"BLUE BUILDING" - A PACKAGE FOR INNOVATIVE OFFICES

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1. THE PROJECT'S CHARACTERISTICS

1.1 Preface

Office building design is constantly challenged by issues concerning the fast development of the supporting technologies related to the office work and its organization.

Work organization models such as "hot desking", "hotelling", "mobile working", "team office", and "docking station", demands to companies new management capabilities and innovative and flexible ways of working. Office building design has to allow these new working models by ***creating a high quality environment which is among the essential factors fostering a higher productivity.***

At the same time, investors and owners in their investments have to confront with:

- increasing of the project total cost;
- new organizational concepts and financial indexes such as square meter for employee, management cost for employee, reduction of rental spaces, profit for each square meter occupied, and especially ***total cost for each employee*** and ***cost per workstation***.
- "***key performance indicators***" such as rental net area, gross internal/external area.

The "**Blue Building**" addresses the above mentioned issues providing a comprehensive design which ***enables investors and owners to plan their "initial investment" and manage it efficiently throughout the building's life.***

The "**Blue Building**" provides investors and owners with precious information not only about the ways their building ***could be renewed or adapted to meet new needs and different working organizations,*** -but also about the operating and maintenance costs thanks to a planned maintenance program for the building's life.

At last, the project shows great attention towards ***lowering operating costs***, through a wide use of the latest tested innovations ***providing energy savings***, and towards ecological issues through a new ***low environmental impact***.

1.2 Guidelines

Guidelines for the “BLUE BUILDING" package are as follows:

- A standard building design which gives maximum choice and efficiency of layouts and functions taking into account the need for ***flexibility and adaptability to meet the present and future needs*** of changing workplace organization.
- A building which enables information technology to be installed, used and upgraded easily.
- A building which can provide a ***high standard of comfort*** and amenity to the occupants.
- A building which employs ***innovative and tested technical solutions***.
- A building which ***minimizes energy use*** and the impact on the environment.
- A building which, by way of standardizing some components and systems, can be produced at ***competitive costs*** without compromising the guidelines above.
- A building which ***enables architects to design with freedom*** both interiors and exteriors to allow individual expression and site specific projects.
- A building which, thanks to the "shell & core" building typology, allows users to complete or change the interiors as they like and as they need reducing costs and increasing flexibility and profitability
- A building ***offered as a “package”*** consisting of:

  - ***optimal construction in terms of time, cost and quality***;

  - annual management contract at fixed low cost.

1.3 Target

The target of the “Blue Building” package is to produce a type of building which ***gives flexibility of external and internal form to the architect*** but maintains an efficient, cost effective and state of the art design.

The “Blue Building” package reduces the operating costs by:

- making it ***easier to change layouts***, partitions and wiring.
- ***Reducing energy consumption*** of lighting, heating and air conditioning by system design and external cladding design interacting with HVAC.
- ***Simplifying maintenance*** of technical systems and the building fabric.
- Reducing the electricity used in lighting by having ***effective daylighting*** and automatic light control.
- Providing quality components that have a ***long and good designed life***.

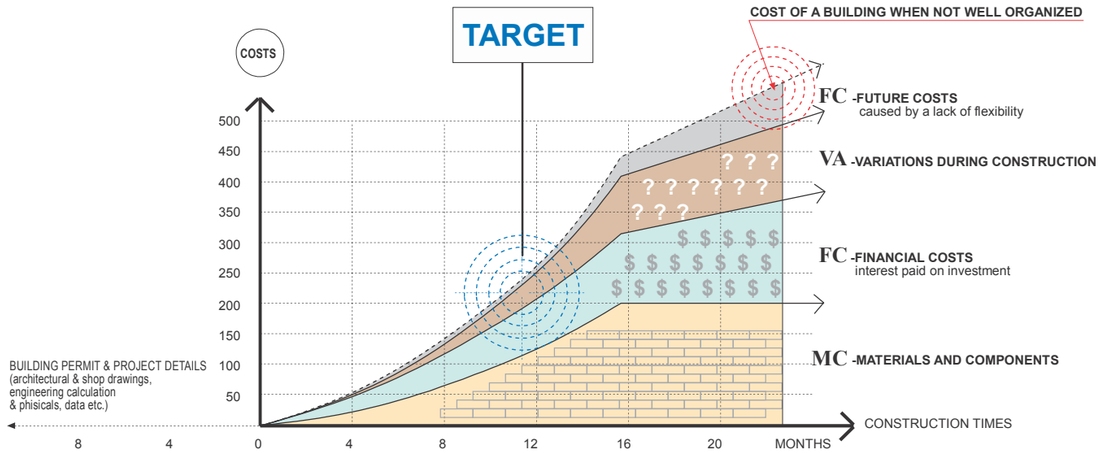


FIG. 1.

The graph identifies the project’s target. The origin is the beginning of the construction phase. At this step the costs due to a lack of information are reduced to zero thanks to the preliminary phase. The costs then increase with the time needed for the building erection. The longer the time the higher are the costs. The different kinds of costs have also different trend. So, for example, once the building is finished (in the graph at this point the curvatures change) the costs for materials and components stop increasing, while the financial costs keep to go up, especially if the building space is not occupied yet. Costs for design variations, lack of flexibility in use, and costs of unusable space due to poor layout planning, generally increase abruptly in a completed project.

The “Blue Building" stresses the importance of a good preliminary design and of a detailed global planning (architectural, structural, financial, maintenance, operating). In this way it is possible to reduce the construction phase time and the related costs and to avoid the increment of costs after building completion.

1.4 Construction Organization

The three following companies

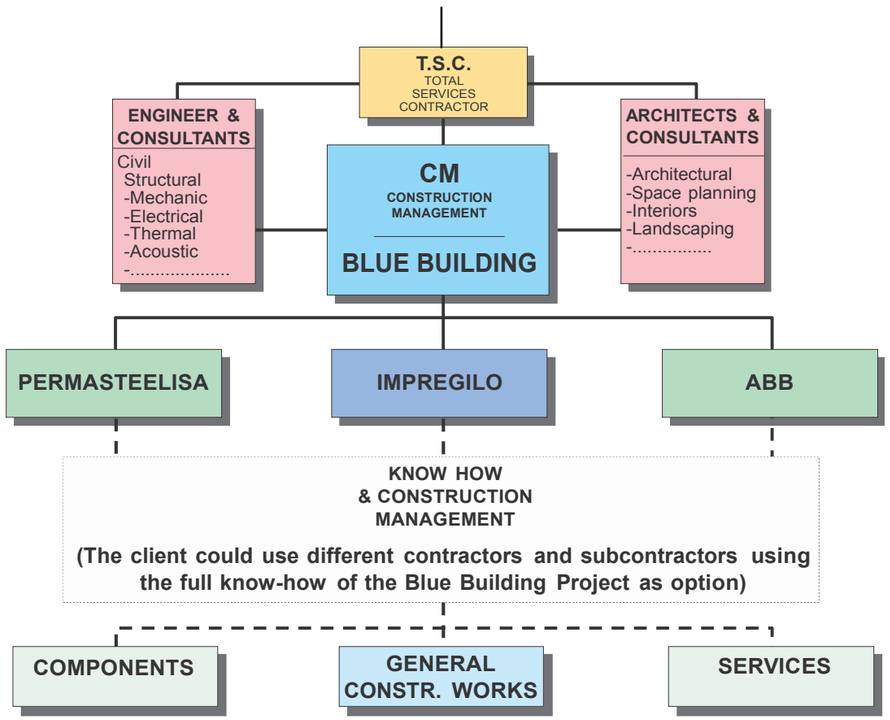
IMPREGILO Construction Management and Main Construction Work

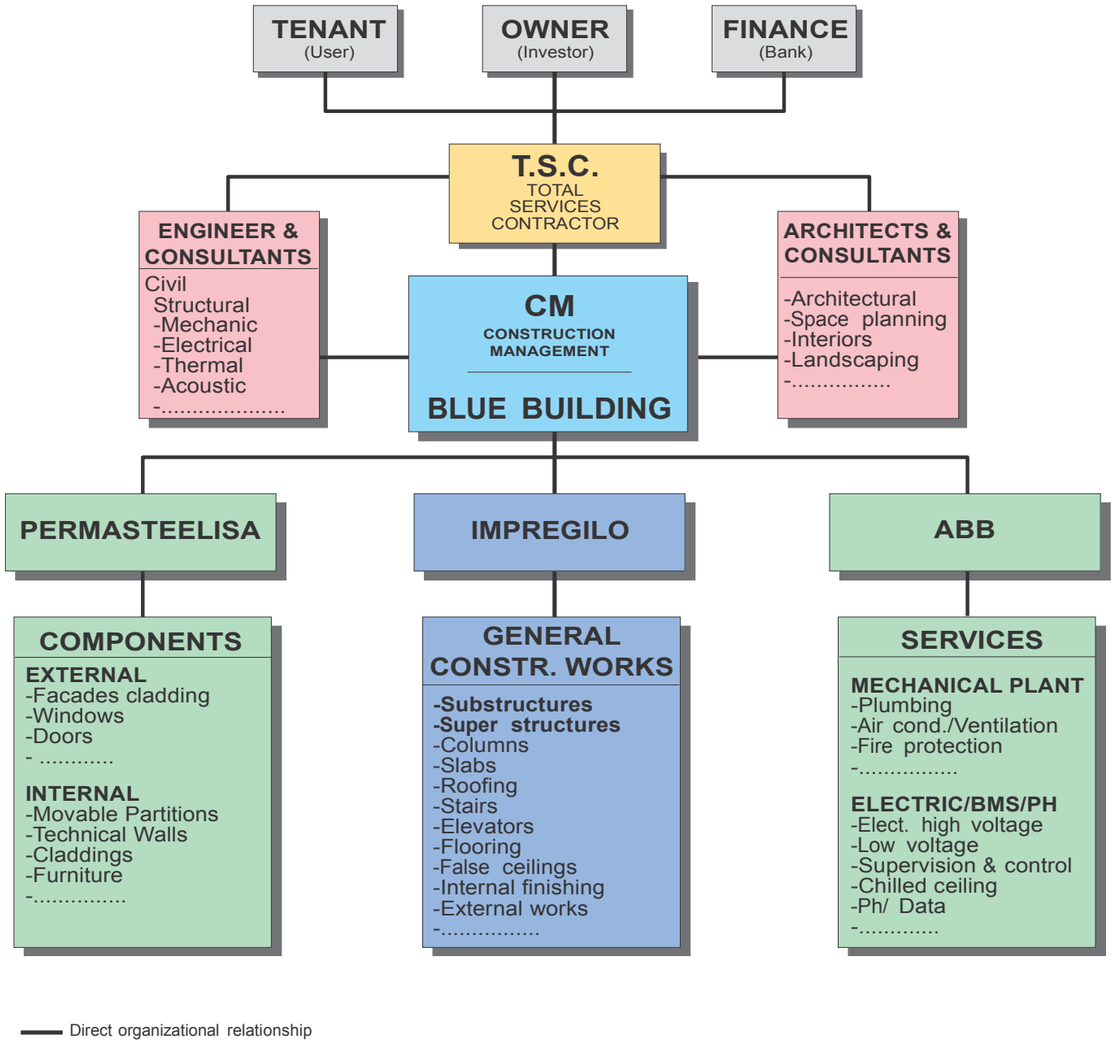
ABB INSTALLAZIONI European leader of Services (mechanical & electrical systems)

PERMASTEELISA European leader of architectural envelope, cladding and internal partitions

have joined their know-how and productive organization to promote and make the project effective. The organization structure is substantially the one specified in the diagram.

The Construction Management Team is the expression of the entrepreneurs' capacities of Impregilo, ABB and Permasteelisa and provides the correct application of the criteria informing the "Blue Building" package.





The Impregilo has the responsibility for the leadership of the Construction Management Team.

The three companies are also offering their knowledge, experience, methodology, and management without necessarily imposing on the client a full construction package.

The three companies guarantee their commitment on a full proved and tested package.

