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CREATEHK

INTERIOR DESIGN BODY OF KNOWLEDGE

Book 1

HUMAN ENVIRONMENT NEEDS

JOINTLY RESEARCHED AND PUBLISHED
by Hong Kong Interior Design Association & The Hong Kong Polytechnic University

Contents

PREFACE

At present, there are no formal educational materials for Hong Kong interior design learning, and educators can only rely on ad hoc literature produced overseas (particularly in the West), or architectural-based materials to learn about interior design. Given that interior design has already established a unique and well-defined body of professional knowledge, and is firmly rooted in the cultural and social practices of a place, there is a need for interior design textbooks to reflect this context and allow interior design students to keep pace with rapid development of the industry. This series of interior design textbooks is aimed at satisfying the needs of Hong Kong interior design students at different academic levels from diploma, higher diploma to bachelor's degree. Filled with case studies of award winning works from across the Asia-Pacific region and beyond,as well as interviews and articles written by well-known professionals and academics from Hong Kong and around the world, these are the first interior design textbooks researched and written in Asia.

The series contains six books, related to the 6 body of knowledge areas well-defined in the Interior Design Professional Guideline, published by the Hong Kong Interior Design Association (HKIDA) in 2014. Based on research of reputable international standards and confirmed by surveys of local interior design educators and practitioners, this guideline sets out in a systematic way the knowledge and skills that Hong Kong interior designers should possess. The 6 body of knowledge areas covers and follows the typical process of any interior design project, which includes:

- Human Environment Needs
- Design
- Products and Materials
- Communication
- Interior Construction, Codes and Regulations
- Professional Practice

This Book 1, **Human Environment Needs**, focuses on the key knowledge that needs to be equipped by interior designers in starting a design project: the study and understanding of client, user and environment needs. Topics include Interior Relevance, Building Services System, Human Sensory Perceptions in Built Environment, Universal Design and Global Sustainable Design Standard will be covered and illustrated with detailed diagrams and case studies.

Our greatest challenge in compiling this book series was deciding which key content to select from the vast pool that is relevant to not only global but also local context and turn them into useful teaching resources and materials for educators' future elaboration. For this reason, choosing examples to fit within the physical constraints of a book required a rigorous edit. We hope it will be of enormous benefit to interior design students, educators and practitioners and inspire everyone to look for more.

Horace Pan
Project Chief Investigator

CHAPTER 1

Interior Challenges, Interior Relevance [i]
By Kees Spanjers

Interior design is seen by many as a fashionable addition to architecture, or as a decoration to the autonomous qualities of a building. And of course, that is what it is, too. While architecture is a slow art, producing buildings that are meant to outlive us by decades, we know that the users of such buildings move or change workplace every 7 or 8 years. The interior is the user-side of architecture and is subject to wear and tear and changing preferences and demands. Interior design is the art of sustainable adaptation of interior spaces to the ever- changing social functional and aesthetic demands of users. A good interior grows with its users and cannot escape fashion influences.

Interior design has long been considered a private affair. People decorate their home, their car, their personal surroundings. Many are influenced by the life-style media that made design fashionable and brought it within everybody's reach. But apart from the safety of their home, most people spend a considerable part of their time in interior spaces that are not their own. Think of schools, offices, hospitals, public buildings, shops and sport facilities. In most cases they do not have any influence on the design of these spaces. Yet, such design (or the lack thereof) can significantly affect their health, their well-being, their happiness. Interiors in all buildings with a collective use are part of the urban society, and if interior design is the art of planning and design of interior spaces to accommodate human occupation and behavior, such public and semi-public spaces deserve our urgent attention, too.

New Challenges

Exactly now that the focus is shifting from "building more" to "using better", the contribution of the interior design is indispensable. Traditionally, interior designers have been involved in re-use, transformation and spatial renewal, in which user quality is of the highest importance. Interior designers are the pre-eminent specialists who create opportunities that reach beyond the building itself. Interior design makes a valuable contribution to developing innovative work processes (the New World of Working[ii]), to new concepts for the health care industry (Healing Environments[iii], Evidence Based Design[iv]), it brings innovation in education, safety and accessibility to public buildings, and it creates opportunities in important economic sectors such as retail, hospitality, leisure and home furnishings.

Workspace

Computer technology and new communication systems have changed the way we work, communicate and do business. Society has become more and more transparent and resources and opportunities are now available for all. With that, the focus changed from building to user, and from long term to short term development. Interior designers have taken a position at the forefront of office design, as the use of buildings and cities became interchangeable in the cloud of technology that binds us together.

At the end of the last century, the Dutch insurance company Interpolis built a new headquarters, designed by architect Abe Bonnema. The building was originally intended to be fitted with classic individual office rooms, and interior designer Nel Verschuuren was hired to design the interiors of public and representative spaces. However, the Interpolis management was well aware of the digital revolution taking place, and contacted consultant Eric Veldhoen. Verschuuren and Veldhoen designed a new office concept in which none of the workers had a private desk. The new way of working was born. In this new concept there are no fixed workplaces, but an environment of atmospheres that relate to different types of concentration and communication. No rooms or cubicles, but a cafe, a lounge, meeting points, concentration rooms and leisure rooms, as well as sport facilities, libraries and even a movie theater. All employees, from director to janitor, log in to the wireless network and find a place that suits their activities of the day. What was also special in Verschuuren's concept was that within her design, she made space to bring in other designers, such as Piet Hein Eek and Jurgen Bey, which helped boost the attention to design in general.

This concept became a standard for new developments. Today, we no longer work five days a week and 8 hours a day. The office is more than a place to work and has developed into a social networking environment. People feel better and perform better in a congenial environment that supports the identity and attitude of both the workers and the company. The office became the new home.

Leaving the one-person, one-workplace concept also turned out to be profitable; flex-working generated a space saving of up to 30%. Of course, it was tempting to see that profit as cost saving, but as soon as clients realize that the real profit is in the happiness and employability of the people, it becomes clear that this gain has to be reinvested as a contribution to further development of the concept. Open offices require a different approach to comfort, routing, acoustics, lighting and climate control. Interior designers are used to working with these aspects and to integrate utilities to human needs.

Fig. 1.1 Interpolis office - chairs that provide privacy to users

Fig. 1.2 Open office concept

The enormous technological developments and the ecological crisis that threatens us spurred this search for new concepts. Why should well-educated independent professionals suffer traffic congestion to go to an office, when they can log in to the network to do their task from virtually every place in the world? The added value of the office is that it is a place for communication, a place to share ideas, a place for development, which starts with the personal development of the office workers, who are the most valuable asset in a knowledge-based networking society. Emerging companies recognize that and want workplaces that are not only functional but also appeal to the young people that fuel the company with their ideas.

Fig. 1.3 Flexible work space

We need to create offices that are durable and flexible, capable to anticipate to changing work processes and contribute to the social climate of the city.

Interior designers are actively working on this new task, and we found a new array of partners to collaborate with: management consultants, strategy developers, facility managers, IT-architects and the like. Key words today are communication, transition and reflection.

Education

These are key words that we also find in education, in the way we pass on our knowledge and train our next generations to become independent thinkers. Today, schools are complex structures, where groups and individuals, pupils and teachers gather in an atmosphere of receptiveness.

For a long time, creating such atmosphere has been the domain of educators, but now we see that interior design has a measurable effect on the way pupils feel and behave. And here also the interior designer turns out to be the partner to facilitate such environments, because interior designers are used to thinking from the users' perspective, to not only functionally accommodate spatial needs but to adapt to processes of communication and interaction.

Fig. 1.4 Encounter, Work, Learn. Erasmus Education Center, Rotterdam, the Netherleands. Design KAAN Architects, 2013

Health Care

Spatial design influences the instincts and emotions of the user. It can cause the user to do or feel something without thinking. For instance, we use leather in the treatment rooms in a cancer treatment centre because it has a soft and warm appearance. The curtains that we hang have a strong emotional impact; you create your own protected space and the flower pattern calls for associations with home and nature.

Fig. 1.5 VUmc Cancer Center Amsterdam

In an open space people communicate more and social interaction makes people happier. Indirectly, that is the way to influence behavior[v] Francesco Messori (D/DOCK Designers Amsterdam) was responsible for the design of the VUmc Cancer Center Amsterdam, one of the first successful examples of healing environments in the Netherlands. In it, scientific research (evidence-based design) supports the way patients experience their physical environment. In this facility where patients are treated with chemotherapy, not just the interior, but the whole process of intake, examination and treatment is designed to provide optimal comfort for the patient. Great emphasis has been given to routing (avoiding distraction and stress), lighting and auditory environment.

Fig. 1.6 VUmc Cancer Center Amsterdam

Patients are given a variety of choices at all times, for instance to choose a more private or a more social environment, or a low or high cognitive environment. Operational management and technology are organized in such a way that it is always in the background.

Especially in the 'care industry' attention to the experiences and perception of the clients is crucial. After all, most people do not eagerly look forward to a doctor's visit or hospitalization. Fear and anxiety color the space between patient and health services. Excellent medical care of the highest standards is of course a prerequisite, but patients also require attention for their personal questions and fears. They want a safe comfortable environment, not an atmosphere that refers to illness, medical engineering and loss of dignity; a quiet and comfortable place for recuperation, not a medical production-unit.

It is important to avoid the monotony that often makes health care facilities boring and to give patients positive stimulants. For decades, beige and grey have been the colors of choice in hospitals. We all know the endless corridors and the crowded waiting rooms where patients have to wait for hours for an available doctor. Today, we want to give clients a sense of identity. We speak of clients or residents, instead of patients, and we respect privacy and human scale. In the new medical center, the patient is a guest. The hospital creates an atmosphere that ensures privacy and relaxation. Guests feel at home in an environment that equals a 4-star hotel, where family and friends can stay over and help to take care of the patient.

Fig. 1.7 Providing health care for the elderly

Where medical conditions permit, guests can use informal meeting facilities, relax rooms and even workspaces, so they do not lose contact with their social context while being physically away from society.

An interior designer can create such a space in which a guest or patient can feel at ease, allowing for dignity and self-respect. However, care also has to be an efficient process. Medical care requires high quality design. The interior designer can join these seemingly incompatible requirements into a spatial concept that leaves room for atmosphere and emotion, and in which efficiency and clinical demands are incorporated optimally. In a pleasant environment people feel better and heal faster.

Health care is a fast-growing market due to the strong increase of the aging population. With that increase comes attention for nursing homes and homes for the elderly. In 2030 we expect 30% of the population to be older than 65, the result of increased prosperity and strongly improved health care. Today the percentage is 15%. Luckily, the older ones have a healthy life expectancy and a good social-economic position, allowing for a relatively long social life. But elderly people are vulnerable, and for many of them there would come a time when they need support and care. Having to leave your familiar surroundings is a radical change. It's our duty to give them a new home that at least matches the comfort and familiarity they were used to.

Fig. 1.8 Glass Music Hall in the Beurs van Berlage Building, Amsterdam the Netherlands. Design Zaanen Spanjers Architects.

Sustainability

Sustainability is of course on top of everybody's agenda these days. It is probably also the most misused term of our days. Governments and companies are very much aware of the marketing value of a sustainable profile, so they want to move to fancy new buildings that are built to the latest standards in green design, thus leaving the environment with a heap of scrap buildings, outdated and abandoned. This is not very sustainable. What's more important, these buildings often form part of our collective memory, of the way we explore the city and find our way in it. They are part of our sense of place. So, simply demolishing is not just unsustainable, it's also an attack on the DNA of our cities and, hence, the emotional relation people have with their environment.

An example from the present author's own practice: in the early 1990's the former stock exchange building in Amsterdam, originally designed by the famous Dutch architect H.P. Berlage in 1904, was transformed into a concert hall and congress center. To solve an acoustical problem between two halls, a glass box in the box hall was created, which served as a music hall for chamber music concerts and also as a small lecture hall for a small audience of 250 people. After 25 years of service, the building is now being renovated again, and of course demand has changed. The glass music hall had to be removed as it was no longer feasible. Instead of just demolishing it, it was put up for sale for 1 Euro. Of course, the buyer would have to rebuilt the hall and give it a new use, preferably something cultural. Interest was overwhelming; over 40 serious bids from all over the world were received, from as far away as New Zealand.

After long consideration, the glass structure was sold to a municipal project in the town of Tilburg, in the south of the Netherlands. Here a former railroad maintenance factory, located in the middle of the city right behind the railway station, will be transformed into a public space, housing the public library, a cultural center and a small lecture hall. And that lecture hall will be the rebuilt glass music hall.

By transforming existing real estate and giving new use to old buildings, interior designers revalue known qualities, enhance social coherence and quality of life, and give a boost to existing neighborhoods. This type of adaptive reuse also enhances creativity; very often we see young start-up companies or cultural organizations settle in these new premises. Last but not least, re-using existing space is cost effective.

New Dynamics

These are just a few practical examples of projects that are innovative and experimental, but above all aimed at user quality and environmental perception. They go way beyond the concept of decoration; these are designs that are rooted in knowledge. Decoration is still an important part of the work, but the true strength lies in the creation of spaces that enhance and empower people.

In general, society today sees a shift from new development directed at growth to consolidation, transformation and revaluation of existing real estate. A changed social context that puts a different emphasis; health, care, education and small-scale (private) commissioning are now the task for the future. Of course, these developments do not go unnoticed by many interior designers, but what is noteworthy is that traditionally, these new challenges have been the scope of work of the interior designers. With the physical space as starting point, interior designers design living spaces that are tailored to the well- being of all users, be they residents, staff, clients or visitors. They take into account aspects of health and safety, implement applicable (building-)rules and regulations, and integrate beauty, comfort and sustainability in designs that satisfy all functional, technical and economic demands. In doing so, they create a social added value that reaches beyond the attractive and functional design of the physical intervention itself. Good design contributes to the coherence, the sustainability and the economic feasibility of society.

A New Design Methodology

Interior design is a dynamic process, a continuous interaction between building and user, contributing to the sustainability and value retention of the built environment. Interior designers are accustomed to working in a direct relationship with clients and users on small scale projects that require a specific approach. They work in variable teams with architects, graphic and product designers and interior furnishers, but also, for example, with facility managers, management consultants, environmental psychologists, anthropologists and art historians. More and more we see the interior designer as a researcher, self-initiated or commissioned, exploring and reinterpreting certain aspects of our living environment. Interior designers are used to playing many different roles, and to making themselves subordinate to the user's demand. In such a multidisciplinary approach it is often difficult to see where the work of one professional ends and that of another other begins. That sometimes makes it difficult for the outside world to see the significance of interior design, but unlike in most forms of fashion and design that is precisely its added value. You only notice it when it is not right.

The interior designer protects and promotes the health, safety and well-being of all users of buildings and integrates beauty, comfort and sustainability in designs that meet functional, technical and economic demands. Like architects, they serve a public interest that goes beyond the direct interests of the client and that contributes to the quality of the built environment. But it's a competitive market, often dominated by public media that show a tendency to focus on different aspects of it. To maintain and develop quality and expertise and to offer clients and consumers clarity and guidance, we have to invest even more in the quality of our education, and research and development must be an integrated part of our everyday work.

We have to share and deepen our knowledge, and by all means we must gather much more knowledge based on practical experience. By now, the instruments to do that are on hand; the Bachelor and Master system made scientific research a compulsory part of the training, and in some countries, we even see PhD programs emerging. The bookshelf with interior design books, which a decade ago was mainly filled with picture books, is slowly sagging under the weight of gathered knowledge. But it is by far not enough yet. Especially in daily practice we do not see much adoption of evidence-based design, post-occupancy evaluations, and the interface of the profession with environmental psychology, neuroscience and behavioral economics. For that we shall have to change the way we work from a linear process, focused on result, into a circular process, in which we constantly research whether what we have done works, and incorporate the result of that research in new assignments. For our clients the result of our work has always been the beginning of the journey. Now, we shall have to convince them that from now on we join them on the trip, to learn, to adjust where needed, and to change when necessary. We will become the consultant who's not only concerned with accommodation, but who also contributes to productivity, effectiveness of processes and happiness in life.

Rethinking Principles

Rather than creating spaces that will be remembered, place making is a dynamic process. More than 2000 years ago Vitruvius formulated his famous doctrine of architecture, Firmitas, Utilitas et Venustas, solid, useful and beautiful. Maybe it's time to reformulate that, or at least to formulate a triad that qualifies interior space. May I suggest Beauty, Comfort and Sustainability?

CHAPTER 2

Building Services Systems and Interior Design

By Jimmy Law Ching-Hin & Eagle Mo

Building services systems refer to all the internal systems that make a building function. They affect people's comfort, health, productivity and safety. Interior designers are expected to work with building services consultants or relevant professionals to ensure that building services meet functional and aesthetic requirements.

