencing loads and system operation throughout the year. It includes the temperature, humidity, and solar radiation conditions of the building. The region and location selected is Asia, Philippines. The city is in Manila but it is not the desired location for building the hospital. However, Manila is set to be the reference point of location since it is nearly located in Batangas City. Also, in looking on the google earth, the latitude and longitude of Batangas City is quite near in Manila for climatic condition of the locality as to where the building is constructed. This selection will be able to get directly weather parameters.

2. Space Data

This section includes all elements which affect heat flow in the space. Usually a space represents a single room. Elements include walls, windows, doors, skylights, floors, occupants, lighting, electrical equipment, miscellaneous heat sources, infiltration and partitions.

2.1 Floor Area and The Ceiling Height

The spaces listed in the space input form includes the rooms for the ground, second and third floor. Each space has corresponding areas and ceiling height. The ceiling height is to be assumed the same for every floor which is 4 m.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name of Space** | **Base Area (m2)** | **Outdoor Air Requirement** | |
| **L/s-person** | **L/s- m2** |
| Power House | 37.4386 |  |  |
| Work Area | 9.6512 |  |  |
| Storage Room | 7.8175 |  |  |
| Maintenance Office | 16.3095 |  |  |
| Female toilet | 18.2991 |  |  |
| Male Toilet | 18.3464 |  |  |
| Minor Operating Room | 23.3886 |  |  |
| Equipment and supply storage area | 5.61 |  |  |
| Examination/Treatment and Observation area | 42.1925 |  |  |
| Cadaver Holding Room | 19.6378 |  |  |
| Supply Room | 31.2893 |  |  |
| Bulk Storage | 3.9772 |  |  |
| Pharmacy | 20.7487 |  |  |
| Medical Records Office | 17.9512 |  |  |
| Medical Records | 18.6308 |  |  |
| PHILHEALTH | 17.1378 |  |  |
| Doctor's Duty | 11.6062 |  |  |
| EMERGENCY ROOM | 130.9682 |  |  |
| Work Area (laboratory) | 32.86 |  |  |
| Waiting area | 12.6775 |  |  |
| OPD clinic dental 1 | 14.3811 |  |  |
| OPD clinic dental 2 | 14.3811 |  |  |
| Elevator | 8.9651 |  |  |
| OPD clinic surgery 1 | 14.4356 |  |  |
| OPD clinic surgery 2 | 14.4356 |  |  |
| Cashier | 5.4875 |  |  |
| Billing | 5.51 |  |  |
| Admitting | 5.6363 |  |  |
| Film File Storage | 5.5203 |  |  |
| Radiologist Office | 9.1492 |  |  |
| Dark Room | 4.9522 |  |  |
| Control Booth | 25.2538 |  |  |
| OPD Clinic Pedia 1 | 14.3811 |  |  |
| OPD Clinic Pedia 2 | 14.3811 |  |  |
| OPD Records | 10.418 |  |  |
| OPD info. And admitting | 9.9805 |  |  |
| OPD Clinic Medical 1 | 14.4356 |  |  |
| OPD Clinic Medical 2 | 14.4356 |  |  |
| Waste Disposal Area | 14.3639 |  |  |
| Pressing Area | 8.431 |  |  |
| Linen Storage 1 | 8.3137 |  |  |
| Linen Office | 8.4375 |  |  |
| Admin Office | 13.607 |  |  |
| Male Toilet | 17.2599 |  |  |
| Washing Area | 17.1267 |  |  |
| Receiving Sorting Area | 8.5711 |  |  |
| Administrative office | 35.3177 |  |  |
| Social Welfare | 13.5984 |  |  |
| Female Toilet | 17.0428 |  |  |
| OPD Info. And admitting | 10.4417 |  |  |
| OPD records | 11.5919 |  |  |
| Ultrasound | 19.0769 |  |  |
| Cooking Area | 34.2152 |  |  |
| Dry storage | 2.5941 |  |  |
| Cold Storage | 1.9625 |  |  |
| Supply Receiving Area | 5.7184 |  |  |
| Dietician's Office | 9.225 |  |  |
| Dietary | 38.0325 |  |  |
| Staff Dining | 50.8881 |  |  |
| OPD clinic Ob-gyne | 27.0056 |  |  |
| Garbage Disposal area | 2.28 |  |  |
| Canteen | 181.6992 |  |  |