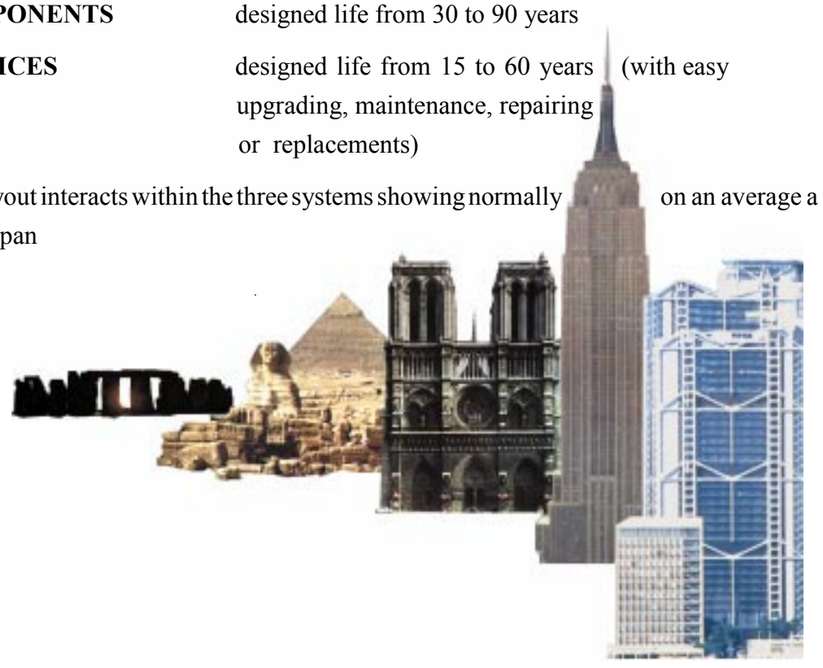
2. A BUILDING DESIGNED FOR A LIFE-SPAN (with low maintenance and renovation costs)

2.1 Building systems and their life spans: "The Quaternario system"*

A modern office building can be subdivided into three systems with different and independent life cycles:

- **STRUCTURE** designed life from 50 years to hundred years
- **COMPONENTS** designed life from 30 to 90 years
- **SERVICES** designed life from 15 to 60 years (with easy upgrading, maintenance, repairing or replacements)

The space layout interacts within the three systems showing normally on an average a shorter life-span

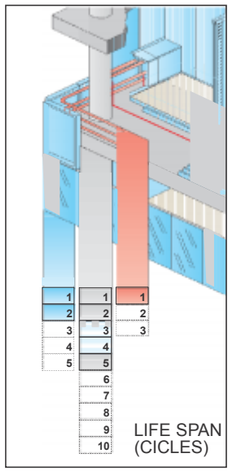


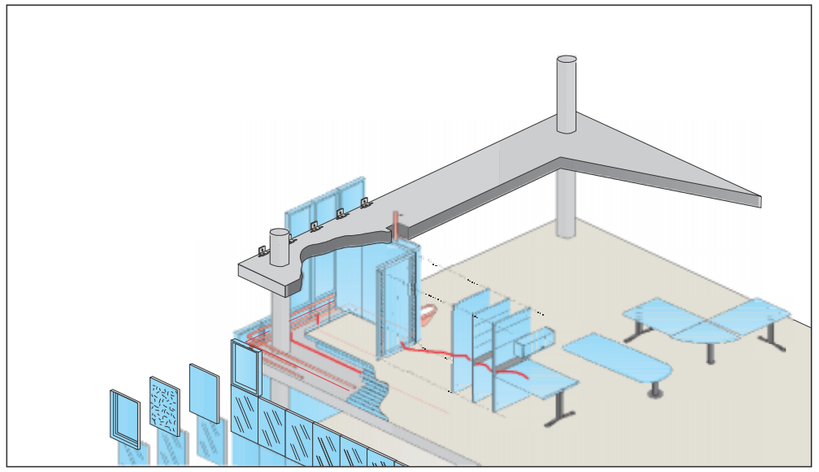
2.2 Easy Maintenance and Renovations

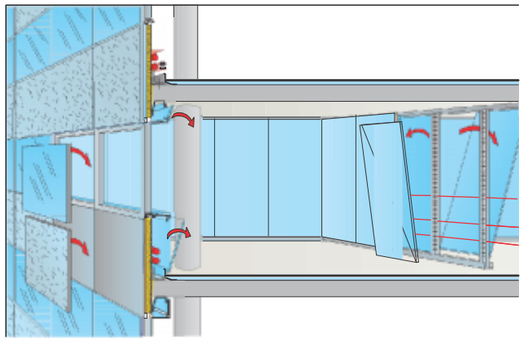
Structures, **components**, and **services** have ***different life span*** **and** ***different maintenance needs.*** Considering the past experience, it is possible to say that a good and **innovative construction** has to be adaptable and has to ***allow easy inspection to all the services***. It has to allow also an ***easy replacement or upgrading*** of each component accordingly to its own life ***without removing or damaging the other ones*** which are still efficient.

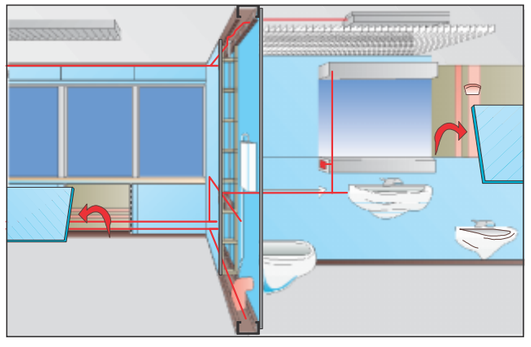
This methodology has informed the "Quaternario System"* which is nowadays successfully used in many office designs. The Quaternario* system's experience and philosophy are the basis of the innovative "Blue Building" package to give the client the freedom to ***update and upgrade the office building easily and economically***.. An optional solution for the interiors foresees partitions and fittings with a life span ranging between 5 and 25 years enabling investor to small spenditure at any change of tenancy.

(*) ***Quaternario*** *is a name indicating* ***the third millennium's process of working*** *where the offices must be more flexible and updatable.*



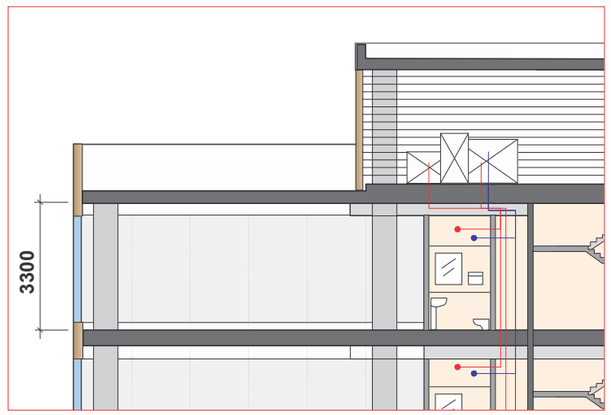






2.3 Shell & Core, and Interiors (a wide range of options)

"The Blue Building" package let the client to take decisions at a later moment about the use of the building. Thanks to the "Quaternario system" principles an order of a project or construction could be developed in several phases as follows.



PHASE ONE: (Shell & Core) The phase includes the construction of all structures (with washrooms and main mechanical and electrical systems on central core) without, at each operative floor, the following components:

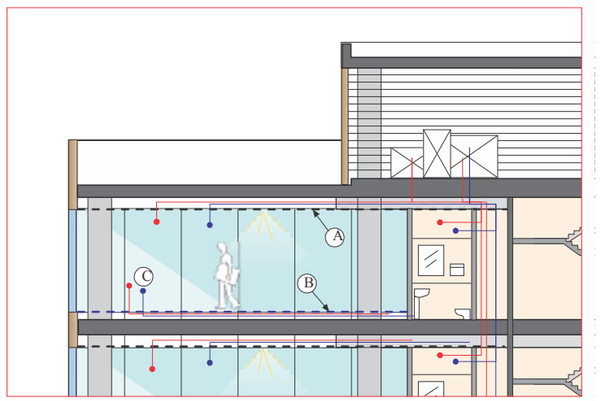
A- mechanical and electrical systems

B- raised floor

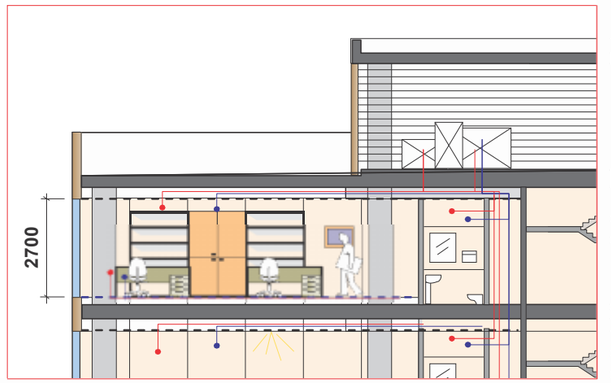
C- chilled ceiling or false ceiling

D- partitions and interiors fittings

At Phase one the building is externally completed including all the central core services. It could be used partially according to the client's need. (The net floor to slab height is 3300 mm approx.)



PHASE TWO: Installation of raised floor, chilled ceiling and mechanical and electrical services (**A**, **B**, and **C**). These components could be installed in all floors, or just in some floors, or in just some areas.



PHASE THREE: Installation of interior finishes (**D**)

FUTURE OPTIONS. ***Owner and client***, choosing for a building with this system and technology, ***could finish each area or floor according to their needs***. They could also use several areas of floor or several floors as offices, others as small assembly lines, others as storage, canteen or any other use, with less cost for interior finishes and a wide usable net height (3300mm).

The ***"Blue Building"*** provides a really multi-functional building shell suitable to a multi-purpose use therefore giving a ***long and better asset value.***

3. COMFORT

The "Blue Building" wants to ***create an ideal working environment.*** It defines ideal conditions for comfort based on:

- Air Temperature
- Radiant Temperature
- Humidity
- Air Movement
- Air Quality
- Noise
- Lighting

The project defines acceptable bands as follows, but it is necessary to bear in mind that no single set of criteria will be ideal for everybody but it must be established with client's consultants.

3.1 Air Temperature

Winter 20ºC

Summer 24ºC

Under high external conditions the temperature will be allowed to increase to 26 or 27ºC. This considerably reduces energy consumption.

3.2 Radiant Temperature

In winter the combined surface temperature will be maintained around 4ºC of air temperature. The climate facade will reduce the effect of the window. In summer the combination of chilled ceiling and climate facade with adjustable blinds will reduce the mean radiant temperature increasing comfort.

3.3 Humidity

A fairly wide range of humidity generally acceptable is 35-65% RH. Humidifiers will provide corrections if humidity rate drops below the minimum for any length of time. Maximum humidity will be controlled by the air system.

3.4 Air Movement

Movement in excess of 0.2 m/s at occupancy positions will be uncomfortable. The ***"Blue Building"*** adopts a combination of systems using air and chilled ceilings which have ***less air and allow draughts control***.

3.5 Air Quality

It is important to maintain sufficient ***fresh air*** in the space. A minimum of 50 m^3 /h per person is used. Air change rates will not drop below 2.5 Ach^{-1} to ensure that pollutants and stale air are adequately removed. Displacement systems remove pollutants by a piston action in the space. Mixed systems by dilution.

3.6 Noise

Noise from mechanical system is kept between NC 35-40 dB to avoid being intrusive.

The noise attenuation between rooms, determined by false ceilings, internal partitions and raised floors, averages 40 dB.

Noise attenuation between inside and outside can be up to 40 dB. Particular attention will be given to high traffic zones.

3.7 Lighting

Lighting system is designed with the following criteria:

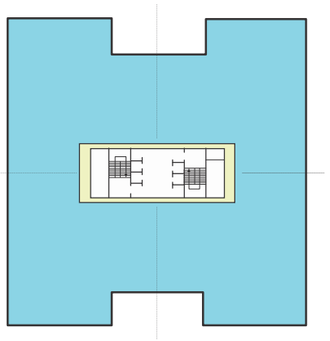
- adaptable interaction between different light sources of the general illumination system,
- additional individual lighting devices where needed
- energy saving
- control system

Natural light's role is emphasize by the interactive curtain wall which enables a wide range of selections up to 80% of natural light transmission.

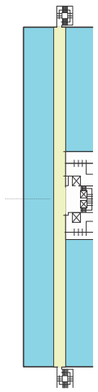
4. ARCHITECTURAL PLANS AND ARCHITECTURAL FORMS (Freedom in architectural choices)

4.1 Building's Shape Examples

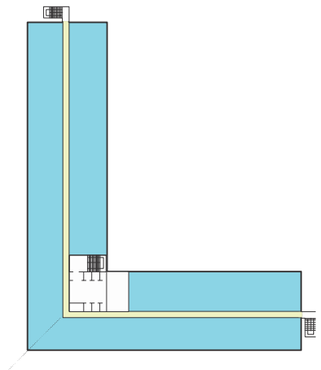
The choice of building shape and plan must take into consideration the architectural, structural, and layout planning as is further shown in section 5.



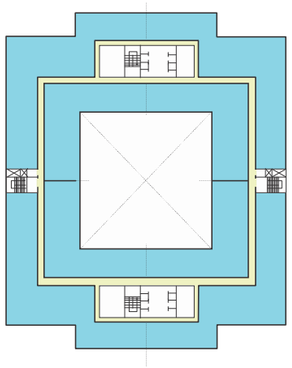
Tower typology
One central core
Max 4 tenancy for floor



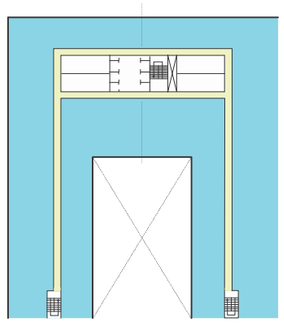
Rectangular typology
One central core
Max 2 tenancy for floor



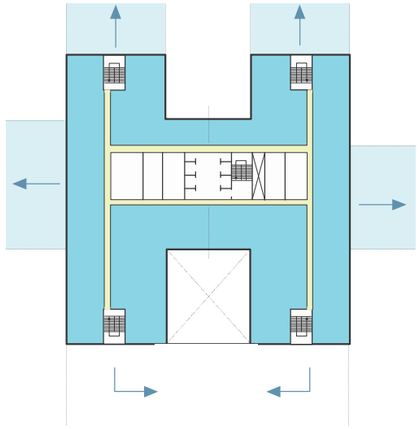
"L" typology
One central core
Max 2 tenancy for floor



Atrium typology
One central atrium
Max 4 tenancy for floor
(with or without enclosure on central atrium)



"C" typology
One central core
Max 2 tenancy for floor

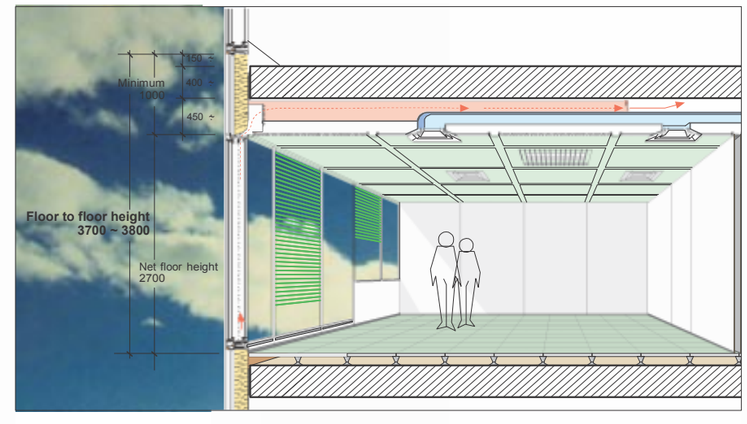


"H" typology
One central core
Max 2 tenancy for floor

4.2 Architectural Envelope and Interiors

The external architectural envelope and the interiors six surfaces could be designed by the architects in many different solutions using a large series of different options of forms, materials, colors, and surfaces' textures.

