# Performance criteria for external walls

External walls are referred to as cladding if they are made of masonry or panels. External walls are vertical elements which enclose the building. In the design of the specified building, the main performance criteria needed as requested by the client are as follows:

## WEATHER PROTECTION:

Walls must be able to exclude rain, wind, snow, frost and sometimes heat and glare from the sun. The walls should often at the same time need to allow the building to be naturally ventilated and natural light to enter the building. In this respect, there are two broad functions the wall needs to perform. It should resist moisture from the ground and therefore would normally need damp proof courses to do so. It should also be able to adequately resist the penetration of weather from the outside to the inside of the building.

## FIRE RESISTANCE OF EXTERNAL WALL

The external envelope of the building should not provide a medium for fire spread if it is likely to be a risk to health or safety. The use of combustible materials for cladding framework, or of combustible thermal insulation as an over-cladding or in ventilated cavities, may present such a risk in the proposed buildings, even though the provisions for external surfaces may have been satisfied.

Considering the event of fire breakout in the building, the walls of the building are required to inhibit the spread from room to room of the flames, smokes and gases. The external walls should fulfill the obligation of containing the fire within the building for prescribed period of time, thus limiting spread to adjacent buildings. It is ultimately necessary that the walls

be able to perform their structural functions during the fire until all occupants have had sufficient time to escape. Based on the use of the building in this project, the time deemed necessary for such an escape is ½-2 hours. The materials must be carefully chosen so as to resist fore to the utmost. The combustibility of the materials must as low as possible so as to prevent quick spreading of the fire.

## THERMAL RESISTANCE

Due to increased energy cost of recent times, and the higher comfort expectations of occupants of buildings, the pressure for better thermal insulation has become a predominant factor in the performance of buildings. There is therefore greater demand for service engineers to be involved in the thermal design of the external fabric of buildings. It therefore makes economic sense to design the walls of a building so that thermal energy consumption will be kept as low as possible. It is therefore recommended that the service engineers be aware of the required heating cycle of the building and should thus decide what thermal insulation is required and where it should be positioned. He should advise on the positioning of vapour barriers, thus reducing the occurrences of one of the major defects common in modern buildings, that of condensation.

The walls having thermal resistance will limit the amount of heat the building will lose from the internal spaces, and gain from the outside environment. The materials used will determine exactly how compliance is achieved and manufacturers can generally provide some form of guidance for their products.

## Cavity Walls

The cavity can be fully filled with insulation or partially filled (consult the manufacturer's before proceeding). If it is partially filled then an air gap is generally required, the size of which will varying depending on the specific products used for the wall construction and insulation. The insulation should go at least 150mm below the DPC level.

## Solid Walls

These walls are generally insulated by placing some form of thermal element on the inside and rendering the outside. The thickness of these products will depend on the thickness and type of block used.

## STRENGH AND STABILITY:

Two main categories are distinguished here: Structural and non-structural. The former make a positive contribution in the structural integrity of the building and in doing do can act in two ways: 1. the walls may be load bearing and/or stabilizing. Here, they are designed to carry not only their own weight but also other loads exerted by the roof and floors. These walls are designed to resist compression. 2. When performing as stabilizing walls, they are designed to resist horizontal or oblique forces such as wind pressure, earth or water pressure, or thrust from other parts of the building such as arches. These walls are designed to resist shear and are often known as shear walls.

The later are more commonly called non-load bearing. They are therefore designed to carry only their own weight and not that of any other elements in the building. It is worth noting here that such walls may still be requested to resist horizontal loads, in particular wind loading.

## DURABILITY

It is often an expectation from most clients that the external fabric of the building will have an acceptable life expectancy. The external walls of the building of this design must be able to withstand the effects of the weather, such as wind, frost, snow, rain, sun and heat to be durable. The walls should also be able to resist physical damage to which they will be subjected during their life. Maintenance is therefore necessary in the elements of the building, including the walls in order to achieve a prescribed life expectancy. It is worth noting that care must be taken in the maintenance work as damage almost often results in the maintenance of the walls.

## BUILDABILITY

Buildability relates more to judgment and knowledge than to mathematical analysis. Buildability reflects whether the specific design can be assembled by various trades without compromising the functional requirements during construction. Buildability is more related to good design than to superior workmanship because, as experience indicates, only a good design can combine all the environmental factors while presenting an easy construction pattern. For the most part, it is the designer who attends to the aspects of buildability such as material installation under different weather conditions, level of skill required for installation, and construction tolerances. Often buildability problems arise when different professions are involved; for instance neither the window manufacturer nor the wall designer may consider the window wall interface as their concern. It is therefore necessary not to disregard the difficulty that the builder can experience when constructing the proposed office building.

