MAXI SPACE

A deeper look into the modular construction industry

Here's what you need to know

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> **The modular construction market is projected to grow from $75.89 billion in 2021 to $114.78 billion in 2028** [1]

INTRODUCTION

The market for modular construction has seen continued world-wide growth in the last decade and the rate of growth is likely to increase significantly in the future, particularly for the UK, China, and the United States. The increasing popularity of modular construction stems largely from the environmental and financial benefits derived from the system, as well as the flexibility and adaptability that it provides. The construction industry is now recognising how modular construction can have a meaningful place alongside traditional methods and that now is the time for the traditional construction industry to adapt and become more productive through its use.

In the UK modular construction is providing a solution to many issues the country is facing. For the housing crisis it has helped provide affordable housing options. It is also expected that modular construction will play a big part in reducing the Uk's carbon emissions to net zero by the year 2050.[2]

This paper has been created as an introduction to this rapidly growing industry. There is a brief look at the history of modular construction, followed by a look at the many benefits it can offer. The process and life cycle of a modular building is then examined. An overview of how the different sectors that are starting to adapt to modular construction is then given. This looks at how each sector could benefit from the modular system. Finally, the paper weighs up some of the current shortcomings of modular construction, thereby suggesting why it may not be the right option for all situations.

[1] [CITATION For21 \l 2057][2] [CITATION Dep \l 2057]

WHAT IS MODULAR CONSTRUCTION?

Before diving into an examination of the modular construction industry it is important to understand some key terms. What exactly is modular and prefabricated construction?

Prefabricated Construction

Prefabricated construction would be any building that uses prefabricated materials in its process. Prefabricated materials being materials that were made in a factory or factory-like settings. This could be the whole building, single areas such as bathrooms and kitchens or it could just be a few parts such as wall panels, roofing fixtures, staircases/elevators, etc.

Modular Construction

Modular construction is the process of creating buildings and structures made from prefabricated materials. Modular units are constructed in factory or factory-like conditions. Each unit will be specifically designed and planned to link to another to create a full structure using a floor plan. They are then transported to their destination on the back of lorries using cranes. Once arriving on site, the units are lifted into place and linked together to create complete buildings.

The materials used do not define modular construction. The units can be constructed out of steel or timber. They can be pre-fitted with electric, heating, and plumbing facilities. As well as internal furnishing, doors, and windows. It all depends on the wants and needs of each construction.

Prefabricated VS Modular

Both modular and prefabricated construction are pretty similar and fall under the same family. So, what is the difference between the two you may ask? It boils down to modular buildings being exclusively made out of prefabricated materials then being moved to site. This meaning they fall under the prefabricated category. However, is not the only type of construction under the prefabricated umbrella. Prefabricated buildings can be full units, or it could be any buildings that uses some prefabricated materials.

Volumetric Construction

The term volumetric modular construction is often used. This refers to a specific type of modular unit. This is when the unit is fully enclosed with all six sides: top, bottom, front, back, left, and right. Whereas some modular buildings may have open sided walls in order to be linked to other units, creating bigger room sizes. Volumetric modular units can also include doors in order to connect them to each other. The benefits of volumetric modular construction are that it has some financial and time savings factors. Due to them all being uniform therefore more efficiently constructed which in turn leads to less work when on site.

A BRIEF HISTORY INTO MODULAR CONSTRUCTION

Despite its recent growth in popularity modular construction is not a new method of construction as its origins can be traced back to the 1600's and possibly even further. Of course the modular aspects were not constructed the in same way, or looked anything like the units seen today. However, it seems the idea of designing and constructing a building in one place, for it to be installed in another has been around for a while.

Housing

Housing was probably the first need for modular construction. It is reported that houses were constructed, then shipped to America in the 1600s in order to utilise British construction. One of the first recorded instances of modular housing becoming popular was in the 1800's. London-based carpenter Henry Manning designed and constructed a home that could be transported in pieces for his son who was emigrating to Australia in 1837. The design was then sold on for other emigrants to use.[3] A much nicer alternative to tents.

