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The Education Edition

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Why precast gets top marks in education

Modern methods of offsite construction

Image credit: Thorp Precast Ltd

Image credit: Sterling Services Ltd

With strong government backing for offsite construction methods in the education sector, and numerous operational efficiencies, precast is perfectly positioned to take advantage.

State support for offsite construction methods has never been stronger. Two years ago, the government announced a "presumption" in favour of using modern methods of construction (MMC). And in March, the Infrastructure & Project Authority's MMC programme director Will Varah told Construction Manager magazine that the new government would continue with this policy.

Leading the way among public clients is education. The university sector is embracing MMC, for faculty buildings and student accommodation [see project case studies, pages 5-8], while the Department for Education (DfE) announced the winners of a £3bn offsite schools framework in January.

In the schools sector, precast undoubtedly scores highly when compared to other offsite construction methods in the market. Robust, with strong acoustic and thermal insulation properties, and quickly assembled on site, it is little surprise that schools are drawn to precast's many advantages.

"The use of precast as a material for schools has been increasing over recent years, with the benefits realised by both the client and end-users alike," says Richard Wilks, technical manager at Sterling Services.

Derek Russell, head of engineering at Techrete, notes that the nature of schools lend themselves to high levels of repeatability – which suits precast.

"A significant advantage of precast concrete in education projects is the economy of design that can be achieved when the modular nature, in terms of classroom layouts, is considered," he explains. "With sufficient lead in time to develop the functional and aesthetical requirements, a high degree of modularisation and offsite manufacturing can be applied to education projects.

"A primary consideration for Techrete is to work with the design team to achieve this modularisation and fully realise the benefits of offsite construction, while creating efficient environments for education."

In the hustle and bustle of the school environment, exposed concrete offers a durable and hard-wearing surface.

"This is a significant benefit in terms of both maintenance costs for internal surfaces and energy efficiency, especially when these are extrapolated over the working life of the structure," says Russell.

Acoustic performance – vital in the noisy corridors and classrooms of a school building – also give precast an edge over other materials.

"Due to the durability and density of C40 grade concrete used in our façade panels, excellent noise reduction properties are achieved, important for buildings located near busy main roads with heavy traffic, with precast having the added benefit of impact resistance and resilience against potential vehicle impact damage directly against the façade," says Wilks.

The UK's first Passivhaus-rated school in Exeter was delivered with the help of precast units – supplied by Buchan, since acquired by FP McCann – demonstrating how the product can be used to achieve strong thermal performance with minimal air leakage.

"Precast cladding provides increased thermal mass, and improved services efficiency with minimal cold bridging," says Steve Morgan, technical manager at Thorp Precast. "It enhances both the structural and air borne acoustic performance of the external envelope. Precast cladding provides equalised air tightness levels of the external envelope."

Thermal performance can be enhanced by adding insulation to the panels, adds Wilks.

"A layer of insulation is fixed to the rear face of the panel during the install period, with the remaining insulation being inserted within the inner skin SFS/metal stud and board system," he explains. "This means U values of 0.15 W/m2degk or less are achievable.

"Excellent air tightness is achieved and each panel and panel junction is fitted with a double seal mastic joint once the panels have been lifted and installed on the façade."

Fire safety, a major consideration for all clients since the Grenfell tragedy, is an area where precast outperforms all its rivals.

"Materials used, and designs employed, address the requirements of Building Regulations, and leading insurance providers," says Morgan. "All materials used are classified non-combustible, A1 fire rated. Firestops, insulation and vapour control layers can be accessed following panel installation."

"The panels are sealed against the individual floor slab edges during installation using a continuous fire break detail, this form of construction being ideal for multi-storey construction," adds Wilks.

A huge range of precast units, architectural and structural, are used in school schemes. Techrete says its most commonly used units are flat wall panels, vertical and horizontal spandrels, and mullions. It delivers façades either as single skin external panels or combined as sandwich panels to create both internal and external skins as a single panel.

"These panels can be delivered to site and erected with windows, service voids and finishes applied," adds Russell. "We are also noticing an increase in requests for window incorporated panels. These panels are pre-installed at our factory and serve to further reduce programme time, on-site labour and overall project cost."