## NOISE

Noise can cause stress and loss of sleep, and lead to ill health. For an office to be comfortable it must be designed so that its layout and structure keep noise to an acceptable level. Designing for noise control is not easy, because the sources of noise are not always apparent at design stage, and the paths by which sound travels are not always obvious. The aim, however, should be to ensure that most activities can be carried out without undue interference from internal or external noise. For external walls where windows provide passive ventilation, the need for ventilation must be balanced with the need to reduce noise – open windows do not reduce noise from outside. To effectively reduce external noise, the external walls should be well constructed and insulated. A wall's ability to reduce noise is dependent on:

- type of construction;
- materials; and
- insulation

There are two main construction techniques for walls:

- Continuous construction

A wall in which the components are mechanically connected such as single brick or single stud.

- Discontinuous construction

A dual layer of wall in which the leaves have a minimum 20mm cavity and are not mechanically connected in any way, except at the periphery such as brick cavity and discontinuous stud.

When choosing a wall system to reduce noise from the inner city environment, the contractor should consider:

- materials;
- general construction; and
- best practice design

Increasing the thickness of the building materials, and ensuring all gaps are sealed can help considerably when dealing with sound insulation.

An important feature of well constructed external walls is correctly sealed junctions, as this aids in the reduction of noise transmission through gaps and cracks at the edge of building elements. These noise flanking paths can defeat noise reduction techniques. An important feature of well constructed exterior walls is properly sealed junctions, which aid in the reduction of noise transferred via flanking paths (gaps at the edge of building elements that allow sound to travel through). Even a sound-rated wall may not perform adequately, if joints and junctions are not properly sealed. Challenges to good acoustic design of external walls can arise from noise transferred via flanking paths. It is important to minimise flanking through services and penetrations. The impact isolation of a wall may also be compromised by insufficient attention to detail. Flanking is the transfer of noise through paths around a building element, rather than through the element directly. Flanking can describe the transfer of noise through gaps and cracks in a building element, or via incorrectly sealed junctions between two materials. These noise flanking paths can defeat noise reduction techniques.

# QUESTION THREE

HOW PARTITIONS, SUSPENDED CEILING AND RAISED FLOOR CAN BE USED TO FACILITE THE CLIENT REQUIREMENT OF THE BUILDING

PARTITIONS can be described as an internal wall of a structure which divides a building into a number of parts to serve its purpose. Partition can be divide into two main groups that is, load bearing and non load bearing.

## FUCTIONAL REQUIREMENT OF STEEL PARTITION SYSTEM

The following are:

Sound Insolution: Is the reduction obtained when sound passes from one side of a partition to another. Sound may considerd as waves of pressure.

Sound Absorption: Is the material used to reduce the amount noise that is reflected from a wall surface back into the room and does not increase the sound reduced value of the structure. Sound absorption is usually achieved by adding a soffit finish to the head surface of a wall.

Flexibility: The material should be flexible enough to resist any forces or any movement that will change it actual function.

Strength and stability: The partition system should be strong enough to resist the various loads that may be imposed on it. These loads include permanent loads such as shelves and wash basins.

Services and accommodation: Partition system should be providing with spaces or voids within partitions system to provide services accessed for repair and maintenance.

## TYPES OF PARTITIONS SYSTEM

Metal stud partition: These can be defined as vertical internal space divides and are usually non loads bearing walls. These can be permanent, constructed of material such as metal post and sheet lining such as plasterboard. This type of partition is suitable for rehabilitation works. Joints in panels are usually filled as the plasterboard is normally covered with a scrim coat of plaster. It is however slowing, wasteful of materials and it is difficult to install components such as door and windows hatches.

Frame and sheet partition: These are similar in concepts metal stud and sheet partitions; except that they are constructed using an arrangement of proprietary components such as doors and glazing element. Cutting component is kept a minimum and joints between panels are usually expressed using cover strips. Frame and sheet partitions are suitable for dismantling and relocation, and can be called demountable partitions.

Frame and panel partition: These are variations on the frame and sheet partition. In this system the panels are placed between the studs or frame which is left exposed. These methods are constructed by using self supporting panels, with double skin of plasterboard separated by egg-create element.

## SUSPENDED CEILING

Suspended ceiling: These can be defined as ceiling which is fixed to a framework suspended from the main structure thus forming voids between the two components. It is used where enough height as available to hang it from the ceiling joists and still have enough height between the floor and

new ceiling. Suspended ceiling have two main functions: a metal grid that provide a structural and a height weight panels that slip into grid.

**The basic functional requirement of suspended ceiling is:**

They should be easy to construct, repaired, maintain and clean.

