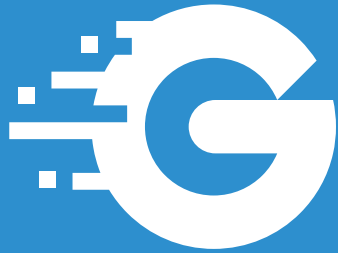




Environmental Benefits of Modular Construction



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The Increasing Benefits of Modular Construction on the Environment

Some have accused modular construction of having a restrained, boring design that can sometimes be difficult to finance, but the benefits are too important to disregard. Especially when you consider the effects that construction has on the environment as global warming continues to increase. The UK construction industry uses over 400 million tons of natural resources every year. However while modular construction is much better for the environment it accounts for just 5% of housing in the UK.



In the past, the term “modular building” may have evoked flat-packed homes or cold-war era architecture, but it’s time to rethink this view. As our population grows, we must consider construction approaches that take less time, use fewer materials and leave a lighter environmental footprint



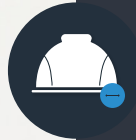
(Tony Arnel, global director of sustainability, Norman Disney and Young, Australia).

Modular construction makes use of recycling materials, but the process is far easier in a controlled factory setting. Additionally, the shorter amount of time taken to put a building together requires less workers and energy to finish the project.

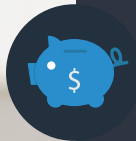
Benefits of Modular Construction



Less Time: Construction takes less time largely because of the combined preparation of the site, while the main sections of the building are put together in a factory.



Fewer Workers Required: In a controlled environment you can hire fewer workers for a job because more work is done through permanent, dependable machinery. This is especially important with the growing skills shortage.



Reduction in Costs: Since construction takes less time and requires fewer workers are required, costs will fall if modular construction is the chosen method.



Recyclable/reusable Material: While approximately 8000 pounds of waste is produced when a single 2000-foot square house of traditional construction is pulled down, this falls to 2170 pounds if a modular structure of this size is taken apart. Aluminum and expanded polystyrene (EPS) are some of the popular recyclable materials that are common in modular construction.



Clean Installation: Building sections in a factory with only the minimum amount of construction being done on-site will reduce the levels of dust and other contaminants released into the atmosphere.



Accident and Injury Rate: As one of the most dangerous industries to work in, construction sites can become extremely congested with workers and heavy machinery operating all day long. When most of the building takes place off-site, this provides other workers with more space and less chance of being caught between or struck by any moving objects.

Most of these benefits have have a positive effect on the natural environment, which is becoming an ever more important issue. There are some disturbing figures which confirm the importance of going green.

Why Building Green?

As the demand for sustainability seeps into every major global industry, innovations like modular construction could be the future for the industry. From bathroom pods to entire homes, the uses for prefabrication techniques extend across the entire building spectrum.

There are a lot of different problems and solutions that need to be considered to improve these alarming figures before a building can be rated as green. Leadership in Energy and Environmental Design (LEED) is the most recognized international system of rating green buildings.

2016:

Research provided by construction blog Bimhow found that construction accounts for 23% of air pollution, 50% of climate change, 40% of drinking water pollution and 50% of landfill waste.

2017:

The Environmental Protection Agency (EPA) showed that the US construction industry is responsible for 25% of the non-industrial waste produced each year.

By 2050:

Almost 70% of the world's population are estimated to be living in cities. Today, the figure stands at 55%, but cities still account for 70% of greenhouse gases emitted. While cities take up only 2% of the land on earth they account for 70% of greenhouse gases emitted.

LEED System of Rating

The LEED green building rating system can be applied to any structure and focuses on the relationship between the planning, design and construction of a building, with the effects this can have on the community and natural environment. Whether they are newly constructed or under restoration, different rating systems can be applied to single family homes or the extension of public buildings such as schools and hospitals.

Provided with awards for high performance, a high rating system can supply companies with a recognized level of performance that is shown to:

- Reduce the level of waste sent to landfills
- Conserve water and reduce water contamination
- Conserve energy
- Reduce greenhouse gas emissions
- Conserve natural resources

Buildings are given a LEED rating level that can be certified, silver, gold, or platinum, which is the highest. These benefits make the rise of modular construction important, as the fall in time spent and waste produced are likely to result in a higher rating level.