Particular attention must be put on flexibility and free layout using grid modules as explained in section 5.



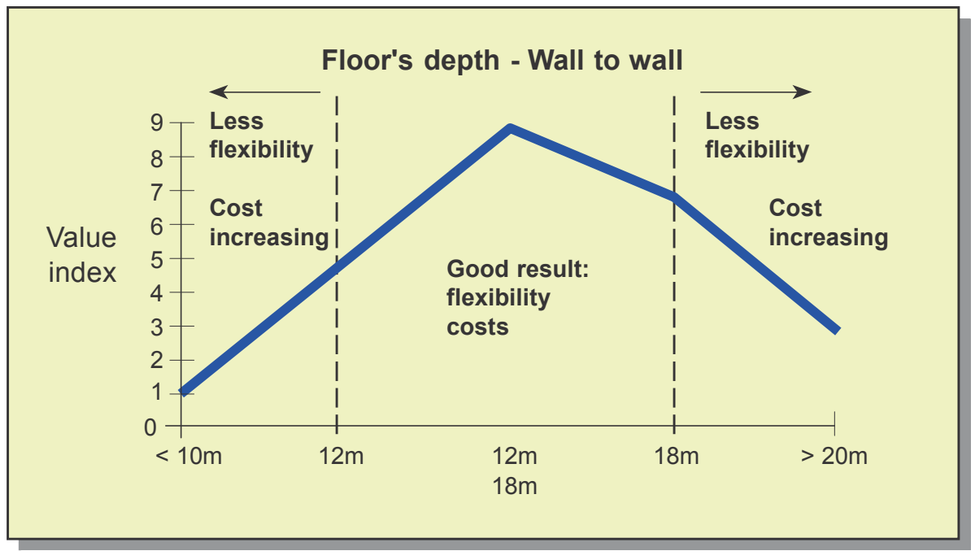
5. ARCHITECTURAL GRIDS AND PLANS

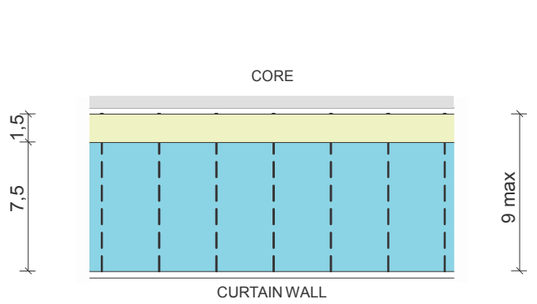
5.1 Depth of Building: daylight comfort

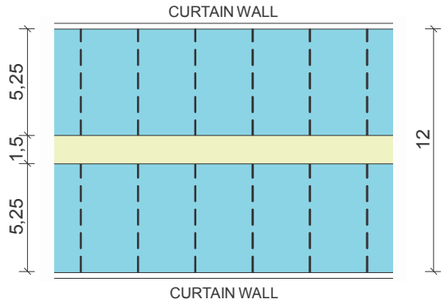
The “Blue Building Project” considers the building’s depth as relevant factor for ***human comfort***. As many work positions as possible should be in daylight.

The maximum distance of a work space from the facade is estimated optimal when not more than 3 times the floor to ceiling height of the space. For example, with a 2.7 m floor-to-ceiling height the work space depth can be no more than 8.1 m, and, considering a plan type with a central non occupied corridor (or core), ***the maximum distance between two opposite facades is of 18 m.***

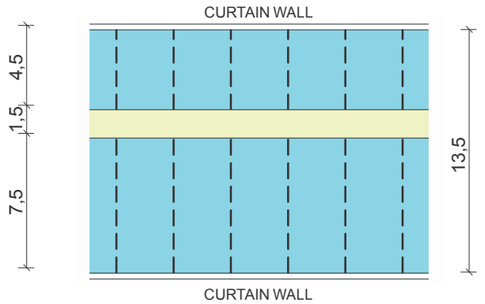
The maximum depth between a transparent facade and the building's service core is 9 m.



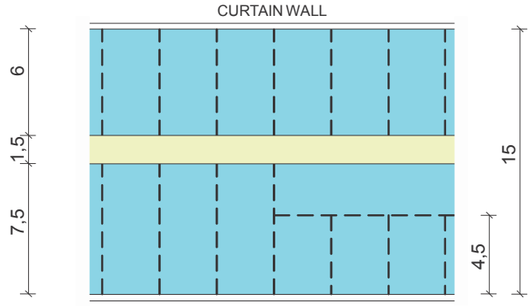




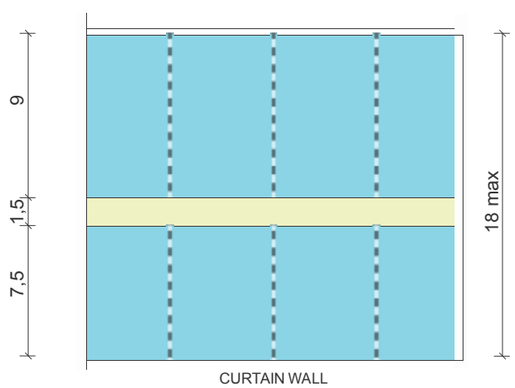
TYPE "A"
(Depth = 12 m)



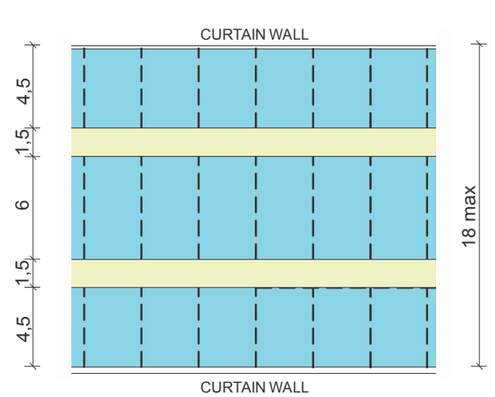
TYPE "A"
(Depth = 13,5 m)



TYPE "B"



TYPE "C"
(Depth = 18 m)

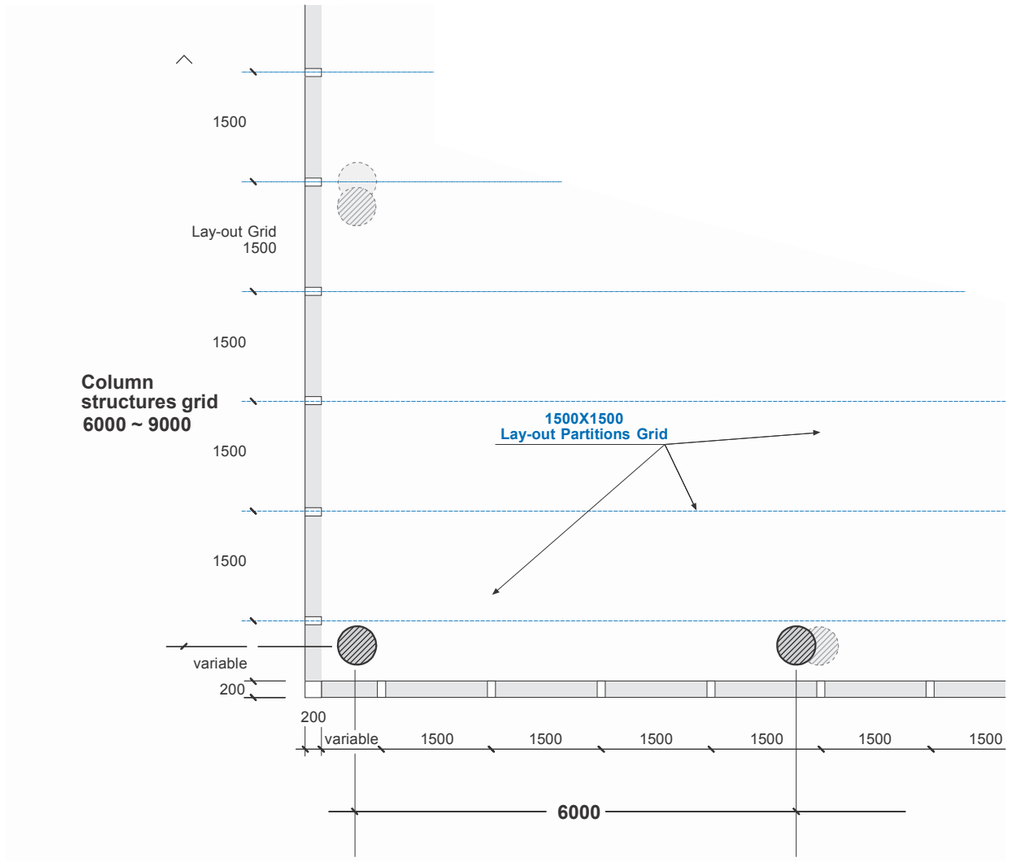


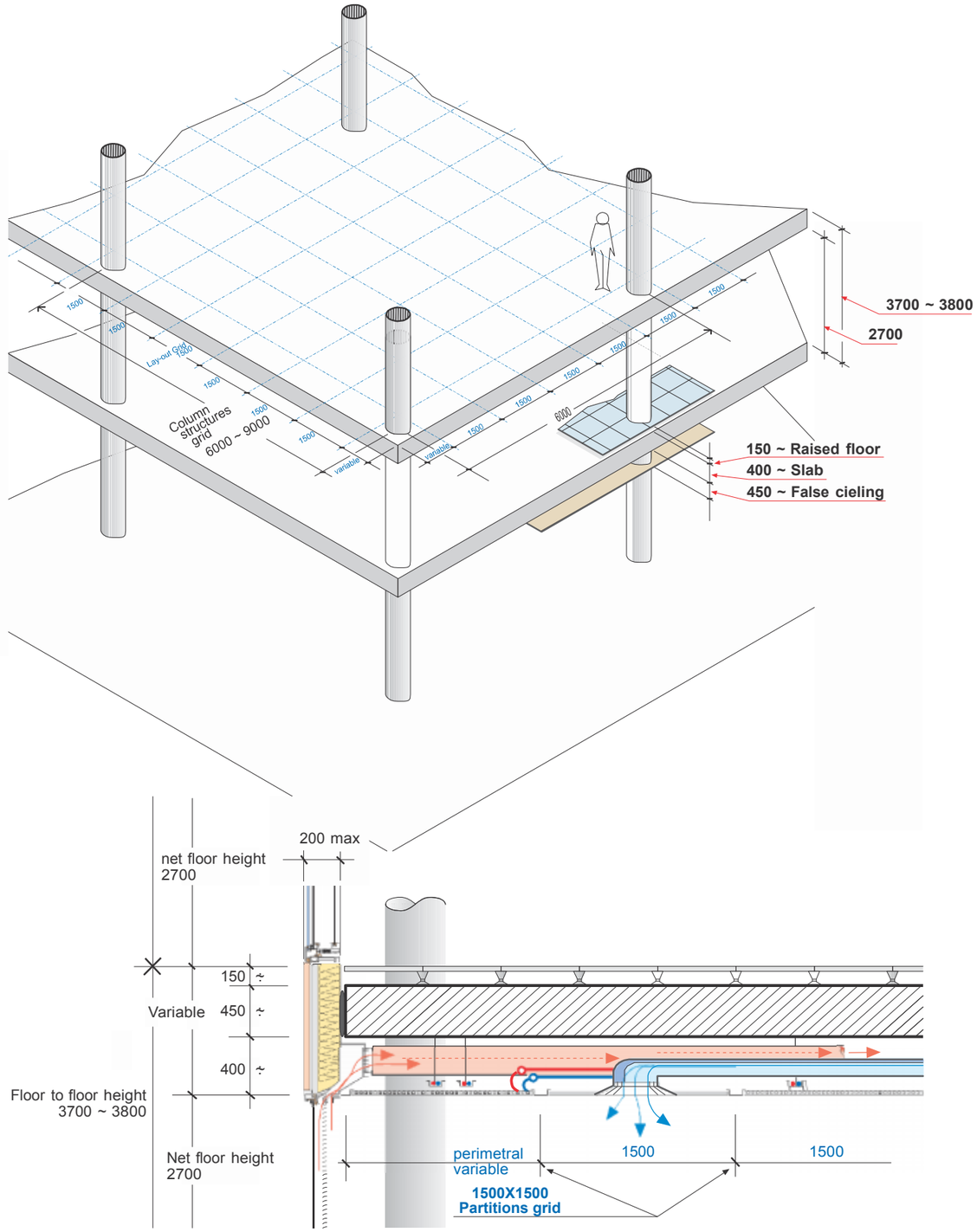
TYPE "C"
(Depth = 18 m)

5.2 Grid Module

The “Blue Building” uses a 1.5 m planning module. In this way two times the module is a 3m wide office which is good for one or two working persons, and three times the module is a 4.5m wide office which is good for director or meeting or multi purpose offices.