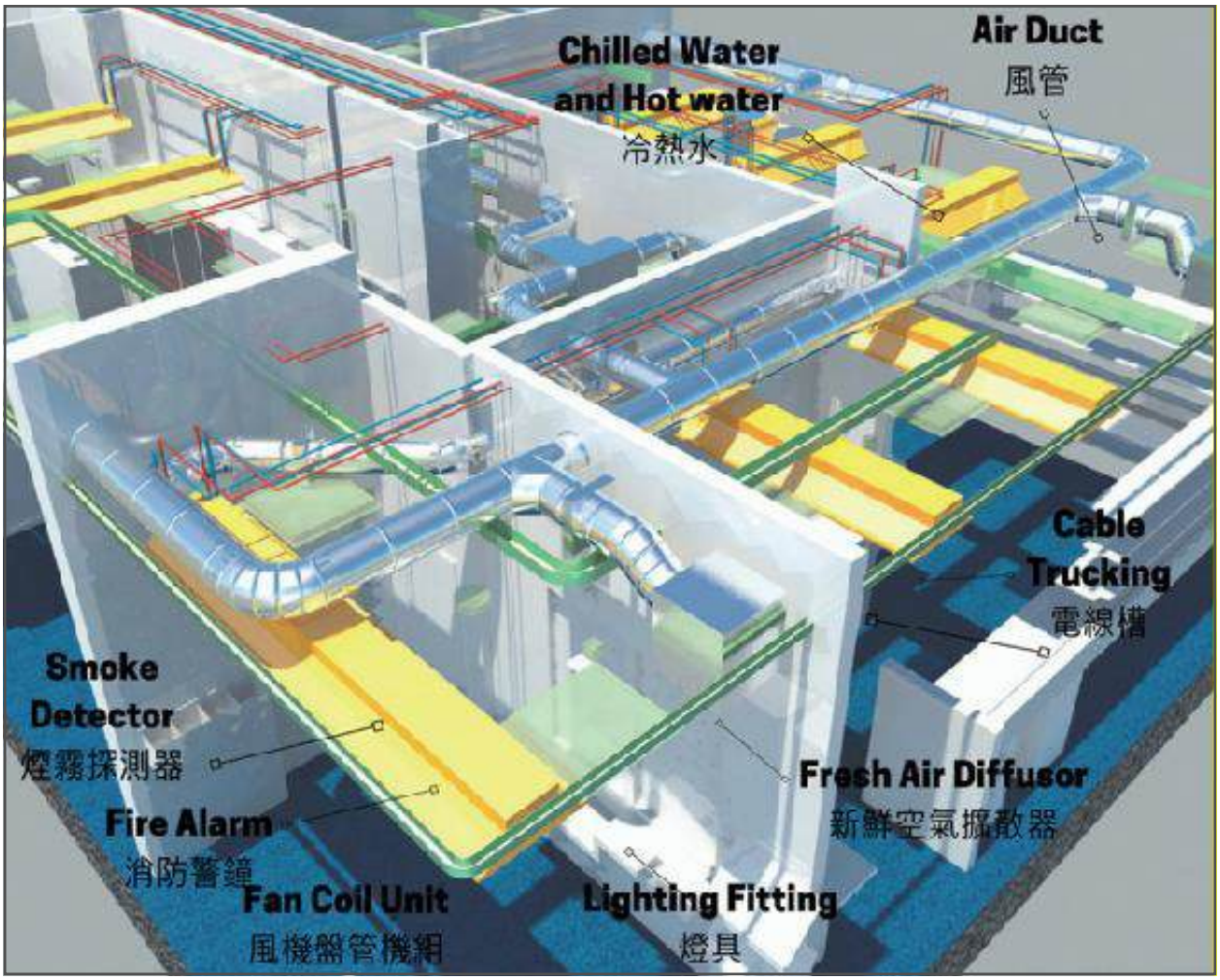


Fig. 2.1 Building Services

In general, building services comprises mainly four components:
(a) Mechanical Ventilation & Air- conditioning (MVAC),
(b) Fire Services,
(c) Plumbing and Drainage,
and **(d) Electrical and Extra-low Voltage (ELV) Services (**風、火、水、電**).**

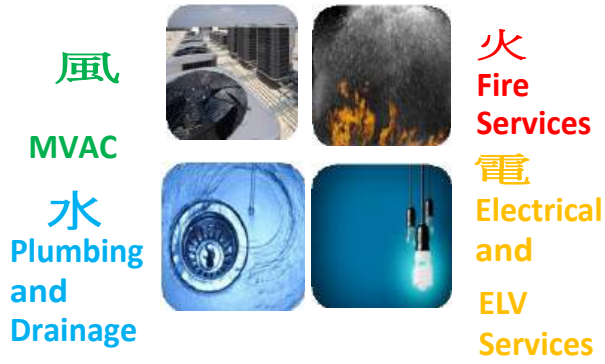


Fig. 2.2

(a) MVAC 風

Natural Ventilation & Mechanical Ventilation

Ventilation can be categorized into natural ventilation and mechanical ventilation. Natural ventilation is a process of supplying and removing air through an indoor space by natural means, like making use of the pressure differences between the building and its surrounding, while mechanical ventilation requires the use of a fan or other mechanical systems.[i]

According to the American Society of Heating and Air-Conditioning Engineers (ASHRAE), air-conditioning is defined as the process of treating air to meet the requirements of a conditioned space by controlling its temperature, humidity, cleanliness, and distribution.[ii]

Ventilation Fan

It includes exhaust fan, which expels air from the interior to outside; and fresh air fan, which draws outdoor fresh air to the interior.

Fig. 2.3 Ventilation Fan

Fan Coil Unit (FCU)

FCU is a kind of simple equipment and self-contained system re-circulating indoor air; it houses an air filter, heating or cooling coil, and a centrifugal fan, and operates by moving air through an opening in the unit and across the coils.

Fig. 2.4

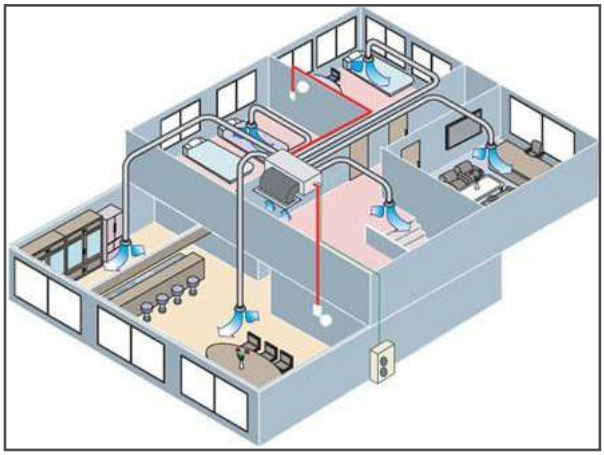


Fig. 2.5

Air Handling Unit (AHU)

AHU is connected to a more complex and larger central air conditioning system with duct works treating outside air, which is usually applied for a larger design space like a whole storey of office. It adjusts the temperature and humidity of the air and controls the air flow. The basic components are supply fan (return fan), water cooling coil, filters, mixing box, dampers and controls.

Fig. 2.6

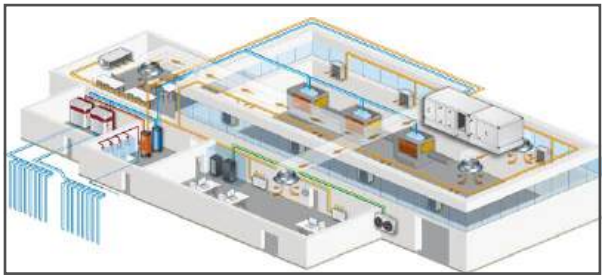


Fig. 2.5

Air diffusers

Air diffuser is one of the essential parts of mechanical ventilation. There are many designs of air diffuser that interior designers can choose from.[iii]

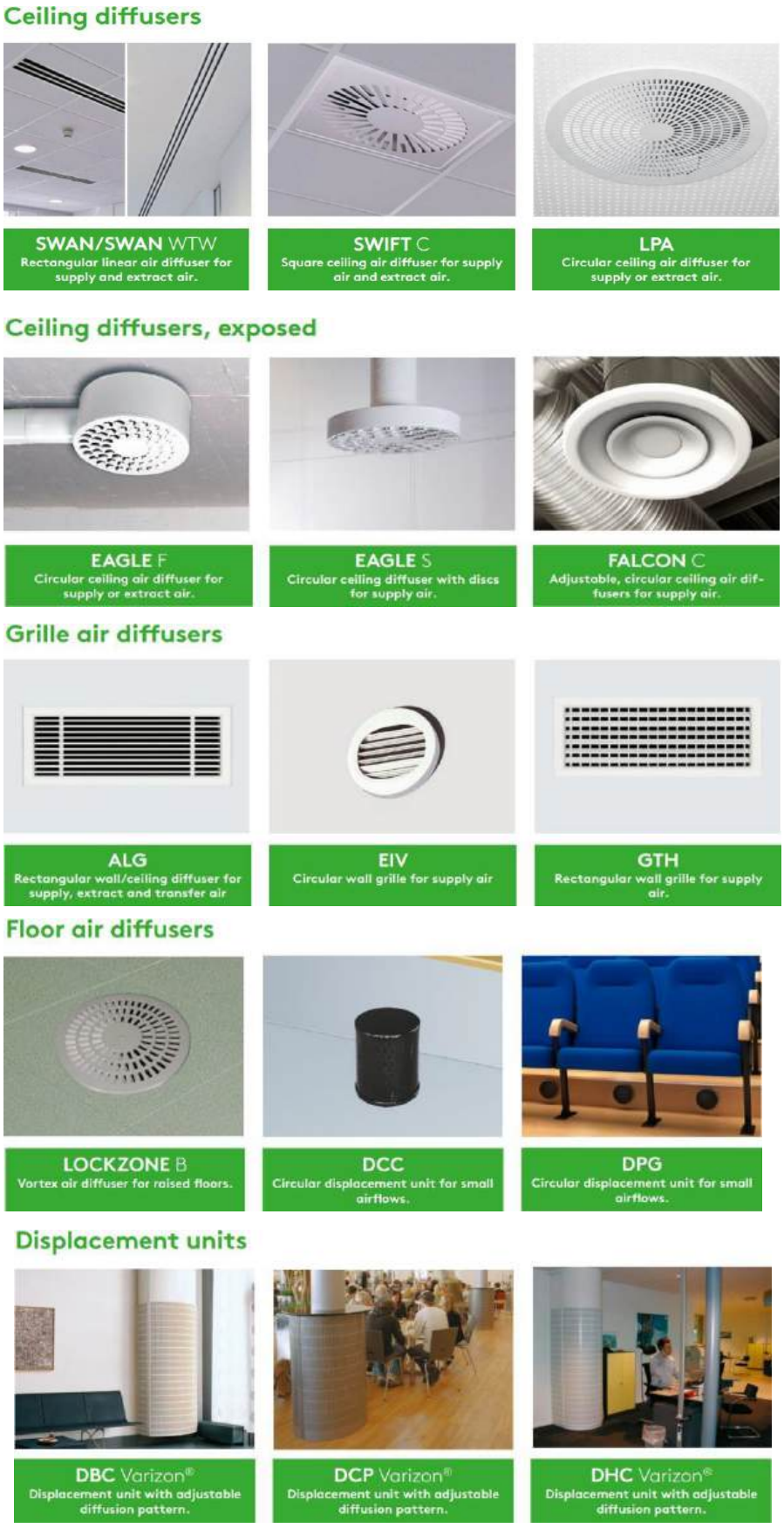


Fig. 2.8

Central Air Conditioning System & Non-Central Air Conditioning System

Central AC system circulates cool air to different room spaces via supply and return ducts, which is a common system applied in larger service area like office buildings.

Fan coil system

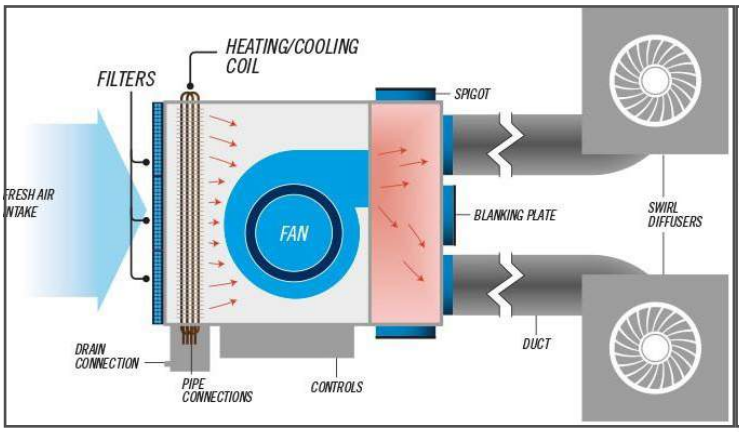


Fig. 2.9

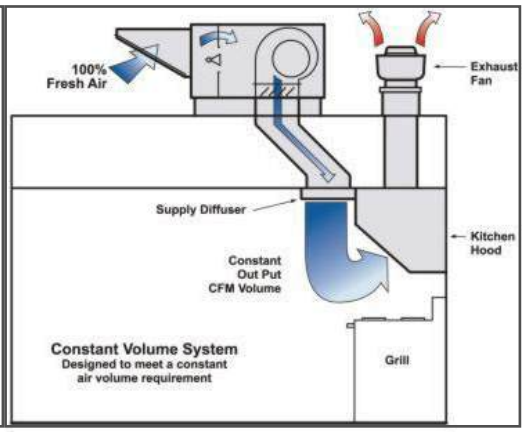


Fig. 2.10 Constant air volume (CAV) system: simple on/off cooling operation, high temperature fluctuations.

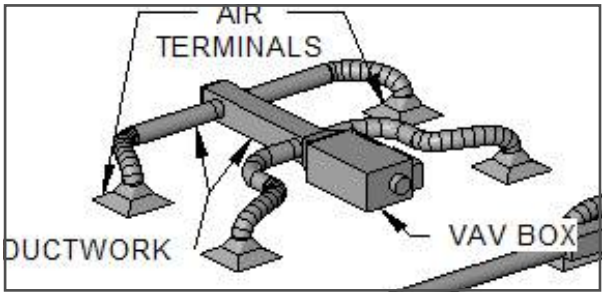


Fig. 2.11 Variable air volume (VAV) system: more precise temperature control, less temperature fluctuations.

Non-central air conditioning system is usually used in a smaller service area, such as a single residential space.

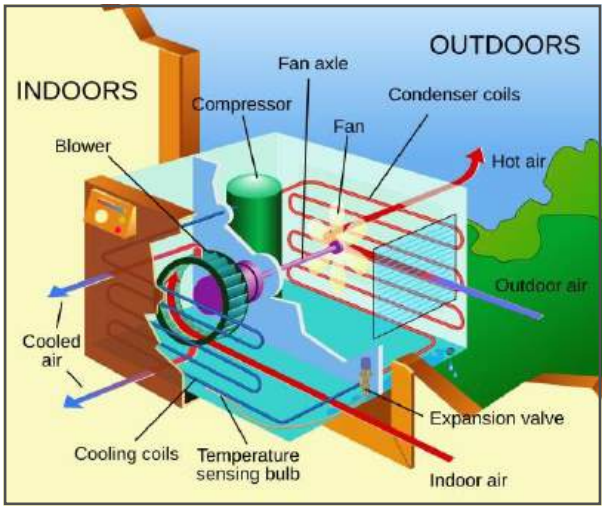


Fig. 2.12 Window type air-conditioner

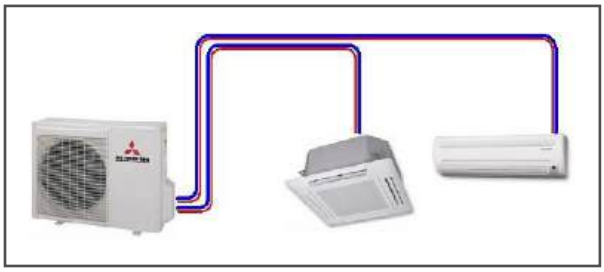


Fig. 2.13 Split type air-conditioner

(b) Fire Services 火

Fire services detect and avoid the destructive effects of potential fires in buildings.

- **Smoke detector** is a device that senses smoke, which generally indicates the presence of fire.

Fig. 2.14

- **Break-glass fire alarm** is a manually activated device which indicates the presence of fire.

Fig. 2.15

- **Fire sprinkler** is thermally activated and consists of water supply through piping. It can help to reduce the spread of flames, thereby ensuring safety and limiting structural damage of buildings.

Fig. 2.16

- **Fire flash light** is connected to the detectors to deliver visual warning signals.

Fig. 2.17

- **Fire shutter** partitions a building during a fire, prevent fire from rapidly spreading to other areas so that occupants can have enough time to escape.

Fig. 2.18

(c) Plumbing and Drainage 水

Water supply systems can be categorized into cold water systems and hot water systems. Water supply is required for drinking, flushing, fire services, air-conditioning and so on in a building

- **Plumbing** utilizes pipes, valves, plumbing fixtures, tanks, and other apparatuses to supply fluids. All plumbing works must be carried out in accordance with the Hong Kong Waterworks Requirements, which include the following types of waterworks:
  - Potable water
  - Flushing water
  - Cleansing water
  - Irrigation water

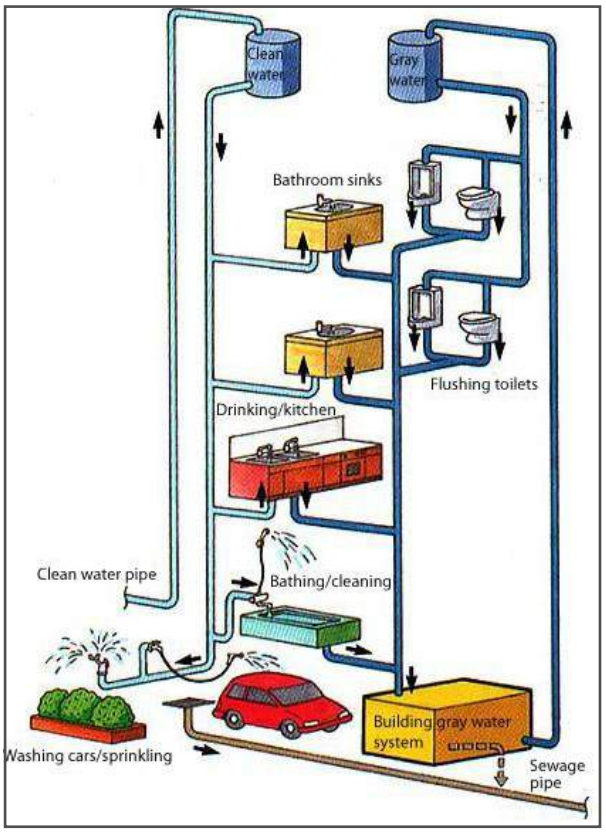


Fig. 2.19

- **Drainage aims** to remove the used water from toilets, sinks, basins, baths, showers, bidets, dishwashers, roof and washing machines. A well-designed drainage system ensures adequate flow during discharge, exclude smells and foul air as well as limit noise during discharge. One of the components is water trap, which prevents foul gas, insects and bacteria from entering the premise. Used water includes the following types of water:
  - Rain water
  - Waste water
  - Soil water

Fig. 2.20

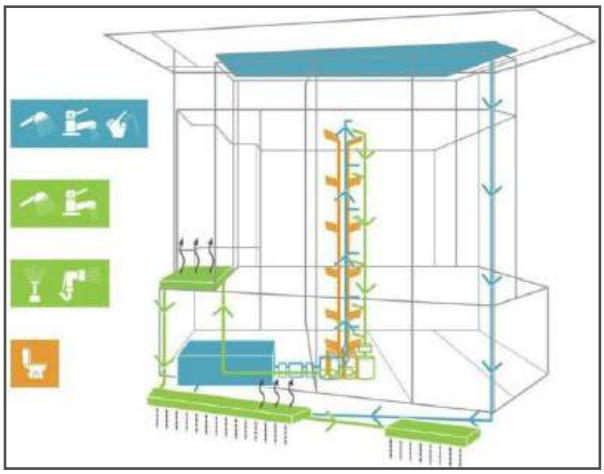


Fig. 2.21

- **False Ceiling** can be used to balance aesthetics and infrastructure needs. For instance, it can be used to hide air ducts or water pipes. In addition, it can be a good heat or acoustical insulation. False ceiling can be made from a variety of materials:[iv]

» Gypsum board: light in weight, flexible, economical.

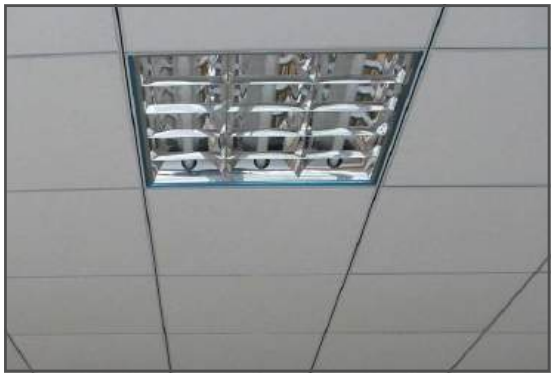


Fig. 2.22

» Metal panels: reusable, strong, higher resistance, modern look.

