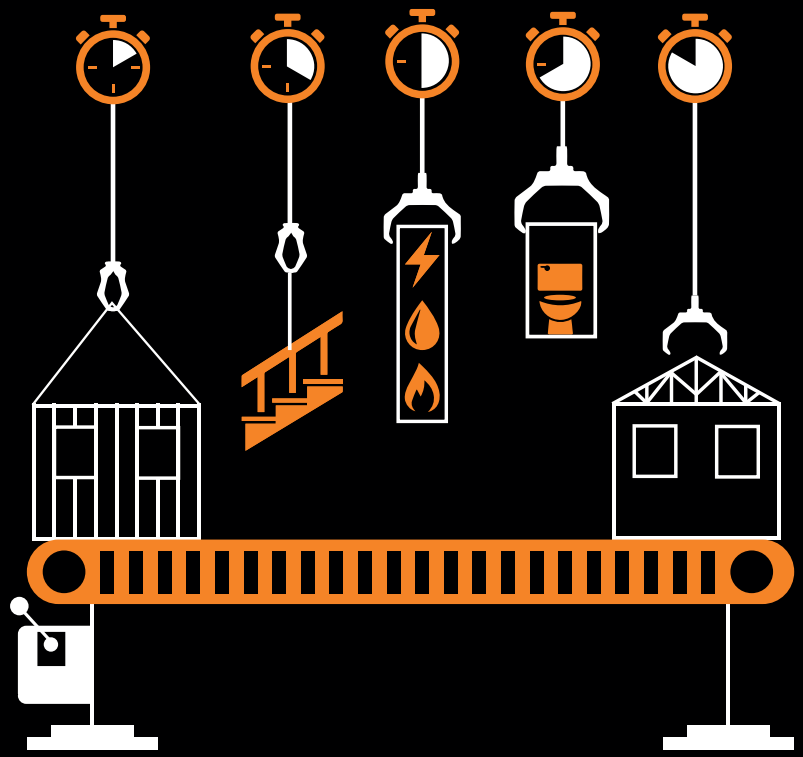
mace

MACE TECH
HIGH RISE SOLUTIONS



FASTER AND SAFER DELIVERY | **CONSISTENT** QUALITY | **OPTIMAL** VALUE

Mace Tech is delivering High Rise Solutions, our industry-leading off-site approach that challenges and consistently out-performs traditional building methods. Benefits include:

DESIGN

High Rise Solutions will work with your existing design and create a unique offering for your building - at no time compromising your design intent. We will optimise your design for offsite manufacture and we will always create a solution that maximises value for you.

MANUFACTURE

Our off-site manufacturing facility ensures consistent, factory-standard quality and safety. We are committed to delivering on time, right first time, every time.

LOGISTICS

By taking the construction process off-site we maximise the efficiency of every delivery. We will reduce vehicle movements by around 40%. This saves time and money, and benefits the environment and local communities.

SITE ASSEMBLY

Our on-site installation process is significantly faster than traditional methods. Reducing programme time by 25%, the benefits relative to reduced funding costs and early income opportunities speak for themselves.

FINISHED PRODUCT

We strive to deliver all of our projects to a consistently exceptional standard. We commit to the highest standards of finish being achieved in our off-site work because such a high proportion of the building is pre-manufactured away from the workface. On-site work is significantly reduced, while predictability of outcome rises exponentially.

PURSUING A BETTER WAY THROUGH INNOVATION

An **innovative** construction approach for the UK

SHAUN TATE
BUSINESS UNIT DIRECTOR, MACE TECH

GEORGE ARGYROU
DIRECTOR, HICKORY GROUP

Hickory.
Building innovation.

Whether we are delivering record-setting skyscrapers, transformative regeneration schemes or large infrastructure programmes, our mission is to continuously pursue a better way and challenge the status quo.

Our vision is to be the industry leader in shaping cities and building sustainable communities.

In partnership with pioneers in prefabricated high-rise construction, Hickory Group, we have developed High Rise Solutions (HRS), an industry-leading off-site construction approach that challenges and out-performs traditional building methods, offering faster and safer delivery without requiring any changes to the design of the projects.

By incorporating Hickory's experience and methodology that have been successfully used in the automotive and mass consumer goods sectors for many years, we are able to guarantee just-in-time delivery of components and consistent quality through an off-site production and assembly line.

This not only offers a faster delivery, but a rigorous quality regime that is integrated into manufacturing throughout the entire process.