Other grids (eg. 1,35 1,80) are available on specific request.





5.3 Layout Planning

New methods of working such as “hot desking” and “hoteling” will require different layout arrangements.

The “***Blue Building" provides open plan arrangements*** for desks with a selection of closed rooms to be used for personnel conferences, telephone and video conferences. There would be also spaces for informal office communication (breakout spaces) with different characteristics from office spaces.

The “Blue Building” aims towards the maximum possible definition of spaces and flexibility to leave open possible future changes in layout and work organization. The “Blue Building” could have full height partitioned room or a full open space or any mixed solution.

The interchangeability of the distributive solutions proposed is obtained by means of:

- modular system of ***partitions completely relocatable***
- false ceiling system arranged to receive partitions according to the modular structures
- modular schemes of services
- ***raised floor and false ceiling***

The following layouts are proposed as example of possible combination of standard types of offices using:

- close type office, from 30 sqm to 36 sqm for President office, Managing Director office and Top manager office
- close or open type office from 13,5 sqm to 18 sqm for senior manager offices
- close or open type office from 6 sqm to 9 sqm for junior manager offices, operating people’s offices and secretary offices.

The offices’ layout can be re-configured according to new working methods.

The proposed distributive solutions have been tested and verified to ensure the highest percentage of use while respecting a ***good quality of the work seat***.

The considered solutions have ***12/15 sqm of surface/work seat*** corresponding to ***17/20 sqm of rental net surface***.

Main stairs, elevators, toilettes and wiring spaces of each floor are grouped in a main core (or more depending on the plan surface dimensions).

Fire stairs are normally located outside the building, together with hoists, to leave the surface of each level completely free.

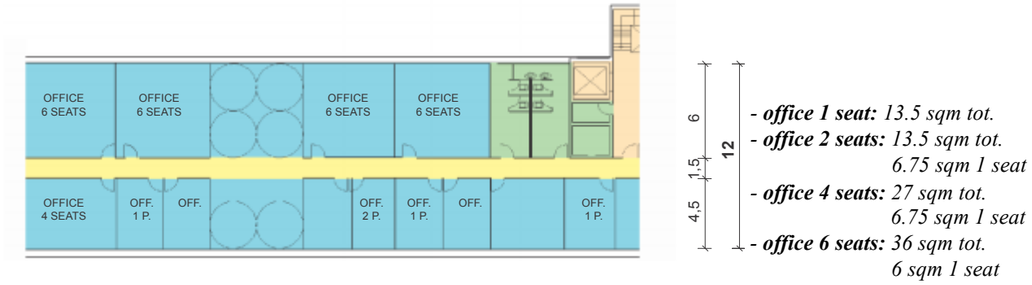
Demountable partitions are proposed for open space offices and cellular offices. Such use meets with the needs of keeping the current file storage.

Historic archives and material storage are located at the ground level. Such rooms, which are

2.7 m height and have concrete or gypsum walls, cost less than the spaces at higher levels.

The construction phase of the “Blue Building” is sized for low and medium height buildings, i.e., 8-10 story. The main project’s criteria can be extended to higher buildings previous specific study.

*- **office 1 seat**: 13.5 sqm tot. (4.5m x 3m)*
*- ◯ **1 person work** (in open space)*



*- **office 1 seat:** 13.5 sqm tot.*
*- **office 2 seats:** 13.5 sqm tot.*
6.75 sqm 1 seat
*- **office 4 seats:** 27 sqm tot.*
6.75 sqm 1 seat
*- **office 6 seats:** 36 sqm tot.*
6 sqm 1 seat

*- **office 1 seat:** 13.5 sqm tot.*
*- **office 2 seats:** 13.5 sqm tot.*
6.75 sqm 1 seat

*- **office 1 seat**: 13.5 sqm tot. (4.5m x 3m)*
*- ◯ **1 person work** (in open space)*

*- **office 1 seat:** 9.00 sqm tot.*
*- **office 6 seats:** 48 sqm tot.*
8 sqm 1 seat
*- **office 8 seats:** 60 sqm tot.*
7.5 sqm 1 seat

5.4 Efficiency indicators

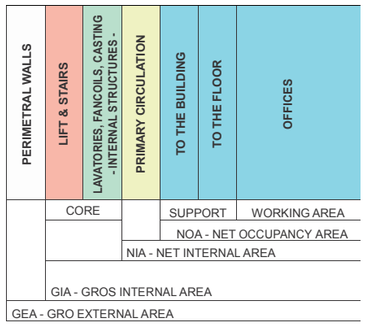
Some specific “indicators” are used to measure the efficiency of an office building:

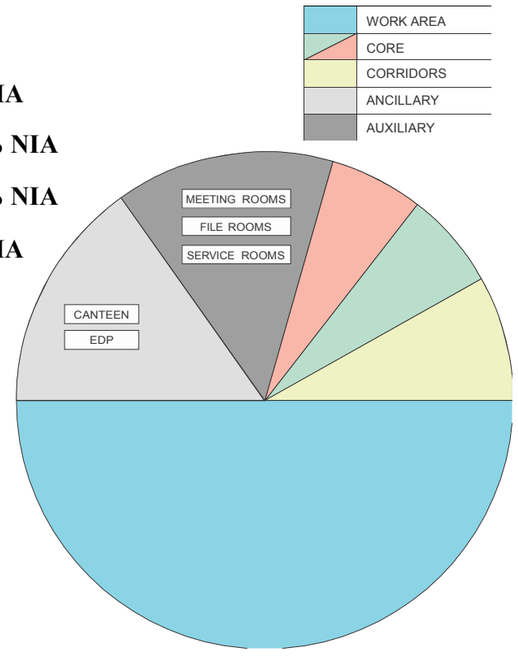
- **Gross Internal Area (GIA)** total area within the outside main walls
- **Core** area including stairs, elevators, common lobbies, shafts and wiring spaces, lavatories, internal structure
- **Net Internal Area (NIA)** internal gross area less the core
- **Primary Circulation** escape corridor linking the escape doors and stairs
- **Net Occupancy Area (NOA)** internal net area less the primary circulation (runaway)
- **Supporting area to the building** area destined to canteen, EDP, bookstores, telecommunications, exhibits, etc.
- **Supporting area on floor level** area destined to meetings, photocopy machine and machinery in general, local archives, etc.
- **Form Factor of the Building (FFB)** Factor considering the lost spaces created by irregular form of the building

The more used indicator by the end user is the quantity in percentage of the Internal Net Area really usable (NOA/NIA*100)

The building efficiency is defined as:

excellent	if	**NOA>85% NIA**
good	if	**NOA=80-84% NIA**
fairly good	if	**NOA=75-79% NIA**
poor	if	**NOA<75% NIA**



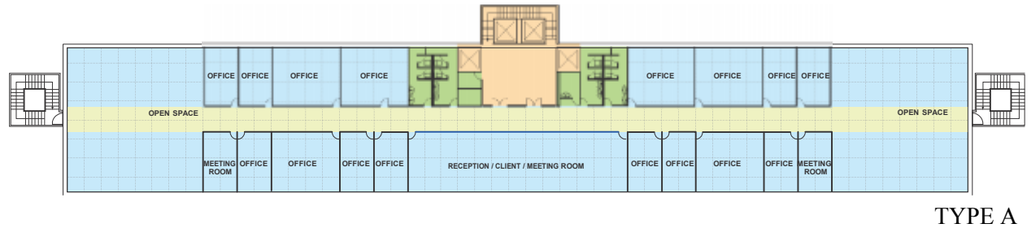


The TARGET of the “BLUE BUILDING " package is to provide an EXCELLENT EFFICIENCY

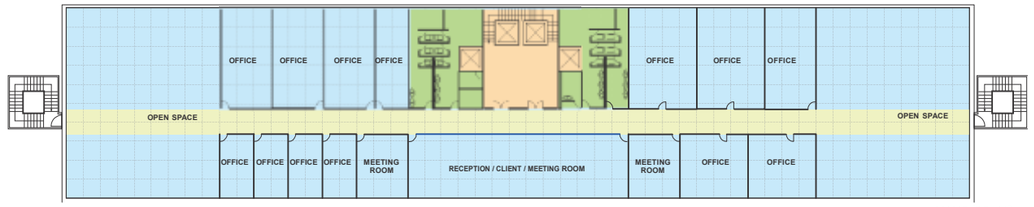
Example:

At this purpose three types of simple buildings have been considered and the following table shows the efficiency indicators.

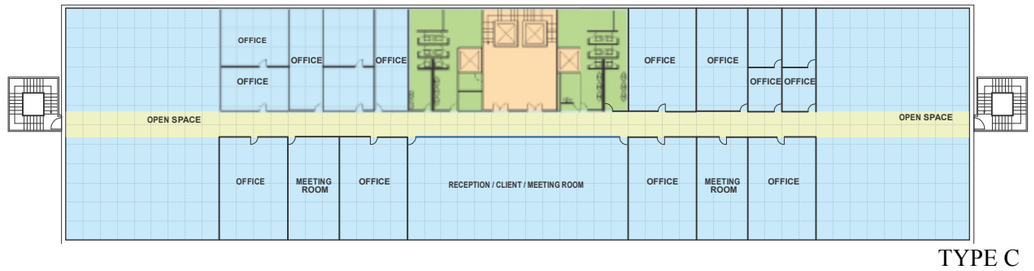
	FLOOR	GIA	CORE	NIA	PRIMARY CIRCUL.	NOA	NOA/NIA EFFICIENCY
TYPA A	TIPICAL	975,12	136,7	838,42	120,00	718,42	86%
TYPE B	TIPICAL	1192,00	171,1	1014,9	120,00	894,9	88%
TYPE C	TIPICAL	1431,00	182,1	1248,9	120,00	1128,9	90%



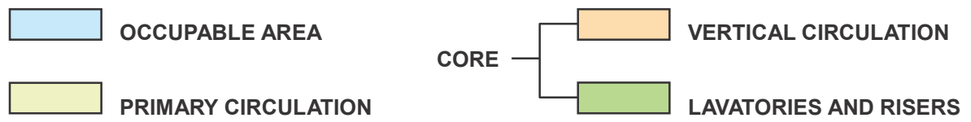
TYPE A



TYPE B



TYPE C



6. ELEVATORS

a) Passenger

A maximum waiting interval with cars assumed to be loaded at 80% (60% for scenic lifts) of capacity. The minimum handling in a 5 minute interval is around 15%.

b) Goods

Dedicated goods lift for buildings is over 10,000 sqm.

7. LAVATORIES / WASHROOMS

a) Single sex

1 person per 14 sqm net based on 120% of population with 60:60 male:female ratio.

b) Unisex

1 person per 14 sqm net based on 100% of population.

c) Additional

Spare risers are considered where appropriate to cope with increased population or subletting.

8. STRUCTURAL CRITERIA

The ”Blue Building” package leads to an ***imaginative and flexible building of the future***, which is nevertheless ***valuable for money,*** by harmonizing the architectural and building services requirements with the structural needs.

In this regard structural systems are proposed which permitted the 1000 mm (minimum) zone for structure and services to be maintained within the floor plate, thereby permitting the floor-to-ceiling height of 2.7m.

The Imposed Loading selected for the sizing of the principal structural elements permits maximum flexibility within the overall constraints of the project. The Imposed Loading used is the following:

Live Loading	=	3.0 kN/m^2
Internal Partitions	=	1.2 kN/m^2
Ceiling and Services	=	0.3 kN/m^2
Imposed Loading		**4.5 kN/m^2**

Foundations and columns could be designed and calculated for a higher imposed loading, on specific request, to allow the constructions of future new floors.