A leed plaque is an international sign that concentrates on five key points, providing a score for each:



Case Study: How SoMa Studios, San Francisco Became a Platinum-Certified LEED Building

In 2012, SoMa Studios in San Francisco was classed as the first modular-built urban infill apartment complex built in the Left-Coast nation of the US. Awarded a LEED platinum rating, it only took three months to construct in a factory in Sacramento and all four stories were put up within four days onsite. Traditional construction is estimated to have taken 13 months. Timelines are harder to predict on-site where problems such as flooding, or vandalism are a much more common interruption.

ZETA was the San-Francisco-based company chosen, with the capability of implementing a wide-range of green features.

Co-founder and vice president of marketing for ZETA, Shilpa Sankaran makes the point that buildings constructed in a controlled environment are more likely to be well sealed, with SoMa studios reaching impressive levels of sound proofing. This can also result in superior air quality. Just some of the other green features include: solar powered hot water heating, natural light and a water reuse system catching rainwater and condensation

from the cooling system of the building.

A reduction in time spent, waste material and noise pollution, along with a more dependable schedule, are some of the environmental benefits that can be observed.

Co-founder and vice president of marketing for ZETA, Shilpa Sankaran stated:

“Because we buy materials almost exactly to what we need for the project – e.g. pre-cut lumber – we have less waste. Also, we can reuse materials and not put them in a dumpster since we aren’t out on a construction site.”

According to the developer, Panoramic Interest of Berkeley, Ca, modular meant:

“No changes, better quality, shorter construction, better scheduling and more predictable outcome.”



Benefits of Modular Construction on the Environment

Some of the environmental benefits of modular construction include:

Reduction of Waste Material

A study carried out by the UK-based organization Waste and Resources Action Programme has found that modular construction can reduce the amount of waste produced by up to 90%.

When this takes place in a factory setting where the building of most parts occurs through an assembly line, waste materials from one activity could be collected along the way and recycled for another purpose. Less waste is likely to be spilled and the exact amount needed can be determined after a short period of time. More of an effort is being taken to use sustainable materials. Materials used, such as steel and aluminum can be easily recycled.

The uniqueness in the design, site and construction of a traditional building makes it likely that more waste will be produced than identical parts that are created in the same controlled factory setting by the same team of experienced workers. Theft and damage, perhaps from poor weather conditions are other reasons why material is more likely to be lost or useless if it is left on-site.

Over 80% of waste on a traditional construction site is generated through the concreting process and related wet trades, often from surplus or spilled concrete.

Recycling and Reuse

Materials like Forest Stewardship Council (FSC)-approved timber and sustainably sourced steel are more common in modular construction, with a lower level of cement being used. Structural steel manufactured in the US contains approximately 80% recycled material. Buildings constructed from wood or steel can be easily taken apart and recycled for other purposes when the building is no longer in use.

Recycling is an environmentally friendly process, but reuse is proven to be preferable, with fewer resources and energy being used up. While recycled objects are altered and used for a new purpose, reused objects may be used for the same or a different purpose, but they are not modified or broken down for this.

If a building is no longer in use, these parts can then be taken apart and stored, available for reuse. Modular buildings can be permanent or temporary structures. Wood is more practical to use in temporary construction, while concrete and steel are most commonly used if the building is permanent. Some examples of temporary structures include emergency medical facilities, extra classrooms or perhaps construction site offices.

For example, after 90% of the buildings at Campsmount Technology College in Doncaster were destroyed by a fire, this was a major disruption for 800 pupils and teachers, left without facilities to work in. Luckily, the Irish modular and portable building supplier 'Portakabin' was responsible for configuring 179 steel-framed, reusable modules, forming 21 buildings, with facilities including temporary classrooms, canteens, laboratories and toilet blocks.

Although a modular building may have been created off-site as a permanent structure, it can still be a lot easier to remove and relocate some of the large pre-assembled parts. This may be necessary if part of the building has been damaged, or if you want to create a new layout, perhaps for a different purpose. The benefits of permanent structures that can be altered but are also built to remain in use, can be seen in the new homes available after the 2012 Olympic Games.