**Table \_** Ground Floor Area

and Outdoor Air Requirement

|  |  |  |  |
| --- | --- | --- | --- |
| **Name of Space** | **Base Area (m2)** | **Outdoor Air Requirement** | |
| **L/s-person** | **L/s- m2** |
| 5-Bed Ward 1 | 34.2769 |  |  |
| 5-Bed Ward 2 | 34.26 |  |  |
| 5-Bed Ward 3 | 34.29 |  |  |
| 5-Bed Ward 4 | 34.1175 |  |  |
| Isolation Room 1 | 13.6738 |  |  |
| Private Room 1 | 13.9206 |  |  |
| Private Room 2 | 13.8754 |  |  |
| Chief Nurse | 30.712 |  |  |
| Treatment Room | 17.9413 |  |  |
| Nurse Station | 22.829 |  |  |
| Dirty Utility | 4.7869 |  |  |
| Clean Linen | 2.4581 |  |  |
| Private Room 3 | 13.8735 |  |  |
| Private Room 4 | 13.8928 |  |  |
| Isolation Room 2 | 13.7066 |  |  |
| Reception | 11.0522 |  |  |
| Private Room 5 | 13.6813 |  |  |
| Chief of Hospital | 18.7319 |  |  |
| 3-Bed Ward 1 | 25.372 |  |  |
| Elevator |  |  |  |
| 3-Bed Ward 2 | 25.48 |  |  |
| Private Room 6 | 13.7512 |  |  |
| Conference Room | 38.4537 |  |  |
| 3-Bed Ward 3 | 25.372 |  |  |
| 3-Bed Ward 4 | 25.48 |  |  |
| Private Room 7 | 13.7512 |  |  |
| Private Room 8 | 13.7512 |  |  |
| Chief of Clinics | 21.3616 |  |  |
| CSSR | 31.4388 |  |  |
| Delivery Room | 34.9862 |  |  |
| Sub-Ster Room 1 | 5.4111 |  |  |
| Labor Room | 25.7486 |  |  |
| Pathologic Nursery | 16.7994 |  |  |
| Pre-mature nursery | 16.7999 |  |  |
| Breastfeeding room | 10.2258 |  |  |
| Pre-operation area | 19.0007 |  |  |
| Autoclave area | 14.9875 |  |  |
| Sterile supply room | 21.6006 |  |  |
| Work Area 1 | 23.6003 |  |  |
| Major Operating Room | 35.0425 |  |  |
| Sub-Ster Room 2 | 5.6912 |  |  |
| Jan.Clo. | 4.1338 |  |  |
| Clean up room | 12.91 |  |  |
| Sterile instrument supply storage area | 7.4784 |  |  |
| anesthesia office and storage | 17.5207 |  |  |
| DR-1 | 2.8 |  |  |
| DR-2 | 2.8 |  |  |
| DR-3 | 2.8 |  |  |
| Recovery Room | 46.9742 |  |  |

