Modern Methods of Construction (MMC)

Introduction

In the Real Estate business with companies actively competing for tenants to occupy their buildings to sustain their income flow and maximise profits the development of new attractive modern buildings using innovative construction materials and techniques can provide a real market advantage. Consequently designers of buildings are under tremendous pressure to reduce erection and manufacturing costs and to consider sustainable materials that offer sufficient thermal insulation properties, whilst still producing aesthetically pleasing buildings.

To achieve this many new and innovative methods of construction are being adopted and the use of Modern Methods of Construction (MMC) is becoming increasingly prevalent. However, from a Risk Engineering and Insurance perspective the introduction of new materials and innovative construction techniques can create uncertainty about the risk posed and the performance of these buildings in the longer-term.

Modern Methods of Construction (MMC) defined

Zurich’s and the generally accepted insurance industry definition of MMC is:

“A construction process that can encompass the use of composite new and traditional materials and components often with extensive factory produced sub-assembly sections and components. This may be in combination with accelerated on-site assembly methods and often to the exclusion of many of the construction industry traditional trades. The process includes new buildings and retrofitting, repair and extension of existing buildings.”

Zurich’s definition, rather inevitably, encompasses a wide range of materials and techniques, reflecting the fact that buildings employing MMC are incredibly varied. Examples range from complete structures built up using Volumetric (modular) units, Pods, or Panellized Systems (ie. factory produced flat panel units) to constructions employing innovative use of materials, eg. straw, wool, timber and polystyrene to name just a few.
Perceived benefits of MMC:

Some of the perceived benefits of MMC are:

- Improved quality control of components produced under factory controlled conditions.
- Services (e.g. electrics, plumbing) can be pre-planned and either fully or partly pre-installed for final connection on site.
- Faster construction times on site.
- Fewer workers required on site and for shorter periods.
- Less wastage of materials.

Current and emerging methods of construction

This section highlights some of the new and innovative building products and methods of construction being encountered now and which are becoming increasingly common. These new methods tend to involve extensive factory production of sub-assembly sections and components in combination with accelerated on-site assembly methods. The methods can broadly be separated into two distinct areas:

1. Superstructure Components
   - Volumetric or modular construction.
   - Pods.
   - Panellized.
   - Hybrid.
   - Timber framed.
   - On-site manufacture.

2. Lightweight Cladding Systems
   - Brick slip.
   - Rain screen.
   - Render systems.
   - Timber.
   - Concrete.
   - Tile hanging.
   - Steel.

The preceding is by no means an exhaustive list with new materials and construction techniques continually being developed and evolving. However, the following sections will provide a little more insight into each of the preceding.

Superstructure components

Volumetric

Factory produced three-dimensional units that are then transported to site and bolted together. The frames will normally be steel, timber or concrete and can be supplied with all external and internal finishes (including services such as electrics and plumbing), or solely the basic structure. Unlike pod construction, volumetric does not require a superstructure. Examples include: hotels, student accommodation, fast food restaurants.

Pods

Factory produced three-dimensional elements that are incorporated into the superstructure of a building. These are ready made rooms which can be pieced together to make complete premises when set within a light steel framework. All the building services will typically be pre-installed with just the final connection made on site. Examples include: hotel bathrooms, kitchen units for accommodation blocks.

Panellized

Factory produced flat panel units transported to site for assembly. Typically these would form the exterior walls of the building – they can be load-bearing (i.e. providing structural support) or non-load-bearing. They can be made of timber, light gauge steel, structurally insulated panels (SIPs), concrete or non-structural in-fill walling used to create the whole building. They can be used for virtually any type of building.

Hybrid

These structures combine both volumetric and panellised approaches within the same building and are also known as semi-volumetric.

Timber framed

Timber framed buildings have been around for hundreds of years, however, the concept is now being used to create some much larger and more innovative structures.
On-site manufacture
Site based assembly methods include the use of traditional components but in innovative designs including the establishment of manufacturing facilities at construction sites. An example of this is aircrete planks that have the strength of concrete but whose micro-cellular structure is low in unit weight.

Lightweight cladding systems
These are external finishes that link well with off-site manufacturing systems due to their low structural loadings and speed of installation.

Brick slips
Individual brick slices that are fixed vertically by adhesive. Normally brick slips will be glued to plastic wall facing sheet though they are also available in larger panels that are hung onto the superstructure.

Rain screen
These are weatherproof external coverings that are easily fixed to factory produced framework attached to the building and can be made from metals, ceramics, granite, terracotta, vitreous enamel, laminates and timber. Insulation material may be present behind the cladding.

Render systems
Render is an external covering applied to the outside of a building, usually directly on to bricks, blockwork, boards or insulation. It is normally made from limestone, cement and polymers and can be produced in a wide variety of colours and finishes. The actual render is non-combustible, but the covered material to which it is applied can often be combustible (e.g. foam plastic insulation).

Timber cladding
Although a traditional building material the use of timber cladding has become increasingly common in recent years alongside the desire for increased use of sustainable building materials. For new commercial buildings it is commonly used in combination with other cladding systems, although it can form the majority of the external area of the building.