Modular homes where also becoming popular in America, especially with the California gold rush, which saw an influx of around 300,000 people travelling west from 1849.[4] Houses were needed and needed fast. Components were built in factories in New York and taken across to California to be constructed. Due to the nature of the work the prospectors would also pack up and move quite often and these modular houses were ideal for that purpose.

[3] [CITATION Gil72 \l 2057] [4] [CITATION Kha \l 2057]

Construction

Modular construction has always been as versatile as it is today, it is not just used for housing. In 1851 London's Exhibition building the ‘Crystal Palace’ was built and is considered a modular building. Only taking a few months to construct. It was eventually dismantled, moved to a different location, and reconstructed, something which wouldn't have been possible if not for its modular nature.

The first use of a transportable modular hospital came in 1855 during the Crimean War. Prefabricated modular hospitals, which allowed for sanitation, ventilation, and flushing toilets were used at this time. These were designed and created by Isambard Kingdom Brunel and built in just five months.[5] This was in response to Florence Nightingale’s letter to The Times in 1854 explaining the awful conditions they were dealing with.

They once again became handy during a war, with the UK creating "Nissen Huts" and “Bellman Hangars”.[6] This time being utilised for mass accommodation of the soldiers which could be erected domestically and internationally during both of the World Wars. They were easy to install and take apart, making them perfect for travelling.

The demand for modular construction has grown in response to the ever-growing population. This has led to continual innovation within the modular construction industry to ensure that new challenges are met and that the units meet the requirements that modern living demand. Whether it is in housing, hospitals, schools, or other sectors, modular construction can be made to fit the bill.

Modular construction has come a long way, with whole skyscrapers now being constructed from modular units. Ten Degrees by Tide Construction in Croydon, standing at 44 storeys and 135M, (currently the tallest modular building in Europe), is a prime example of what can now be achieved. It is clear that modular construction has a significant part to play in the future and it will be interesting to see how it evolves and what further innovation may occur.

For it to have been around for so long it is clear that modular construction brings many benefits such as its transportable nature and its versatility.

[5] [CITATION CPS04 \l 2057] [6] [CITATION Jam17 \l 2057]

BENEFITS OF MODULAR CONSTRUCTION

Modular construction brings with it many benefits and advantages. This is why we are seeing such a rise in popularity and demand. Many industries and companies are starting to realise the many opportunities that modular construction can bring. Each of these benefits sees modular construction having the upper hand compared to traditional construction methods.

The key benefits looked at going forward are:

Health and safety – The construction industry is a dangerous one despite the many rules, regulations and guidelines that are put in place. Modular construction can help reduce a number of the potential hazards that might arise during conventional building methods, for example: working at height.

Environmental – Everyone is currently focussed on how best to save our planet. Modular construction is greener and more sustainable than traditional methods of build. This is due to several factors, including: causing less waste, using eco-friendly material and the fact that they can be recycled when no longer required.

Versatility – The range of different buildings and structures available is extensive. Modular construction lends itself to flexibility being able to adapt to many different requirements. Being designed and moulded for each client depending on their needs.

Time – The time it takes to create a modular building is considerably less than that of a regular build. This is a huge advantage for projects which need to be completed as soon as possible.

Cost – Huge financial savings can be made with modular construction. They can be extremely cost effective in a number of ways. This includes the materials; less time being worked on and labour costs.
This is not however to ignore the drawbacks and limitations of modular construction. There are ways in which they would come as a disadvantage and a traditional build may be more suitable. This will also be looked at.

HEALTH AND SAFETY

The construction industry is one of the most dangerous industries to work in within the UK. In 2020/2021 construction had the most fatal injuries, (39) more than any other industry.[7] The industry faces a high risk of accidents and injuries. That is why there is a constant effort made to improve on health and safety standards. Including appropriate training and equipment.