**Table \_** Second Floor Area

and Outdoor Air Requirement

|  |  |  |  |
| --- | --- | --- | --- |
| **Name of Space** | **Base Area (m2)** | **Outdoor Air Requirement** | |
| **L/s-person** | **L/s- m2** |
| 5-Bed Ward 1 | 34.2769 |  |  |
| 5-Bed Ward 2 | 34.26 |  |  |
| Waiting Area 1 | 37.4087 |  |  |
| Waiting Area 2 | 37.4087 |  |  |
| 5-Bed Ward 3 | 34.26 |  |  |
| 5-Bed Ward 4 | 34.26 |  |  |
| Isolation Room 1 | 10.1393 |  |  |
| Private Room 1 | 13.9222 |  |  |
| Private Room 2 | 13.8738 |  |  |
| Chief Nurse | 30.712 |  |  |
| Treatment Room | 17.9413 |  |  |
| Nurse Station | 22.829 |  |  |
| Dirty Utility | 4.7869 |  |  |
| Clean Linen | 2.4581 |  |  |
| Private Room 3 | 13.8735 |  |  |
| Private Room 4 | 13.8928 |  |  |
| Isolation Room 2 | 10.1716 |  |  |
| Private Room 5 | 15.8619 |  |  |
| Privaate Room 6 | 15.8619 |  |  |
| 3-Bed Ward 1 | 24.783 |  |  |
| 3-Bed Ward 2 | 24.8909 |  |  |
| Private Room 7 | 13.6813 |  |  |
| Private Room 8 | 13.7512 |  |  |
| Private Room 9 | 16.0112 |  |  |
| Private Room 10 | 16.0112 |  |  |
| Elevator | 8.9651 |  |  |
| Private Room 11 | 13.7512 |  |  |
| Private Room 12 | 13.7512 |  |  |
| Waiting Area | 23.4829 |  |  |
| Private Room 13 | 10.7572 |  |  |
| Private Room 14 | 11.315 |  |  |
| Solarium 1 | 13.3083 |  |  |
| Stretcher's Wheelchair Nook 1 | 11.0872 |  |  |
| Stretcher's Wheelchair Nook 2 | 8.275 |  |  |
| Solarium 2 | 13.4675 |  |  |
| Chapel | 58.8601 |  |  |
| Male Toilet | 17.4452 |  |  |
| Female Toilet | 17.4806 |  |  |
| Waiting Area | 43.5914 |  |  |
| Admitting | 10.9006 |  |  |
| Billing | 10.7831 |  |  |
| Cashier | 9.4163 |  |  |
| Personel's dining | 26.9958 |  |  |

**Table \_** Third Floor Area

and Outdoor Air Requirement

2.2 Lighting

This section shows the tabulation of data’s in terms of the lamp ratings per unit area of lighting area of the entire room, utilization factor and ballast factor in the specified floor.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Name of Space** | **Fixture Type** | **W/m2** | **Fu** | **Fb** |
| Power House |  |  |  |  |
| Work Area |  |  |  |  |
| Storage Room |  |  |  |  |
| Maintenance Office |  |  |  |  |
| Female toilet |  |  |  |  |
| Male Toilet |  |  |  |  |
| Minor Operating Room |  |  |  |  |
| Equipment and supply storage area |  |  |  |  |
| Examination/Treatment and Observation area |  |  |  |  |
| Cadaver Holding Room |  |  |  |  |
| Supply Room |  |  |  |  |
| Bulk Storage |  |  |  |  |
| Pharmacy |  |  |  |  |
| Medical Records Office |  |  |  |  |
| Medical Records |  |  |  |  |
| PHILHEALTH |  |  |  |  |
| Doctor's Duty |  |  |  |  |
| EMERGENCY ROOM |  |  |  |  |
| Work Area (laboratory) |  |  |  |  |
| Waiting area |  |  |  |  |
| OPD clinic dental 1 |  |  |  |  |
| OPD clinic dental 2 |  |  |  |  |
| Elevator |  |  |  |  |
| OPD clinic surgery 1 |  |  |  |  |
| OPD clinic surgery 2 |  |  |  |  |
| Cashier |  |  |  |  |
| Billing |  |  |  |  |
| Admitting |  |  |  |  |
| Film File Storage |  |  |  |  |
| Radiologist Office |  |  |  |  |
| Dark Room |  |  |  |  |
| Control Booth |  |  |  |  |
| OPD Clinic Pedia 1 |  |  |  |  |
| OPD Clinic Pedia 2 |  |  |  |  |
| OPD Records |  |  |  |  |
| OPD info. And admitting |  |  |  |  |
| OPD Clinic Medical 1 |  |  |  |  |
| OPD Clinic Medical 2 |  |  |  |  |
| Waste Disposal Area |  |  |  |  |
| Pressing Area |  |  |  |  |
| Linen Storage 1 |  |  |  |  |
| Linen Office |  |  |  |  |
| Admin Office |  |  |  |  |
| Male Toilet |  |  |  |  |
| Washing Area |  |  |  |  |
| Receiving Sorting Area |  |  |  |  |
| Administrative office |  |  |  |  |
| Social Welfare |  |  |  |  |
| Female Toilet |  |  |  |  |
| OPD Info. And admitting |  |  |  |  |
| OPD records |  |  |  |  |
| Ultrasound |  |  |  |  |
| Cooking Area |  |  |  |  |
| Dry storage |  |  |  |  |
| Cold Storage |  |  |  |  |
| Supply Receiving Area |  |  |  |  |
| Dietician's Office |  |  |  |  |
| Dietary |  |  |  |  |
| Staff Dining |  |  |  |  |
| OPD clinic Ob-gyne |  |  |  |  |
| Garbage Disposal area |  |  |  |  |
| Canteen |  |  |  |  |