Case Study: Olympic and Paralympic Games Village, Stratford

For the 2012 Olympic Games, reusable residential units were constructed off-site to accommodate housing for 17,000 athletes in London. Complying with the Code for Sustainable Homes (CfSH) Level 4, a method of rating used on new homes in the UK, these buildings were safely reassembled into new houses.

Some of the interesting features making this process possible include movable partitions that could be relocated to change the shape and size of different spaces. Cladding panels are another feature, separately attached to the external building structure, to form a non-structural and interchangeable surface, usually a full story high.

In the UK, an extra 300,000 homes are estimated to be needed each year to deal with the housing crisis. 2,818 new homes were created after the games as well as the Chobham Academy, a new education campus holding places for 1800 student, aged 3-19. This school building was first used as the main center of team organization and management during the Olympics.



Reduced Onsite Pollution

As the Control of Substances Hazardous to Health (COSHH) is organized and easily managed in an on off-site factory setting, there are no hazardous materials likely to be sent into a modular building environment.

Improved Indoor Air Quality (IAQ) is the result of the increased use of dry materials and a shorter time for gases to be released. Too much contact with wet cement could cause chemical burns and/or dermatitis. With less time spent working on-site the amount of sawdust and other contaminants released during construction will fall. Dusty or polluted air has been known to cause lung disease in workers, such as welders and woodworkers who spend a lot of time around it.



Less Time Required

The much shorter time that it takes to construct these identical buildings significantly lowers the amount of energy used up. When long-term workers become familiar with the machinery used and the people they're working with daily, the construction of different parts passed through an assembly line is likely to become more efficient.

While these parts are being put together in a factory, the site where this building is going to be placed can be prepared for its installation at the same time. This could include levelling out the ground, along with the removal of trees, rocks, or abandoned buildings. If construction occurs on-site then this work will all have to be done, with the site well prepared and safe before

building even begins. Taking place in a controlled environment, unexpected problems, such as flooding or vandalism, often requiring more energy if work has to be postponed, are less likely to occur offsite.

Modular buildings can also be pre-fitted with electrics, plumbing, heating, doors, and windows. These differences can reduce the time usually spent on-site by 50%. One example, a Washington state Elite Care residential care community had an estimate of an entire year to build through traditional construction was given a timeline of just five months. If transport to and from this site is also cut by 50%, this will greatly reduce the amount of pollution released.



Traffic and Machinery

Modular construction can also lead to an up to 90% drop in vehicle movement. The Journal of Industrial Ecology has identified the reduction of transportation energy and carbon emission released by workers just travelling to a factory instead of a job site and supply yard every day, as the greatest environmental benefit of modular construction.

The limited use of machinery in modular construction means fewer materials are required, such as cardboard, shrink wrap or wooden pallets for the transport of large amounts of small supplies, e.g. bricks, food products, hand tools, toxic gases, or liquids.

The transportation and assembly of such large sections is a difficult part of modular construction, but still requires much less time, without the constant transport of large collections of these different materials.

Noise Pollution

Without the loud machinery used to construct buildings on-site and the large number of daily workers in charge of this machinery, the amount of noise produced would be greatly reduced. Complaints could even be made and slow down the speed of on-site construction. Noise pollution is often overlooked but there are some points that make it an important problem to consider.

Patients are likely to recover over a shorter period without loud construction work to obstruct their rest period. Students are also less likely to be distracted in school and businesses won't have any problems talking to colleagues or customers.