Modular construction can be seen to have some advantages concerning health and safety. With the construction phase all taking place in a quality-controlled environment many risks and hazards can be more easily avoided. Working practises can be closely monitored and policed, making sure rules and regulations are being followed.

Human Error

When working with modular, workers are following precise guidelines on how to manufacture each unit. There is less opportunity for them to then make any mistakes which could in turn lead to an accident.

Limited time on site.

The only time workers will need to be on site is during the installation process. This gives less opportunity for an accident to present itself. The factory setting offers lower risks than the on-site counter- part.

Working from height

The most common fatal accidents in the UK are falls from height (35).[8] The majority of work on modular construction is done at a ground level with the units being lifted by cranes. This mostly eliminating one of the deadliest accident areas. Of course, some work at height is still carried out. Such as to bolt the units together during the installation. This is a lot less than traditional construction, however.

Waste reduction

Modular units are built with particular and precise materials. This and their standardised factory conditions causes there to be less waste. Less waste leads to it being less likely any accidents will occur from slip or trips.

There is also a reduction in energy waste. As modular construction uses less energy and takes less time than a traditional build. This will have advantageous effects on the environment, which can be seen as a health and safety factor.

[7] [CITATION HSE21 \l 2057] [8] [CITATION HSE21 \l 2057]

ENVIRONMENTALLY FRIENDLY

There probably isn't a business on the planet right now that isn't thinking about how they can become greener and reduced their carbon footprint. Our ever-growing eco conscious society demands that everybody should do their bit to save the planet.

Modular construction is being looked at as a key-way for the construction industry to become greener going forward. It can provide many benefits to the environment which a traditional build is unable to deliver.

Travel

As the units are all manufactured on one site there is less travelling to and from locations, thereby cutting down on vehicle emissions. Traditional builds will involve multiple trips to and from sites bringing materials and equipment. This will often be occurring over a long time period, meaning more trips.

It should be noted however, that the transport of modular units is still a big a carbon producer. It is a key area that the modular construction industry should look into when trying to improve its carbon footprint. For [9] example switching to electric vehicles could help.

Material

The majority of modular construction is made with steel. Steel is a 100% recyclable material.[10]They are well insulated with (depending on each case due to the customisation options and the suppliers) double glazed windows and other energy efficient options.

Less waste

'Construction, demolition and excavation (CD&E; including dredging) generated around three fifths (62%) of total UK waste in 2018' [11]

One of the construction industries biggest issues environmentally is the amount of waste it produces. Modular construction, on the other hand, produces relatively little waste. This is due to the fact that the process of construction takes place in a controlled setting. Each unit is standardised meaning the same parts will be used on all, eliminating potential waste. Much of the waste created by modular construction can then also be recycled such as any off cuts.

Reusability

Once a customer is finished with their modular building it will not be the end of its life. They are able to be reused, repurposed, and recycled without going to waste. No matter the age of the building whether it is 2 or 20 years old. They are easily transported to a new destination. This meaning the new owner will not need to have a brand new one commissioned, in turn helping out the environment.

[9] [CITATION Leo10 \l 2057] [10] [CITATION Rec \l 2057] [11] [CITATION Dep21 \l 2057]

VERSATILITY

A key reason for the rise in popularity and demand of modular construction is its versatility. Modular units are capable of being transformed into many different buildings and structures so as to exactly meet the requirements of the user.

Transportability

A huge advantage of modular units is their ability to be transported on the back of a lorry. They can therefore be transported nationwide. This means (as long as planning permission is granted) modular constructions can be erected anywhere, even at hard-to-reach locations.

Customisable

Although often constructed as uniformed controlled units, it does not mean every modular construction will be the same. In fact, they offer a huge degree of customisation that is available to the buyer to choose from in the design stage. The base units are a blank canvas, to be turned into whatever the customer wants/needs. A range of internal and external finishes can be used to transform the units into unrecognisable unique buildings. Using different shapes, styles, colours and designs helps to provide unique and bespoke outcomes.