**Table \_** Ground Floor Lighting Details

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Name of Space** | **Fixture Type** | **W/m2** | **Fu** | **Fb** |
| 5-Bed Ward 1 |  |  |  |  |
| 5-Bed Ward 2 |  |  |  |  |
| 5-Bed Ward 3 |  |  |  |  |
| 5-Bed Ward 4 |  |  |  |  |
| Isolation Room 1 |  |  |  |  |
| Private Room 1 |  |  |  |  |
| Private Room 2 |  |  |  |  |
| Chief Nurse |  |  |  |  |
| Treatment Room |  |  |  |  |
| Nurse Station |  |  |  |  |
| Dirty Utility |  |  |  |  |
| Clean Linen |  |  |  |  |
| Private Room 3 |  |  |  |  |
| Private Room 4 |  |  |  |  |
| Isolation Room 2 |  |  |  |  |
| Reception |  |  |  |  |
| Private Room 5 |  |  |  |  |
| Chief of Hospital |  |  |  |  |
| 3-Bed Ward 1 |  |  |  |  |
| Elevator |  |  |  |  |
| 3-Bed Ward 2 |  |  |  |  |
| Private Room 6 |  |  |  |  |
| Conference Room |  |  |  |  |
| 3-Bed Ward 3 |  |  |  |  |
| 3-Bed Ward 4 |  |  |  |  |
| Private Room 7 |  |  |  |  |
| Private Room 8 |  |  |  |  |
| Chief of Clinics |  |  |  |  |
| CSSR |  |  |  |  |
| Delivery Room |  |  |  |  |
| Sub-Ster Room 1 |  |  |  |  |
| Labor Room |  |  |  |  |
| Pathologic Nursery |  |  |  |  |
| Pre-mature nursery |  |  |  |  |
| Breastfeeding room |  |  |  |  |
| Pre-operation area |  |  |  |  |
| Autoclave area |  |  |  |  |
| Sterile supply room |  |  |  |  |
| Work Area 1 |  |  |  |  |
| Major Operating Room |  |  |  |  |
| Sub-Ster Room 2 |  |  |  |  |
| Jan.Clo. |  |  |  |  |
| Clean up room |  |  |  |  |
| Sterile instrument supply storage area |  |  |  |  |
| anesthesia office and storage |  |  |  |  |
| DR-1 |  |  |  |  |
| DR-2 |  |  |  |  |
| DR-3 |  |  |  |  |
| Recovery Room |  |  |  |  |

**Table \_** Second Floor Lighting Details

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Name of Space** | **Fixture Type** | **W/m2** | **Fu** | **Fb** |
| 5-Bed Ward 1 |  |  |  |  |
| 5-Bed Ward 2 |  |  |  |  |
| Waiting Area 1 |  |  |  |  |
| Waiting Area 2 |  |  |  |  |
| 5-Bed Ward 3 |  |  |  |  |
| 5-Bed Ward 4 |  |  |  |  |
| Isolation Room 1 |  |  |  |  |
| Private Room 1 |  |  |  |  |
| Private Room 2 |  |  |  |  |
| Chief Nurse |  |  |  |  |
| Treatment Room |  |  |  |  |
| Nurse Station |  |  |  |  |
| Dirty Utility |  |  |  |  |
| Clean Linen |  |  |  |  |
| Private Room 3 |  |  |  |  |
| Private Room 4 |  |  |  |  |
| Isolation Room 2 |  |  |  |  |
| Private Room 5 |  |  |  |  |
| Privaate Room 6 |  |  |  |  |
| 3-Bed Ward 1 |  |  |  |  |
| 3-Bed Ward 2 |  |  |  |  |
| Private Room 7 |  |  |  |  |
| Private Room 8 |  |  |  |  |
| Private Room 9 |  |  |  |  |
| Private Room 10 |  |  |  |  |
| Elevator |  |  |  |  |
| Private Room 11 |  |  |  |  |
| Private Room 12 |  |  |  |  |
| Waiting Area |  |  |  |  |
| Private Room 13 |  |  |  |  |
| Private Room 14 |  |  |  |  |
| Solarium 1 |  |  |  |  |
| Stretcher's Wheelchair Nook 1 |  |  |  |  |
| Stretcher's Wheelchair Nook 2 |  |  |  |  |
| Solarium 2 |  |  |  |  |
| Chapel |  |  |  |  |
| Male Toilet |  |  |  |  |
| Female Toilet |  |  |  |  |
| Waiting Area |  |  |  |  |
| Admitting |  |  |  |  |
| Billing |  |  |  |  |
| Cashier |  |  |  |  |
| Personel's dining |  |  |  |  |