Fig. 2.23

» Plaster of Paris (POP): light in weight, smooth texture, uniform finish.

Fig. 2.24

» Plywood: strong, various finishes

Fig. 2.25

» Fiberboard/Mineral reinforced tiles: high sound and fire insulation, various finishes.

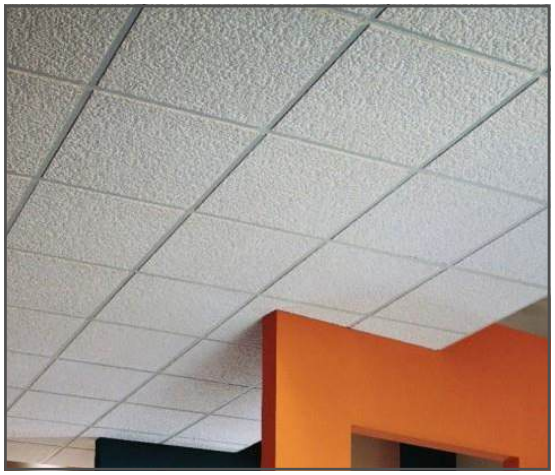


Fig. 2.26

(d) Electrical and ELV Services 電

Electrical and ELV (Extra Low Voltage) services are a vital component in any building. It includes wiring, schemes of distribution and protection for lighting and power installations. In Hong Kong, the normal power supply is 220V for AC single phase electricity; 380V for 3 phases electricity.

- **Lighting** provides illumination for people to use a space and to see well enough to function at their designated tasks. It also creates perception of the space or form and allows interior designers to present their spatial concepts and reveal texture and color. Methods for creating visual environment include ambient lighting, accent lighting, task lighting and perimeter lighting. The photo below illustrates an example of reflected ceiling plan. For more project details, please refer to Chapter 5.

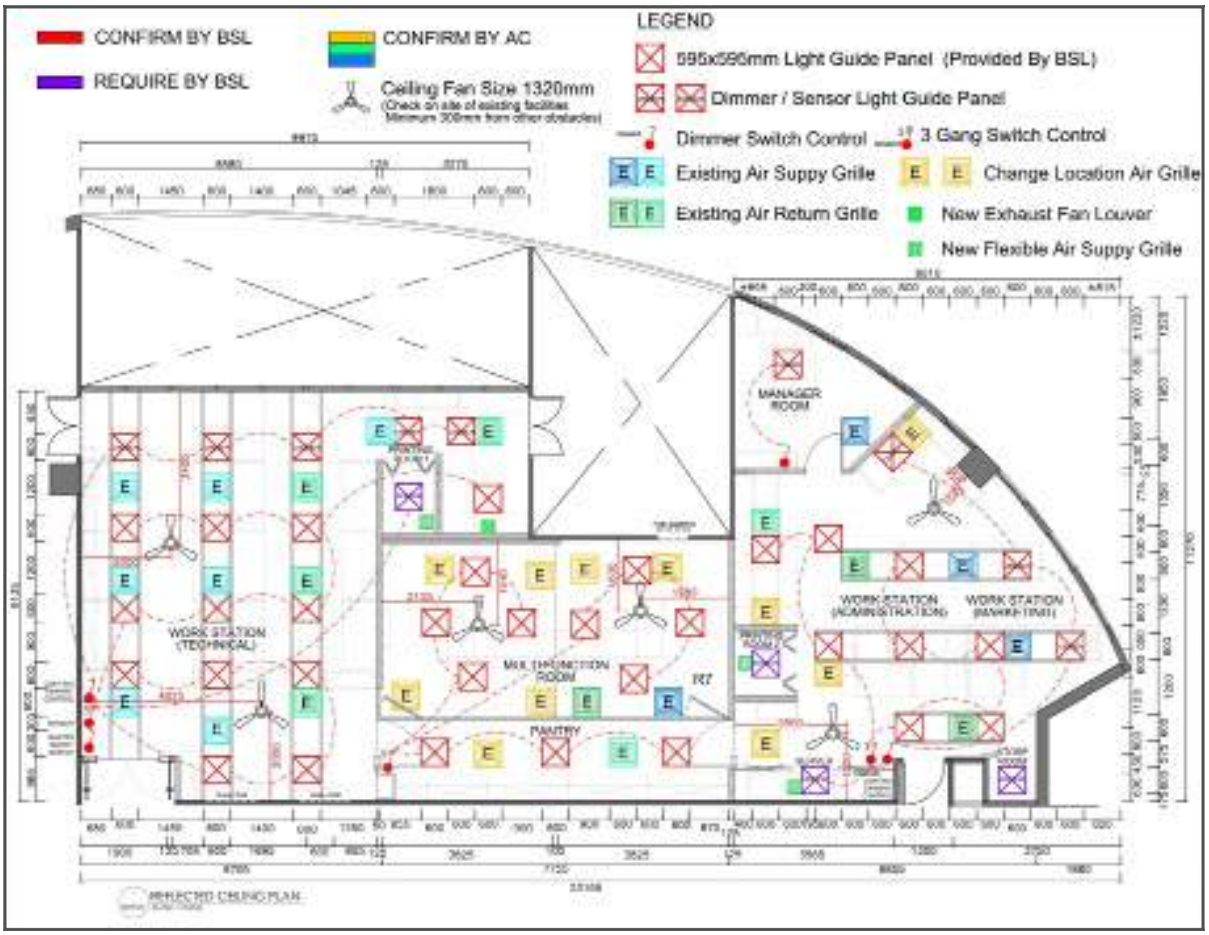


Fig. 2.27 Reflected ceiling plan

- **Power plugs and sockets** are devices that allow electrically operated equipment to be connected to the primary alternating current (AC) power supply in a building. Electrical plugs and sockets differ in voltage and current rating, shape, size and type of connectors. There are currently 15 types of electrical outlet plugs in use today, according to the US Department of Commerce International Trade Administration (ITA).[v] The photo below illustrates an example of electrical plan of BEAM Society Limited Office - Reno Green. For more project details, please refer to Chapter 5.

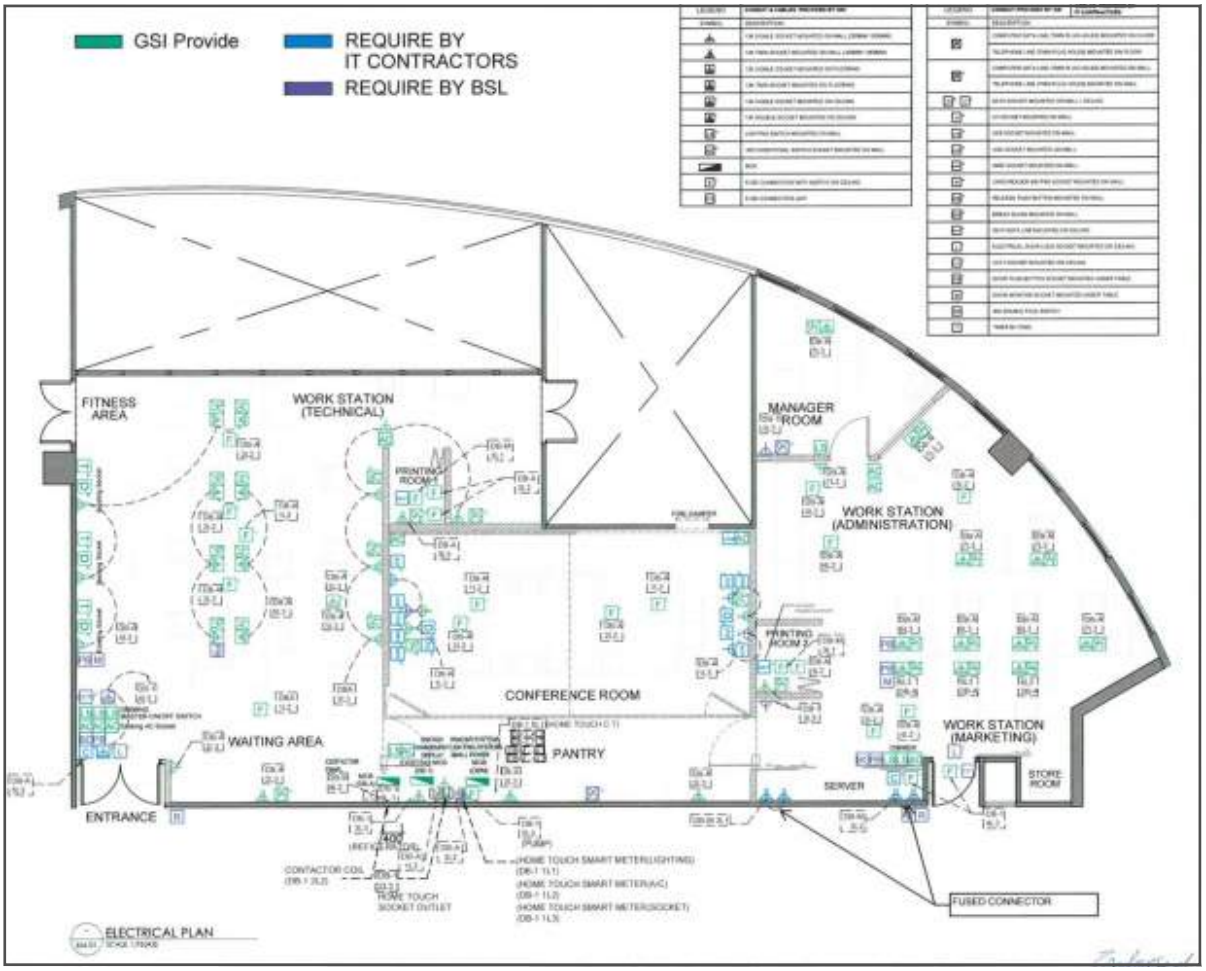


Fig. 2.28 Electrical plan

- **Telecom and Internet** Telecom refers to telecommunication, which is defined as “Any transmission, emission or reception of signs, signals, writings, images and sounds or intelligence of any nature by wire, radio, optical or other electromagnetic systems.” In interior design, telephone, radio, television and especially internet, are the most important forms of telecom.

Fig. 2.29

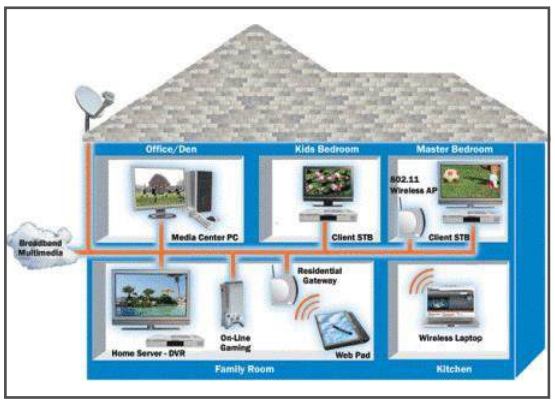


Fig. 2.30

CHAPTER 3

Human Sensory Perceptions in Built Environment
By Jimmy Law Ching-Hin & Eagle Mo

Interior design aims to create different spatial experiences by manipulating human senses. By selecting different kinds of lighting, providing access to daylight and fresh air, or by modulating indoor temperature and room acoustics, the way people see, hear, smell and feel can be affected. In addition, there is a variety of measurement tools and standards to help designers achieve the desired effect in precise and scientific ways.

3.1 Vision

Indoor lighting

Hue is the general description of the perceived color of an object, that is, the name of the color like red, green or blue. **Value** indicates the relative lightness or darkness of a color like sky blue and pond blue. In addition, **chroma** indicates how saturated a color appears. Last but not least, **Correlated color temperature (CCT)** is used to specify source color's appearance, which is expressed using Kelvin temperature scale. A lower CCT means an object emitting light rays with longer wavelength that gives a warmer color. CCT is one of the major considerations of interior designers.

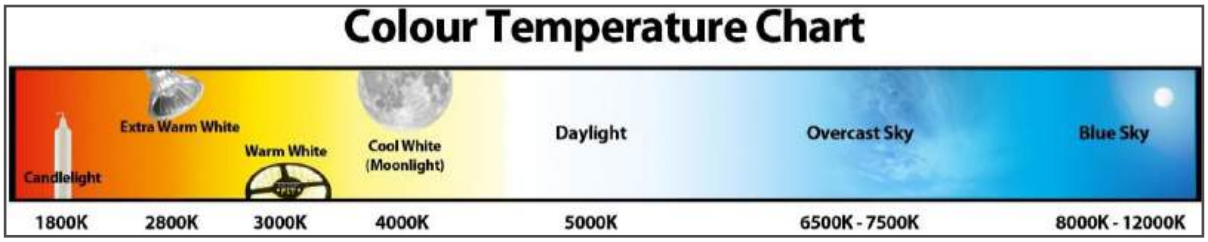


Fig. 3.1

Room Type	Properties	Example	CCT
Home	Warm White, which gives an orange-tinted and comfortable colour	2700K	
Office	Cool White, which is suitable for reading and task work	3500K	

1. Types of lighting functionality

Fig. 3.4

» **Ambient lighting** provides overall illumination, which define the space and forms a comfortable visual environment.

Fig. 3.6

» **Accent lighting** focuses on selected objects and surfaces, providing a dramatic effect.

Fig. 3.5

» **Task lighting** illuminates the area where work is performed, which enhances productivity.

Fig. 3.7

» **Decorative lighting** highlights and accents hallways, walkways, and other elements of interior and exterior design.

Fig. 3.8

» **Exterior lighting** provides light in outdoor areas where people may enjoy various activities.

Fig. 3.9

» **Landscape lighting** adds beauty, character and safety to the landscape and offers the functionality and peace of mind of a well-lit landscape design.

WELL Building Standard is a U.S. public benefit corporation whose mission is to improve human health and well-being through the built environment. **WELL Building Standard 58: Color quality** states that light color quality impacts visual appeal and can either contribute to or detract from occupant comfort. Poor color quality reduces visual acuity and the accurate rendering of illuminated objects. This standard ensures that lights with high color quality are in place.

Types of lighting sources

Type	Characteristics
Incandescent bulb  *Fig. 3.10*	» Light generated by electric current passing through a filament » Inexpensive bulb » Shorter service time » Less energy efficiency
Fluorescent bulb/tube  *Fig. 3.11*  *Fig. 3.12*	» Light generated by phosphor coating » Risk of leaked toxic mercury gas » Expensive bulb/tube » Fair service time » Better energy efficiency
Light Emitting Diodes (LEDs)  *Fig. 3.13*  *Fig. 3.14*	» Light generated by recombining electrons » Very expensive bulb » Long service time » Highest energy efficiency

Halogen lamp *Fig. 3.15*		» A form of incandescent lamp that has a small amount of a halogen such as iodine or bromine added » Operates at a very high temperature » Risk of fire hazards » Higher color temperature

Access to daylight

There are many benefits to using daylight. It can save energy by reducing the use of electric lights and increase users' satisfaction and achieve visual comfort. Good daylighting requires both qualitative and quantitative aspects of design.

To be specific, **daylight factor (DF)** is an indication of amount of daylight at a point inside a room. Various size and arrangement of windows can change the DF value. On the other hand, daylight model can be simulated and analyzed using software **RADIANCE**.

Lux is the International System of Units' unit of luminance, which measures the luminous flux per unit area.

The Chartered Institution of Building Services Engineers (CIBSE), which is the standard setter and authority on building services engineering, has set out the lux requirement for different activities according to CIBSE SLL Code for lighting.

Fig. 3.16

Type of area, task or activity	Lux requirement
Rest rooms	100
Store and stockrooms	100
Circulation areas and corridors	100
Elevators, lifts	100
Canteens, pantries	100
Cloakrooms, washrooms, bath-rooms, toilets	200
Rooms for physical exercise	200
Classrooms, tutorial rooms	300
Office – Reception desk	300
Laboratories	300
Auditorium, lecture halls	500
Library – Reading area	500
Kitchen	500
Office – Conference and meeting rooms	500
Office – Writing, typing, reading, data processing	500
Rooms for medical attention	500
Art rooms in art schools	750
Technical drawing rooms	750
Dentist patient rooms	1000

WELL Building Standard 63: Daylighting Fenestration states that exposure to natural light can improve mood, alertness and overall health. This standard outlines design parameters for windows to optimize the quantity and quality of daylight.

Fig. 3.17

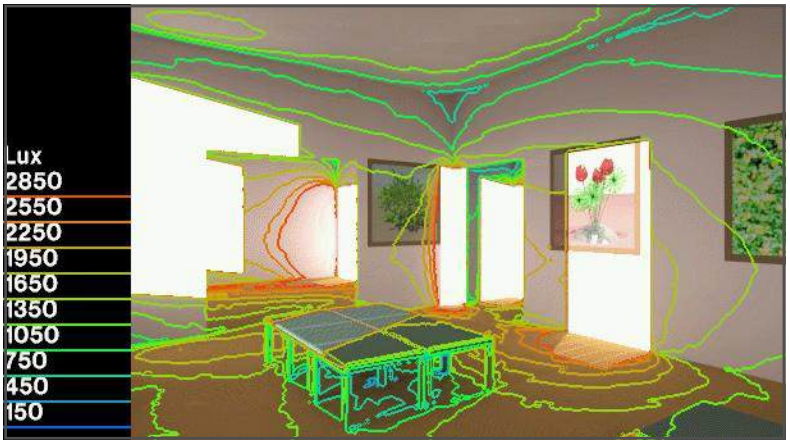


Fig. 3.18

Spatial arrangement/Congestion

The U.S. verification scheme "Leadership in Energy and Environmental Design" (LEED) has devised the **LEED EQ Credit 8.2: Daylight & Views: Views for 90% of Spaces**, which intends to provide for building occupants with a connection between indoor spaces and the outdoors through the introduction of daylight and views into the regularly occupied areas of the building. The scheme states that a direct line of sight to the outdoor environment between 0.8 meters and 2.3 meters above finish floor for building occupants in 90% of all regularly occupied areas should be achieved.