Crucially, the Mace-Hickory (HRS) technique unlocks the potential for maximising value in ways that were not considered possible in the development of the original design.

We have explored a range of options with clients that drive safe practice and provide certainty of design, which can be adapted to best suit their needs. HRS is not a product but a method that will help realise our clients' ambitions, offering faster programmes, higher quality and sustainable delivery, cost savings and safer construction.

THE CONSTRUCTION INDUSTRY AND US

Optimum delivery for **forward-thinking developments**

2025 GOVERNMENT CONSTRUCTION STRATEGY

Construction is a sector in which Britain has a strong competitive edge. We have world-class expertise in architecture, design and engineering, and British companies are leading the way in sustainable construction solutions. It is also a sector with considerable growth opportunities, with the global construction market forecast expected to grow by over 70% by 2025. Working together, industry and Government have developed a clear and defined set of aspirations for UK construction:

33%
COST REDUCTION
Initial cost of construction and the whole life cost of built assets.

50%
FASTER DELIVERY
Reduction in the overall time, from inception to completion, for new build and refurbished assets.

50%
LOWER EMISSIONS
Reduction in greenhouse gas emissions in the built environment.

2022 RESPONSIBLE BUSINESS STRATEGY

Mace is committed to being a leading responsible business.

We understand the impact we have on our environment and have already taken several steps to reduce the impact of our work. In 2017 we launched our Responsible Business strategy.

WELLBEING & OPPORTUNITY | **QUALITY OF ENVIRONMENT** | **RESOURCE EFFICIENCY**

The ultimate goal of our responsible business strategy is to be more efficient, progressive and collaborative in delivering our vision, and to quantify the shared value that we generate together with our clients, suppliers, partners and stakeholders.

To become a more successful company and to create better outcomes in line with government-mandated industry targets, we will advance our activities in each of the three key performance areas.

MACE TECH MAJOR BENEFITS

Our Mace Tech approach, with integrated design, an optimised logistics solution and improved programmes, sets us on a path to achieving these objectives.

25% FASTER DELIVERY

40% LESS TRANSPORT

75% LESS WASTE

100% CONSISTENT DESIGN QUALITY

15% LESS EMBODIED ENERGY

20% LIGHTER STRUCTURE

DESIGN

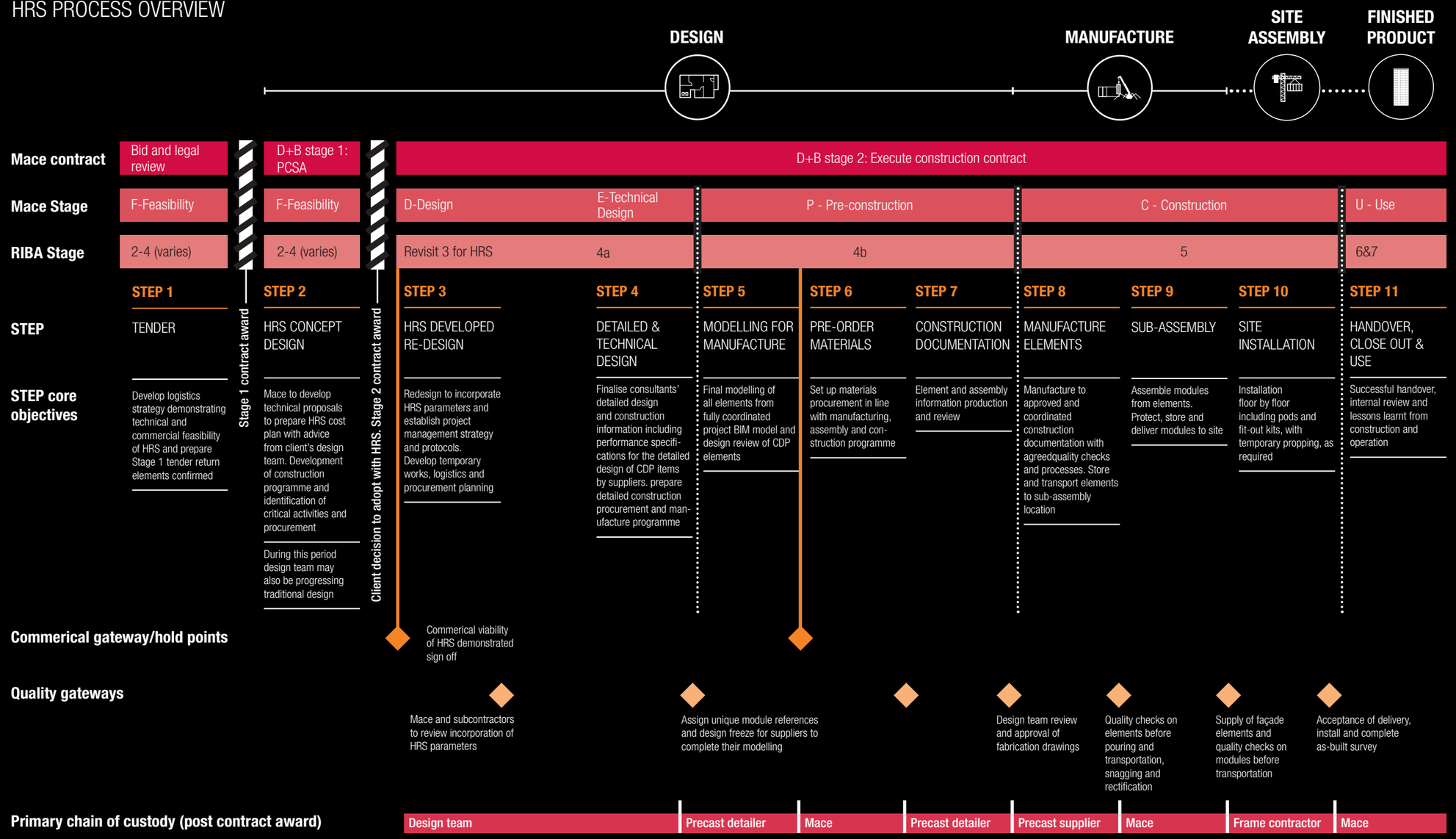
HRS is Mace Tech's industry-leading off-site manufacture solution that builds upon the experience of our partners Hickory to challenge and consistently out-perform traditional building methods.