**Table \_** Third Floor Lighting Details

2.3 Equipments

The table below presents the types of equipments used in the entire building and its corresponding wattage. Equipments also serve as things that increases capacity of the heat load to absorb of the air conditioned space.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Equipment** | **Location** | **No. of Units** | **Unit**  **Ratings, W** | **Fu** |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

Table \_ Ground Floor Equipment Details

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Equipment** | **Location** | **No. of Units** | **Unit**  **Ratings, W** | **Fu** |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

Table \_ Second Floor Equipment Details

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Equipment** | **Location** | **No. of Units** | **Unit**  **Ratings, W** | **Fu** |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

Table \_ Third Floor Equipment Details

2.4 Occupancy

The table shows below the tabulation of data’s in terms of maximum occupants to the assigned space and its activity level.

|  |  |  |
| --- | --- | --- |
| **Name of Space** | **No. Occupants** | **Activity Level** |
| Power House |  |  |
| Work Area |  |  |
| Storage Room |  |  |
| Maintenance Office |  |  |
| Female toilet |  |  |
| Male Toilet |  |  |
| Minor Operating Room |  |  |
| Equipment and supply storage area |  |  |
| Examination/Treatment and Observation area |  |  |
| Cadaver Holding Room |  |  |
| Supply Room |  |  |
| Bulk Storage |  |  |
| Pharmacy |  |  |
| Medical Records Office |  |  |
| Medical Records |  |  |
| PHILHEALTH |  |  |
| Doctor's Duty |  |  |
| EMERGENCY ROOM |  |  |
| Work Area (laboratory) |  |  |
| Waiting area |  |  |
| OPD clinic dental 1 |  |  |
| OPD clinic dental 2 |  |  |
| Elevator |  |  |
| OPD clinic surgery 1 |  |  |
| OPD clinic surgery 2 |  |  |
| Cashier |  |  |
| Billing |  |  |
| Admitting |  |  |
| Film File Storage |  |  |
| Radiologist Office |  |  |
| Dark Room |  |  |
| Control Booth |  |  |
| OPD Clinic Pedia 1 |  |  |
| OPD Clinic Pedia 2 |  |  |
| OPD Records |  |  |
| OPD info. And admitting |  |  |
| OPD Clinic Medical 1 |  |  |
| OPD Clinic Medical 2 |  |  |
| Waste Disposal Area |  |  |
| Pressing Area |  |  |
| Linen Storage 1 |  |  |
| Linen Office |  |  |
| Admin Office |  |  |
| Male Toilet |  |  |
| Washing Area |  |  |
| Receiving Sorting Area |  |  |
| Administrative office |  |  |
| Social Welfare |  |  |
| Female Toilet |  |  |
| OPD Info. And admitting |  |  |
| OPD records |  |  |
| Ultrasound |  |  |
| Cooking Area |  |  |
| Dry storage |  |  |
| Cold Storage |  |  |
| Supply Receiving Area |  |  |
| Dietician's Office |  |  |
| Dietary |  |  |
| Staff Dining |  |  |
| OPD clinic Ob-gyne |  |  |
| Garbage Disposal area |  |  |
| Canteen |  |  |