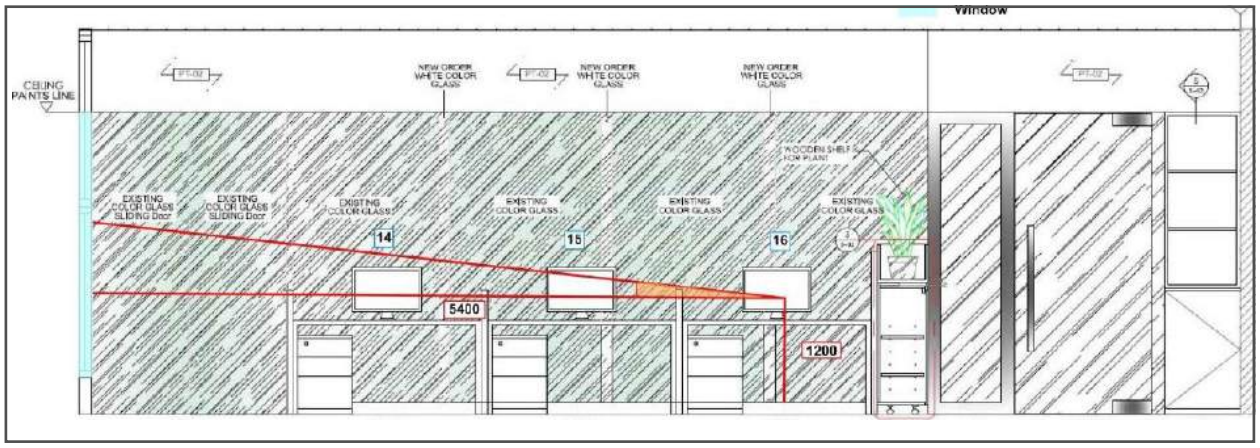


Fig. 3.19

3.2 Hearing

Noise isolation

Noise is unwanted and unpleasant sound, which may lead to hearing loss and high blood pressure.[i] For example, noise is produced by printers and ventilation system in an office. Noise isolation can be affected by the structure of buildings, namely the building envelope, walls and floors. Noise Isolation Class (NIC) indicates the sound control between two adjoining areas. The higher the number, the better the sound control. Sound Transmission Class (STC) is another sound parameter that indicates how well a wall can stop the transmission of sound. The higher the number, the better the wall can stop the sound transmission. The following tables shows the STC values based on different building materials.[ii]

Thickness and Material	STC
5/16” Plywood	25
5/8” Gypsum Board	28
1/4” Plate Glass	30
3/16” Steel plate	35
1” Thick wood panel	36
12” Brick wall	59

Building Environmental Assessment Method (BEAM Plus) is a Hong Kong voluntary green building labeling scheme. **BEAM PLUS For New Buildings IEQ 19 Noise Isolation** is a guideline that aims at improving the noise isolation of normally occupied premises or rooms to reduce impact of unwanted noise. Different performance criteria are mentioned in the guideline. For example, Noise Isolation Class (NIC) should be at least 40 for cellular offices; Sound Transmission Class (STC) between bedrooms and living rooms in residential premises should be STC46.[iii]

WELL Building Standard 81 Sound barriers states that noise from adjacent spaces can be very disturbing to building occupants. Careful detailing and high quality construction materials can greatly improve the sound reducing abilities of an interior partition or door.

Fig. 3.20

Fig. 3.21

Room Acoustic

Room Acoustic describes how sound behaves in an enclosed space. It concerns how sound is created, propagated, perceived, measured and modeled inside a room. One of the important parameters in room acoustic is **reverberation time**, which measures how long the acoustic energy emitted from sound sources inside a room will linger.

The optimal reverberation time depends on the nature of the room. To be specific, longer reverberation time is suitable for churches and large concert halls for enhancing the musical experience.[iv] The table below suggests the reverberation time for different room types: [v]

Room Type	Optimum Reverberation Time (s)
Studio	0.2-0.5
Classroom	0.5-1.0
Small Theatre	1.0-1.5
Church	1.5-2.0
Orchestra	2.0-2.5

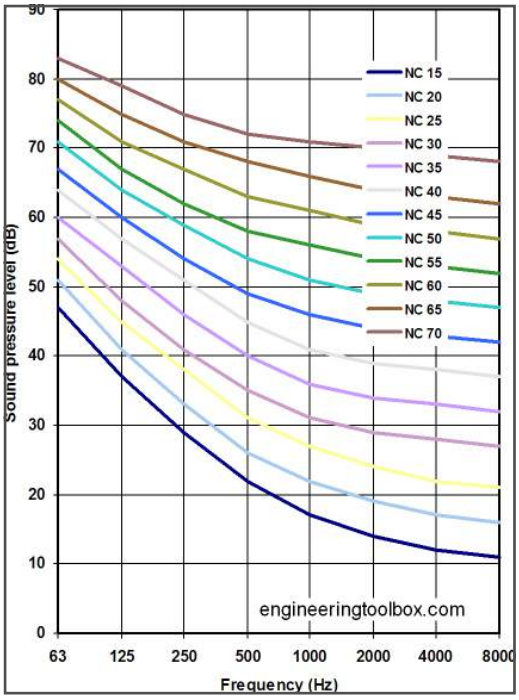


Fig. 3.22

In addition, Noise Criterion (NC) was established in U.S. for rating indoor noise, which is a set of criteria curves defining the limits of octave band spectra that must not be exceeded for the sake of human comfort in certain spaces. The graph left illustrates the NC curve.[vi]

For instance, 1000Hz sound measured at 60dB cannot be accepted in a space with NC40 requirement.

BEAM PLUS For New Buildings IEQ 18 Room Acoustics is the guideline aimed at improving the acoustical properties of rooms in which speech intelligibility is important. The suggested reverberation time of A-weighted sound pressure level, in modular (private) offices and conference rooms, should be 0.6 s or below. The noise assessment criterion should be NC40.

WELL Building Standard 78 Reverberation Time seeks to establish lower reverberation time to help maintain comfortable sound levels. This performance specification can be met through the use of sound-absorbing materials on various surface and design elements.

Fig. 3.23

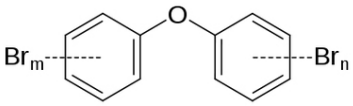
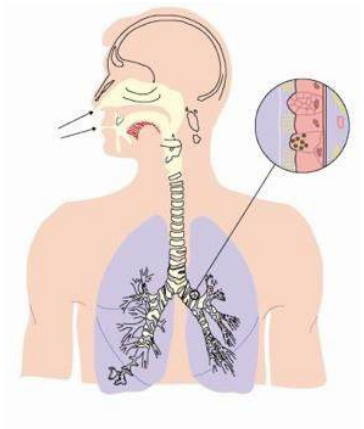
Fig. 3.24

3.3 Air

Indoor air quality (Pollutants and Odor)

Indoor air quality (IAQ) relates to the health and comfort of building occupants. IAQ can be affected by gases like carbon monoxide, radon, volatile organic compounds (VOC), particulates and microbial contaminants. Poor IAQ contributes to coughing, sneezing, watery eyes, headaches and so on.[vii] Worse still, poor IAQ can sometimes lead to bad odor.

Pollutants generated from different interior sources can cause many adverse health problems.[viii]

Pollutant	Potential health problems	Possible sources
Asbestos  *Fig. 3.25*	• Asbestosis • Mesothelioma • Lung cancer	• Floor tiles • Roofing materials
Flame retardants (PBDEs)  *Fig. 3.26*	• Potential effects on behavioral and nervous system development	• Some plastics • Electrical and electronic equipment • Upholstered furniture • Non-clothing textiles • Foam products
Formaldehyde (Methanol)  *Fig. 3.27*	• Burning sensations in the eyes, nose and throat • Breathing problems • Allergies	• Tobacco smoke • Varnish and glues • Wallpapers, cardboard and paper products • Furniture, cabinets and building materials made from particleboard
Volatile organic compounds (VOCs)  *Fig. 3.28*	• Eye, nose and throat irritation • Headaches, loss of coordination and nausea • Damage to liver, kidney and central nervous system	• Cigarette smoke • Varnish and glues • Hair sprays and nail polish
Radon  *Fig. 3.29*	• DNA damage • Lung cancer	• Building materials • Soil and rock

BEAM PLUS For New Buildings IEQ 6 Outdoor Sources of Air Pollution is the guideline that aims at ensuring airborne contaminants from external sources will not give rise to unacceptable levels of indoor air pollution in normally occupied spaces. Similarly, **IEQ 7 Indoor Sources of Air Pollution** aims to ensure airborne contaminants from internal sources are within acceptable levels.

WELL Building Standard 01 Air quality standards requires an accredited assessor to complete aperformance test after occupancy as an independent means of verifying that the building, whether naturally or mechanically ventilated, meets critical air quality requirements.

Fig. 3.30

Fig. 3.31

3.4 Thermal Environment

Indoor temperature

Indoor temperature can affect productivity indirectly by possibly inducing sick building syndrome symptoms or influence occupants' satisfaction with air quality. However, different people have different sensory perceptions to temperature. It is better to have a consensus among the room occupants and then setting an average temperature.

Predicted Mean Vote (PMV) is a thermal scale that runs from Cold (-3) to Hot (+3). Data describing comfort sensation is collected by a large group of people subjected to different thermal conditions, and then a mathematical relation between all the environmental and physiological factors is derived. This relation allows us to calculate the value of PMV once several parameters are given, which include:[ix]

1. Metabolic rate (met): The energy generated from the human body;
2. Clothing insulation (clo): The amount of thermal insulation the person is wearing;
3. Air temperature: Temperature of the air surrounding the occupant;
4. Radiant temperature: The weighted average of all the temperatures from surfaces surrounding an occupant;
5. Air velocity: Rate of air movement given distance over time;
6. Relative humidity: Percentage of water vapor in the air.

ASHRAE 55 recommends the acceptable PMV range for thermal comfort is between -0.5 and +0.5. The table below shows the PMV sensation scale:

Value	Sensation
-3	Cold
-2	Cold
-1	Slightly cool
0	Neutral
1	Slightly warm
2	Warm
3	Hot

There is an online Comfort Calculator (ISO7730-1993) which can interactively suggest the PMV based on these parameters.

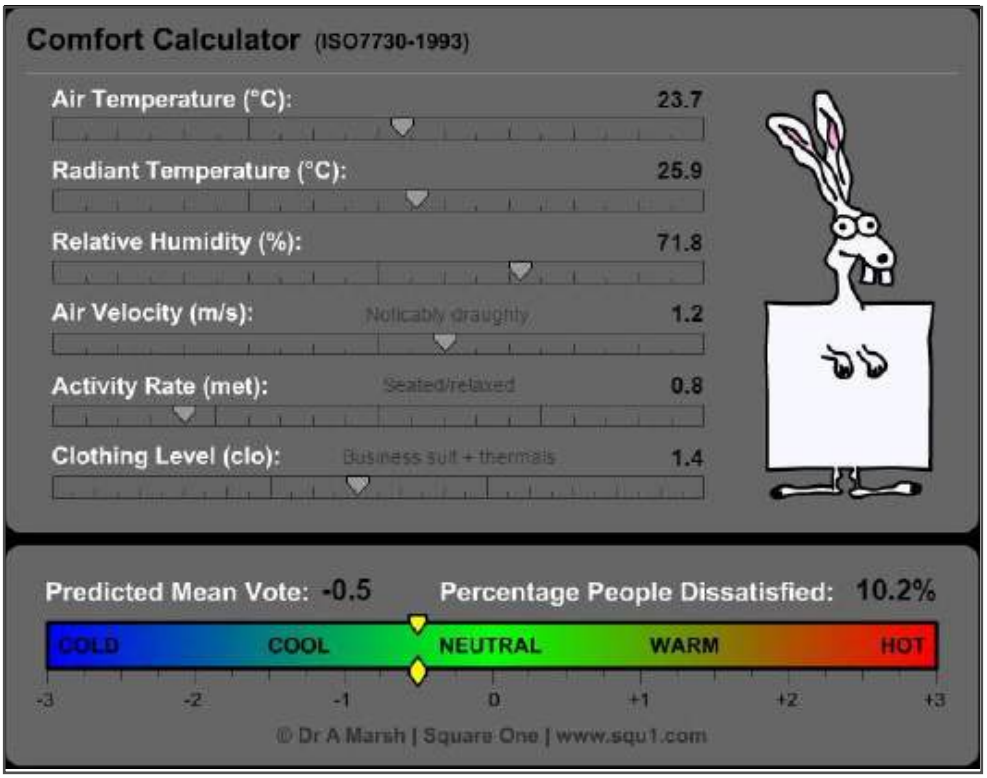


Fig. 3.32

The objective of **BEAM PLUS For New Buildings IEQ 13 Thermal Comfort in Air-conditioned Premises** is to ensure that air-conditioning systems provide the stated design conditions in occupied spaces under changing load conditions. Also, **IEQ 14 Thermal Comfort in Naturally Ventilated Premises** aims at promoting the application of measures that reduce elevated temperatures caused by external heat gains and ensure installed air-conditioning units can provide adequate control of indoor temperature.

WELL Building Standard 76 Thermal comfort states that thermal comfort can affect mood, focus and productivity. However, preferences are highly personal and differ greatly from one individual to another. Balancing the energy requirements of large buildings with these varied occupant preferences can be challenging.

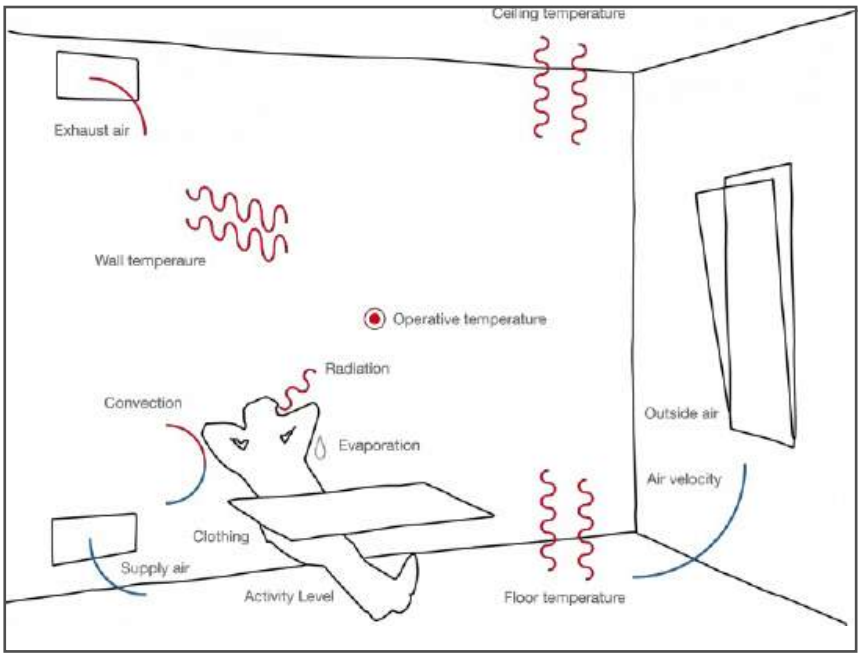


Fig. 3.33

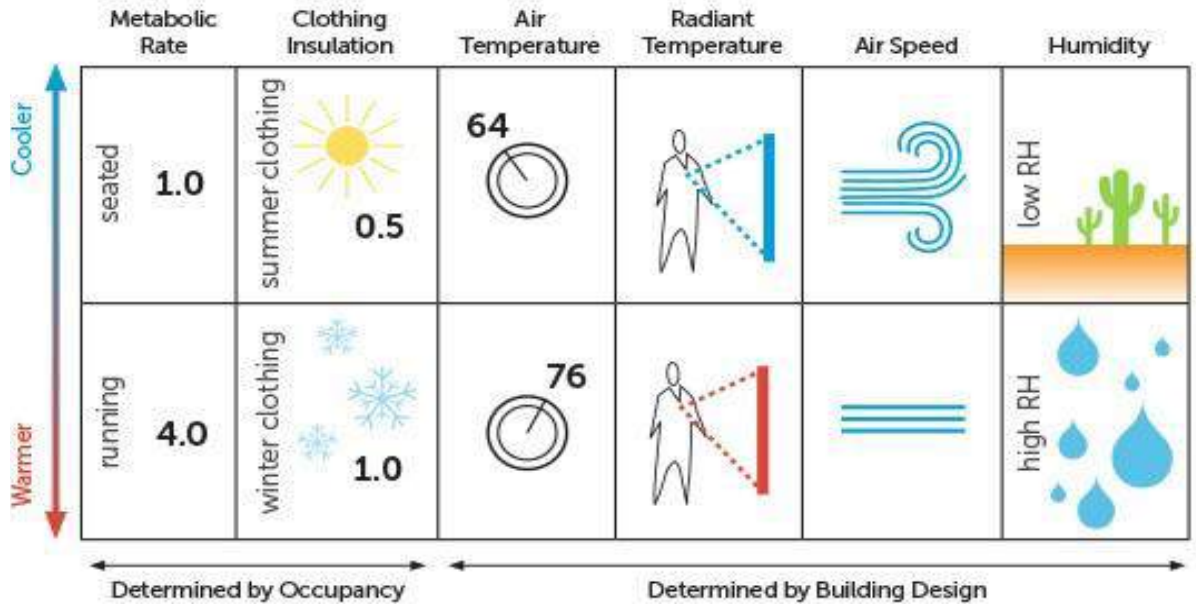


Fig. 3.34

Natural ventilation (or passive ventilation) is the process that supplies air to and removes air from an indoor space without using electrical and mechanical systems. The process that the air flows from exterior to an indoor space is a result of stack effect arising from pressure difference. This process can cool and ventilate a building while reducing a large fraction of total energy use.

For a room using natural ventilation, occupants sitting nearby windows will be affected by the breezes circulating the space. A certain amount of air movement around the human body is essential for thermal comfort. It is also important in dispersing air pollutants. However, when the wind speed is too high or unstable, it can interrupt work and adversely affect occupants' comfort.

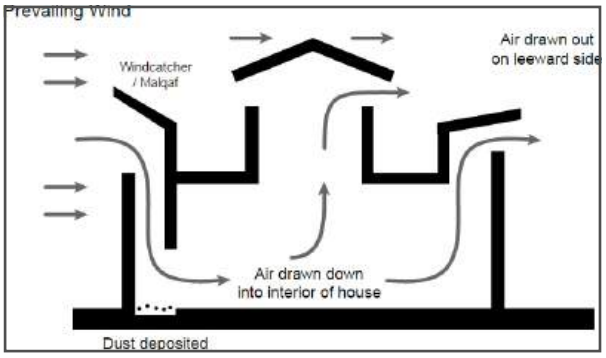


Fig. 3.35

BEAM PLUS For New Buildings SA 8 Microclimate Around Buildings states that physical discomfort sets in at wind speeds of about 5 ms -1 , with speeds above 8 ms -1 being very uncomfortable.

A wind-catcher in traditional Persian/Arabic architecture makes use of the wind movement to achieve natural ventilation. The ceiling opening of the tower faces opposite to the direction of the prevailing wind, and indoor air will tend to be expelled while warm air will naturally rise to ceiling. Thus air is drawn upwards by this process.[ix]

According to **BEAM Plus for New Buildings Appendices 8.8.1.4 Natural Ventilation**, there are several cross-ventilation suggestions for wind movement that interior designers have to consider when designing interior structures.