This also makes precast highly suitable for remote school projects, such as Techrete's Wick High School project on the north coast of Scotland, where it installed 511 precast units totalling 3,420 sq m.

With windows, service channels and finishes invariably taken care of in the factory, site installation of precast panels has become increasingly efficient and quick, says Morgan.

"There are no external scaffolding requirements and no wet trades required on site," he says. "Safety is increased through reduced numbers on site, with significantly less site traffic and supervision required. Small teams of specialist erection gangs – typically four men and a crane operator – travel to site together. Crane time and number of positive lifts are optimised.

"No site storage is required. Panels are lifted from our specially adapted delivery vehicles directly onto the building.

"There are minimal noise levels – extremely important in sensitive neighbourhoods. Power tools are not required to install precast panels."

It all helps to minimise disruption for schools during construction work.

"For school projects, the fast erection times allow construction to take place during school holiday periods, with minimal waste, noise or dust," says Wilks.

> "...all materials used are classified non-combustible, A1 fire rated. Firestops, insulation and vapour control layers can be accessed following panel installation."

...top marks in education continued

School design possibilities with precast

Image credit: Techrete Ltd

Exposed precast concrete offers plenty of scope for architects and designers working on schools projects.

Techrete worked on the Burntwood School project in Wandsworth, south London, which won the RIBA Stirling Prize of 2015.

"One key advantage of precast and the manufacturing process is the ability to create a high-quality finished surface to both the internal and external faces, subject to the architectural requirements," says Russell.

There are numerous finishing options. "The panels can be faced with brick, terracotta, natural stone or an etched concrete finish to a very high standard of workmanship," says Morgan.

Thorp's Loxford School project used 500 panels covering an area of 5,000 sq m, the majority brick faced panels.

"All manufacturing is undertaken in factory-controlled conditions and the completed panels can be viewed off-site by the client and design team prior to delivery to site," says Morgan.

"Project specific detailing that may be required by the client to the external façade can easily be incorporated at time of manufacture using bespoke CNC produced mould liners. These liners are produced to replicate coats of arms, crests, school names, patterns and even photographic representations within the finished concrete surface."

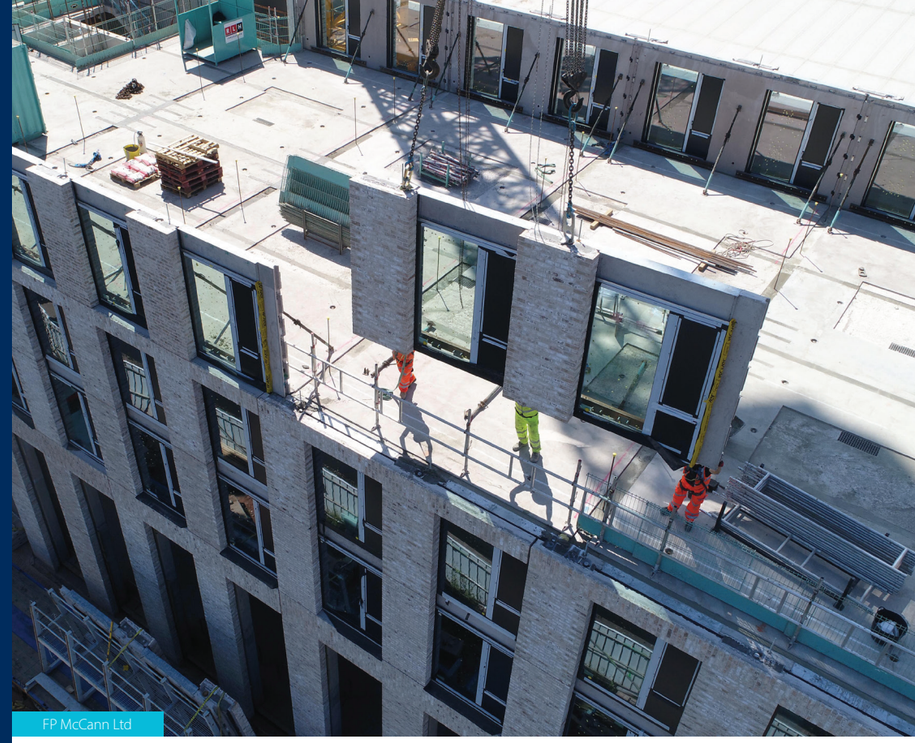
Creagh's Toronto Primary School in Livingston, Scotland, used bespoke mould detailing to create the school's crest on a precast panel, while Sterling has picked out the name of the school on wall sections for the Hackney Academy City of London at Shoreditch Park.