**Table \_** Ground Floor Occupancy Details

|  |  |  |
| --- | --- | --- |
| **Name of Space** | **No. of Occupants** | **Activity Level** |
| 5-Bed Ward 1 |  |  |
| 5-Bed Ward 2 |  |  |
| 5-Bed Ward 3 |  |  |
| 5-Bed Ward 4 |  |  |
| Isolation Room 1 |  |  |
| Private Room 1 |  |  |
| Private Room 2 |  |  |
| Chief Nurse |  |  |
| Treatment Room |  |  |
| Nurse Station |  |  |
| Dirty Utility |  |  |
| Clean Linen |  |  |
| Private Room 3 |  |  |
| Private Room 4 |  |  |
| Isolation Room 2 |  |  |
| Reception |  |  |
| Private Room 5 |  |  |
| Chief of Hospital |  |  |
| 3-Bed Ward 1 |  |  |
| Elevator |  |  |
| 3-Bed Ward 2 |  |  |
| Private Room 6 |  |  |
| Conference Room |  |  |
| 3-Bed Ward 3 |  |  |
| 3-Bed Ward 4 |  |  |
| Private Room 7 |  |  |
| Private Room 8 |  |  |
| Chief of Clinics |  |  |
| CSSR |  |  |
| Delivery Room |  |  |
| Sub-Ster Room 1 |  |  |
| Labor Room |  |  |
| Pathologic Nursery |  |  |
| Pre-mature nursery |  |  |
| Breastfeeding room |  |  |
| Pre-operation area |  |  |
| Autoclave area |  |  |
| Sterile supply room |  |  |
| Work Area 1 |  |  |
| Major Operating Room |  |  |
| Sub-Ster Room 2 |  |  |
| Jan.Clo. |  |  |
| Clean up room |  |  |
| Sterile instrument supply storage area |  |  |
| anesthesia office and storage |  |  |
| DR-1 |  |  |
| DR-2 |  |  |
| DR-3 |  |  |
| Recovery Room |  |  |

**Table \_** Second Floor Occupancy Details

|  |  |  |
| --- | --- | --- |
| **Name of Space** | **No. of Occupants** | **Activity Level** |
| 5-Bed Ward 1 |  |  |
| 5-Bed Ward 2 |  |  |
| Waiting Area 1 |  |  |
| Waiting Area 2 |  |  |
| 5-Bed Ward 3 |  |  |
| 5-Bed Ward 4 |  |  |
| Isolation Room 1 |  |  |
| Private Room 1 |  |  |
| Private Room 2 |  |  |
| Chief Nurse |  |  |
| Treatment Room |  |  |
| Nurse Station |  |  |
| Dirty Utility |  |  |
| Clean Linen |  |  |
| Private Room 3 |  |  |
| Private Room 4 |  |  |
| Isolation Room 2 |  |  |
| Private Room 5 |  |  |
| Privaate Room 6 |  |  |
| 3-Bed Ward 1 |  |  |
| 3-Bed Ward 2 |  |  |
| Private Room 7 |  |  |
| Private Room 8 |  |  |
| Private Room 9 |  |  |
| Private Room 10 |  |  |
| Elevator |  |  |
| Private Room 11 |  |  |
| Private Room 12 |  |  |
| Waiting Area |  |  |
| Private Room 13 |  |  |
| Private Room 14 |  |  |
| Solarium 1 |  |  |
| Stretcher's Wheelchair Nook 1 |  |  |
| Stretcher's Wheelchair Nook 2 |  |  |
| Solarium 2 |  |  |
| Chapel |  |  |
| Male Toilet |  |  |
| Female Toilet |  |  |
| Waiting Area |  |  |
| Admitting |  |  |
| Billing |  |  |
| Cashier |  |  |
| Personel's dining |  |  |

