



THE NEW WAREHOUSE: CONCRETE BENEFITS



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The British Association of Reinforcement (BAR) is the trade association of UK manufacturers and fabricators of steel reinforcement products including cut and bent bar and mesh. BAR aims to add value to the reinforcement industry through market and product development, promotion of good industry and health and safety practices and forwarding the development of the reinforced concrete industry as a whole. All BAR members are audited and approved by recognised industry accredited quality schemes.

Front and back cover image: Seeberger Architecture, tilt-up Class A warehouse, Port of Houston, Texas

INTRODUCTION: THE NEW WAREHOUSE

Warehouses, distribution and logistic centres are a growth sector that is being driven by online retailers, logistic and delivery companies and just-in-time supply chains. Nearly 100 million sq ft in additional warehouse space will be needed by 2024 to keep up with the growth of online retail, new analysis suggests. Growth of online grocery alone could create demand for 7.1 million sq ft of warehouse space in four years, according to a recent survey by Knight Frank.

Meanwhile, the increased use of automation, barcode and RFID/smart tag technology, higher lift trucks and value-added processes is calling for construction solutions that are more sophisticated than the ubiquitous tin shed. The new warehouse has to be more functional, more efficient and more accessible. It needs to meet sustainability and climate resilience expectations. It needs to be able to adapt to future requirements.

Whereas many are examining how to improve warehouse operations through the use of robotics and

technology, those with vision are recognising that the structure and construction of the building can also play an important role in achieving improved warehouse operations.

Heavyweight concrete construction offers a real alternative to run-off-the-mill lightweight constructed warehouses and distribution centres. It is an alternative that provides inherent fire resistance, enhanced thermal efficiency, robust security, flooding resilience and sustainability. In addition, heavyweight concrete is better for meeting the changing demands of the evolving warehouse and logistics sector. These free, built-in, concrete benefits provide a construction solution that is better suited to meet the growing demand for higher-value, automated warehouses.

Today's and future warehouses are more than just storage spaces. They need a construction solution that works with their evolving requirements. Concrete provides just that.



Concrete warehouse, Becosan concrete floor

THE NEW WAREHOUSE: CONCRETE BENEFITS

Heavyweight concrete construction offers a range of benefits that have particular relevance for warehouse and distribution centres. These benefits come without any additional financial or environmental costs.

Fire resistance

According to the latest Home Office Fire and Rescue Incident Statistics, between March 2019 and March 2020 1,973 industrial premises suffered from a significant fire. Warehouses often store highly flammable products and materials making them particularly vulnerable to catastrophic fires.

Concrete construction can offer up to four hours fire resistance, well beyond the 30 minutes as stipulated by Building Regulations. The increased structural stability provided by concrete construction during a fire provides greater time and access for fire fighters and, post-fire, facilitates repair rather than demolition and rebuilding.

Cast concrete or concrete block walls are often used for fire compartmentation within steel-framed buildings. The same criteria should be used for the load-bearing frame and external walls for a more complete and overall fire resistant construction solution.



Steel structures offer limited fire structural integrity

Energy efficiency

Warehouses must be energy efficient. The ever-increasing technology load increases the amount of internal heat generated whilst a refrigerated warehouse for perishable foodstuffs or those requiring a humidity controlled environment needs a construction solution that has a high level of air tightness that minimises potential air leakage which can account for significant heat loss/gain. All modern warehouses should incorporate significant consideration for energy efficiency and alternative energy options into their plans. Not only does the ever-increasing technology load increase the amount of energy required to keep a warehouse running – costs that are then passed onto clients – but many clients are actively looking for operators utilising sustainable energy systems.

Concrete structures provide a high rate of air tightness thanks to a minimum air leakage from interface and joint detailing. In addition, over the life time of the building the stiffer structure provide by concrete will maintain its level of air tightness better than more flexible structures.

In addition to enhanced air-tightness, concrete construction offers unrivalled thermal efficiency. The inherent thermal mass of heavyweight concrete absorbs heat during the day which is then released at night. The combination of this and good ventilation can assist with stabilising and lowering internal temperatures with recourse to air conditioning. In contrast, lightweight steel buildings offer minimum thermal mass and are far more likely to overheat in the summer and require significant air conditioning thus increasing their operational energy costs and environmental impact.

Data compiled by the Met Office, University of East Anglia (UEA) and the UK National Centre for Atmospheric Science found that 2020 was the second hottest year on record and this part of a continuing trend. With higher summer temperatures predicted as a result of climate change, the thermal mass of concrete will increasingly be appreciated and its use optimised.

The recent winter of 2020-2021 included in February the coldest overnight temperature recorded in the UK for 25 years: -23C at Braemar, Scotland. In the same way that concrete's thermal mass can minimise heat gains in the summer it can also be used to minimise sharp drops in temperature during the winter.