On specific request, an efficient structural grid, for each of the floor layouts, might be selected among three different structural floor arrangements. Each floor arrangement satisfies its basic functions, and sizes the principal structural elements and might be evaluated in the light of the following fundamental criteria:

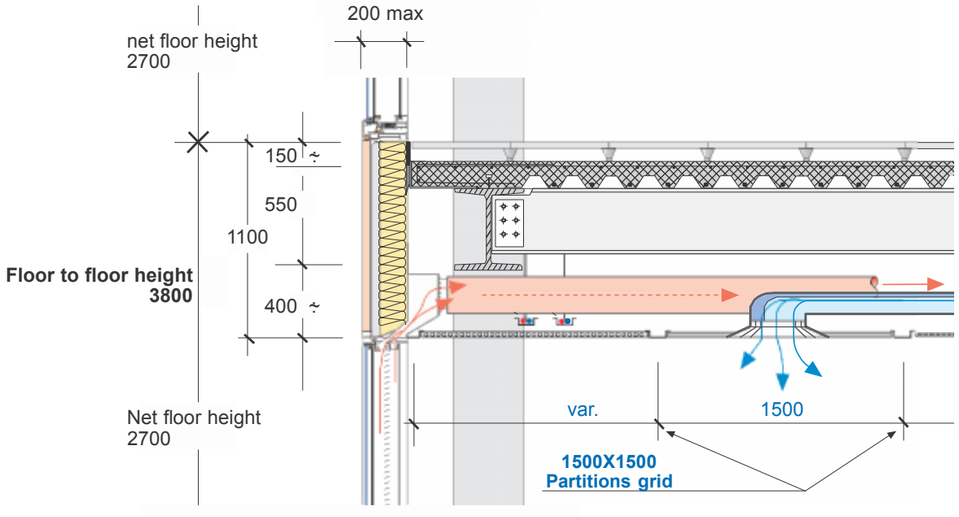
1. Availability of materials
2. Ease/speed of fabrication
3. Ease/speed of erection
4. Familiarity of construction
5. Relative cost
6. Position of restrictions

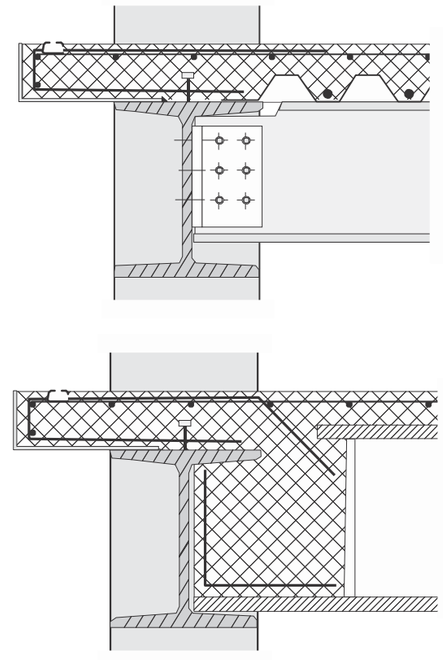
8.1 Floor arrangement Type A: Composite Construction mainly using Steel

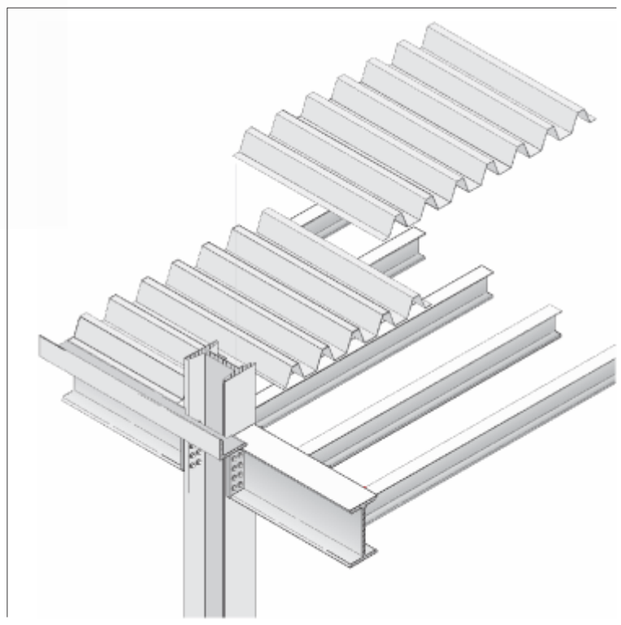
1. Material not universally available, but it is relatively straight forward matter to import structural steel sections where necessary.
2. Fabrication requires skilled personnel, but ***it is quick and easy in countries that use this form*** of construction.
3. Erection requires semi-skilled personnel, but it is quick and easy where this form of construction is used.
4. Some European countries do not have a culture of building in structural steel, but they are gaining expertise.
5. Normally more expensive than reinforced concrete, but ***speed of construction*** and ***lack of required falsework*** could make, in same cases, this ***method of construction very competitive*** indeed.
6. a)- Beams will be castellated to provide flexibility to services routes.

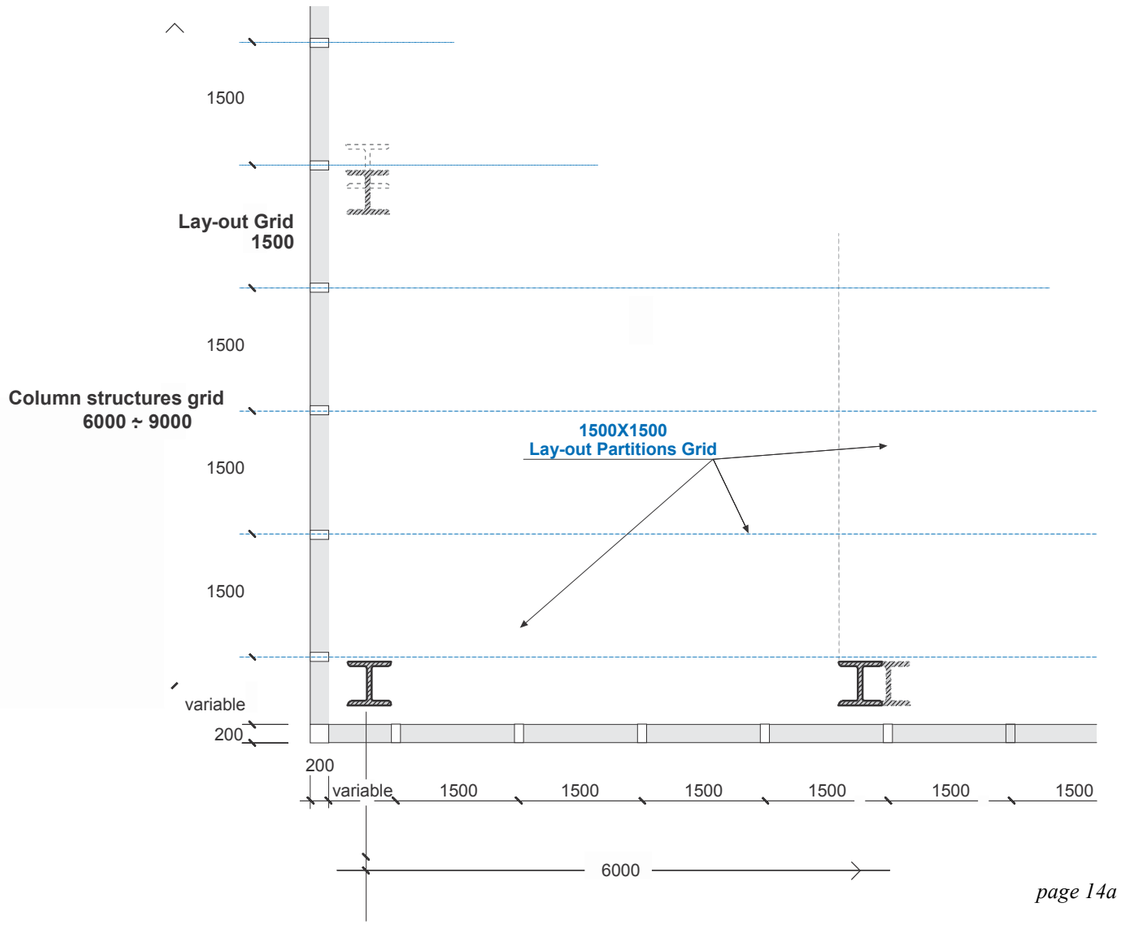
   b)- A minimum protection treatment (shot-blasting and single coat primer) is required for durability.

   c)- ***Fire-protection treatment is provided.***







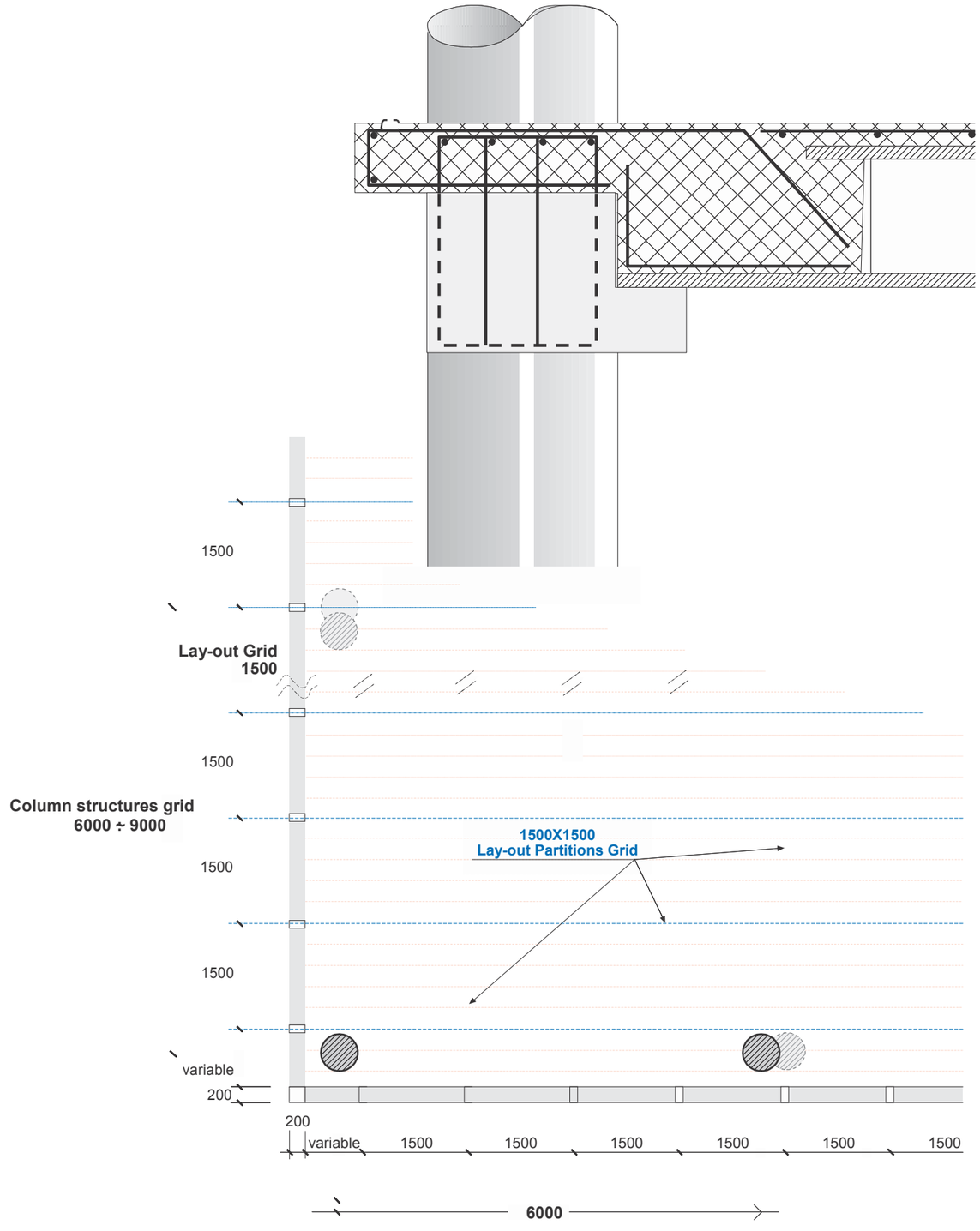


8.2 Floor Arrangement Type B: Reinforced Concrete mainly Precast

This arrangement is a post and beam precast system combined with pre-stressed slab elements, hollow type.

1. Requires easy availability of precast/pre-stressed elements.
2. Precast panels are often available as standard proprietary products.
3. Erection speed is as fast as composite construction.
4. This system requires skilled personnel, but it is quick and easy in countries that use this form of construction. .
5. ***Less expensive than structural steel*** frame.
6. a)- Requires good attention to connections and details.

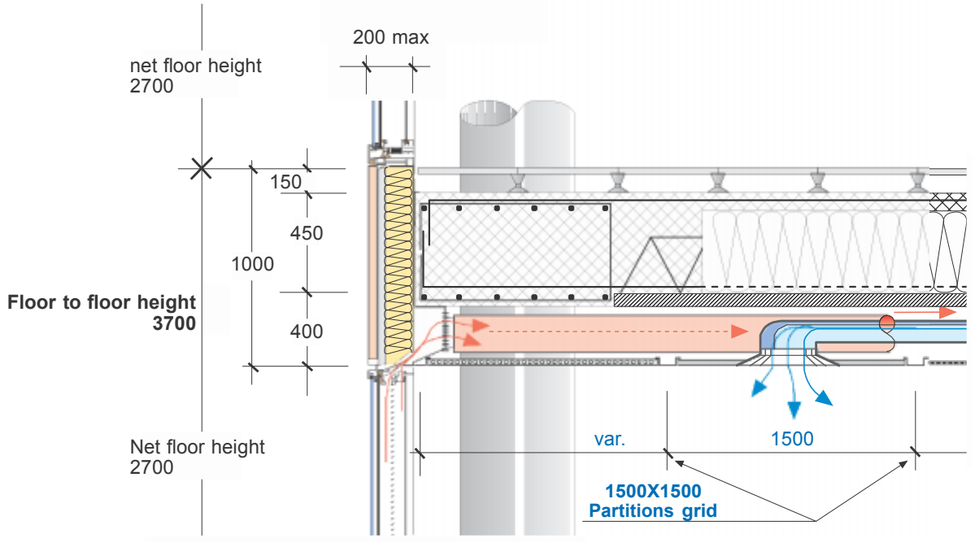
   b)- Good durability, good fire and acoustic performances.