Table \_ Third Floor Occupancy Details

2.5 External Walls, Windows, and Doors

The table below presents the external walls, windows and doors which are exposed directly to the sun. For the external wall, the materials used for the three-storey hospital building are concrete wall finish and concrete block lightweight aggregate (150mm). The computed value of resistance is \_\_\_ m2·°K/W and the over-all coefficient of heat transfer is \_\_\_ W/m2·°K.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Name of Space** | **Exposure** | **Wall Gross Area (m2)** | **Window Quantity** | **Door Quantity** |
| Power House | N |  |  |  |
| E |  |  |  |
| W |  |  |  |
| Work Area |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Storage Room |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Maintenance Office |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Female toilet |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Male Toilet |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Minor Operating Room |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Equipment and supply storage area |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Examination/Treatment Area |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Cadaver Holding Room |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Supply Room |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Bulk Storage |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Pharmacy |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Medical Records Office |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Medical Records |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| PHILHEALTH |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Doctor's Duty |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| EMERGENCY ROOM |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Work Area (laboratory) |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Waiting area |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| OPD clinic dental 1 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| OPD clinic dental 2 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Elevator |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| OPD clinic surgery 1 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| OPD clinic surgery 2 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Cashier |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Billing |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Admitting |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Film File Storage |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Radiologist Office |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Dark Room |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Control Booth |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| OPD Clinic Pedia 1 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| OPD Clinic Pedia 2 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| OPD Records |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| OPD info. And admitting |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| OPD Clinic Medical 1 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| OPD Clinic Medical 2 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Waste Disposal Area |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Pressing Area |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Linen Storage 1 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Linen Office |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Admin Office |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Male Toilet |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Washing Area |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Receiving Sorting Area |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Administrative office |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Social Welfare |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Female Toilet |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| OPD Info. And admitting |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| OPD records |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Ultrasound |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Cooking Area |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Dry storage |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Cold Storage |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Supply Receiving Area |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Dietician's Office |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Dietary |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Staff Dining |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| OPD clinic Ob-gyne |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Garbage Disposal area |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Canteen |  |  |  |  |
|  |  |  |  |
|  |  |  |  |

**Table \_** Ground Floor Externall Walls, Windows and Doors

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Name of Space** | **Exposure** | **Wall Gross Area (m2)** | **Window Quantity** | **Door Quantity** |
| 5- Bed Ward 1 | N |  |  |  |
| E |  |  |  |
| W |  |  |  |
| 5 Bed Ward 2 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| 5 Bed Ward 3 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| 5 Bed Ward 4 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Isolation Room |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Private Room 1 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Private Room 2 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Chief Nurse |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Treatment Room |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Nurse Station |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Dirty Utility |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Clean Linen |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Private Room 3 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Private Room 4 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Isolation Room 2 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Reception |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Private Room 5 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Chief of Hospital |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| 3 Bed ward 1 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| 3 Bed Ward 2 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Private Room 6 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Conference Room |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| 3-Bed ward 3 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| 3-Bed Ward 4 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Private Room 7 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Private Room 8 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Chief of Clinics |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| CSSR |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Delivery Room |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Sub-Ster Room 1 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Labor Room |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Pathologic Nursery |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Premature Nursery |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Breastfeeding Room |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Pre-operation Area |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Autoclave Area |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Sterile Supply Room |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Work Area 1 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Major Operating Room |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Sub-Ster room 2 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Jan. Clo. |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Clean up room |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Sterile instrument supply storage area |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Anesthesia office and storage |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| DR-1 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| DR-2 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| DR-3 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Recovery Room |  |  |  |  |
|  |  |  |  |
|  |  |  |  |

**Table \_** Second Floor Externall Walls, Windows and Doors

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Name of Space** | **Exposure** | **Wall Gross Area (m2)** | **Window Quantity** | **Door Quantity** |
| 5- Bed Ward 1 | N |  |  |  |
| E |  |  |  |
| W |  |  |  |
| 5-Bed Ward 2 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Waiting Area 1 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Waiting Area 2 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| 5- Bed Ward 3 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| 5- Bed Ward 4 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Isolation Room |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Private Room 1 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Private Room 2 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Chief Nurse |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Treatment Room |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Nurse Station |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Dirty Utility |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Clean Linen |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Private Room 3 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Private Room 4 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Isolation Room 2 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Private Room 5 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Private Room 6 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| 3-Bed Ward 1 |  |  |  |  |
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| 3-Bed Ward 2 |  |  |  |  |
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| Private Room 7 |  |  |  |  |
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| Private Room 8 |  |  |  |  |
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| Private Room 9 |  |  |  |  |
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| Private Room 10 |  |  |  |  |
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| Private Room 11 |  |  |  |  |
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| Private Room 12 |  |  |  |  |
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| Waiting Area |  |  |  |  |
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| Private Room 13 |  |  |  |  |
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| Private Room 14 |  |  |  |  |
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| Solarium 1 |  |  |  |  |
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| Solarium 2 |  |  |  |  |
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| Male Toilet |  |  |  |  |
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| Female Toilet |  |  |  |  |
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| Waiting Area |  |  |  |  |
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| Admitting |  |  |  |  |
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| Billing |  |  |  |  |
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| Cashier |  |  |  |  |
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| Personal’s Dining |  |  |  |  |
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