Internal

Internally, modular builds can include any feature you would expect to find in a traditional house/building. Whole rooms, bathrooms, kitchens, bedrooms, offices, canteens and much more can be provided as part of the build specification. The buildings can be open-planned, separated into multiple rooms and floors, and include internal staircases. Electrics, plumbing, gas, heating, air conditioning and running water can also be fitted as required.

External

Externally, modular constructions are extremely versatile. They have the capability of seamlessly blending into their surrounding environment. Likewise, the builds can be made to stand out from their environment through unique designs. Different materials, colours and finishes can be added to transform the look of the units in whatever way is desired.

Uses

Proof of the versatility of modular construction can be seen in how many different industries now use it to meet their varied range of purposes (more details of this on page 15). Modular units are capable to being transformed into hotels, schools, hospitals, show rooms and much more. Furthermore, they can be repurposed when they are no longer needed for their intended use.

For example, a business may initially need a temporary office. However, when they no longer require the office they have the option to repurpose it into say a canteen or break room or, alternatively, sell it on to a third party.

Expansion

Due to the way modular construction functions, the customer can expand their building space at any time. More units can simply be attached to create more space, capable of growing outwards and upwards. Alternatively, the buildings can also be reduced in size if needed.

TIMING AND COST

> **“Recent research published by the Department for Business, Innovation and Skills (BIS) suggests that three out of five construction projects are completed late.”** [12]

The construction industry often struggles with project delays. This can be due to a wide variety of variables. Any solutions to reducing the number of delayed projects would clearly be welcome.

It is said that manufacturing modular units off-site, in factory-like settings, can save up to 50% of construction time over that required for conventional buildings. Due to the nature of modular constructions being m[13]This is an obvious benefit in many ways to both the supply company and the customers.

Time is saved at all stages of production, from the design, construction, through to installation. The design stage is faster because, although extremely customised, the designs are all still based around the same templates. It’s just deciding on variables such as the size, external and internal features as well the style and colours.

Construction is quicker, essentially due to the units being made on an assembly line in a factory, using simple prefabricated components. The production of the units can also be started immediately - planning permission does not have to be granted before production can begin. The only issue with working like this is that the buildings could be constructed and then planning permission Is denied. Weather conditions such as rain or snow will also not affect construction as might happen with traditional builds.

The on-site install is extremely fast as all that is needed is for the units to be crane lifted into place and then secured together. As it is all planned out beforehand the installation should run smoothly and efficiently with no delays.

Under controlled conditions, and with the schedule of the project closely managed there is generally less chance of over-running.

[12] [CITATION UKC21 \l 2057] [13] [CITATION Nic19 \l 2057]

Supplier

The supplier benefits from the reduced construction times as it means they will be able to take on more projects, thereby potentially earning more profit. The shorter production time will also be very attractive to help meet the needs of customers who require new buildings with minimal delay.

Customer

A lot of customers considering modular construction will be impressed by the faster process. It will attract many buyers if they know their project needs can be fulfilled in the shortest possible time.. The short installation time will also be seen as a huge benefit if it means the disruption to everyday life can be mitigated through the use of modular construction.

If we look at a school for example. A school requiring extra classrooms to create more space for students would not want to endure disruptive building work if it could be avoided. By choosing modular, all the noise and disruption arising from conventional construction would be avoided. The relatively quiet installation of the modules, taking place over a short period, is the only disruption the school would experience, and it is likely this would have no impact on the operation of the school if this work were to be completed during a school holiday.

Temporary

Modular construction is also perfect for temporary solutions. Suppliers can have pre-made structures ready and waiting if there is ever a need for them in an emergency. For example, during the Covid-19 pandemic many businesses found they needed extra space in order to address the covid impact, especially the need for social distancing. Whether the need was for extra offices, bathrooms, or canteens, modular constructions was found to provide the answer.