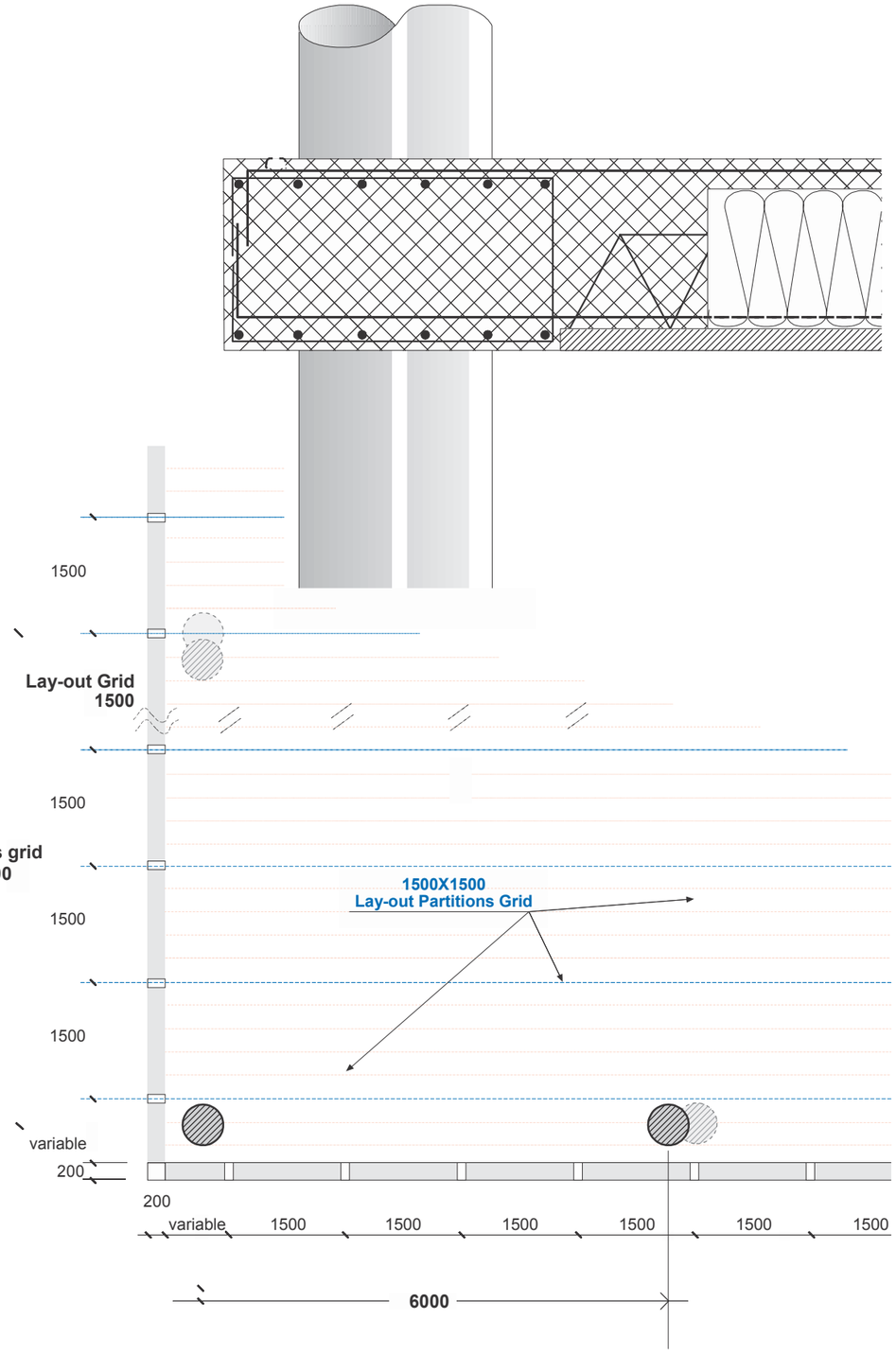


8.3 Floor Arrangement Type C: Reinforced Concrete mainli Cast in-situ

1. Material easily available in most places.
2. No fabrication required.
3. ***Slowest of the three considered floor arrangements***.
4. Most countries use this system to a greater or lesser degree.
5. Least expensive of the three considered floor arrangements.
6. - No restriction on services in the ceiling.

   - ***Best durability, fire and acoustic performance*** of the three considered floor arrangements.





9. THE "ARCHITECTURAL ENVELOPE"

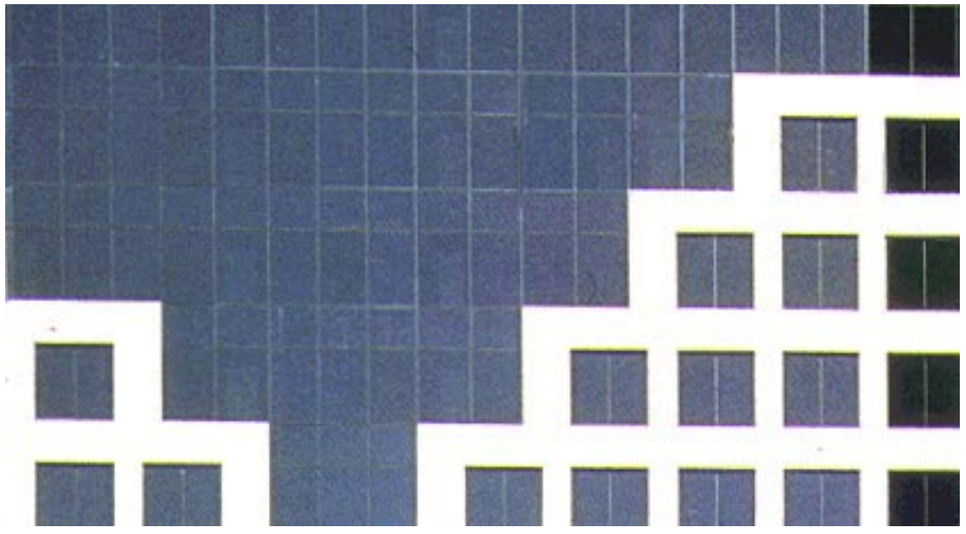
Facades and their Performances

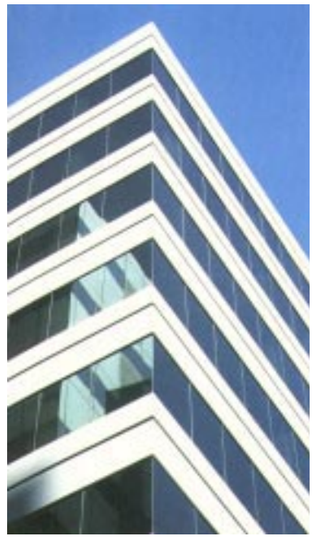
9.1 Functions, durability and Image

The facade is the part of the building which ***interacts between the inside and outside environment***.

A facade***acts as a skin which wraps as an envelope the working inside space separating it from the outside environment***. Architects, through the facade design, filter the interaction between the external environmental conditions and the internal working space. To a certain extent the facade acts similarly to a human skin ***absorbing, selecting, isolating, reflecting*** to provide a working space with a good level of comfort. The facade has to be carefully designed and tested to guarantee the real efficiency of all the complex functions it has to perform and their quality along time.

The same ***facade***, however, in an office building a facade might be a mean by which a company creates its own ***image*** to distinguish its services or production from competitors or simply ***to affirm a reached successful position in the marketplace***.





9.2 “Normal Wall” and “Active Wall” facades: general description

The curtain wall system - proposed and produced by Permasteelisa - is characterized by high performances, aesthetic and quality standards, which comes as result of a long experience and continuous research.

The innovative “Blue Building” package foresees the use of “normal wall” facades and of “active wall” ones. The latter one has to be considered like a technological evolution of the normal solution.

The use of two types of facades depends on the exposition of the building (the facades exposed to north are not subject to radiation) and on the thermal/climatic external fast variations.

Both systems allow the design of curtain wall with a good freedom of architectural forms and surfaces. Any possible different type will be defined by the architect or by the client.

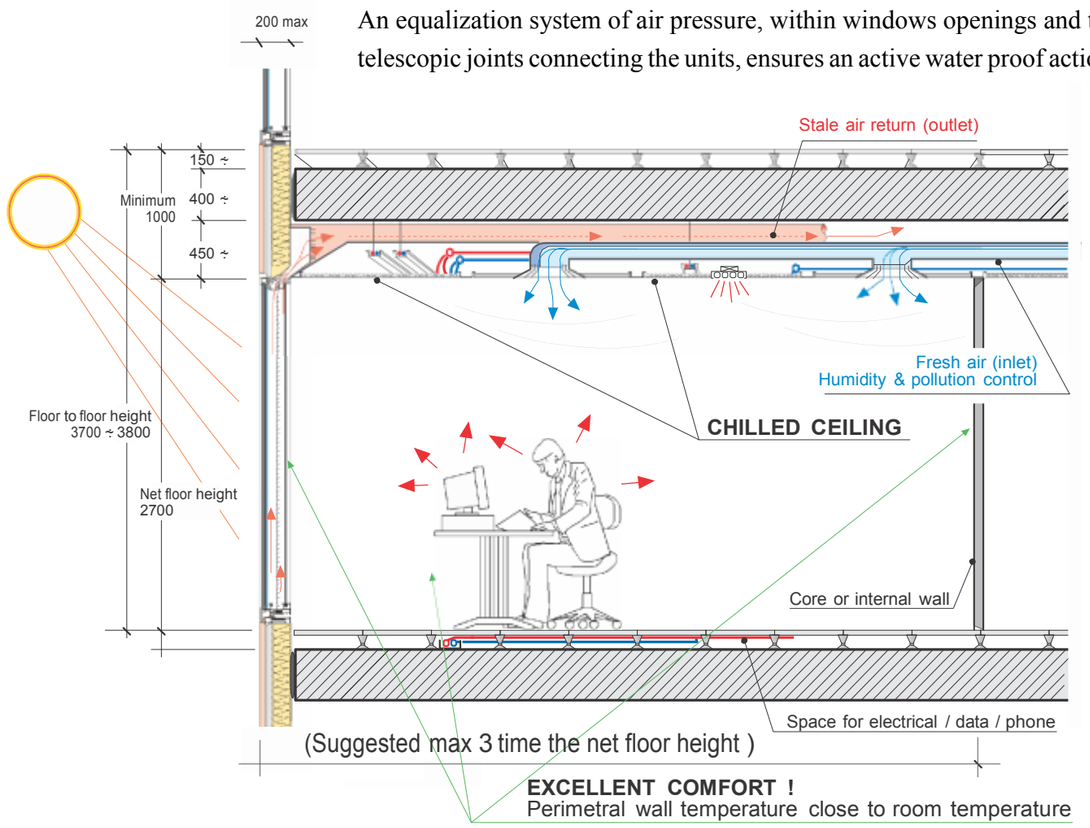
Types commonly used are:

- glass curtain wall
- horizontal or vertical accents with metal panel, granite, or other materials.

The curtain wall is made with extruded structural aluminum alloy, which arranged in the inner side, in comparison to the window level, are forming monolithic modular frames, factory prefabricated unitized panels.

Glass panels, of window and/or metal panel, are integrated to the structure frame by means of joints, fasteners, and seals.

An equalization system of air pressure, within windows openings and the telescopic joints connecting the units, ensures an active water proof action.



The air seal is obtained by means of weather strips located at different levels, so as to allow the leveling of the pressure within the telescopic joint rooms between the frames.

An “active wall”consists in:

-an external double glazed unit

- a third internal glass

- a blind between the two above mentioned glazed units

The blind is automatically lowered in relation to sun inclination. Stale air, sucked up from the mechanical room, removes the heat gained by the blind in the cavity between the two glasses.

9.3 Facades’ Performances

The following table compares the typical performances of the two kinds of facades:

		K value W/sqm	Sound insulation dB	Total Energy Transmission TET (=SF%)	Total Light Transmission TLT
NORMAL WALL (passive wall)	Normal wall using one of the best high performance vision glass	1.5	33	35%	63%
INTERACTIVE WALL	(Variations depending on air speed flowing inside the cavity)	1 (0.6 ⏐ 1.2)	38 (36 ⏐ 40)	15% (10 ⏐ 20%)	75% (0 ⏐ 80%)
FINAL CONSIDERATION	Positive balance comparing interactive wall to high performance normal (passive) wall	average 50% better	average 2÷3 times better	average 100% better	average 20% better

The active or interactive wall shows the following advantages:

- Reduction of the summer and winter thermal loads and peaks (the reduction of the loads and peaks allows the use of chilled ceiling systems as an alternative to fan-coil systems or full air systems with a considerable energy saving.
- ***Reduction of energy consumption by ~15% 30%***.
- ***Possibility*** to install ***full height transparent glass facades*** between floors and ceilings and consequent ***daylight diffusion in depth***.
- ***Possibility to use space up to 30 cm from the internal glass surface*** (instead of the usual 1.5m) with considerable gain of space dueto unnecessary perimetric heating or cooling and relative reduction of radiating and cooling surfaces.
- ***Improvement of the internal comfort*** because all wall surfaces, including glass walls, will be at a temperature very close to the air room temperature.
- ***Daylight diffusion more calibrated*** and in depth, thanks to particular revolving blinds (venetian blinds).
- ***Better acoustic insulation*** (external towards internal)

9.4 The industrialized construction process

The ***"Blue Building"*** package uses a ***full industrialized process of erection which includes packing, transportation, storage at level and laying***.

Structure

The structure will be fabricated partially on site and partially off site.

Facade

Facade units complete with glass and panels are packed on pallets, wrapped in polyethylene cloths, and loaded on trucks.

When the job site has been reached the material is unloaded and lifted up to the laying level by job site crane or hoists.

The panels are positioned vertically through a hoist running on a monorail located on the slab border of the floor above the one used for the installation.

In some cases the installation can be carried out by local control at each level, by special hoists supplied by Permasteelisa.

The facade erection starts with horizontal and vertical alignment of the anchors recuperating any possible tolerance of the structure; later on the facade brackets are integrated to the slab by means of bolts into Halfen type cast on cement.