Flood resilience

In addition to higher summer temperatures, climate change is also predicted to result in more significant rain events leading to the increased potential for flooding. Between November 2019 and February 2020, severe winter flooding occurred across the UK. The first wave of flooding occurred in November 2019, mainly affecting Yorkshire and the Humber, the East Midlands and the West Midlands. Further isolated flooding incidents were reported in December and January, before the second main wave of flooding, caused by Storms Ciara and Dennis, occurred in February 2020. The excessive rainfall led to the wettest February since records began in 1766.

Concrete construction is inherently flood resilient. It will not rust and is structurally robust against flood damage. Its inherent flood resilience lends itself to being an integral part of flood management construction either where buildings are designed to prevent low level flood water from entering a building or as part of a water entry strategy, where for greater flood depths, measures are incorporated into the building to reduce the impact of flood water on the property once water has entered.

Unlike heavyweight construction, lightweight steel structures may incur structural damage due to excessive differential flood water pressures.

Robustness

Concrete construction is tough and robust. As such it can withstand events such as fire and explosions or impact damage such as from forklift trucks without being structurally disproportionately damaged. This robustness is a further inherent construction benefit. Unlike lightweight steel construction for which structural robustness requires an appropriately designed system of connections between the steel frame's constituents. The robustness of concrete also offers greater security and protection against unlawful entry such as ram-raiding.

Sustainability

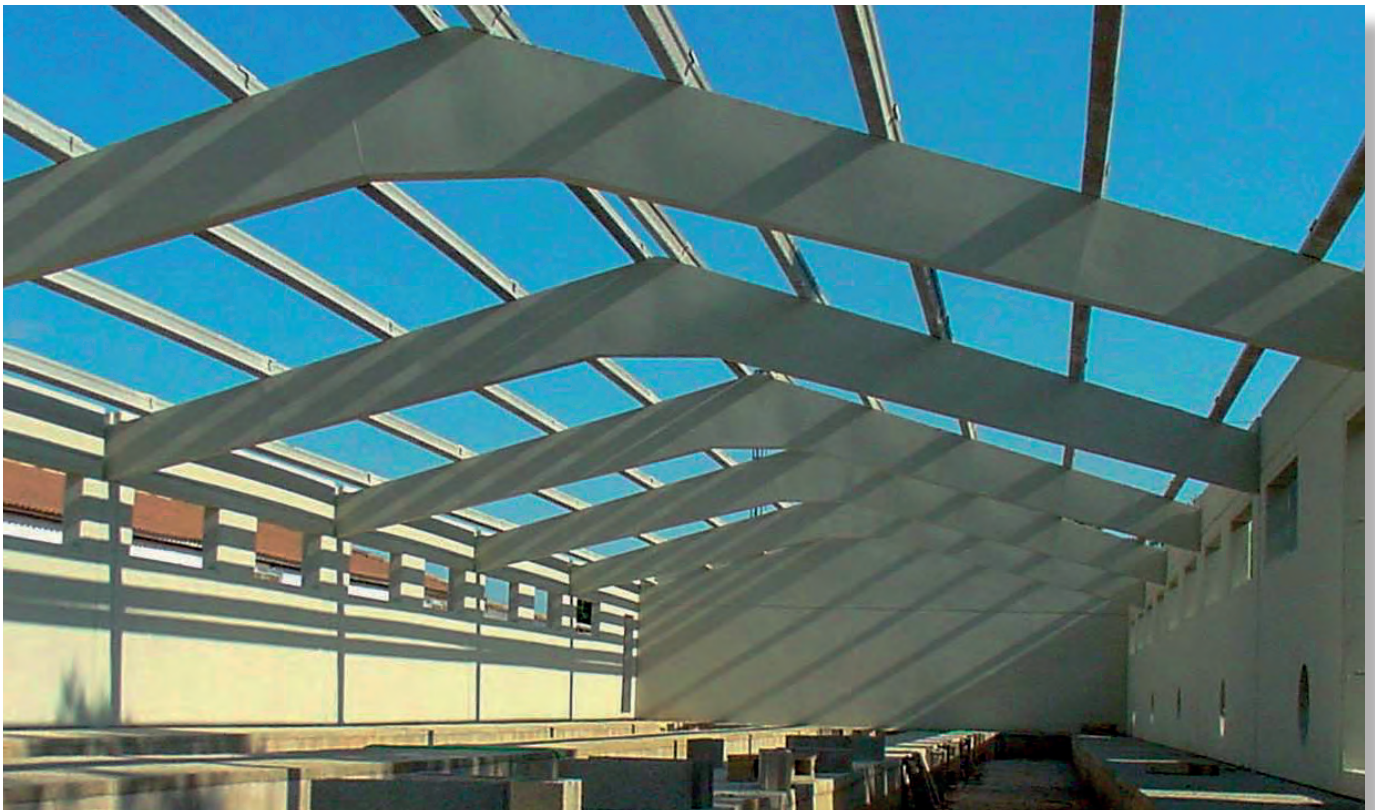
Concrete warehouses are a sustainable construction solution. The high thermal mass of concrete structures reduces air conditioning and heating requirements, and so reduces their operational CO2 energy emissions. The range inherent benefits such as fire resistance reduces the need for additional finishes and therefore their additional CO2 emissions resulting from their manufacture and installation.