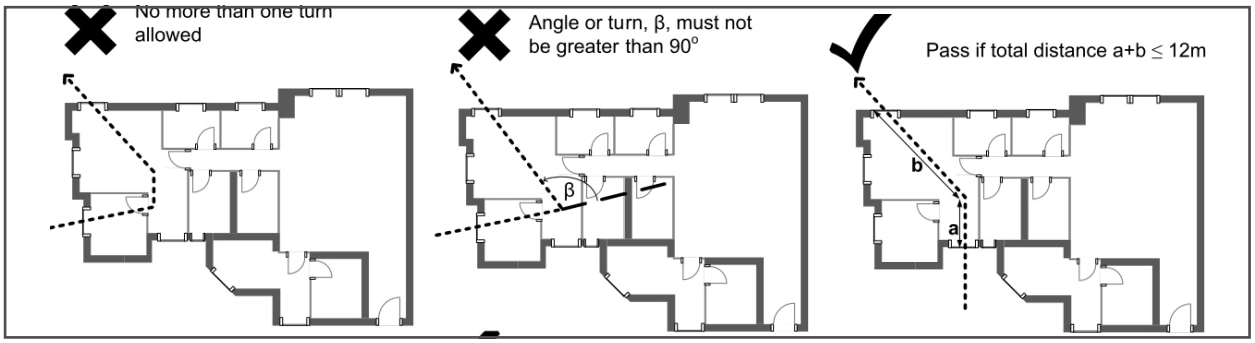


Fig. 3.36

However, interior designers have to realize the constraints of natural ventilation. First, sites with high level of acoustic noise and air contamination will be less suitable for natural ventilation, which requires a high interaction with the surrounding space.[x] Secondly, buildings in cold weather regions require a relatively closed space to trap heat. Thus, it may not be feasible to achieve natural ventilation. On the other hand it is necessary to consider the daylighting when designing the facade for ventilation.

Fig. 3.37

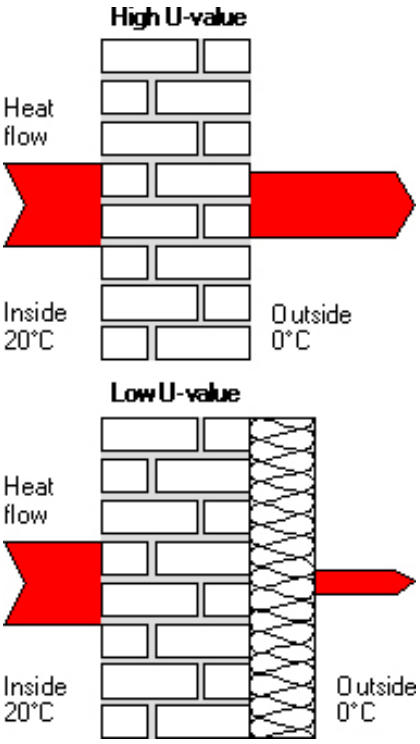


Fig. 3.38

- **Glass Type**
  A major component of thermal environmental is glass insulation. There are many types of glass available in the market. In order to create a suitable thermal environment, interior designers have to take into account two parameters when selecting glass for insulation.[xi]

  The first is U-values. The 'U' value of a double glazing window is the measure of its ability to transfer heat – so double glazing windows with the lowest U value are the most efficient insulators against heat loss from a room.

  The second parameter is the Solar Heat Gain Coefficient (SHGC), which measures the ability of thermal insulation glass to transmit solar energy into a room, as measured in value from 0 to 1. The lower a window's solar heat gain coefficient, the less solar heat it transmits.

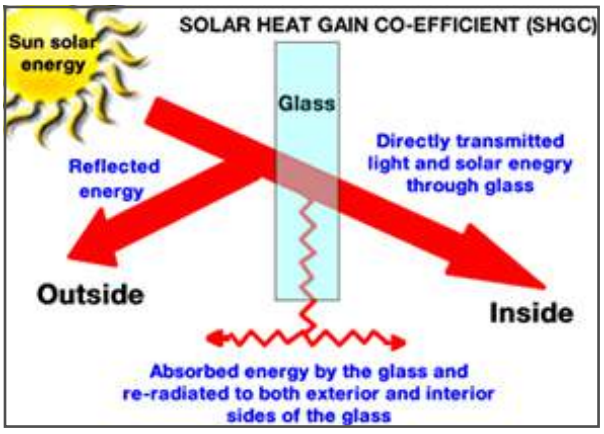


Fig. 3.39

There are many types of insulation glass in the market, each with different characteristics. Below is a sampling of a few common types.

» **Clear Float Glass:** ordinary, transmission, widely used. high light

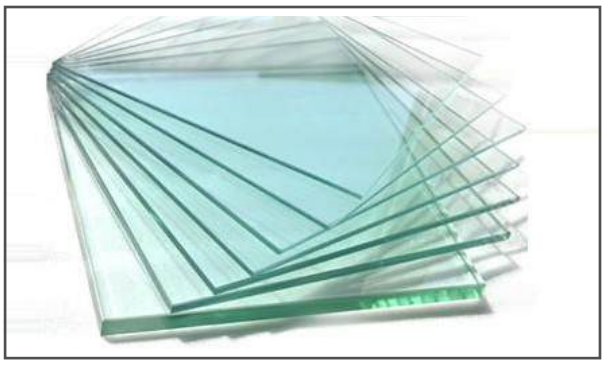


Fig. 3.40

» **Tinted Float Glass:** colored, high sunshade efficiency

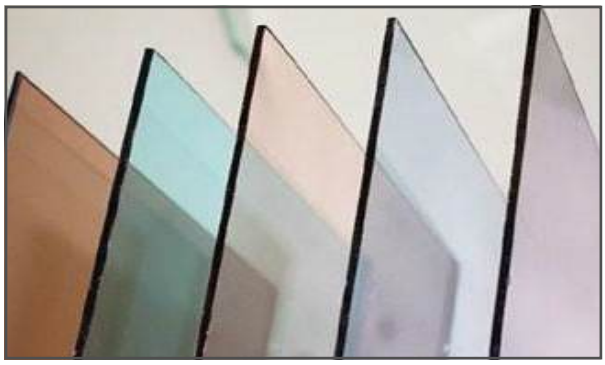


Fig. 3.41

» **Low-E glass:** microscopically thin and transparent coating on glass, low ultraviolet and infrared light transmission but considerable visible light transmission.

Fig. 3.42

» **Laminated glass:** PVB interlayer between multiple glass layers, hard to break, prevention against hurricane and earthquake

Fig. 3.43

» **Insulating glass:** glazed glass comprises multiple piles of glass separated by a vacuum or gas filled space to reduce heat transfer, very low 'U' value.

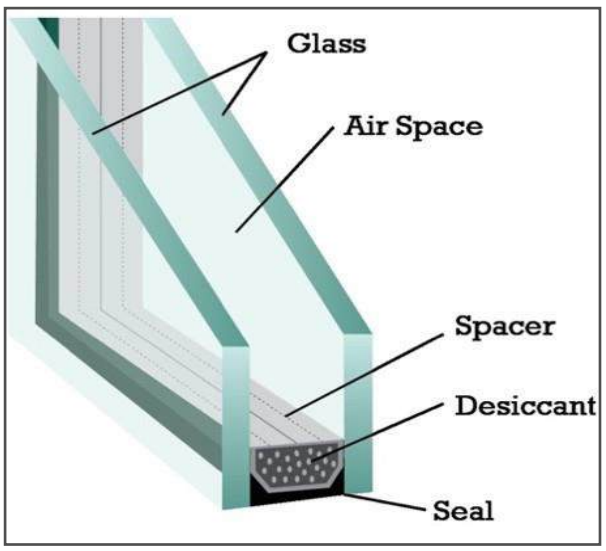


Fig. 3.44

» **Photovoltaic glass (PV glass):** the glass incorporates solar cells to generate electricity from sunlight.

Fig. 3.45

3.5 Case Study
Project: Small Home Smart Home
Firm: LAAB (www.LAAB.pro)

Small Home, Smart Home is a 309 square-feet apartment situated in Hong Kong. The clients, a young professional couple, had a long wish-list for this small space, including a full kitchen, large bathtub, home cinema, gym, cat friendly spaces and plenty of storage room. To fulfill these requirements, the designers applied meticulous planning and extraordinary craftsmanship to create a space with many different components that serve multiple functions and can be moved around. Different parts of the apartment can open and close depending on the purposes needed at that particular time, and the synchronization of components, structures and appliances make for a spatial experience well-tailored to the needs of the clients.

Fig. 3.46 Overhead view of the space

Fig. 3.47

Fig. 3.48

Fig. 3.49

The use of partitions allows different activities to take place at the same time.

The bathtub area can serve as a bathroom and can also be turned into a second tier seating for guests. It also functions as a guest bedroom for short-stay guests.

The design tackles different human senses to create an overall sense of well-being and comfort.

Visual: All elements, from the 4K TV, dining table, to the make-up table and storage are all designed to be flat and easy to hide, so as to keep the flat looking neat and spacious.

Lighting : The smart lights are able to slowly brighten the room in the morning, giving the couple a gentle wake-up.

Air: Materials, details and mechanical systems were all strategically designed to keep the spaces dry, cleanable, cat-friendly, and free of undesirable smells. As an example, the cat toilet has been equipped with its own ventilation system that pulls smells out of the building.

Fig. 3.50

Fig. 3.51

Fig. 3.52

Fig. 3.53

In addition to the human inhabitants, the designers also cater to the needs of the owners' three cats. Cat areas include a cat walk around the ceiling, cat ladder, litter-box hidden beneath the bathroom sink, cat food trays hidden within the kitchen cabinets and a hidden den for them to relax in.

Fig. 3.54

Fig. 3.55

This apartment is a smart home in which technology plays a big role. A range of app-controlled smart home technologies have also been implemented, such as smart bulbs and smart lock. The lights can be adjusted according to time and brightness, while the door lock enables the owners to enter effortlessly or send electronic keys to friends to help them look after their cats.

CHAPTER 4

Universal Design and User-friendly Space

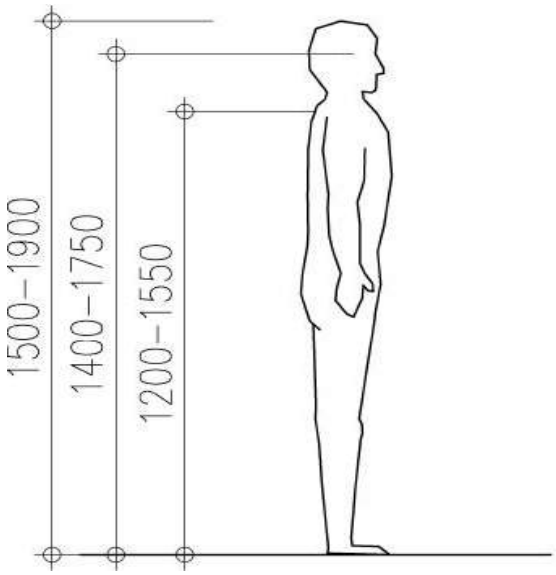
By Simon Leung, Edwin Leung, Issac Tam

As society develops, there is a growing awareness that people with different needs and abilities should have equal access to goods and services. Universal Design, also known as inclusive design, is a design approach to a universally accessible standard in which all products, environments and communications will cater to all people regardless of diversity, age and physical conditions. The designed products and constructions through the universal design approach are user-friendly and aim to be as convenient as possible to grant access to different social groups[i].

Human Factors and Ergonomics

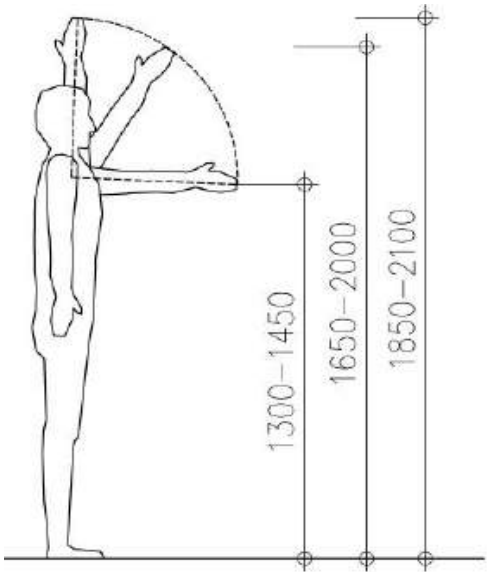
Anthropometrics

Interior design is human-centric, and designers must come up with furniture and spaces that fit the needs of users. The dimensions of the individual human being vary with time and from one person to another, and there are also variations from one country to another. When carrying out detailed design, consideration should also be given to size variation between males and females as well as people of different ages.



Height	1500mm – 1900mm
Eye	1400mm – 1750mm
Shoulder	1200mm – 1550mm

Fig. 4.1 Dimensional Data of an Average Person



Max. Reach Up	1850mm – 2100mm
Oblique Reach Up	1650mm – 2000mm
Forward Reach	1300mm – 1450mm

Fig. 4.2 Reaching Zones of an Average Person

Below are the key dimensions for an Asian male with an average height of 1680mm.[ii]

	KEY DIMENSIONS	MEAN DIMENSIONS	STANDARD DEVIATION
A	VERTEX HEIGHT	1239	47
B	EYELLEVEL	1124	47
C	SHOULDER HEIGHT	960	45
D	UPPER KNEE HEIGHT	502	23
E	LOWER ELBOW HEIGHT	607	39
F	ARM LENGTH	298	16
G	FOREARM LENGTH	238	13
H	HAND LENGTH	189	11
I	UNDERSIDE THIGH HEIGHT	407	16
J	SHOULDER BREADTH	377	26
K	HIPS BREADTH	319	24

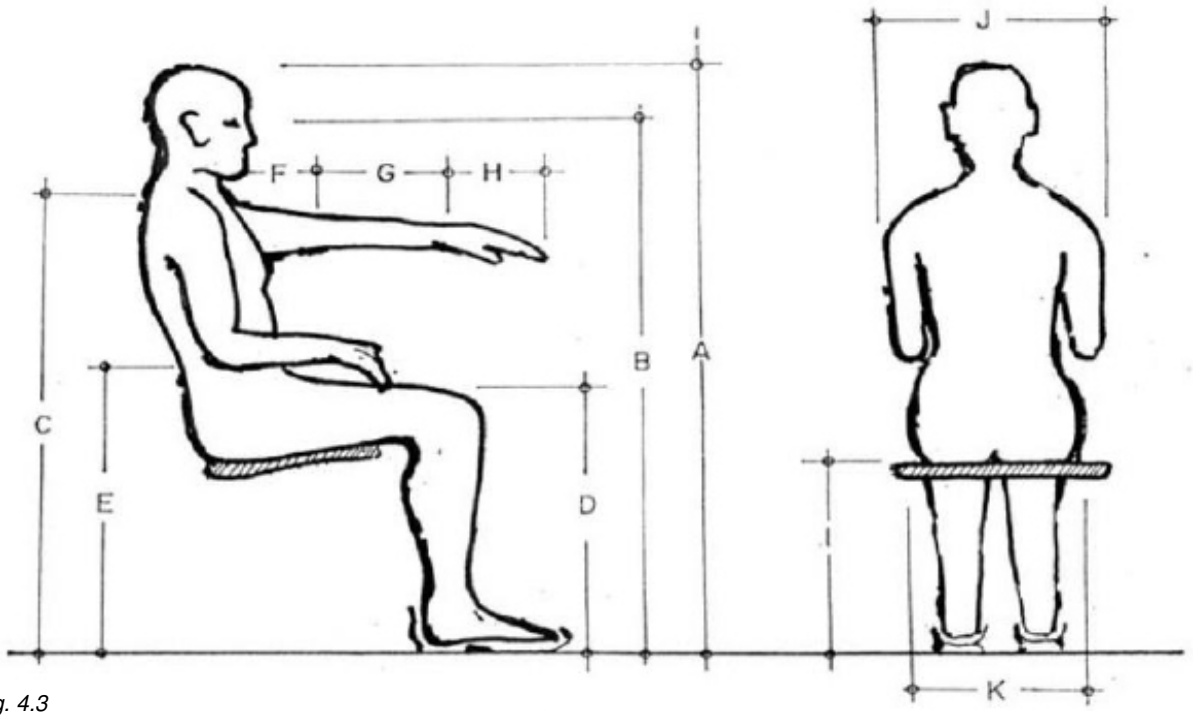


Fig. 4.3

Ergonomic Recommendations for Seating Furniture

In making designs for seated furniture, comfort requires that the seat slant down slightly toward the rear. The more the back slants to the rear the more important it is that the seat slant downward to the rear.

Seat surface should not be set too high. If it does, it tends to compress the thigh and results in constricted blood circulation, and also weakens body stability because the soles of the feet are not permitted proper contact with the floor surface. Nor should it be set too low because it tends to extend the legs and be positioned forward, depriving them of stability. Furthermore, it will cause the body to slide away from the backrest that gives proper lumbar support.

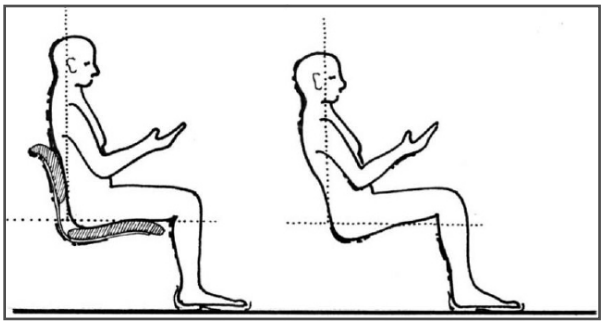


Fig. 4.4 Proper seat height

Office Furniture

For rectangular tables, an ideal length is to provide an elbow room of 560 mm. to 600 mm. per seater and a space allowance of 300 mm. on each side. This is recommended where the room or area is small.

For circular table, space allotment is 560mm. to 600 mm. of the circumference. To determine the diameter of required table, multiply intended capacity by the allotted space or elbow room per seater (560 mm. to 600 mm.), then divide the result by 3.14 (the value of pi) The final answer will be the approximate diameter of the table required.

The height of tables should complement the seats. Ideal seat level is 300 mm. below the table top. For average Asian stature, table height of 730 mm. is recommended. Complementing chairs with a seat height of 430 mm. is ideal.

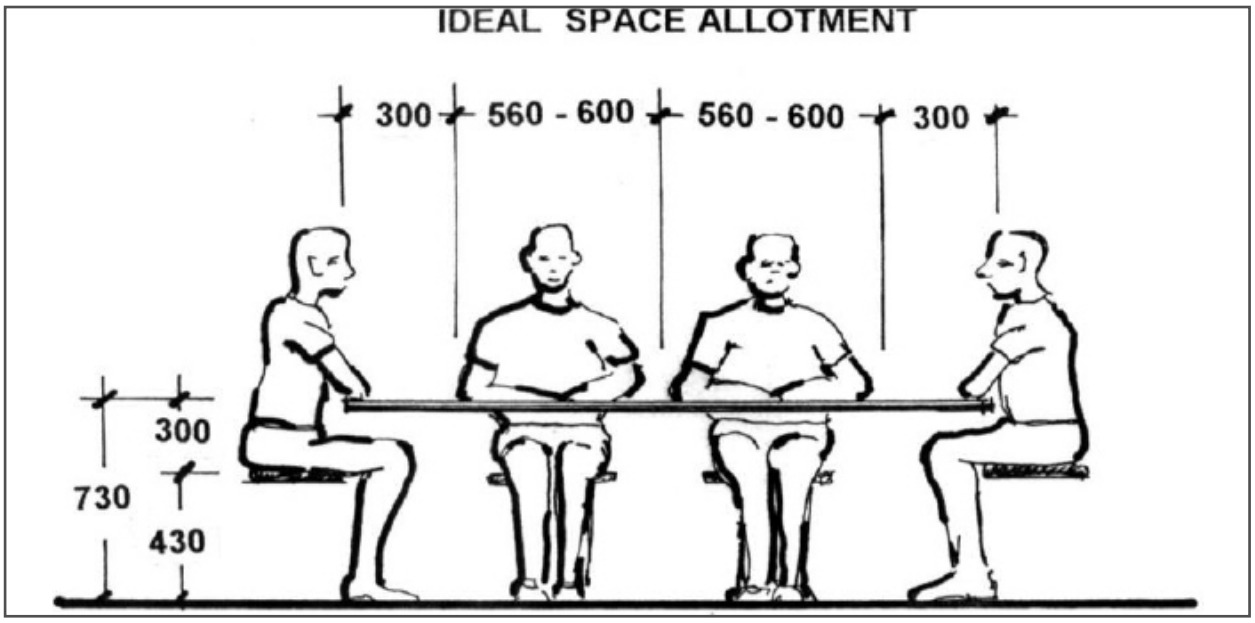


Fig. 4.5

Wheelchair access

In Hong Kong, new buildings are now required to provide access for people with disabilities. The dimensions of corridors and doorways must be wide enough for people travelling on wheelchairs.