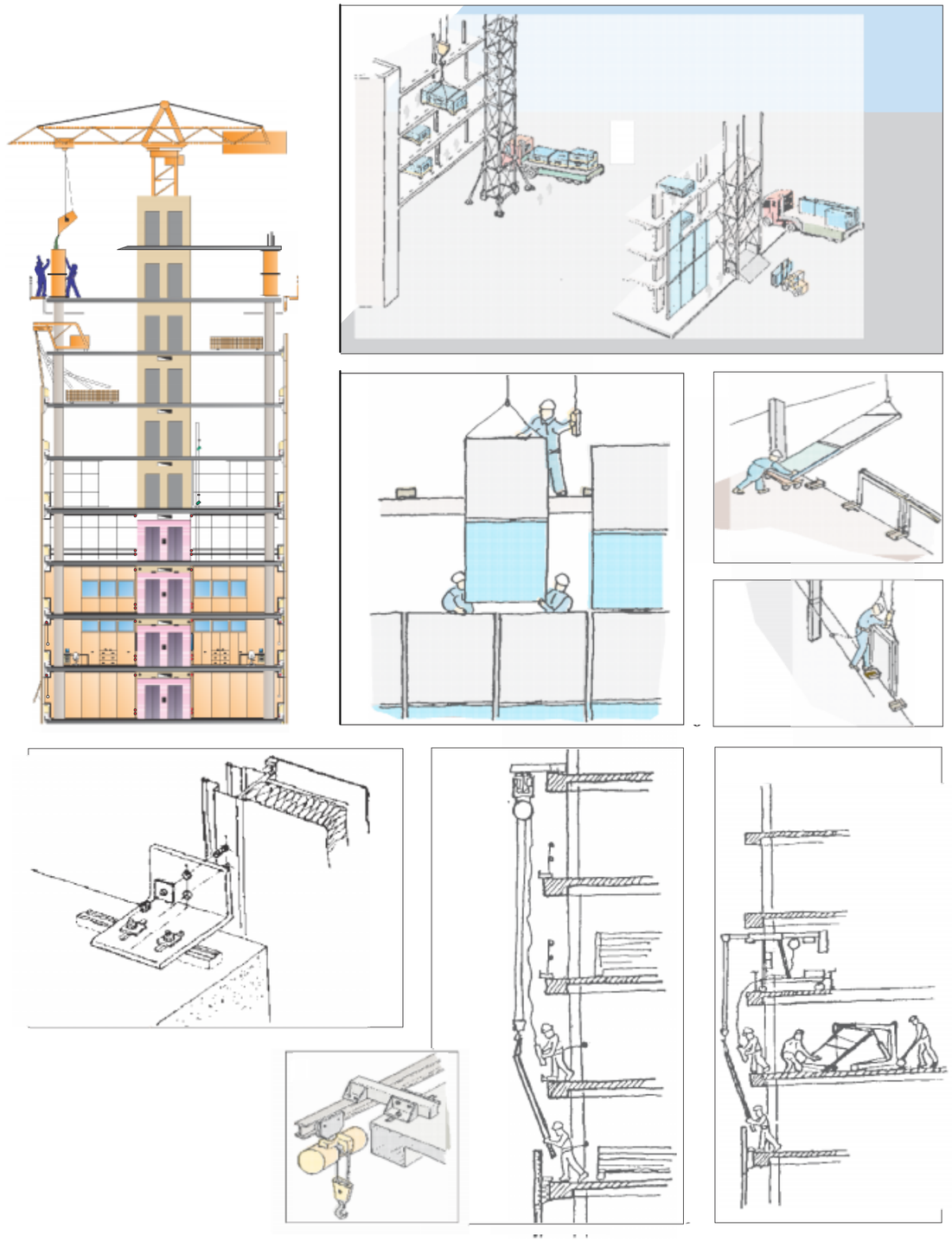
The installation proceeds with a floor-by-floor sequence by means of particular machinery, without using scaffolding or tower crane.

Units are laid simultaneously on various floors with a 3-4 men's staff for each floor, proceeding from the lower floors up to the higher ones.

The "Blue Building" package considers an installation schedule based on an average of 15 panels a day for each team. One or more floor per week will be completed depending on an agreed schedule.

Services

Services will be produced mainly on factory and then installed on site. Factory production is preferred because products can be tested and high standards of production can be followed. Several internal services are installed to be easily relocatable for interior renovations or to satisfy changes in users' needs.



10. AIR CONDITIONING AND SERVICES SYSTEMS

10.1 Air Conditioning as Integrated System

The ***"Blue Building"*** meets the comfort criteria and environmental quality utilizing an ***active facade, a chilled ceiling system and an air supply*** rate of between two and three air changes per hour. The air supply is from the ceiling.

The chilled ceiling is made up of a metallic paneled sound absorbing false ceiling applied (by exclusive ABB technology) with an aluminum section bearing a copper tube in which hot or cold water circulates according to external environmental conditions.

The ***advantages*** of this system are as follows:

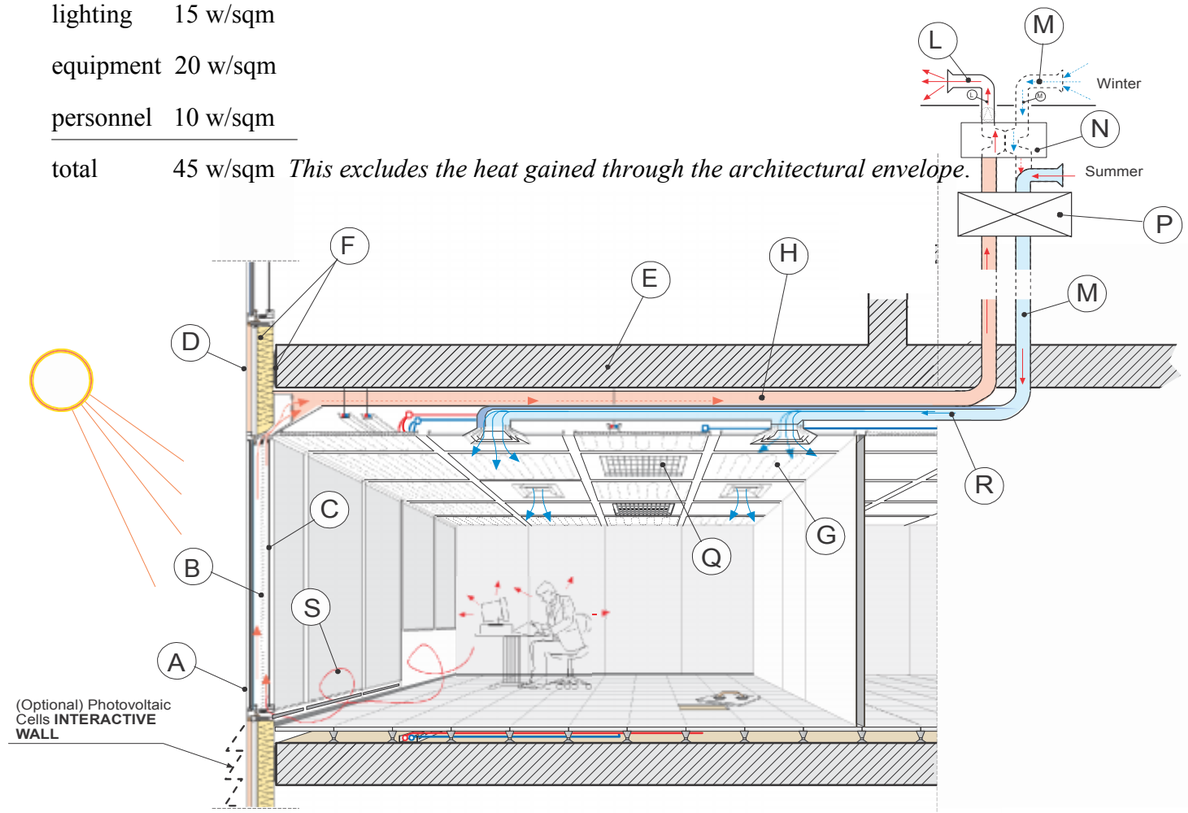
- The chilled ceiling gives a ***uniform heat absorbing surface***.
- The low ***air movements decrease draughts*** but provide sufficient air change to remove odors, pollutants and keep the space fresh.
- The chilled ceilings are ***controlled in zones*** to suit the occupation and layout of the spaces.
- The chilled ceiling may be made in any form, and thus easily ***adapts to any architectural design and unusual forms***.
- The chilled ceiling is ***controlled by an on/off valv***e which is the ***only part requiring maintenance.***
- The chilled ceiling uses ***water at 16° or 17°C*** which is ***generated more economically*** than traditional systems and provided also by natural sources as lake or river fresh water according to local rules.
- The system permits ***energy savings*** from 15% up to 30% and an important ***reduction of maintenance costs***.
- The chilled ceiling generates ***no noise*** and the low volume air supply is easily controlled to the established noise level.
- ***The system is self-compensating*** in that the higher the temperature of the room surfaces the greater the load absorbed by the ceiling.
- The system is integrated with a high efficiency facade which ***eliminates areas of high heat gain.***
- Areas of exceptionally high load such as computer rooms and/or machine rooms, are provided with an additional system ("active beam") to cope with the load.

The production of hot and cold fluids is achieved using water heating and refrigeration plant, preferably situated on the roof of the building, thus avoiding structural encumbrance on the lower floors.

One or two air conditioning units provide the winter/summer conditioning of the introduced air which will bethen expelled through the active walls cavity. A ***heat recovery system*** is envisaged within the conditioning plant.

The following heat load has been considered on a typical operative office:

lighting	15 w/sqm
equipment	20 w/sqm
personnel	10 w/sqm
total	45 w/sqm *This excludes the heat gained through the architectural envelope.*



A - Insulating double glazed unit K= 3,00 W/sqm
B - Venitian blinds (manual or electrical)
C - Clear single glass

Vision external wall average K=1W/sqm

D - Decorative or reflecting or solar panel
E - Concrete slab
F - Insulating and fire-stop interstice
G - False ceiling with radiant panels
H - Air extraction duct

L - Duct for stale air
M - Air suction
N - Heat exchanger
P - Air conditioning unit (it controls temperature, pollution, and humidity)
Q - Lighting
R - Primary air conditioned (filtered and controlled in temperature and humidity
S - Stale air suction inside the cavity between the two glass walls

10.2 Lighting, Electrical, and Cabling System

The illumination of the workplace is one of the main factors of environmental quality which can positively influence the productivity of office personnel.

The careful management of illumination levels can also bring about tangible energy savings with no reduction of environmental quality.

The "Blue Building" package wishes to propose an advanced illumination system based on the ABB *i*-bus EIB system, which is able to satisfy numerous demands:

- ***maximum use of natural light***
- Controlled reduction of luminosity levels suitable for the use of personal computers
- Dual-light systems, with the addition of a desk-top light source to permit different light levels in the same environment. On a typical operative office, a room lighting system will provide an average of 300 lux at desktop level
- Maximum flexibility of the various elements (light sources, sensor, controlled sockets, etc.) in relation to the layout and demands of the working area
- Control and programmability

This system based on EIB protocol, is based on a single 2 wire control conductor to which all components (controlled sockets, light sources, sensor, switches) are connected in parallel.

The specific "Blue Building" solution envisages a ***control bus in the false ceiling,*** and another ***in*** the ***technological floor***.

Power elements are connected to 220V supply as well as to the control bus. In this way the traditional concept of application command and control is revolutionized. Wiring is simplified to the extreme, which makes installment possible even in places where the laying of traditional wiring would otherwise be very difficult. Furthermore, the entire command system works exclusively at the safe voltage of 24V.

10.2.1 Systems Expandability

The application of the ABB *i*-bus EIB system ***allows the control system to be expanded*** to numerous other uses at marginal cost, even post-installation, without the addition of further wiring and control units, using a widely available European standard interface.

For example, a curtain control unit may be integrated with the lighting controls, raising or lowering curtains in relation to the level of external light or temperature. Curtains may be lowered to reduce the effect of solar radiation and thus the consumption of air conditioning units.

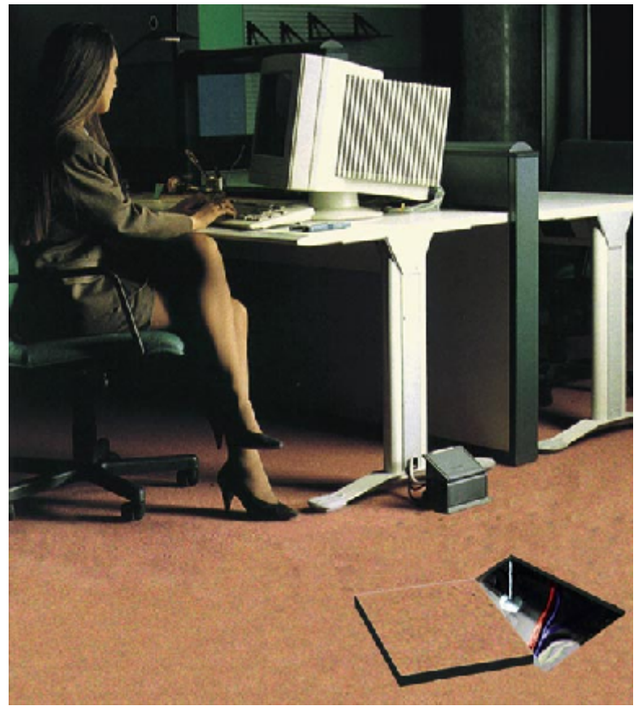
11. FLOORINGS AND RAISED FLOORS

11.1 Entrance, hall, Stairs, Toilettes

Sardinia grey granite or ceramic tiles will be used in these areas accordingly to local specifications and architect's choices.