External Insulated Finish Systems (EIFS)
These systems involve attaching insulation material directly to an external wall that is then covered with a render or other type of finish such as tiles, metal or brick. There are ventilated and non-ventilated systems, the former having an air gap between the insulation and the exterior covering. The insulation used is very often a foam plastic material (e.g. expanded polystyrene) which is highly combustible when exposed to fire.

Risk and insurance considerations
As many of these method and forms of construction are new there is a level of uncertainty how they will perform over time and the impact that might arise on the frequency and size of loss. Issues which need to be considered in relation to MMC buildings include:

- The use of lightweight and combustible materials may allow a greater degree of fire spread leading to increased claims costs. Similarly the use of combustible materials externally may increase potential for damage from external fires whether deliberate (arson) or accidental.
- Where component parts are fixed together (notably modules and pods), there may well be hidden voids through which smoke and water can permeate throughout the building, leading to even a small incident causing a disproportionately high loss.

- Repairs may be more or less straightforward. For example if a building is constructed of pods and one of these is damaged the pod may not be able to be repaired in situ but may need to be removed and replaced causing disruption to and removal of the surrounding pods and external finishes thus increasing the replacement costs and times.
- There may be increased risks of water damage and storm losses due to the materials used and the effects of wear and tear over time. Also, the ability of many MMC materials to withstand the effects of flooding is unknown in many cases.
• Because many MMC systems are new and innovative, the contractors may have no previous experience of the materials and assembly techniques required. This may actually lead to a poorer quality finish than if more traditional methods had been used.

• There may be problems in obtaining replacement components in future, especially in the event that manufacturers go out of business.

A word on fire engineered buildings

To achieve many of the new building designs a fire safety engineered approach is often adopted. Typically such buildings will incorporate large open areas and/or reduced levels of structural fire protection which may be compensated for by the provision of fire sprinkler systems. Examples include: shopping centers, large office developments, some large public buildings.

Many of these buildings have very little basic structural strength as they rely on the sprinkler protection to control a fire in the early stages, thereby preventing the fire from growing. For this approach to be effective, the fire protection systems and building management regimes have to be maintained to the highest standards.

Any failure on the part of the fire protection system to control the fire is likely to lead to extensive structural and financial loss. Because of the reduced structural fire protection and large compartment sizes associated with many fire safety engineered buildings, effective fire fighting operations can be extremely difficult.

As a consequence there may well be a potential for increased property losses in the event of fire, as more costly fire losses can typically be expected in open plan buildings when compared to properties of similar size but with higher standards of structural fire protection and greater sub-division.

Additional thoughts for Real Estate companies

• In the majority of cases building designers will only look to satisfy local building regulations requirements which will invariably only consider life safety issues. Safeguarding the building as a company asset will seldom be a consideration unless specifically instructed at the pre-planning stage. Whilst tenants may simply be able to relocate following a major loss involving the building, the property owner is very often left to pick up the pieces.

• In some cases there may be benefits derived from using MMC methods. In the event of a fire in a non-complex building, reinstatement may simply be a straightforward matter of clearing the site, delivering the new materials and assembling them to form the new building. If this can all be achieved quickly, then claims costs and loss of rental income may be greatly reduced.

• However, if the building has been constructed using materials which are not readily available and/or using methods which cannot be easily replicated, this is likely to result in disproportionately higher repair costs, or possibly even complete demolition and rebuild. The property owner is likely to suffer significant loss of rental income during this reinstatement period. Loss of the company’s reputation should not be under-estimated also.

• Consideration also needs to be given to the usage and upkeep of the building over the whole duration of its lifespan. Issues to consider include:
  – the resilience and durability of the products used in many MMC buildings is unknown. In the event that regular repair or replacement of building components is required, this could necessitate an increase in service charges which would impact the occupancy costs for tenants;
  – whilst the building may be ‘state of the art’ at the time of its original construction, at some stage in the future the property owner may wish to carry out alterations to keep abreast of tenants’ needs (e.g., build an extension or refurbish the property). An MMC building may only be suitable for its original designed purpose and altering it may not be an option.
  – In the event that durability and resilience are not good, the overall useful lifespan of the property may be less than expected resulting in a reduced net total return on the original investment.
Modern Methods of Construction (MMC) provide the ability to design and build some very exciting and innovative buildings, however, with these new methods come potentially new risks. It would be prudent to engage Zurich and their Risk Engineering team at the design stage in the assessment of risk both during the construction and completion phases. This will help reduce the total cost of risk and help eliminate the potential requirement for additional fire protection or loss control measures to be installed retrospectively in the completed building. It is invariably more costly to undertake these in a completed structure than to incorporate during the design and construction phase.

As the leading Global Real Estate insurer Zurich has a deep understanding of the Real Estate business and a market leading Risk Engineering team that can help real estate companies identify and manage risk.

If you have any questions regarding this document or would like to know more about how Zurich Risk Engineering can help you identify and manage risk in your business please send them to: realestaterisk@zurich.com