By adopting the Mace-Hickory (HRS) technique we can achieve faster and safer delivery, consistent quality and optimal value.

This process diagram describes the key steps from invitation to tender to project completion, based on a 2-stage design and build contract initially tendered on RIBA Stage 2-3 information.

The standard residential HRS incorporates a precast concrete frame with integrated facade sub-assemblies and bathroom pods. The process can be adapted to cover other building types and to include post tensioned concrete, prefabricated service corridors and 'ultimately' kitchen modules and pre-serviced walls.

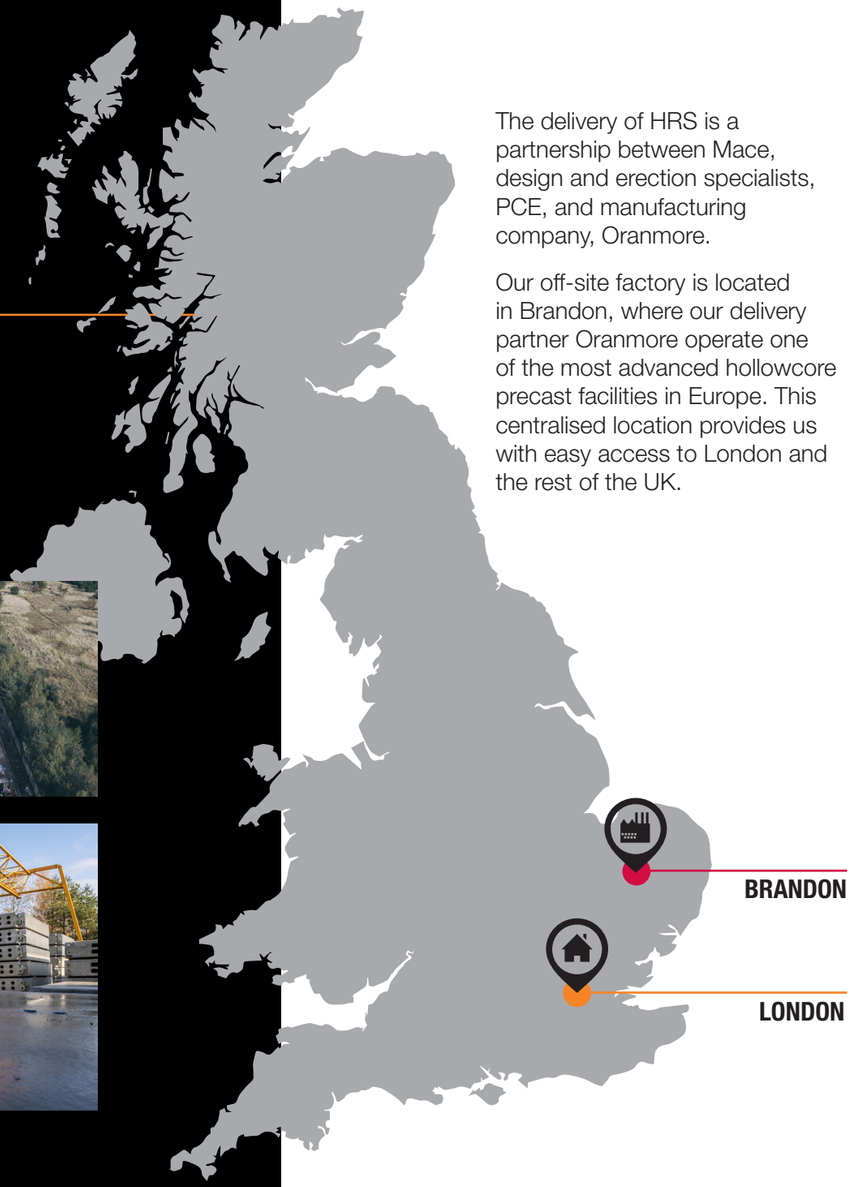
HRS PROCESS OVERVIEW



MANUFACTURE: EMBRACING THE FUTURE OF CONSTRUCTION

The delivery of HRS is a partnership between Mace, design and erection specialists, PCE, and manufacturing company, Oranmore.

Our off-site factory is located in Brandon, where our delivery partner Oranmore operate one of the most advanced hollowcore precast facilities in Europe. This centralised location provides us with easy access to London and the rest of the UK.



A NEW APPROACH TO OFF-SITE CONSTRUCTION

Traditionally, the notion of prefabrication was that while it offers many benefits to the delivery phase, the quality of the end product was compromised in the process. In addition, due to the limitations of the road network, the original design intent would need to suit a maximum size of a 3.5 metre grid. The HRS method entirely negates this compromise and will significantly improve the delivery of high-rise towers, while fully maintaining the design intent.

Inspection at the production facility can be streamlined and completed earlier in the process. Under these conditions, control over the design and quality checks is greatly improved. In the factory environment, inspections take place at ground floor level as part of progressive vetting. The benefits of this methodology are significant. For example, compare this to a more traditional cladding approach, where checks are carried out at the point of installation, as the building becomes increasingly taller. HRS achieves a greatly enhanced end product and reduces the need to work at height, improving safe working practices.

Significantly **less on-site deliveries** means a **reduction in CO_2** emissions and a **safer site**