FINANCIAL SAVINGS

Saving time on projects invariably results in a financial saving. However, there are other factors arising from the use of modular construction that can lead to financial benefits. Overall, financial savings of up to 20% can be made. [14]**The extent of the financial benefits does of course depend on various factors, such as the materials used, the design and location. Businesses in every sector are always looking to cut costs, this in no different in construction. Modular construction can create cost saving measures in a number of ways. Furthermore, such savings will benefit both the suppliers and customers.**

This biggest cost saving is derived from the fact that the units are manufactured in a purpose-built factories. This saves money in a number of areas. Firstly, less waste is created, meaning money will not be lost on unused materials. Standardised units, all using the same parts, results in an efficient use of materials. However, some materials used in certain forms of modular production can be more expensive than similar parts used in traditional build so, in these circumstances, the overall financial saving would be reduced accordingly.

Secondly, labour costs are also reduced. The work in itself is less labour intensive than traditional builds leading to a smaller workforce being required. The secure factory environment also reduces the risk of theft or vandalism of materials and equipment, which can be a significant issue on exposed building sites. Furthermore, working within a safe and sheltered factory environment means that manufacturing and assembly processes will not be affected by adverse weather, and workers may be less inclined to suffer from the illnesses that adverse weather can create.

Finally, the biggest savings of all come from the benefit of being able to create a uniform design of units so that they can be repeated over and over again. This is particularly beneficial for large scale projects such as hotels or student accommodation. Although a more customisable specific design, such as an office block that needs to blend in with its environment, may not achieve the same level of saving, modular construction is still likely to be considerably cheaper than conventional construction.

Suppliers

The financial savings can be beneficial to suppliers as they can use these savings to reinvest into the company. They can also then price their projects at a lower price to a traditional build. Attracting more customers and remaining competitive.

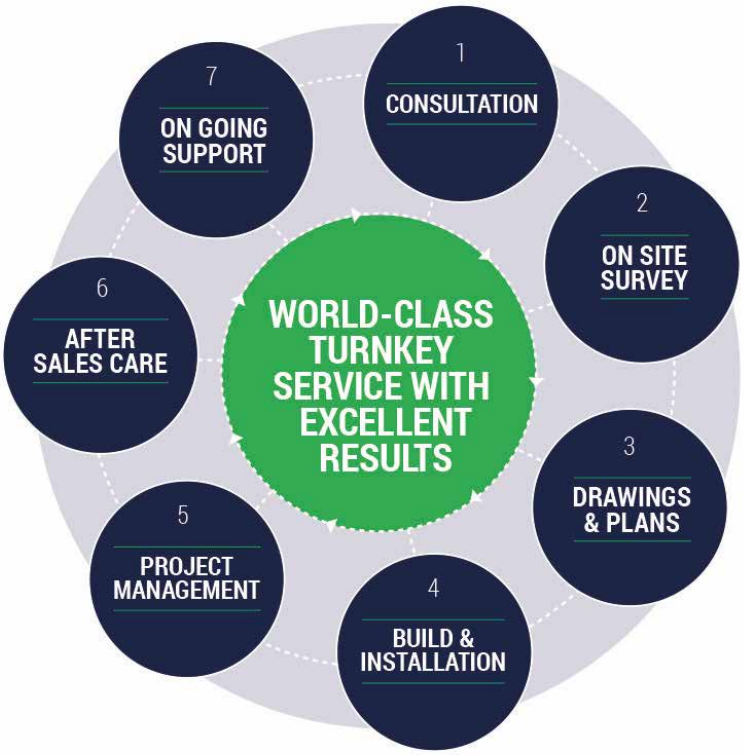
Customers

The financial savings for customers should mean a cheaper project. This is a big attraction and could be the ultimate deciding factor on whether to choose modular or a traditional build. This is particularly the case with the NHS. They have been using modular for extra wards, staff accommodation, testing stations and more. Tight budget constraints make going modular the easy solution.

[14] [CITATION Nic19 \l 2057]

LIFE CYCLE OF MODULAR CONSTRUCTION

The process from concept to completion for a modular construction is a relatively simple one. All projects will follow a fairly similar path on their way to completion. Following through the design, construction to the installation.