10 reasons
to specify precast in schools

1. Buildings can be manufactured during term time then erected quickly during the school holidays, to minimise disruption.
2. Increasingly, windows and services channels are pre-fitted in the factory, adding further speed to the site programme.
3. The 'repeatable' nature of classrooms and education facilities add efficiency to the precast design and manufacturing process.
4. There is a wide range of design possibilities, including the potential to pick out the school crest and name in bespoke precast panels.
5. Robust and durable, precast is ideal for a bustling school environment, while offering long-term operational savings through reduced maintenance.
6. Precast offers strong acoustic performance – vital in a noisy school environment building and for schools located near busy roads.
7. The excellent thermal properties of precast – the UK's first Passivhaus-rated school in Exeter was delivered with the help of precast units – mean further operational savings.
8. Minimal noise levels during construction and reduced trades mean a safer, less disruptive site.
9. Precast concrete is inert with no harmful "off-gassing" emissions during use and A1 fire ratings.
10. Precast products are installed to long-established industry standards and come with long warranties and guarantees. Precast cladding is fitted using British Standard BS8297, typically with a 12-year warranty and a 50-year design life guarantee.

FP McCann's modular solution for student rooms

659 rooms & 19 storeys high



FP McCann Ltd

FP McCann's trademarked RoomSolution product has proved ideally suited to student accommodation.

The precast specialist has used the system on numerous university halls of residence, and to date, has manufactured and installed nearly 20,000 student rooms on over 30 schemes across the UK.

One project which used RoomSolution was Birmingham's £48m canal side student accommodation scheme at University Locks, part of the Birmingham City University (BCU) City Centre Campus. FP McCann worked on the Alumno Developments scheme with main contractor John Sisk, structural engineer BWB Consulting and architect Glen Howells Associates.

The project involved construction of 659 student rooms, some 21,405m^2 of accommodation, in cluster flats with a main tower 19 storeys high.

Walls, floor and ceiling slabs are linked together to form a unique crosswall construction, with the precast panels formed to suit design requirements. The five panels framing each pair of bedrooms consist of walls 180mm thick, and floor slabs 175mm thick. Window and door openings have been accommodated and each bedroom has four conduits cast into the walls for electrics and communications networks.

All horizontal and vertical sections were designed for ease of build, linked together with hidden tie rods. Joints were finished with a high-strength non-shrink grout. Walls were either battery cast or power-floated, which allowed for a simple gypsum wash prior to final decoration. The floors were given a pan float finish to the room side and steel mould finish to the ceiling. Individual bathroom pods were installed as part of the build.

The modular room system offers excellent acoustic and thermal mass properties, ideal for student accommodation requirements.

Additionally, FP Cann provided 3,500 precast units for the structural frame and the cladding envelope on the University Locks scheme. External facade sandwich panels were 525mm or 725mm thick, with the inner leaf 195mm, and the insulation between the concrete faces either 250mm or 450mm. The outer 80mm skin of Portland coloured facade panels was cast with white cement and a selected decorative aggregate, followed by a light acid etch.

FP McCann worked with the same architect, Glenn Howells Associates, on another Birmingham student accommodation scheme in Selly Oak, the 418-bed Battery Park development. The precast specialist again supplied its modular system on the Interserve-built project.

FP McCann also used RoomSolution on Swansea University's Bay campus, working with regeneration specialist St Modwen and main contractor Galliford Try on a 545-unit student accommodation scheme.