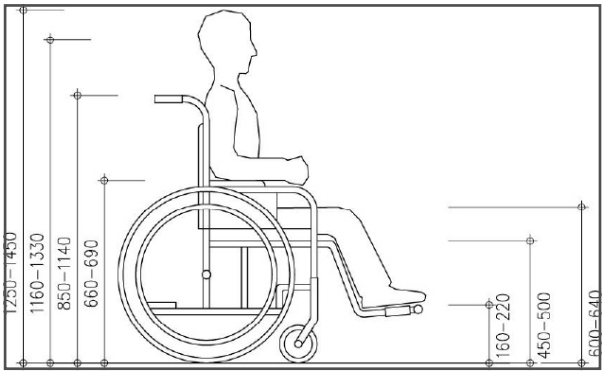


Fig. 4.5

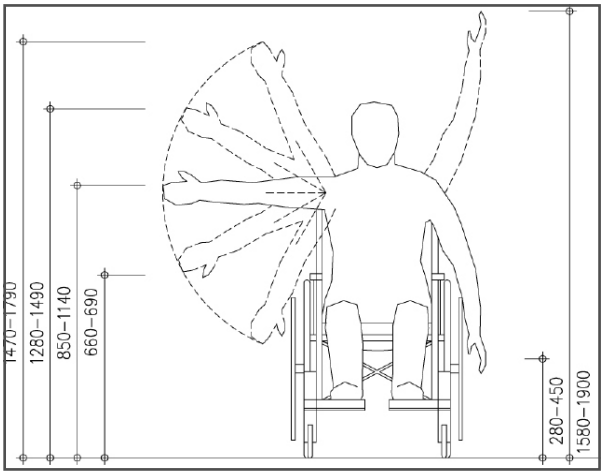
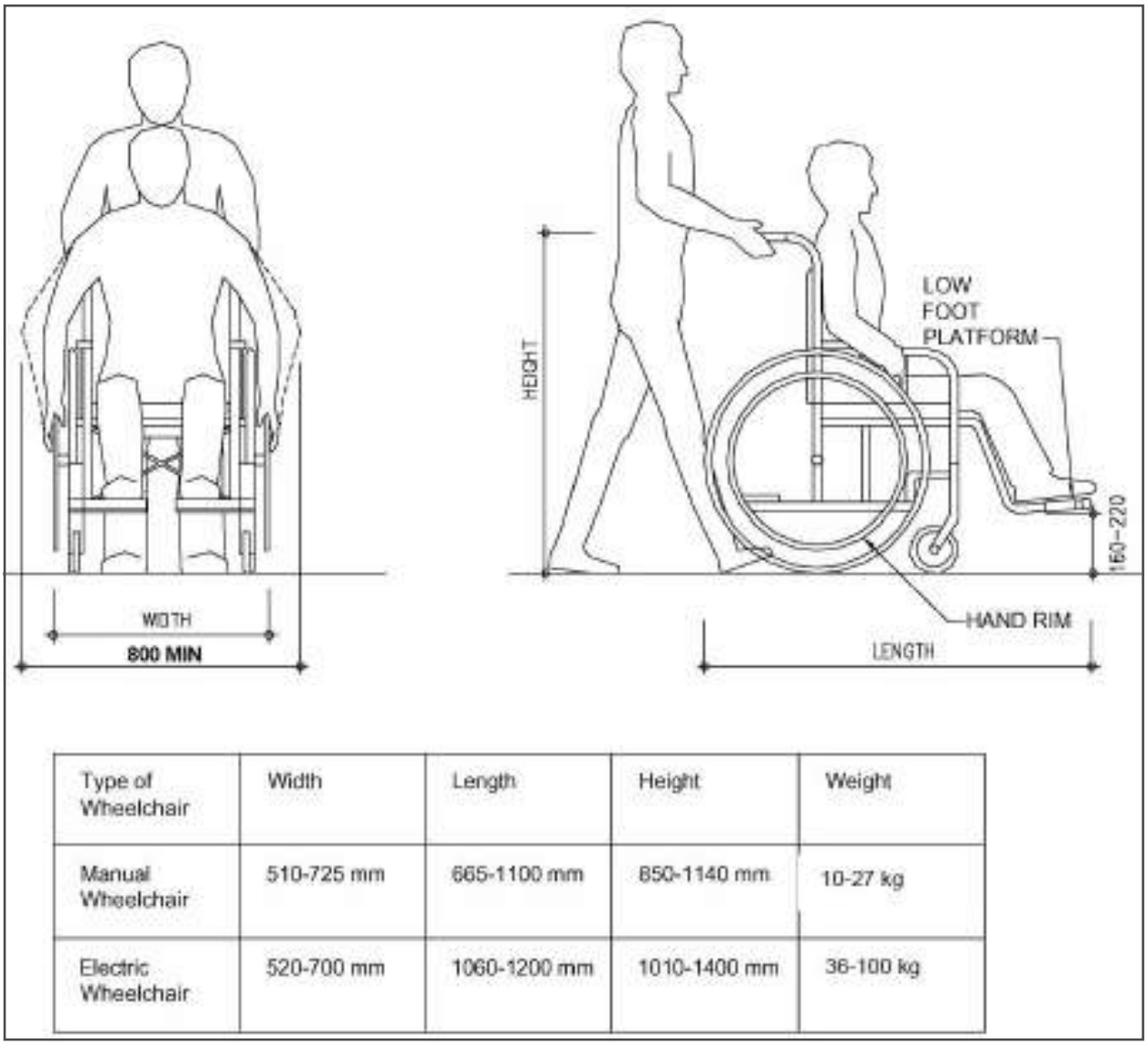


Fig. 4.5

Dimensions Of Wheelchairs

The dimensions of wheelchairs commonly used by persons with a disability in Hong Kong are provided below.



Type of Wheelchair	Width	Length	Height	Weight
Manual Wheelchair	510-725 mm	665-1100 mm	850-1140 mm	10-27 kg
Electric Wheelchair	520-700 mm	1060-1200 mm	1010-1400 mm	36-100 kg

Fig.4 8 Dimensions of Wheelchairs

Disabled Toilets

Restaurants, shopping malls and public facilities must be equipped with toilets for the disabled. By law, there must be sufficient, properly designed and located toilet and W.C. cubicles stalls available for use by everybody including people of either gender, people with babies and small children, persons with disability, wheelchair users and the elderly and elderly with frailty, etc. with or without any assistance from others. Space requirements for disabled toilets must be such that a wheelchair user can maneuver into position for frontal, side or diagonal transfer to and from the toilet seat.

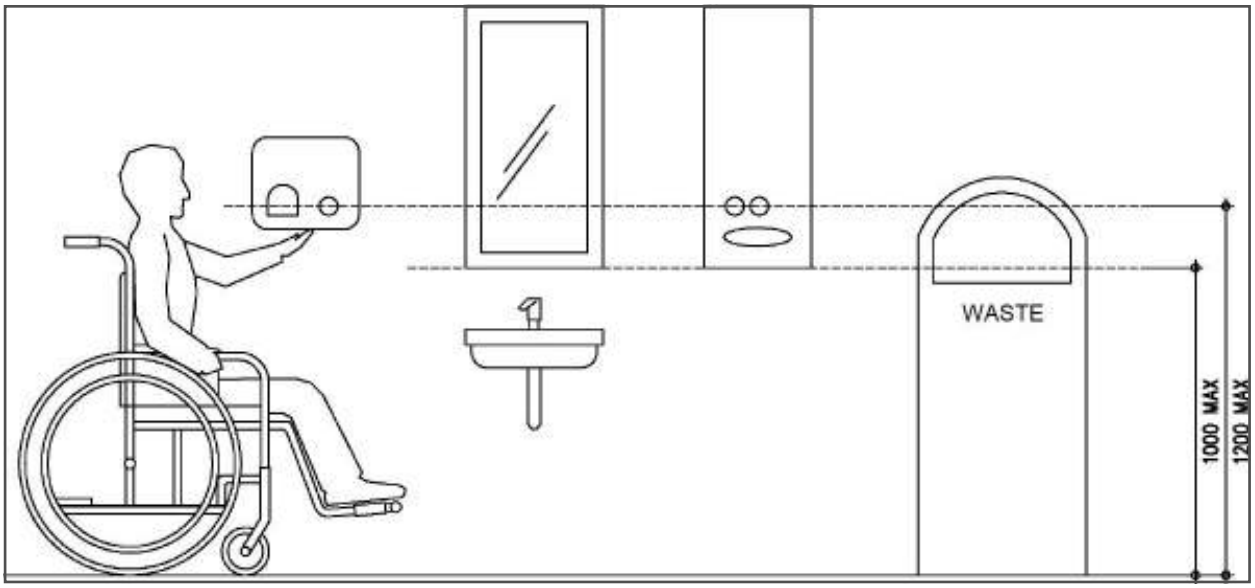


Fig. 4 .9 Design Heights for Various Features

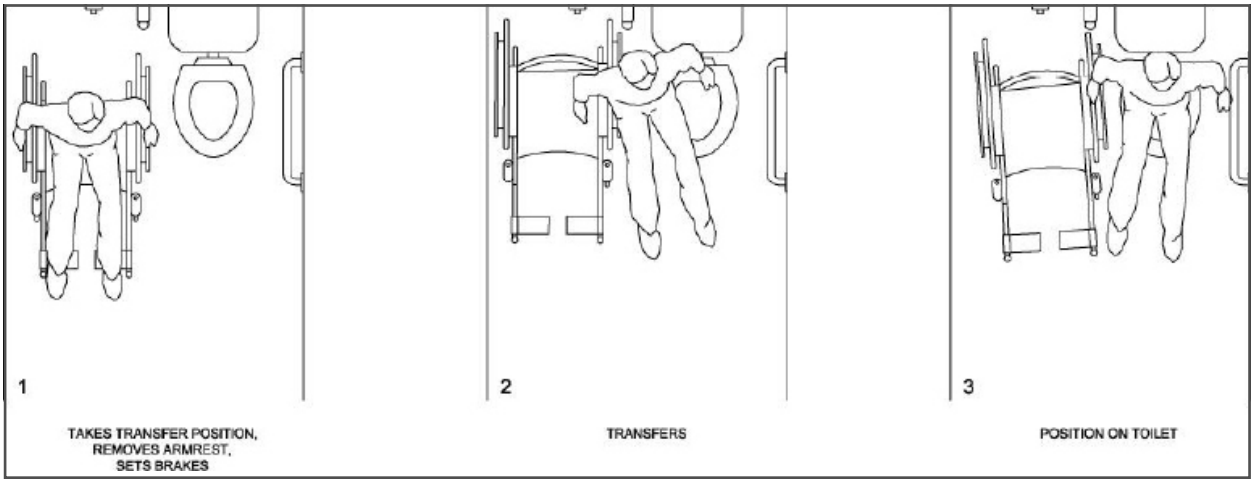


Fig. 4 .10 Diagonal Approach for Transferring from a wheelchair to a W.C.

The Seven Principles of Universal Design

The Seven Principles of Universal Design were developed in 1997 by a working group of architects, product designers, engineers and environmental design researchers at the North Carolina State University. The purpose of the Principles is to guide the design of environments, products and communications. According to the Center for Universal Design in NCSU, the Principles "may be applied to evaluate existing designs, guide the design process and educate both designers and consumers about the characteristics of more usable products and environments." [iii] Universal Design, also known as "design for all people", is a principle for designing environments for all people, regardless of age, gender, ability or change in ability.

1. Equitable use.

The building's design should make it equally accessible to everyone. Ideally, the means by which people use the building should be the same (e.g., providing one means of entry to the building that works well for everyone). If it cannot be identical, the several means provided must be equivalent in terms of their privacy, security, safety and convenience. The building must never employ means that isolate or stigmatize any group of users or privilege one group over another.[iv]

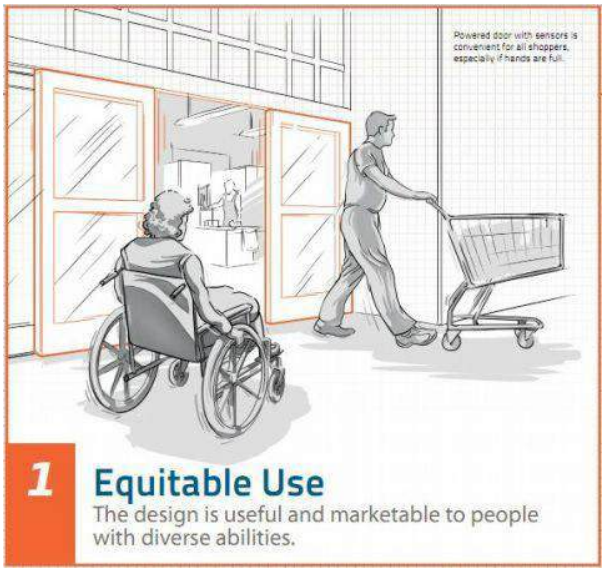


Fig. 4 .11

2. Flexibility in Use.

The building's design should allow people to use its design features in more than one prescribed way (e.g., providing a countertop orientation map that is viewable from either a seated or standing position). It should accommodate both right and left-handed use and be adaptable to the individual user's pace. The building's design should have the built-in flexibility to be usable even when it is employed in an unconventional or unanticipated manner.

Fig. 4 .12 Information counter at a shopping mall is viewable from either a seated or standing position

3. Simple and intuitive.

The building should make it easy for everyone to understand the purpose of each design feature and how to use it (e.g., providing washroom lavatory faucets that make their method of operation readily apparent and relatively easy). Moreover, its means of use should be intuitively obvious so that it operates as anticipated and, therefore, can be used spontaneously.

Fig. 4 .13

4. Perceptible information

The building should provide all essential information in a variety of modes (e.g., written, symbolic, tactile, verbal) to ensure effective communication with all users regardless of their sensory abilities. The information provided must be presented with sufficient contrast to surrounding conditions so that it is distinguishable from its context and decipherable in all its various modes of presentation.

Fig. 4 .14

5. Tolerance for error

Ideally, the building's design should eliminate, isolate or shield any design features that could prove hazardous or inconvenient to any user. When potentially dangerous conditions are unavoidable, users should receive warnings as they approach the design feature (e.g., providing proximity warnings in a variety of sensory modes near the top of stairs). The building's design should also anticipate accidental or unintended actions by any user to minimize the inconvenience and/or protect the user from harm.

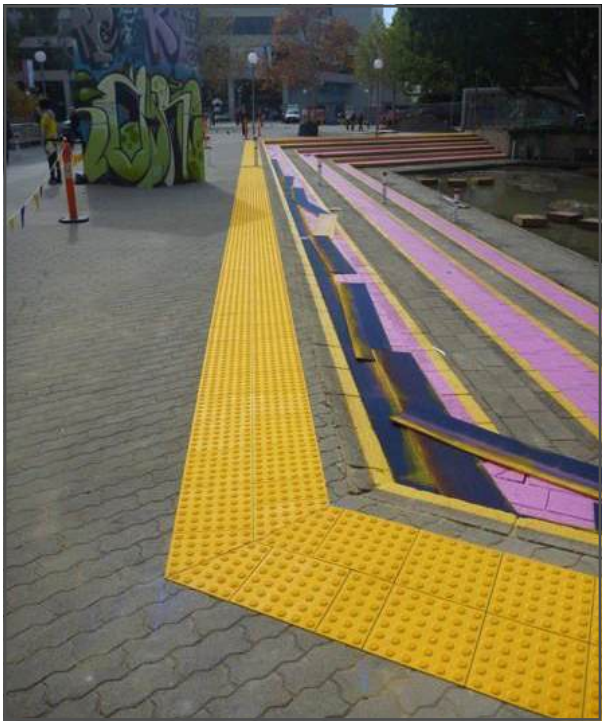


Fig. 4 .15

6. Low physical effort.

The building's design should employ design features that require little or no physical force to use them (e.g., replacing a traditional door knob with a lever handle that does not require the ability to grasp and turn the wrist). If a low level of force is required, any user should be able to engage the feature without assuming an awkward or hazardous body position (e.g., providing a smooth travel surface with minimal slope along the path of travel leading to the entrance).

Fig. 4 .16

7. Size and space for approach and use.

A building's design features should provide an adequate amount of space that is appropriately arranged to enable anyone to use them (e.g., providing knee space under a washroom lavatory to enable use by someone in a seated position). In addition, the space needs to be arranged to provide a clear path of travel to and from important design features for all users.

Fig. 4 .17

CHAPTER 5

Sustainability in Interior Design
By Jimmy Law Ching-Hin & Eagle Mo

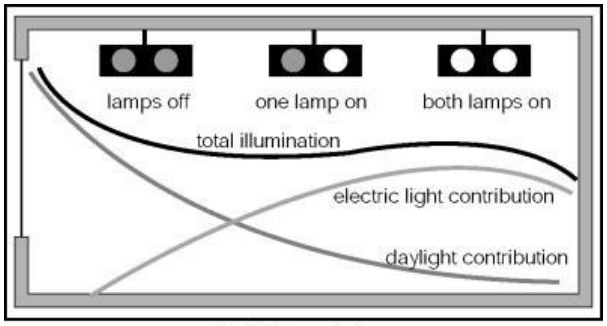
Sustainability has become an important consideration in the practice of interior design world-wide. Interior designers ought to select various products that help clients conserve resources and save on utility bills. In addition, there are a number of local and global green building and green interiors standards, and attaining relevant certifications can make a positive contribution to the environment while safeguarding the well-being of occupants.

5.1 Resource Management

a) Electricity

i. Daylighting controls

With daylighting controls, a building can consume less energy for lighting as well as save on cooling costs. Usually, the electric energy consumed during peak demand period (e.g. 3 – 6 p.m.) is the most expensive. Therefore, making use of skylights during the period can significantly save the lighting cost.