CONSULTATION & ON-SITE SURVEY

The customer will come to the supplier and set out their requirements and desires for the project. The suppliers will carry out an on-site survey to make sure all their plans are achievable for the location.

DRAWINGS & PLANS

Once the suppliers know what the customer is looking for, they can get to work on designing the project with them. Creating detailed plans of the project, including the schedule and all design details such as size, shape, and styles.

CONSTRUCTION

In the factory construction will then begin on creating each of the individual modular units following the plan closely. Once each unit is made it will be stored, ready to be transferred to site.

INSTALLATION

When all complete, the individual units will all be transported to the projects location ready for the install. When they have arrived, they will be craned off of the lorries into position and secured together. Internal trimmings such as furniture can then be put in, making it ready for use.

REPURPOSED

Whether it is in 5 or 50 years the customer may eventually no longer require their modular construction. This does not however mean it is the end of its life. Due to their transportability, they can be sold on. Repurposed and ready to be reused by someone else.

INDUSTRIES

There is a vast array of industries that utilise modular construction to solve their building problems. Modular solutions have been used to expand, relocate, and introduce businesses from multiple sectors due to their versatility. With modular construction industries are able to gain both temporary and permanent spaces that are tailored to their exact requirements, whilst working within their budgetary constraints. The time and financial savings are a big draw to many sectors.

Education

The education industry benefits from modular construction across the board from nurseries, primary and secondary schools to universities. The industry is ever-growing and expanding yet budgetary constraints may not always allow them to do this easily. That is a big reason why the industry utilises modular construction. The speed of builds is also a big factor due to the lack of disruption caused to students and their education. Modular constructions flexibility means clients are able to fit extra buildings into their pre-existing sites.

Healthcare

Having tight budgets at a time when they need to expand also affects the healthcare sector, which is why this sector has also embraced modular construction as a cost-effective way of addressing many of its needs. Speed of installations is a major benefit as, again, it avoids disturbance, especially to workers and patients. Flexibility and speed helps in times of emergencies when space is needed urgently. The covid-19 pandemic is perhaps the best example of where modular units played a significant part in the logistics of addressing a healthcare emergency.

Construction

The nature of the construction industry lends itself to temporary building solutions. Construction projects often need temporary buildings to facilitate their operations. Modular buildings such as offices, canteens, drying/rooms, ideally suit the needs of this sector. They are particularly useful when it comes to remote/hard to reach locations. On completion of the project they can simply be returned to the supplier.

Retail

The retail industry has utilised modular construction to facilitate the exhibition and sale of products. For example, the concept of ‘container villages’ such as Buck Street Market which has recently opened in Camden is on the increase.[15] This is again due to their cost-effective nature along with their ability to have unique designs.

Events

Modular construction’s ability to be a temporary solution lends itself to the event industry. The buildings can even be moved from location to location to be used for multiple events.

Leisure

The leisure industry is also able to take advantage of modular construction’s lower costs. For example, an amateur sports club with a small budget would now be able to create spaces for their athletes and spectators and do so within their limited financial resources. Something which they may not have been able to afford before the availability of a suitable modular solution.

[15] [CITATION Sec20 \l 2057]

CASE STUDY

HOW MODULAR BUILDINGS HELPED THE NHS DURING THE COVID-19 PANDEMIC.

> **The initiative provides an organisational framework which can be shared and used across NHS organisations to identify, procure and deliver modular healthcare facilities that match the evolving treatment requirements to combat the virus** [16]

During the pandemic the NHS took up contracts with many modular construction companies. This was done to ensure they could provide the necessary infrastructure quickly and effectively, thereby, easing the severe strain the NHS was experiencing because of the pandemic, and allowing their staff to concentrate on treating the ever-increasing number of patients and to combate the virus.

Due to the increased admittance of patients the NHS became overstretched and were running out of beds. Due to this we saw the opening of a series of emergency temporary hospitals titled NHS Nightingale Hospitals. Interestingly, not the first time we have seen Florence Nightingale associated with modular buildings.