Should be designed that an adequate means of access is provide to the voids spaces for the maintenance of the suspension system concealed services and / or light fighting.

Provide any required sound and / or thermal insulation.

Provide any required acoustic control in terms absorption and reverberation.

Should be provide with fire resistance or protection to structure steel beams supporting floor.

Conform with the minimum requirements set out in the Building Regulations and in particular the regulations governing the restriction of spread of flame over surfaces of ceiling and exceptions permitting the uses of certain plastic material.

**TYPES OF SUSPENDED CEILING**

The suspended ceiling can be classified as the way in which they are constructed as following:

Jointless ceiling: These ceilings although suspended below the main form uses sheets of plasterboard. In these systems the plasterboard is fixed to the underside of the suspended framework. This can provide fire resistant ceiling

and this may be one of the reasons for using this type of construction. Moreover it is not suitable for a situation where service is to be carried in the voids unless they can be approached from the floor area above. This type of ceiling is particularly useful where the ceiling needs to take s sculptured shape. It can provide a fire resistant ceiling construction.

Jointed or frame and tile systems: These ceilings are the commonest form of suspended ceiling use in construction industry today. They constructed with a metal framed grid suspended from the floor or structure above. In this system the grid are fitted tiles made from different materials such as minerals fibre board, plaster and metal and it is supported by the grid. Generally these types of ceiling are easily constructed, maintained and easy means of access to services.

Open ceiling: These ceiling are designed to give a visual barrier between the rooms below and the ceiling voids above by the use of an open grid. This type ceiling the light is fixed to the lower side of the ceiling.

## RAISED FLOOR

TYPES OF RAISED FLOOR

The shallow or battened floor: This type of floor is supported on battens fixed to the structural sub-floor. This type of floor provide spaces of wiring and the floor contain the acoustic properties of a floor and as cavities seldom exceeds 100mm is normally only used to conceal cable runs.

Platform floor: This type of floor is supported on adjustable jacks whom rest on the structural sub-floor. Using pedestals an adjustable cavity with depth

ranging from 40mm to 150mm depending on which proprietary system can be provided. It is suitable for most services installation requirements.

# SECTION TWO

## TECHNICAL DESIGN DECISIONS TO BE TAKEN TO SPEED UP CONSTRUCTION PROCESS

Clients often demand faster construction so as to benefit from early completion of projects. Although there are notable examples where fast construction has been achieved, the consensus is that the construction industry has not been entirely successful in meeting clients' expectations. This is mainly due to a disjointed industry, in which design is often separated from the construction activities. Traditional practices are proving inadequate, to the point where either they can no longer achieve the desired delivery time, or, if projects are forced to meet the programme, they do not provide the required quality and long term performance. If faster construction is needed, the level of attainment of the targets is an essential part of assessing the overall performance of the construction industry in meeting client needs.

### Site location

The location of the structure on the chosen site is often fundamental to the success of the faster construction initiative. Attention should be paid to site topography, especially noting potential sources of problems such as the water table, contamination, existing structures, substations and overhead high load cables.

## Repetition

Repetition is a most effective way to speed up activities. This can involve the use of standardised components installed in the same way each time. For detail installation, “ repetition” might mean standardising the grade of concrete everywhere on the project at 35 N/mm2, avoiding the additional management time of checking on each pour. Repetition might involve keeping an element to a constant dimension or position – e. g. all lighting pendants are in the centre of every room, or extract vents are always 150 mm down from the ceiling.

## Standard modules

Use of identical or standard modules speeds construction because it simplifies the checking of drawings, fabrication and installation. The principle can be applied by using a standard dense concrete block for all block work, or by employing standard air handling units in roof plant or standard toilet pods within the building

## Orientation

The orientation of the project could dramatically affect the speed of construction. A project located some distance from the site access is likely to have more space available for off-loading facilities and storage. If the project structure is close to the access point, or obstructs or restricts access to the remainder of the site, then faster construction is likely to be more difficult.

## Configuration

The mass, height or plan shape of a project will significantly affect the ease and speed of construction. While massed elements may speed construction, they may also obstruct the site and so slow progress. For example, large

ductwork elements reduce the number of joint connections that need to be made and so reduce construction time. However, the greater size and length of the elements might hinder access and slow the process down. Prefabrication, pre-assembly and modularisation. Consider the potential of methods based on prefabrication; pre-assembly and modularisation.

## Environmental and sustainability issues

Recognise the environmental and sustainability issues inherent in faster construction on site. It will probably be necessary to expend equal or more energy over a shorter period to achieve the same end-product earlier. The procedures should ensure that the materials used are sustainable.