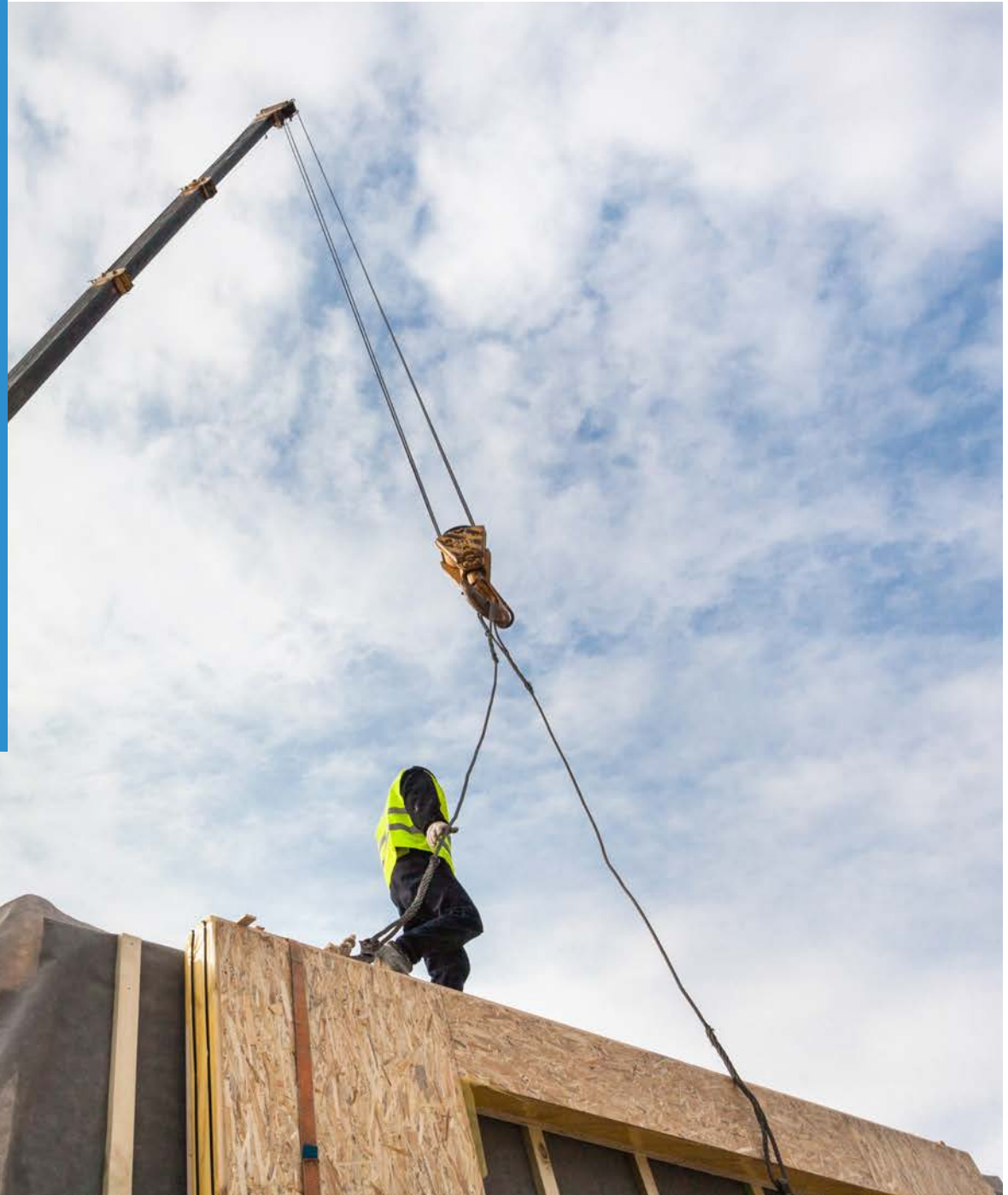
The benefits mentioned result in a large decrease in the energy needed for construction and therefore the effects that it can have on the environment. Comparing modular buildings to an equivalent structure that has been built traditionally, it is found to require 67% less energy.

Conclusion

Benefits such as a fall in costs and safer worker environment are two of the reasons why modular construction is becoming a more popular form of building. The importance of building green is one of the main reasons why its increase should be regarded as essential.

Some benefits already mentioned can be seen in the reduction of waste produced, falling by as much as 90%. Building in a more controlled and sheltered space can also make benefits such as recycling and reuse much easier to incorporate into the daily working routine.

As the year continues, there is predicted to be a growing increase in modular construction units and companies. Between 2017 and 2022 the increase in modular buildings is estimated to rise globally by 6%. Hopefully, this will have a positive effect on the problem of buildings currently accounting for 39% of total energy use, 38% of CO₂ emissions and 12% of water consumption in the US.





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