Although most of these utilised pre-existing buildings and spaces such as convention centres (ExCel London, Manchester Central Convention Complex) or university campuses (University of the West of England). They also used modular buildings to help facilitate the increased demand for space. For example. The Nightingale Hospital Exeter Installed five single-storey modular buildings an extra 116 beds in just four weeks[17] (a similar sized project could take up to four months if it were not modular). Pre-existing hospitals were also using modular buildings to help increase their capacities. Such as the Royal Surrey County Hospital ordering a 20-bed isolation ward. [18]

There was an ever-growing demand for testing stations to help the Government track the spread and to collect data. Along with allowing public to know if they were infected and needed to isolate. Modular buildings were ideal for many of these. With them capable of being equipped with separate entrances and exits, collection and drop off zones, PPE rooms, staff rooms and toilets. [19]

In order to adhere to social distancing more accommodation was needed to keep NHS staff a safe distance apart. NHS Jersey for example used modular construction to achieve this. Ordering units that included one-way systems, canteens, washrooms and plenty of space, all installed in two days. [20]

[16] [CITATION NHS20 \l 2057] [17] [CITATION PBC20 \l 2057] [18] [CITATION PBC201 \l 2057] [19] [CITATION PBC202 \l 2057] [20] [CITATION Ian20 \l 2057]

MOST COMMON USES FOR MODULAR CONSTRUCTION

With modular construction almost any type of building/structure can be made. It is all dependent on what the customer requires. Of all of the different applications of modular construction used across the various industries there are a few that seem most popular:

Offices

Renting or buying office space is often one of the biggest expenditures of a business, therefore any opportunity to reduce this cost would be a welcome. Modular offices offer a cost effective option with the added benefit that they can be customised to meet the specific needs of the business. Offices can be open-plan or have internal walls – these are easily fitted if separates offices/rooms are required.

Accommodation

Accommodation is important for many industries whether it is for staff, visitors, students, or patients. People need a bed for the night no matter how temporary that may be. Due to the customisation this could take many forms. It could include single units with a simple bed, desk, and bathroom for a university student for example. A full multi-storey house for a family to live in is also possible.

Bathroom/shower blocks

No matter what sector or industry you are in toilets are always needed. Modular toilet blocks give customers the ability to have fully functioning bathrooms for whoever may need them. This being a big step up and more of a luxury option than a traditional portable toilet. Shower blocks are also commonly used to give users the ability to wash and stay clean.

Storage

Modular units are often used as a solution for creating extra storage space at low cost. This could be used for excess stock, equipment, or anything else that may need to be stored away.

NEGATIVES

Whilst there are many sound reasons why modular construction is becoming so popular, including the many advantages it has over traditional buildings, (as outlined in this report), in closing it is only right to mention a few aspects of the methodology that may mean it is not always the most appropriate solution.

Transportation

The need to transport completed units to site raises some environmental and cost issues. The transportation costs are relatively high, and the more units that require transportation and the distances involved have to be considered when comparing the modular methodology with traditional build methods. Depending on the overall scale of the project there is potential for some of the cost savings derived from the build process being negated by the cost of transportation. As mentioned previously, the transportation aspect of the project will also have the potential to produce relatively high levels of carbon emissions.

Transportation could also be costly time-wise. A huge appeal of modular construction is the short install time. Time could be lost due to relying on factors such as traffic and waiting for the lorries to make multiple journeys back and forth to deliver the units. This could cause delays to the install time and could potentially be costly if the install is not completed to schedule.

Size

Transportation also affects the sizing of units. Each individual modular unit is restricted in its size due to the fact that it has to fit on the back of a lorry to be transported. Of course, modules are joined together to created bigger spaces with no walls in-between. The transport limitations do however have a direct impact on the ability to create completely open-plan room configurations.