In total, some 2,400 individual precast units were installed, consisting of walls, floors, stairs and landings. Gable walls and party walls are 160mm thick, with each room floor slab 175mm thick. Window and door openings have been accommodated and each bedroom has four conduits cast into the walls for electrics and communications networks.

Other student accommodation projects FP McCann has worked on include a 788-room scheme at the University of East London campus at Royal Albert Docks, plus schemes at Southampton University and on the huge North West Cambridge development.

The project involved construction of 659 student rooms, some 21,405m^2 of accommodation, in cluster flats with a main tower 19 storeys high.

Techrete applies science to Newcastle Biosphere job

£20m, 77,000 sq ft

All images credited to: Ryder Architecture and Kier Construction

Almost 400 tonnes of acid-etched precast units were supplied by Techrete for a landmark new building in Newcastle's science quarter.

The Newcastle Biosphere is a new £20m, 77,000 sq ft laboratory facility, designed by Ryder Architecture and constructed by Kier for Newcastle City Council. The building is part of Newcastle Science Central, a new urban quarter in the centre of the city, in close proximity to the Universities of Northumbria and Newcastle.

The building comprises two wings served by a central core, over seven floors, with uses split between office and laboratory. A lower ground floor accommodates the entrance and delivery area, the level above includes the office functions, while the next four storeys are designated for laboratory space with a seventh floor dedicated to services plant and tenant amenities.

Techrete was appointed by Kier to manufacture and install almost 400 architectural and structural precast units for the scheme [see box]. The precast firm was able to achieve productivity gains from the building's design and through its own use of digital technology.

"Steel moulds were used instead of Techrete's usual timber moulds due to the high repetition of the window units," explains Techrete's regional contracts manager Archie Fotheringham.

"BIM was used to develop the precast concrete façade model, the benefits of which were realised in reducing both manufacturing and construction times. Techrete is increasingly adopting BIM for the creation of 'digital twins' for the facades on projects."

The biggest sections were the structural mullions and columns, weighing in at over nine tonnes, though Fotheringham says the most complex panels to produce were the punched window panels.

> "BIM was used to develop the precast concrete façade model, the benefits of which were realised in reducing both manufacturing and construction times.

"These were sloped and designed in a wedge shape," he explains. "Particular attention needed to be paid to the finishing of these panels to ensure the consistency of each panel was achieved."

The panels used Techrete's C190 mix with an acid-etched finish, giving what Fotherinham describes as "a warm, off-white colour", providing a uniform appearance throughout the building".

On the seventh storey of the building, Techrete's roof mullions and spandrels, with the steel frame of the roof, serve to mechanical and electrical plant.

A combination of tower and mobile cranes were used for the installation.

"Due to building work ongoing on an adjacent site, access to two ends of the building was limited and a mobile crane situated in the courtyard area was necessary to reach these areas," says Fotheringham.

Techrete completed the installation works within the scheduled 12-week programme.

Newcastle Biosphere: Precast units supplied by Techrete

193
mullions/spandrels, area 3.25 sq m, weight 1 tonne

66
wall panels, area 16.4 sq m, weight 5.4 tonnes

56
punch window panels, area 23.41 sq m, weight 7.4 tonnes

44
structural mullions and columns, area 25.55 sq m, weight 9.26 tonnes

40
spandrel and roof parapet units (first floor), area 2.86 sq m, weight 0.85 tonne

Decomo delivers brick-faced finish in Roehampton

610 precast concrete panels

All images credited to: Decomo UK

Precast specialist Decomo worked main contractor Geoffrey Osborne and MJP Architects on a new brick-clad student accommodation scheme at the University of Roehampton in south-west London.

The company designed, manufactured and installed 610 precast concrete panels, faced with rusticated Marziale bricks, supplied by Wienerberger, along with 206 acid etched copings.

The panels, typically weighing 8,000kg, were fixed back to the in-situ concrete structure using bespoke engineered fixings. Decomo fitted insulation to the panels in the factory and installed cavity barriers on site to achieve acoustic and fire performance requirements, and added panel-to-panel mastic joints.