Daylighting controls

5.1 Resource Management

There are two types of daylighting control, which are manual control and automatic control. Manual control means it is the responsibility of the occupants to switch off the lighting when daylight is adequate. There is no additional hardware required but it seems not to be feasible when a building is very large and complex.

Fig. 5.2

On the other hand, automatic control does not rely on the daily decision of building users. Photo sensors are mounted in the ceiling to detect the illumination automatically. Light source, control unit, photo sensor and controller are the components of a complete control unit.[i]

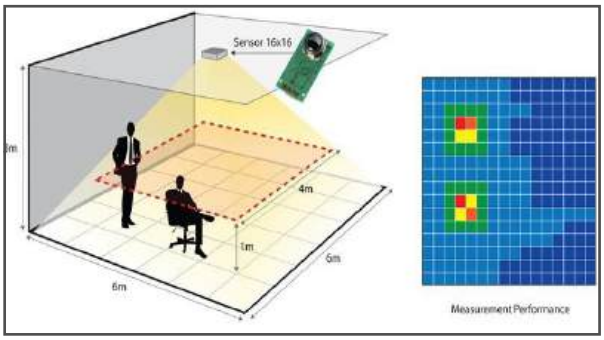


Fig. 5.3

ii. Energy Label

The rapid growth in the ownership of energy-using products has brought with it huge energy consumption and increased pressure on the living environment. To encourage the public to choose energy efficient appliances and raise public awareness on energy saving, the HKSAR Government has introduced the Mandatory Energy Efficiency Labeling Scheme (MEELS) through the Energy Efficiency (Labeling of Products) Ordinance, Cap. 598. Under MEELS, energy labels are required to be shown on prescribed products sold in Hong Kong to inform consumers of their energy efficiency performance.[ii]

(Official Website: http://www.energylabel.emsd.gov.hk/en/about/background2.html)

Fig. 5.4

In addition, China's energy efficiency labeling management system, known as the **China Energy Label**, is a type of information tag attached to the product or its packaging, which indicates the energy efficiency grade, energy consumption and other indices of energy-using products. It provides consumers (including all levels of government, enterprises and individuals) with the information they need when they are making purchasing decisions to guide and help them in choosing energy-efficient products. Based on the energy efficiency distribution and technical potential/cost-effectiveness of energy efficiency improvement, energy efficiency labels display different grade classifications.[iii]

(Official Website: http://www.energylabel.gov.cn/)

BEAM Plus EU 9 ENERGY EFFICIENT EQUIPMENT encourages the wider use of energy efficient appliances. For example, 2 credits will be given when 80% of total rated power of appliances and equipment are certified energy efficient products.

iii. Energy Star

"**ENERGY STAR** is a U.S. Environmental Protection Agency (EPA) voluntary program that helps businesses and individuals save money and protect our climate through superior energy efficiency."[iv] Energy Star certified lighting fixtures consume 70- 90% less operational energy and produce about 70-90% less heat than traditional incandescent light bulbs. The certified lighting fixtures distribute light more efficiently and effectively, which helps to protect the environment by reducing greenhouse gas emissions.

(Official Website: https://www.energystar.gov/)

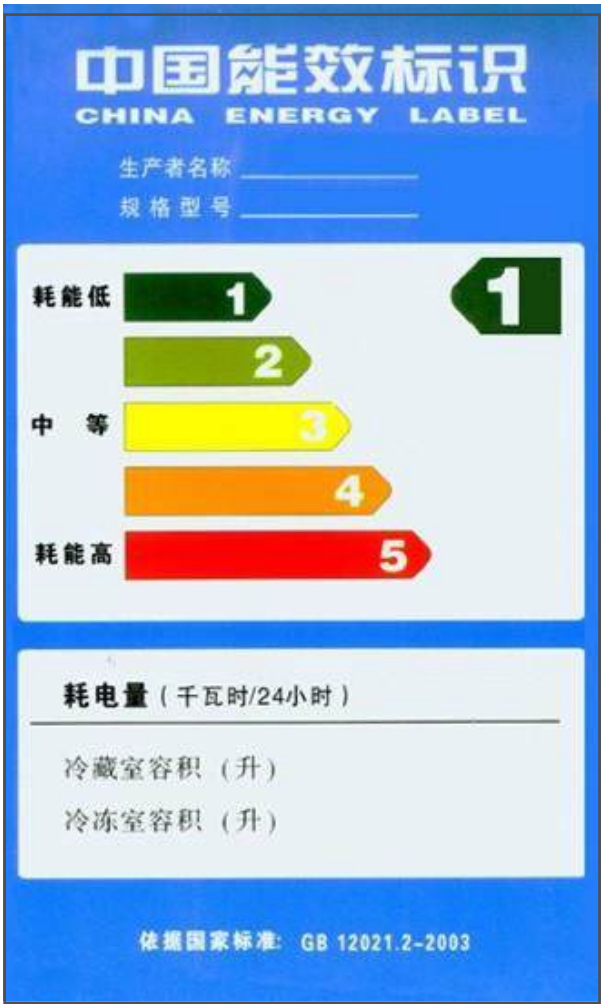


Fig. 5.5

Fig. 5.6

b) Water efficiency features

Water efficiency refers to using less water to achieve same level of service or same result. Some water fixtures allow us to consume less water to finish a task effectively, such as water-efficient showerheads, taps and toilets.

Voluntary **Water Efficiency Labeling and Standards (WELS) scheme** is a HKSAR Government water efficiency labeling scheme. Products participating in WELS incorporate a water efficiency labels that inform consumers the level of water consumption and water efficiency to help them choose water efficient products for water conservation. The labeling scheme includes showers for bathing, water taps, washing machines, urinal equipment and flow controllers.

(Official Website:
http://www.wsd.gov.hk/enplumbing_and_engineering/wels/index.html)

Fig. 5.7

c) Sustainable materials

BEAM PLUS Interiors Commercial, **Retail and Institutional Materials Aspects MA6 Sustainable Flooring Products, MA 7 Sustainable Ceiling Products and MA 8 Sustainable Wall and Door Products** encourage the use of rapidly renewable materials, recycled materials and sustainable timber for flooring products, ceiling products and wall and door products respectively. For example, some flooring products like carpet cushion-backing are made of recycled used bottles. Thanks to the technological advancement, these backing systems are comfortable, environmentally friendly, and readily available in the market.

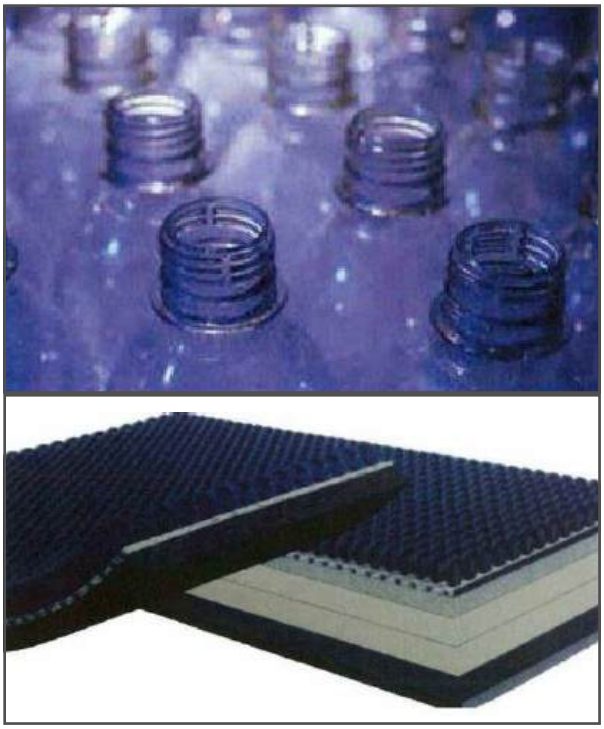


Fig. 5.8-9

In addition, some manufacturers provide upcycling of waste materials, which is a good practice to prolong the lifecycle of wood products. Furniture like doors and partitions can also be upcycled or recycled to reduce environmental pollution. Sustainable materials can be a good option for interior designers.

Fig. 5.10-11 Upcycling wooden components

5.2 Recommended / Voluntary / Valued-added Standards

- **BEAM Plus / LEED**

  BEAM (Building Environmental Assessment Method) is a Hong Kong- based scheme which aims to achieve a sustainable community and a green livable built environment in harmony with nature. The BEAM Plus assessment tools help to build capacity in the community through education and training to advance health and well-being of occupants.

  BEAM Plus provides users with a single performance label that demonstrate the overall quality of a building. BEAM Plus New Buildings include a large variety of parameters that can be assessed.
  (Official Website: https://www.hkgbc.org.hk/eng/NB_Intro.aspx)

Fig. 5.12

- **LEED (Leadership in Energy and Environmental Design)**

  LEED is a US green label for assessing different kinds of buildings. LEED-certified buildings are resource efficient, provide a competitive differentiator, make for happier employees and occupants, attract tenants, save energy and resources, lower operating costs, provide public relations community benefits, increase rental rates and optimize health.
  (Official Website: http://www.usgbc.org leedeng/NB_Intro.aspx)

Fig. 5.13

- **WELL Building Standard**

  The WELL Building Standard is administered by the International WELL Building Institute (IWBI), launched in 2013, a public benefit corporation whose mission is to improve human health and well-being through the built environment. The WELL standard features seven performance-based standards to optimize the building quality to humans. Unlike other standards for creating more environmentally-friendly buildings, WELL focuses on the connection between buildings and the impact on the health and wellness of its occupants.
  (Official Website: https://www.wellcertified.com/) (Official Website: https://www.hkgbc.org.hk/eng/NB_Intro.aspxt)

Fig. 5.14

- **Indoor Air Quality Certification Scheme**

  The Indoor Air Quality (IAQ) Certification Scheme aims to improve indoor air quality and promote public awareness of the importance of IAQ. This voluntary and self-regulatory approach provides two-levels of IAQ objectives (Excellent Class and Good Class) to suit the needs of different premises and buildings. IAQ Certification Scheme sets different monitoring parameters, such as room temperature, relative humidity, air movement, CO2, CO, PM10, NO2, O3, HCHO, TVOC, radon and airborne bacteria.

  (Official Website: http://www.iaq.gov.hk/en/iaq-certification-scheme.aspx)

Fig. 5.15

- **Green building standards for interior design**

  BEAM Plus Interiors – Commercial, Retai and Institutional Manual is an environmental assessment method for interior spaces, and includes offices, shops, and related interior premises. The BEAM Plus Interiors rating system benchmarks sustainability in the fit-out, renovation and refurbishment of non-domestic, occupied interior spaces. The aspects considered include:

1. Green Building Attributes (GBA)
2. Management (MAN)
3. Materials Aspects (MA)
4. Energy Use (EU)
5. Water Use (WU)
6. Indoor Environmental Quality (IEQ)
7. Innovation (IV)

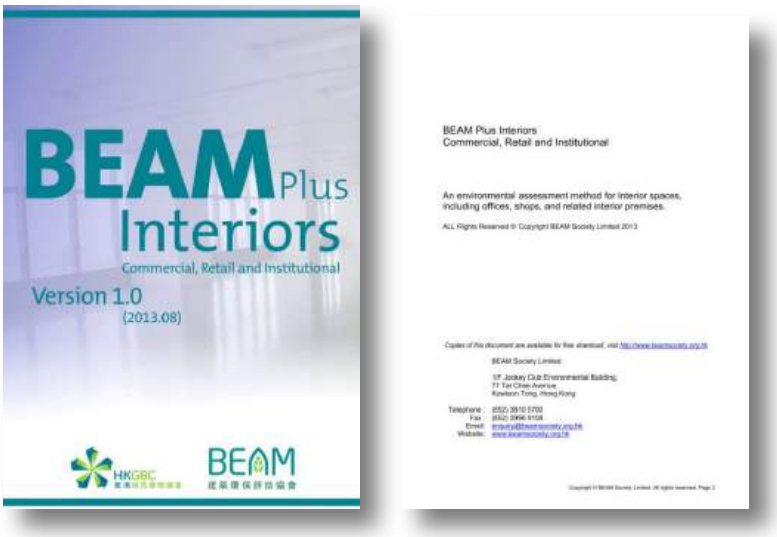


Fig. 5.16

b) **LEED v4 for Interior Design and Construction** is a green building standard developed in the United States. It is an environmental assessment method for interior spaces, including Green Building Attributes (GBA) commercial interiors, retail and hospitality. The aspects considered include:

1. Location and Transportation (LT)
2. Sustainable Sites (SS)
3. Water Efficiency (WE)
4. Energy and Atmosphere (EA)
5. Materials and Resources (MR)
6. Indoor Environmental Quality (EQ)
7. Innovation (IN)

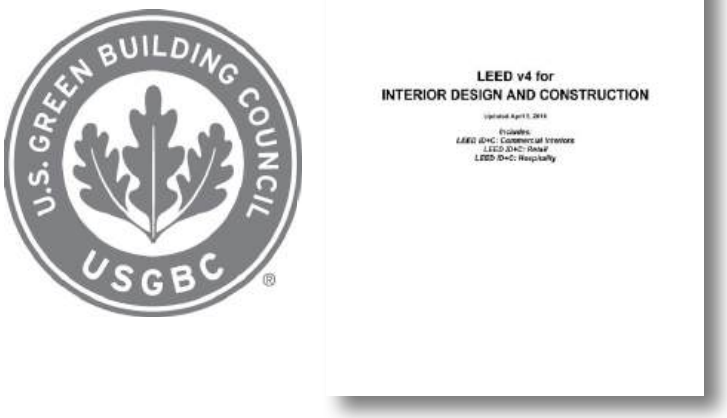


Fig. 5.17

Examples of LEED Green Features

MR Credit: Interiors Life-Cycle Impact Reduction

Interior nonstructural elements should be reused or salvaged for at least 50% of the surface area. Also, furniture and furnishings should be reused, salvaged or refurbished for at least 30% of the total furniture and furnishings cost. These measures aim to encourage adaptive reuse and optimize the environmental performance of products and materials.

Fig. 5.18

MR Credit: Building Product Disclosure and Optimization – Sourcing of Raw Materials

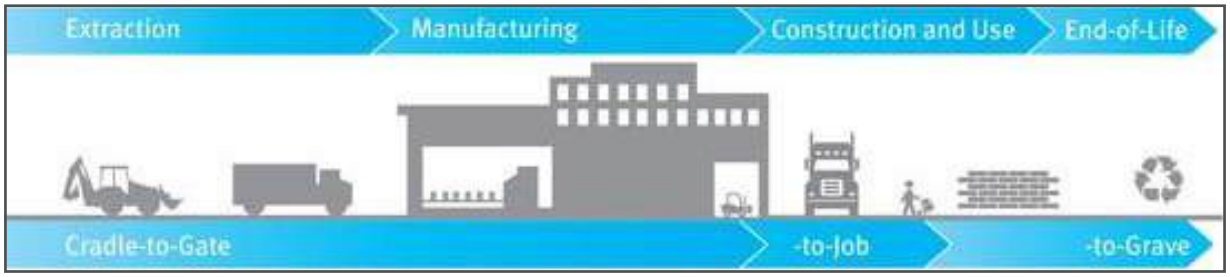


Fig. 5.19

At least 20 different permanently installed products from at least five different manufacturers that have publicly released reports from their raw material suppliers are used. The reports include raw material supplier extraction locations, commitment to long-term ecologically responsible land use, commitment to reducing environmental harms from extraction and/or manufacturing processes, and commitment to meeting applicable standards or programs voluntarily that address responsible sourcing criteria.

Table 1. Thresholds of compliance with emissions and content standards for 6 categories of materials

Category	Threshold	Emissions and content requirements
Interior paints and coatings applied on site	At least 90%, by volume, for emissions; 100% for VOC content	• General Emissions Evaluation for paints and coatings applied to walls, floors, and celings • VOC content requirements for wet applied products
Interior adhesives and sealants applied on site (including flooring adhesive)	At least 90%, by volume, for emissions; 100% for VOC content	• General Emissions Evaluation • VOC content requirements for wet applied products
Flooring	100%	• General Emissions Evaluation
Ceilings, walls, thermal, and acoustic insulation	100%	• General Emissions Evaluation
Furniture	At least 90%, by cost	• Furniture Evaluation

The office of BEAM Society Limited (BSL) is situated at the Jockey Club Environmental Building in Kowloon Tong. It achieved Platinum rating under **BEAM Plus Interiors (BI) v1.0 Accreditation**.

Fig. 5.20

The office renovation project embodies the key concepts of BEAM Plus Assessment tools, which involve providing a comfortable yet simple workplace with various green features, illustrating how a balance of sustainability and efficiency can be achieved at a modest budget.

Some of the features of the office that enabled it to attain the Platinum rating include:

Fig. 5.21

BEAM Society Limited Office - Reno Green"Platinum"Rating Accreditation Examples

MAN | MA | EU | WU | IEQ

MAN 5 Corporate Social Responsibility Facilities

- Encourage space development that is an asset to the society and promotes the organization's Corporate Social Responsibility (CSR)
  - » Provide a safe and healthy working environment for employees and occupants within the space area
  - » A fitness area with air climber and resistance band

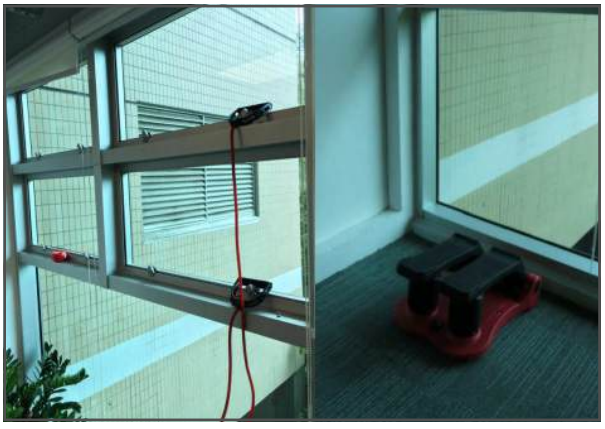
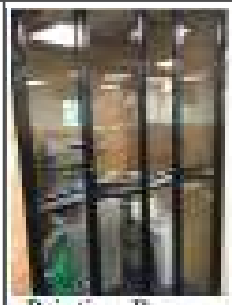


Fig. 5.22-23

MAN 7 Occupational Health and Safety

- Interior layout provisions that embrace health and safety Some of the items under this category include:

Items	Achieved Point	Narrative	Photo Record
Ergonomics			
Item 1 Provided adjustable & movable office chairs.	**1**	The chair was purchase from second hand supplier and the catalogue is not applicable. All chairs are adjustable and moveable. The layout showed the quantity and location of chair.	
Item 2 Armrests on office chair (if provided) shall be adjustable in height.	**1**	Office chairs with adjustable armest can be chosen by the colleagues.	
Item 3 Standing-height-benches can be adjustable in height (if provided).	**1**	Standing-height-benches which can be adjustable in height located at photocopy room.	