Manufacturing in factory conditions provides **consistent and exceptional quality results**

Inspections at the production facility can be **streamlined** and **completed earlier**

MANUFACTURE

1 The modules are formed around a precast concrete slab, the fundamental enabler of the approach. The size of the structural unit is entirely flexible, allowing scalability from small to large.

The recess for the bathroom pod is built into the unit at the point of fabrication, allowing easy install. Further accommodation for services, pre-tensioned beams can be incorporated, dependent on the design specifics. Importantly, the method does not impose restrictions on building layouts or configuration.

2 Propping is installed to units and supports the following levels of modules. The props are progressively removed as the building rises quickly. The lighter building structure allows potentially reduced foundation requirements.

The combination of lighter structure and the modularised approach unlocks the possibility of adding floors to high-rise projects without compromising internal floor-to-ceiling height.

3 Façades are pre-attached to the modules, with the only real difference in usage being that we design them to be fixed from the bottom, rather than from the top. Each one aligns precisely when the units are installed on-site.

By installing façades under factory conditions, they are precisely aligned to the datum. The advanced façade installation also removes the leading edge from the structure and therefore offers a safer on-site environment.

LOGISTICS

4 Service distribution modules are manufactured by the building services contractor and then delivered to Brandon. Here they are incorporated into the precast U-slabs which act as link beams within the cores.

These units are then delivered to site as part of the coordinated logistics for all of the structural core elements.

5 A large volume of modules can be stored at the production facility in readiness for collection and delivery to site. These are in the form of full external units which also feature cladding panels; and internal (non-façade) modules, can be stacked and delivered in bulk for swift installation.
The factory facility in Brandon features open spaces for safe passage of vehicles, lifting and loading of HRS modules, and departure from site.