Location

It is not only the modular construction itself that needs to be considered. The ground it will be installed on plays a huge part in the process too. This can often bring its own set of issues. Groundworks may have to be laid in order to support the units. This would be an additional cost as well as causing some disruption on-site. There is the potential that the project could be delayed if these advance groundworks (including services) are not planned and co-ordinated within the overall project time-line. Similarly, if the site requires new services, such as sewers etc. these would need advanced planning and careful coordination.

Modular construction also requires planning permission. Just because a project may be temporary or on land already owned it is not exempt from this and will still need permission.[21] builds just the labour and materials would be needed, with the ability to hire plant as and when required. There are a lot more factors to consider with modular, however. Firstly there is the infrastructure needed to produce the buildings. Then the need to recruit the specialised labour that has the necessary training and skills in this type of construction. Overtime of course this will even itself out with the cost saving factors made elsewhere.

[21] [CITATION Cro \l 2057]

Fire safety

There has recently been concerns over the fire safety of these modular constructions despite the adherence to fire safety rules and regulation in all their components. It has been suggested more research is needed into these particular risks.[22]

It has become a topic of conversation due to two recent incidents which both took place in the Shetland Islands. The Fair Island Bird Observatory in 2019 and the Moorfield Hotel in 2020 both caught fire and were destroyed.[23] Both of these were considered modular buildings. Luckily nobody was injured in either event.

The industry needs to carry out further investigation into the cause of these fires. Understanding the cause and putting appropriate mitigation measures in place so as to prevent an incident of this type in the future is a priority. The future of the industry could depend on this. Another incident in the future that ends in tragedy could severely damage the reputation of the modular industry.

Bad reputation

Modular buildings have somewhat of a poor reputation, as they are often seen as temporary and weak when compared with their traditional counterparts. Although this reputation is unfounded due to the fact that they are built to the same safety regulations, and modular construction has come a very long way in recent years, with newer technology constantly improving, the public perception has not caught up with the reality of the situation.

In a YouGov poll for example, 52% of people surveyed said they would not live in a modular home.[24] The results of the survey show that the public perception isn't based on the modern newer modular methods but rather they associate modular construction with storage containers (around 70%). There will be a limit to how far the industry can grow without it having a better reputation. Work must be done on improving this.

Higher Initial Costs

A disadvantage to a supplier of modular construction would be the high initial start-up costs. With traditional builds just the labour and materials would be needed, with the ability to hire plant as and when required. There are a lot more factors to consider with modular, however. Firstly there is the infrastructure needed to produce the buildings. Then the need to recruit the specialised labour that has the necessary training and skills in this type of construction. Overtime of course this will even itself out with the cost saving factors made elsewhere.

Late Design changes

The design stage for modular construction offers a vast amount of flexibility. However, after this stage is complete there is not much opportunity for any changes to take place. Once the design is approved and locked-in there is little opportunity to change even the smallest of details as such changes could affect the whole building and its plans.

[22] [CITATION BBC21 \l 2057] [23][CITATION Jen20 \l 2057] [24] [CITATION Mar18 \l 2057]

IN CONCLUSION

This paper has been prepared in order to provide an introduction to the ever-growing modular construction industry. Whether you are looking to take your first steps into the industry (perhaps considering modular construction for your next project) or just interested in this blossoming industry.

It is clear there are many benefits to be derived from modular construction. The benefits of reduced costs and time-lines, along with the eco friendliness of the methodology are driving the industry forward at a rapid rate. The future looks very positive but will this form of construction achieve longevity and ultimately replace traditional builds as the number 1 form of construction? Will the potential shortcomings mentioned in this report impact on the future of this form of construction, potentially preventing it from becoming a major player to rival traditional methods? Or will the industry find a way to address these shortcomings and forge ahead? Only time will tell.

MAXI SPACE

We here at Maxi Space are modular experts. We are one of the UK's leading suppliers of modular solutions. We have experience in working on a wide range of projects helping our customers in taking advantage of all modular construction has to offer. If you have any further questions regarding the industry or are interested in our products/services be sure to get in contact with us.

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