11.2 Operative Offices (raised floor)

The raised floor is made of an updated technology which give total flexibility on floor cabling.



The qualities of the system are:

- durability
- maximum efficiency and flexibility
- maximum insulation - minimum 45 dB

The finishing of the floor surface is:

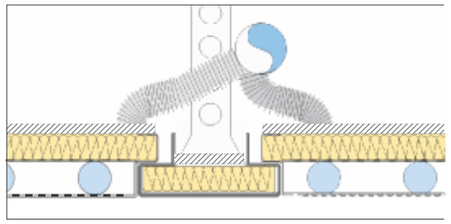
- 2.5 mm linoleum
- 2 mm vinyl (fire resistant class 1)
- moquette (carpet) with several choices
- granite (natural or artificial) for entrance, hall, and life lobby (a raised floor when requested for technical reasons)
- ceramic type for lavatories

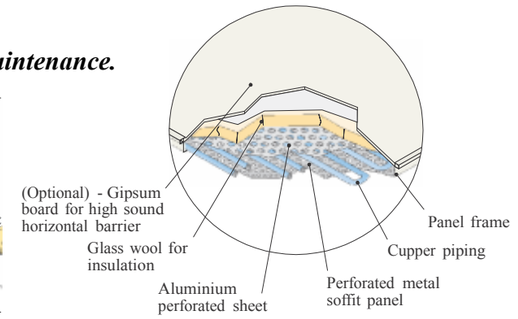
12. FALSE CEILING AND CHILLED CEILING

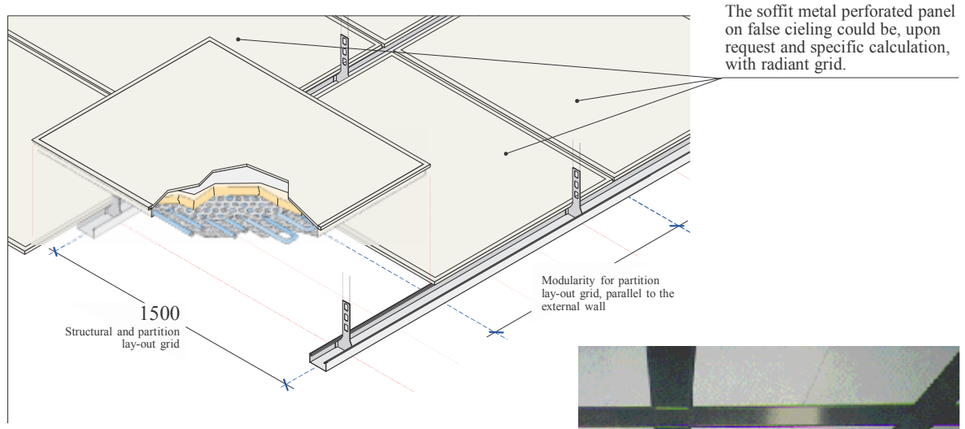
All false ceilings are in perforate paint metal with rockwool insulation, and good sound absorption. They are perfectly modular to receive the movable partitions into the grid system.

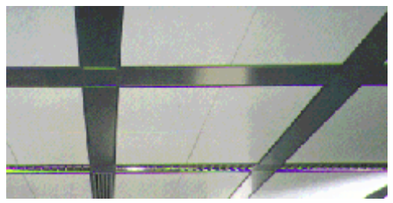
The false ceiling guaranties:

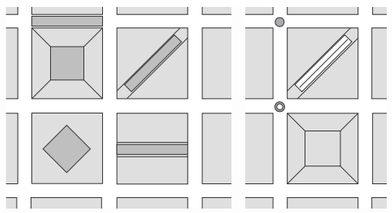
- ***high sound absorption***
- ***pre-engineering connection*** into a grid system in order to accommodate walls, services, panels for airflow, light, sound, etc.
- ***Easy disassembling for services maintenance.***











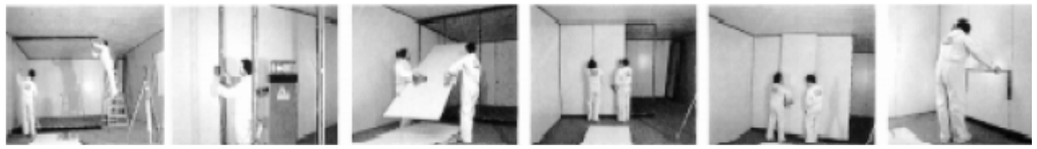
13. INTERIOR COMPONENTS AND FINISHING

Various different solutions available for internal finishing allow maximum personalization and high flexibility for future changes.

Hereafter there are indications of some solutions which conform to the quality of the “Blue Building” package.

13.1 Internal partitions and claddings

Fire-ISA wall by Permasteelisa is more than a simple partition. It is an integrated system for the furnishing of inner spaces with total flexibility. Technical systems, control systems, and safety systems find place inside the wall and their inspection is extremely fast. Claddings and service cores can also be executed.



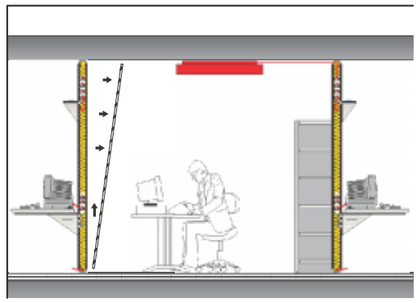
The integrated modular elements, can be quickly laid. Once installed, they can be demounted and eventually recovered for a wide adaptation.

The components range allow the definition of all types of work space for the services sector, the managing activities, etc...

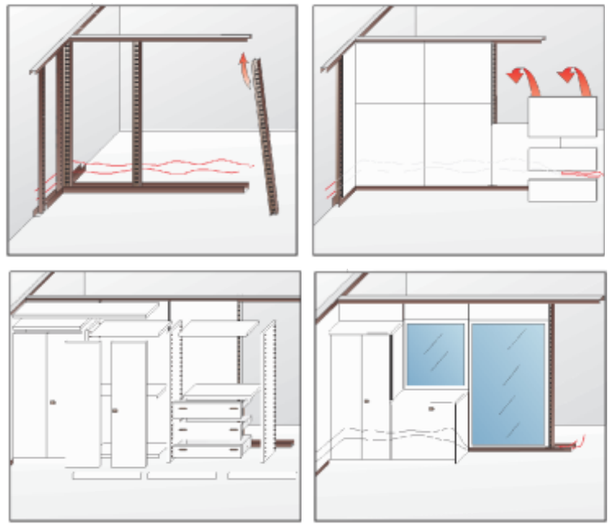
The thickness of the finished panel amounts to 100 mm. Many types of panels are obtainable from the diversified composition of the blind panels, window panels and doors. The possible types are almost unlimited if combined to the range of furnishing products, alternative materials for finishing (like fabrics, wood, composite materials, alloy) and the many color shades and aspects of the two opposite surfaces of the panel.

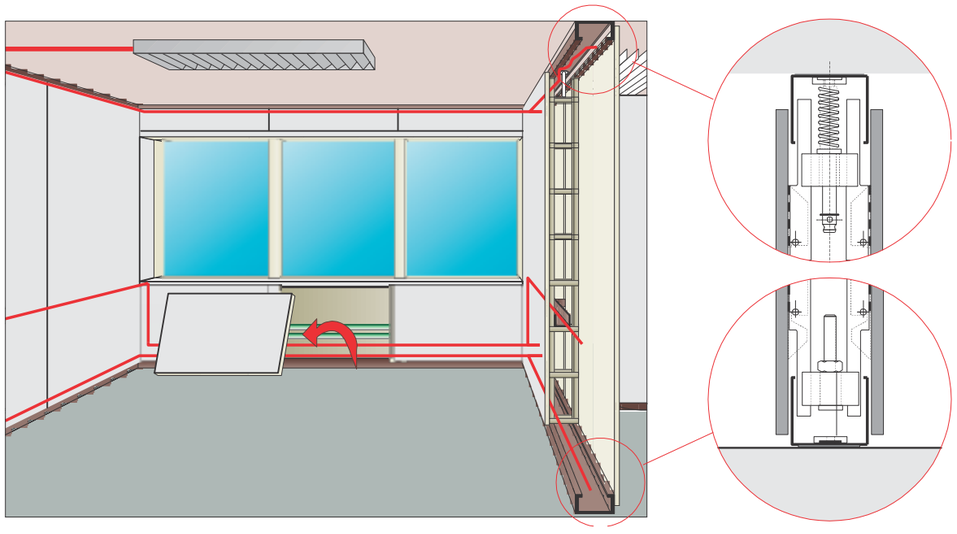
The sightproof panel consists of a zinc plated steel sheet 0,6 mm thick. The internal side of each panel contains a gypsum sheet 12,5 mm thick as counterplating of the plane surface, which solves the problems of:

- ***flatness of the surface with a higher rigidity*** supplied by the binding of the steel sheet with the gypsum
- ***acoustic resistance*** with the higher weight-volume of the two combined materials (insulation 45 dB)
- ***fire resistance*** up to 90 minutes



The window panels and the opaque/sightproof panels are hung up on galvanized steel frames forming a perfectly smooth and flat wall. The window panels are made of 2 glass panes on aluminum frame with, eventually, a venetian aluminum blind (manually or automatically controlled) in the space between.





13.2 Internal fittings and accessories

A wide range of integrated products is available in the "Quaternario System", including office furniture, fittings for partitions, workstations, freestanding and work-station wall, cupboard, and archive components, etc.

14. CONSTRUCTION TIME SCHEDULE

14.1 Works' Sequence

It is examined an 8-story building type with rectangular dimensions of 80x18 meters (***total 11.520 sqm offices + 3.000 sqm of underground garage = <u>total 14.520</u>***).

For the mentioned building type the sequences of works are:

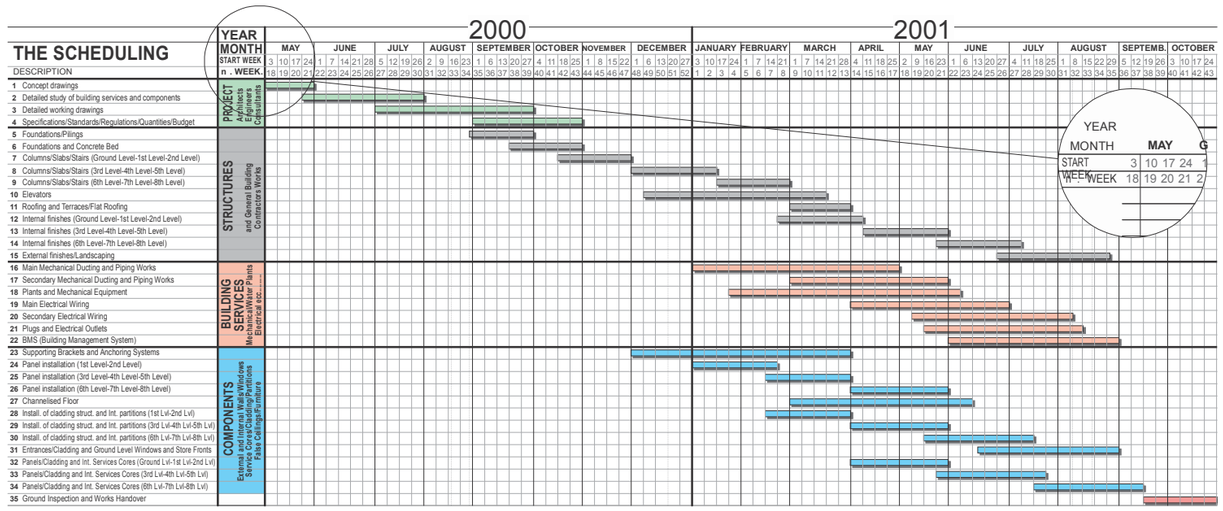
1. escavation and execution of underground structures at the same time with the beginning of elevation structures
2. completion of structures (substructures and superstructures)
3. completion of external enclosure through a fast installation of all perimetral walls
4. roof membrane and finishing
5. internal services and components and at at the same time external landscape.

The estimated time to build up the whole building is 9 months

14.2 Conditions on construction time schedule

The following conditions are assumed as basic for the proposed time schedule:

- the project design must be completed before the beginning of construction works
- components and processes are highly industrialized and repetitive
- the prefabricated structures are available within the first months of construction works
- all materials and components must be chosen and ordered before the beginning of construction works
- the whole building process will have a construction management team by "Blue Building" including a Quality Insurance and Quality Control Team.



15. WARRANTY

A "Blue Building" 10 years total warranty certificate is given to all our clients. The warranty includes all maintenance program and excludes only the electrical and minor parts.

16. MAINTENANCE PROGRAM

A ten years long maintenance program at fixed costs could be defined in advance .

17. OPERATING COST

Owner or client could have a fully operating cost control and contract (defining in advance the full package of operating costs) through a specialized company in conjunction with the "Blue Building" organization.

18. PROJECT FINANCING

The client, who desires just to pay the rent and not to invest in real estate, could have a total project financing. The client acccept to pay a fix rent for a period of several years and the Blue Building Company arrange the total Project Financing package.

They say about this project

The objective of the package "Blue Building" is to produce a type of building that gives the flexibility of the external form and internal to the architect, but retains an efficient, economic status of the art design.

The package "Blue Building" reduces operating costs by:

• make it easier to change layouts, partitions and wiring.

• Reduce energy consumption for lighting, heating and air conditioning system

To the kind attention:
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