Furthermore, concrete is a 'local' construction material as the materials are sourced from the UK. Most aggregates and cement are sourced within 30 miles of a concrete producer and 95% of reinforcing steel made in the UK is made from UK sourced recycled steel. In addition, both UK cement and reinforcement manufacturers have ongoing programmes to reduce the environmental impacts of their manufacturing processes.

CONCRETE SOLUTIONS

Given the wide range of positive concrete construction benefits it is understandable that across the United States, Australia and Europe, concrete is the default option for warehouse construction. What is less understandable is why this is not the case in the UK.

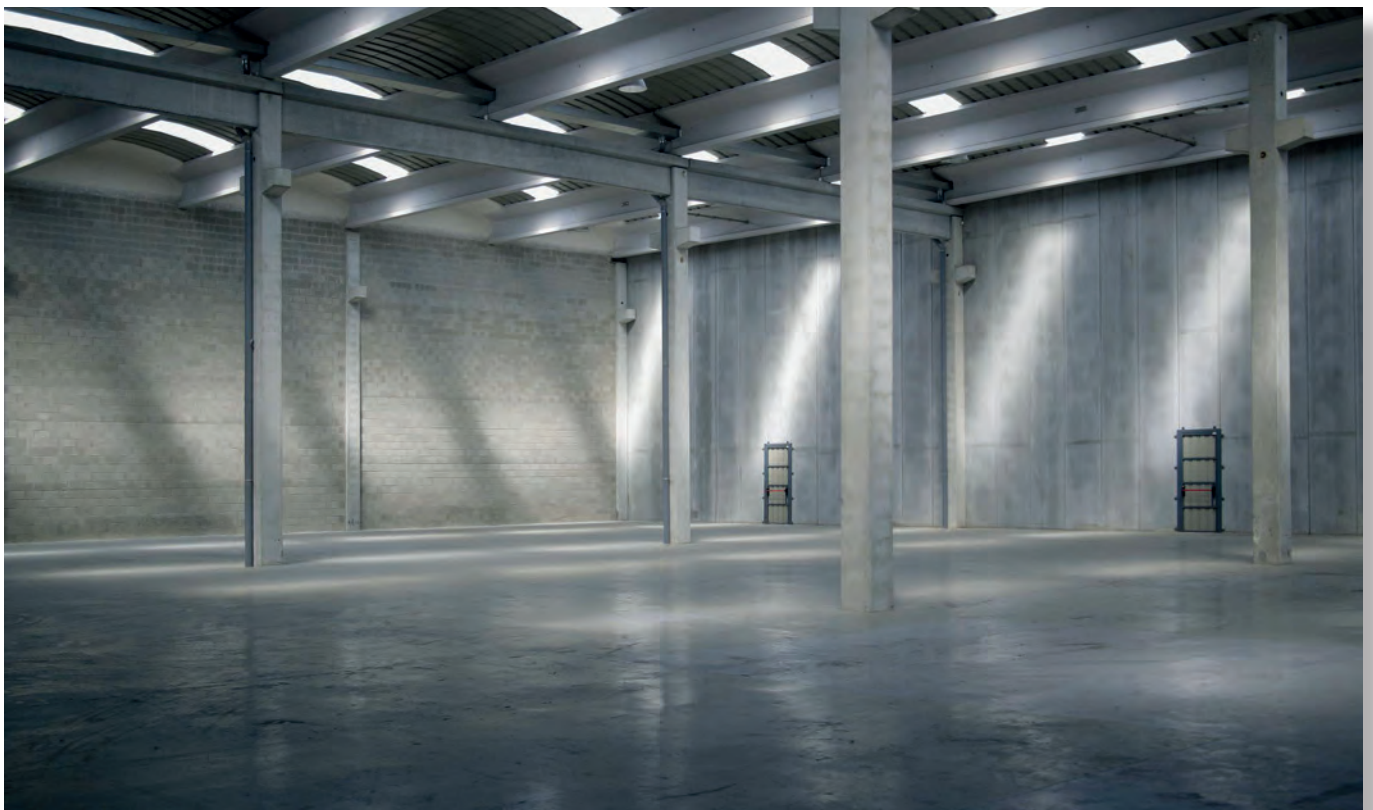
There are a number of concrete options for the construction of warehouses. These include reinforced insitu formwork such as high-wall shuttering, hybrid construction of precast twinwalls with an internal insitu concrete core or tilt-up insitu concrete panels that are cast horizontally on site and then tilted into position. A further option is the provision of concrete load-bearing walls – propped or cantilevered – that carry the vertical load and provide the necessary longitudinal bracing when topped with a lightweight roof – although a heavyweight roof would provide greater thermal efficiency. Neither wall would have intrusive column instands which can account for up to 5% of space in portal steel frame warehouses. The roof construction is simple as a roof beams are simply supported by the walls.



Isostatic reinforced concrete portal frame



Tilt-up reinforced concrete wall panel



Concrete construction provides inherent thermal efficiency, fire resistance, flood resilience, robustness and security without the need for additional finishes



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