6 Logistics are different for our method in that they are designed around the concept of facilitating safe movement of vehicles, setting down and unloading via crane, and immediate departure from site. Full modules arrive, are lifted and set in place in around 20 minutes and vehicle movements are significantly reduced.

SITE ASSEMBLY

7 Perimeter modules including cladding are installed as a priority – this removes the leading edge from the floor and establishes a safe work environment for follow-on activities. During installation of the units, the number of site operatives required to successfully execute each step are significantly reduced in comparison to conventional methods – this has the natural consequence of exposing less staff to the site environment for less time, driving down risk. Precast columns are installed, concrete stitching poured, and then the next level begins.

8 The final structure is constructed with the façade to the same tolerances and accuracy. Temporary connectors are part of the temporary propping frame of the module and marry with ferrules cast into the slab – the entire process features design and manufacturing elements that are purposely included to effect easy integration of modules, while maintaining the overall integrity of the structure.

Slab penetrations for service risers and fixings are also installed in factory conditions, ensuring that the potential for site measurement errors are significantly reduced.

Jump Factory
N08 East Village

MAXIMISING RESPONSIBLE BUSINESS TARGETS

The efficiencies created across the spectrum of work using the HRS method delivers significant environmental benefits. Independent research of this method (already evidenced by our partners Hickory) demonstrates that HRS offers a more sustainable construction solution when compared with traditional construction, utilising less carbon-intensive materials and reducing waste, energy and water usage throughout the build process.

'JUST-IN-TIME' LOGISTICS STRATEGY TO IMPROVE EFFICIENCY

Our 'just-in-time' logistics strategy will be used to forecast the required demand and optimise the number of fully constructed modules prior to them arriving on site. This process increases efficiency and minimises material and energy waste. This achieves a 75% reduction in waste, and 15% reduction of embodied energy.

The design can be inspected and signed off in one place, resulting in fewer architectural changes during the project life cycle, keeping material waste to an absolute minimum. There are commercial advantages of reducing material and storage costs by eliminating further warehouse needs.

Less vehicle movement and on-site activity means **less noise pollution on site**

Fewer on-site deliveries means a **reduction in CO_2 emissions**

REDUCTION IN NOISE POLLUTION AND IMPACT ON LOCAL RESIDENTS

The production facility in Brandon is not in a busy city centre location and is operated under controlled parameters. As a result, the development of pre-assembled modules decreases noise pollution close to site and has no impact on local residents.

Traditionally, main contractors factor into their operations how best to minimise disruption to the surrounding neighbours and the local community. Projects often utilise noise reduction techniques which can be both complex and expensive. Our HRS method significantly reduces this challenge. Reduction in noise pollution even offers the potential to work at night, including deliveries between 19:00 and 22:00, which will drive even faster programmes. While community engagement is pivotal, through HRS it means that discussions can take place from a more environmentally-friendly and cost-effective standpoint.

EASIER TO TRACK AND RECORD SUSTAINABILITY DATA

Sustainability data can be managed in a more efficient fashion, taking place in the off-site facility. A simplified method of tracking and recording data gives the opportunity of deciphering how best to improve productivity and performance along the way. An example of this is the reduction of vehicles and deliveries which equates to 40% less traffic near to site – significantly decreasing carbon emissions from heavy goods vehicles.

Streamlined operations allow a more focused approach on BREEAM credits, **maximising further environmental opportunities**

75%
WASTE REDUCTION

East Village prototype

A HEALTHIER AND SAFER INSTALLATION

Working in factory conditions at our off-site production facility in Brandon offers significant improvements in health and safety when compared with traditional construction methods. Reducing the need for both people and vehicle activity in busy site locations minimises the likelihood of accidents and improves general health and safety performance across the whole project.

A CONTROLLED ENVIRONMENT, ELIMINATING WORKING FROM HEIGHT

The construction of pre-assembled modules takes place in a controlled environment which is safe, protected from usual site hazards and less affected by the elements. Not only does this make the setting less likely for accidents and slippages, but by including the cladding on the modules, it eliminates the necessity for operatives to work at leading edges, providing considerable health and safety benefits compared to traditional cladding installation.