Indoor Environmental Quality			
Item 8 Wall/Sound barrier between occupant and noisy equipment or locations (e.g. photocopiers, kitchen etc.).	**1**	By setting up room for photocopying, and doors for server area, the photocopy machine and server are isolated from the workstations.	 Printing Room  Server Area
Item 9 Draught: Air from air diffuser is not directed at seating occupants.	**1**	Air is not directed directly blown at seating occupants, since ceiling fans are provided to reduce the air velocity from cooled air diffuser to seating occupant.	 
Item 10 Glare: No monitors (computer, TV) are facing windows.	**1**	All monitors are not facing the window.	Please refer to Appendix B

MA 1 Waste Recycling Facilities

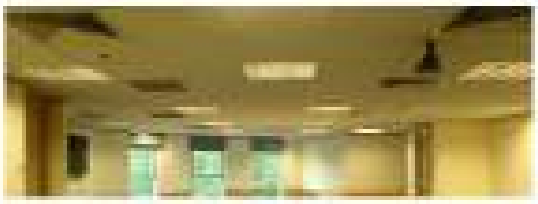
- Reduce pressure on landfill sites and help to preserve non-renewable resources by promoting the recycling of waste materials

  » Recycling of waste paper, plastic, metal, rechargeable batteries, fluorescent lamps, waste electrical and electronic equipment, glass containers.

Fig. 5.24-25

MA 2 Interior Components Reuse

- Extend the life cycle of the existing wall, doors, and glazing in the premises to conserve resources, reduce waste, and lower environmental impact.
    - » These items include the following;

Item	Pre-Construction	Post-Construction
Ceiling	 	 
Internal Doors	 	
Flooring	 	

MA 6 Sustainable Flooring Products

- Promote the use of environmentally friendly materials, manufacturing processing, and minimize impacts arising from material transportation.

  » Reused existing carpet;

  » Newly purchased dark green carpet backing made of recycled bottles, manufactured within 800 sq. km of the site in Jiangxi province.

Fig. 5.26-27

MAN | MA | EU | WU | IEQ

EU 1 Energy Performance – Prescriptive-Based Approach

- Reduce the consumption of energy, resources and consequentially harmful emissions of carbon dioxide (CO_2) to the atmosphere.

  » HVAC&R System
  - Six ceiling mounted fans serving more than 50% of the occupied area;
  - The windows in this office are openable.

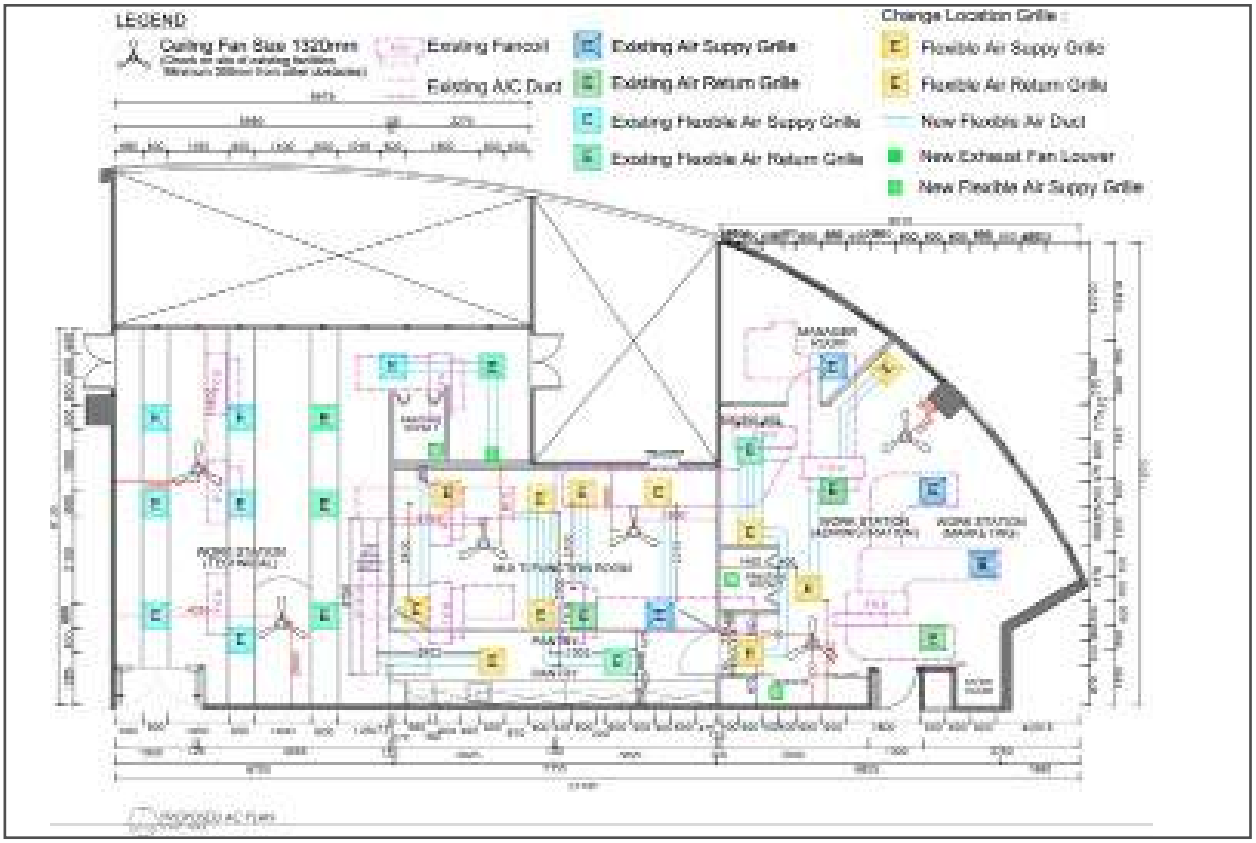


Fig. 5.28

» **Lighting System**

- **LED panels with acceptable Lighting Power Density (LPD);**
- **Appropriate lighting zoning and manual control distribution system;**
- **Occupancy sensor controls and timer controls are widely adopted;**
- **Task lights are provided for every workstation;**
- **Master light switch is installed for easily turning off of all non-essential lights.**

Fig. 5.29

EU 2 Energy Efficient Appliances

- **Procurement of labeled energy efficient equipment and appliances**
  - » **One new LED Monitor with USEPA Energy Star Certificated was purchased;**

Fig. 5.29

Datasheet

HP EliteDisplay E241i 61 cm (24") IPS LED Backlit Monitor Specifications Table

Product Number	F0W81AA; F0W81AT
Display size (diagonal)	61 cm (24")
Viewing Angle	178° horizontal; 178° vertical
Brightness	250 cd/m²
Contrast Ratio	1000:1 static; 5000000:1 dynamic
Response Ratio	8 ms gray to gray
Aspect Ratio	16:10
Native Resolution	1920 x 1200
Resolutions Supported	1920 x 1200; 1920 x 1080; 1600 x 1200; 1600 x 900; 1680 x 1050; 1440 x 900; 1280 x 1024; 1280 x 800; 1280 x 720; 1024 x 768; 800 x 600; 640 x 480
Display Features	Plug and Play; Anti-glare; User programmable; Language selection; On-screen controls
User Controls	Menu; Minus ("-"); Plus ("+"); OK/Auto; Power
Input signal	1 VGA; 1 DVI-D (with HDCP support); 1 DisplayPort 1.2 (with HDCP support)
Ports and Connectors	3 USB 2.0 (one upstream, two downstream)
Input power	Input voltage: 90 - 265 VAC
Power consumption	40 W (maximum), 35 W (typical), < 0.5 W (standby); Screen resolution: 1920 x 1200
Dimensions without Stand (W x D x H)	55.6 x 5.5 x 36.26 cm
Weight	6.58 kg (With stand)
Ergonomic features	Tilt: -5 to +35°; Swivel: ± 180°
Environmental	Arsenic-free display glass; Low halogen; Mercury-free display backlights; TCO Certified
Energy Efficiency Compliance	ENERGY STAR® qualified
Warranty	3-years limited warranty including 3 years of parts and labour. Certain restrictions and exclusions apply.

Fig. 5.31

EU 5 Metering And Monitoring

- **Real time monitoring, measurement, and historical record keeping, to enable managing and improving energy performance.**

  » **A real time monitoring display is located in the pantry of BSL office;**
  » **Displays real time raw information of the energy usage at 15-minute intervals.**

Fig. 5.32

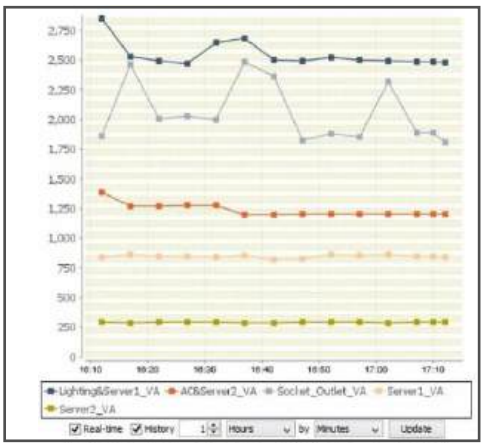


Fig. 5.33

MAN | MA | EU | **WU** | IEQ

WU 2 Annual Water Use

- **Reduce the consumption of fresh (potable) water through the application of water saving devices that have proven performance and reliability**

  » **The water tap (Brand & Model: GTB GA 4072) is certified Grade 1 according to the Water Efficiency Labeling Scheme (WELS), with a flow rate of 2.6l/min.**

Fig. 5.34

MAN | MA | EU | WU | **IEQ**

IEQ 2 Indoor Planting

- **Improve indoor air quality and enhance productivity.**

  » **Two green walls are located at waiting area, with a total area 5.28m².**

Fig. 5.35

IEQ 9 Natural Lighting

- **Encourage a holistic examination of interior layout, building design, and fenestration design, so as to maximize access to daylight for the purposes of improved health and comfort**
  - » **Achieved where 75% of workstations or seating are located in an area of floor plate that has a natural light luminance level of 100 lux.**

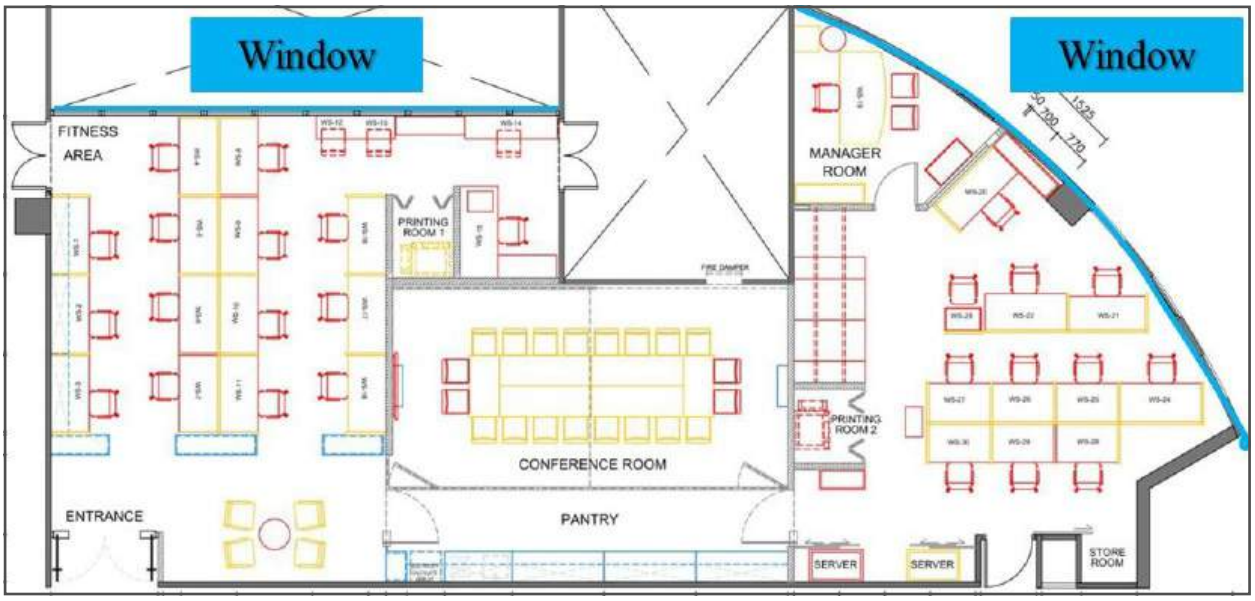


Fig. 5.36

IEQ 10 Views To Outside

- **Provide occupants in normally occupied spaces with a connection to the outdoors.**
  - » **All workstations are within 8m of the nearest vision glazing and have direct line of sight at seated eye level of 1.2m of the vision glazing.**

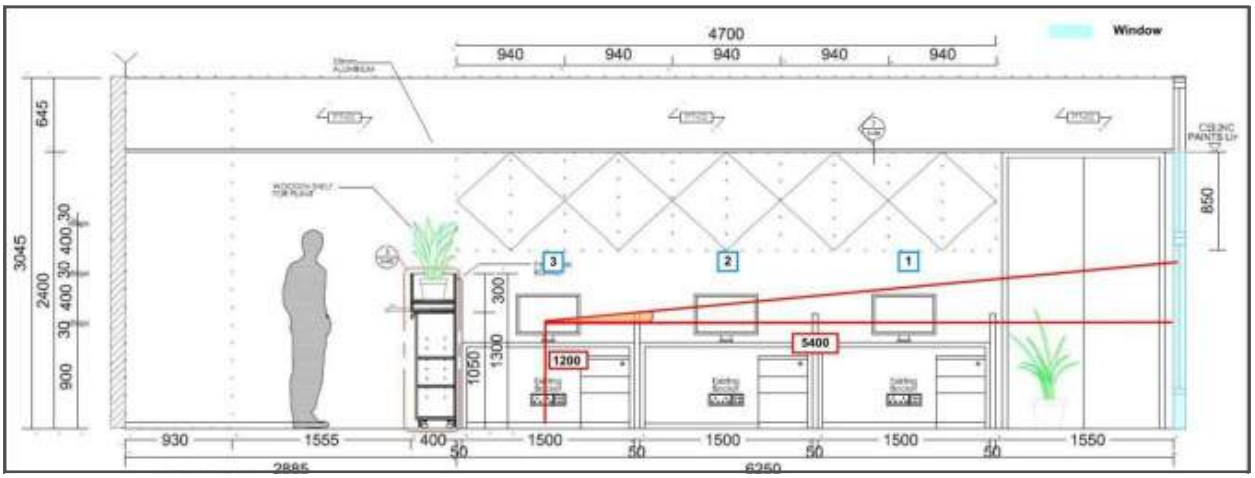


Fig. 5.37 The angle of view is 7.5°

GLOSSARY

Chapter 2 Building Services Systems and Interior Design	
Building Services	屋宇設備
Cable Trucking	電線槽
Air Duct	風管
Mechanical Ventalation & Air-conditioning (MVAC)	通風及空調
Fire Services	消防設備
Plumbing and Drainage	水管和排水設施
Electrical and Extra-low Voltage (ELV) Services	特低電壓設備
Natural Ventilation	自然通風
Mechanical Ventilation	機械通風
Ventilation Fan	通風機
Fan Coil Unit (FCU)	風機盤管機組
Air Handling Unit (AHU)	空氣處理機組
Dampers	閘閥
Air diffusers	空氣擴散器
Constant air volume (CAV) system	定風量系統
Variable air volume (VAV) system	變風量系統
Window type air-conditioner	窗式空調機
Split type air-conditioner	分體式空調機
Chilled Water	冷凍水
Smoke Detector	煙霧探測器
Fire Alarm	消防警鐘
Fire sprinkler	消防灑水器
Fire flash light	消防閃光燈
Fire shutter	防火擋板
False Ceiling	假天花
Lighting Fitting	燈具
Power plugs and sockets	電源插頭及插座
Telecom and Internet	電訊及互聯網

Chapter 3 Human Sensory Perceptions in Built Environment	
Hue	色調
Chroma	色品
Correlated color temperature (CCT)	相對色溫
Lux	光通量/勒克斯
Illuminance	照度
Ambient lighting	環境照明
Accent lighting	重點照明
Task lighting	工作照明
Decorative lighting	裝飾照明
Exterior lighting	室外照明
Landscape lighting	景觀照明
Incandescent bulb	白熾/鎢絲燈泡
Fluorescent bulb	螢光燈
Halogen lamp	鹵素燈
Daylight factor (DF)	日照係數
Spatial arrangement	空間佈置
Room Acoustic	室內聲學
Noise Isolation Class (NIC)	隔音等級
Sound Transmission Class (STC)	聲音穿透等級
Reverberation Time (RT)	迴響時間
Noise Criterion (NC)	噪聲標準
Indoor air quality (IAQ)	室內空氣質素
Asbestos	石棉
Flame retardants (PBDEs)	阻燃劑
Formaldehyde (Methanal)	甲醛
Volatile organic compounds (VOCs)	揮發性有機化合物
Radon	氡
Predicted Mean Vote (PMV)	舒適感指標
Metabolic rate (met)	代謝率
Clothing insulation (clo)	衣物隔熱
Radiant temperature	輻射溫度
Air velocity	風速
Relative humidity	相對濕度
Windcatcher	風斗
U-values	總熱傳送值
Solar Heat Gain Coefficient (SHGC)	太陽得熱係數

Chapter 5 Sustainability in Interior Design	
Daylighting controls	日光控制
Photosensors	光電傳感器
Energy Label	能源標籤
China Energy Label	中國能效標識
ENERGY STAR	能源之星
Voluntary Water Efficiency Labelling and Standards (WELS) scheme	自願參與用水效益標籤計劃
Sustainable materials	永續材料
Upcycling	升級再造
BEAM Plus	綠建環評
USGBC	美國綠色建築協會
LEED	領先環境能源設計
Indoor Air Quality Certification Scheme	室內空氣質素檢定計劃
Life Cycle	生命週期
Low-Emitting Materials	低排放材料

Notes

Chapter 1

i. This article is an adaptation of an essay published in the Journal of Interior Architecture, published by the Association of Estonian Interior Architects, 2016.

ii. The term 'New World of Work' stems from an executive email from Bill Gates published May 19, 2005 (http://www.microsoft.com/mscorp/execmail/2005/05- 19newworldofwork.mspx). Erik Veldhoen published the strategy earlier in his book 'The Art of Working', 2004, Academic Service. New ways of working may find their roots in Frank Duffy's 'The Changing Workplace' 1992, Phaidon Press.

iii. According to Wikipedia the term 'Healing Environment' goes back to Florence Nightingale's 'Notes on Hospitals', published in 1859, now available on Google Books (public domain). Today the term refers to a concept of spatially designing and organizing healthcare in a holistic way that puts the patients wellbeing central. It is closely related with Evidence Based Design.

iv. 'Evidence Based Design' is a field of study emphasizing credible evidence to influence design, mostly in the health care sector. Note to this note: www.informedesign.org is a good starting point for Evidence Based Design resources.

v. Interview with Francesco Messori by Marit Overbeek in 'de Architect', September 2011.

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1.4 Flexible work space
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