The production facility in Brandon is a tried-and-tested environment for constructing precast slabs. This estate has allowed us to custom-design our own facility for both storage and production, resulting in a bespoke area for works of this nature. As our HRS method takes place on this site, there is no requirement for transporting the concrete products to another factory as everything is in the same place, meaning that the process is both easier and safer.

Use of spider **cranes** for installation of cladding provides **a safer working environment** and **eliminates working at height**

Prefabrication methods **remove the need for 12 trades on site**, **improving efficiency** and **decreasing on-site movement**

REDUCING ON-SITE MOVEMENT AND ACTIVITY

On average, HRS prefabrication methods remove the need for 12 trades on site, who would typically be working in the same areas, sharing space across the floor plate. We estimate that there will be a 40% reduction in vehicle movements and people on site, further improving efficiency and decreasing the likelihood of incidents between trades.

The majority of work takes place prior to the modules arriving on site through a 'just-in-time' logistics strategy – a unified, efficient and safer method than traditional construction.

USE OF SPIDER CRANES AND SAFER ACCESS TO APPARATUS

Off-site production also allows safer and easier access to cladding and panels than on-site construction. This enables the use of spider cranes in our off-site assembly areas for swift but safe operation, providing easier access to apparatus and removing potentially hazardous working operations. As HRS structures arrive to site with finished façades, we eliminate the risk of falls and remove the need for work on the building edge, creating a safer environment for workers and the community alike.

Operations are fully streamlined and efficiencies are maximised in terms of on-site activity under the High Rise Solutions method, meaning that health and safety is significantly improved as a result.

Off-site production facility allows **safer and easier access** to cladding and panels

40%

FEWER VEHICLES AND PEOPLE ON SITE

FINISHED PRODUCT

With Mace Tech we strive to deliver a consistent quality service time after time, employing the best people to deliver and install products that have undergone the most rigorous factory checks – significantly reducing time required for on-site quality control.

Your building will not only be completed on time, but it will be delivered to the very highest quality and the days of protracted post PC quality close-out periods will become a thing of the past. Our HRS method will demonstrate faster, sustainable and safer delivery, consistent quality and optimal value.

CONSISTENT QUALITY & DESIGN INTEGRITY

With HRS there will be no changes in design, layout or grids. This allows quality checks to happen earlier in the process.

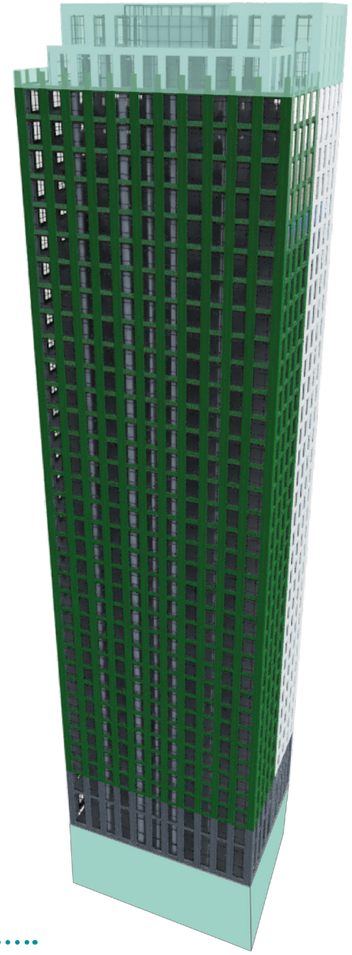
The setup of a production line means that all components are produced and assembled in a controlled factory environment guaranteeing a consistent quality standard.

With regards to façades and MEP, there is no change to the architectural design when compared with traditional construction delivery. Similarly, the acoustic and fire performance of the completed building is not compromised by using the methodology, NHBC and insurance requirements remain the same and all standard and robust details can be achieved.

Mace Tech is not just restricted to optimising structure and façade elements. It also maximises bespoke offsite pre-manufacture and assembly for a range of building types and components.

As a baseline we will engineer offsite sub assembly solutions for structure, envelope, vertical and horizontal services distribution, bathrooms, utility cupboards, pre-serviced partition walls, pre-assembled kitchens and wardrobes and packaged plantrooms.

With Mace Tech we are using digital modelling tools and artificial intelligence, we are able to draw from a catalogue of components to design and manufacture the structure and façade sub-assemblies offsite.



We will continue to work with our supply chain partners to find better ways of pre-assembling lifts, BMUs, roofing solutions and anything else where value can be added. Our goal is to pre-manufacture and assemble 75% to 80% of all project components.

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