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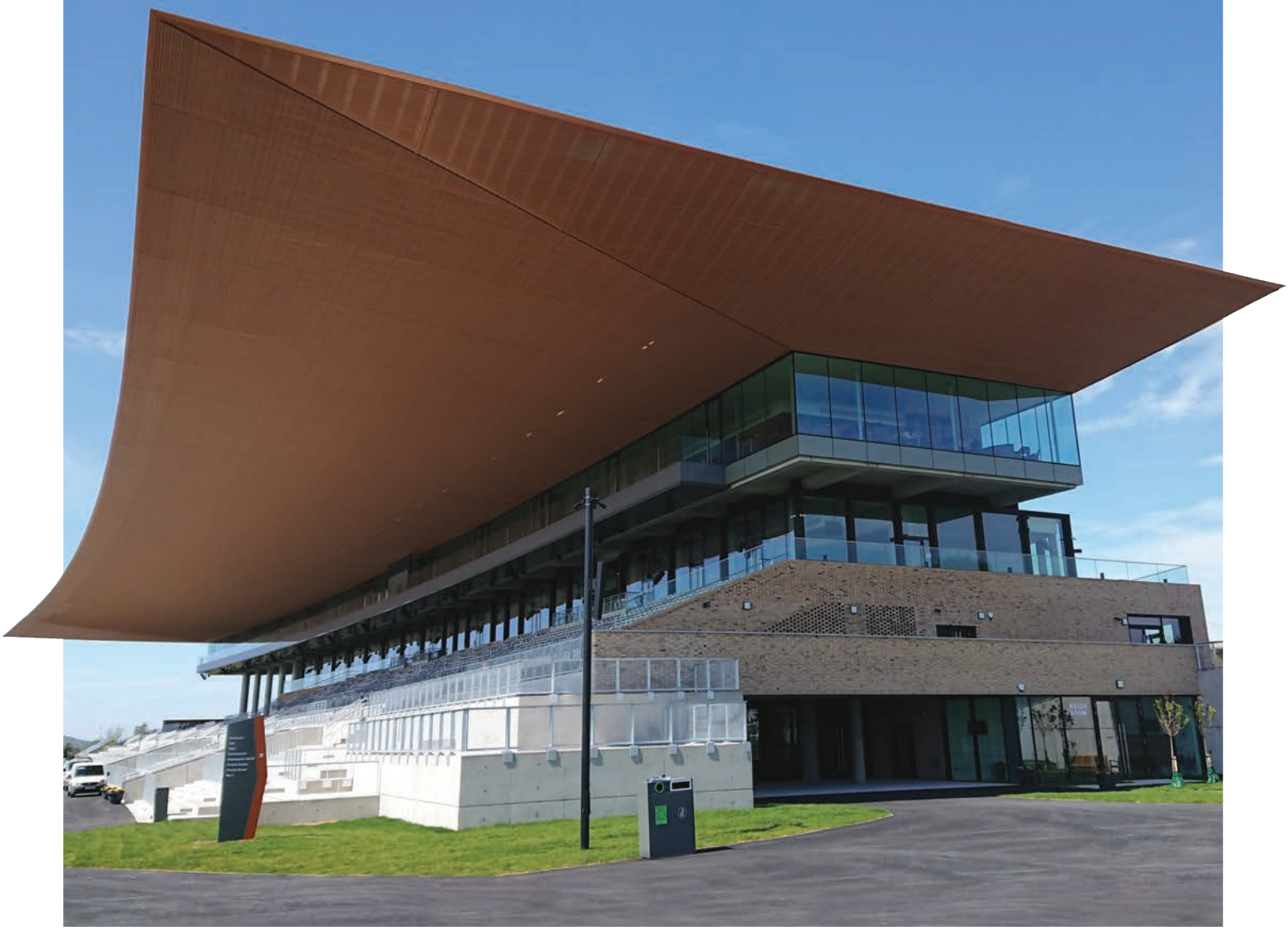
Grandstanding

Precast shapes The Curragh

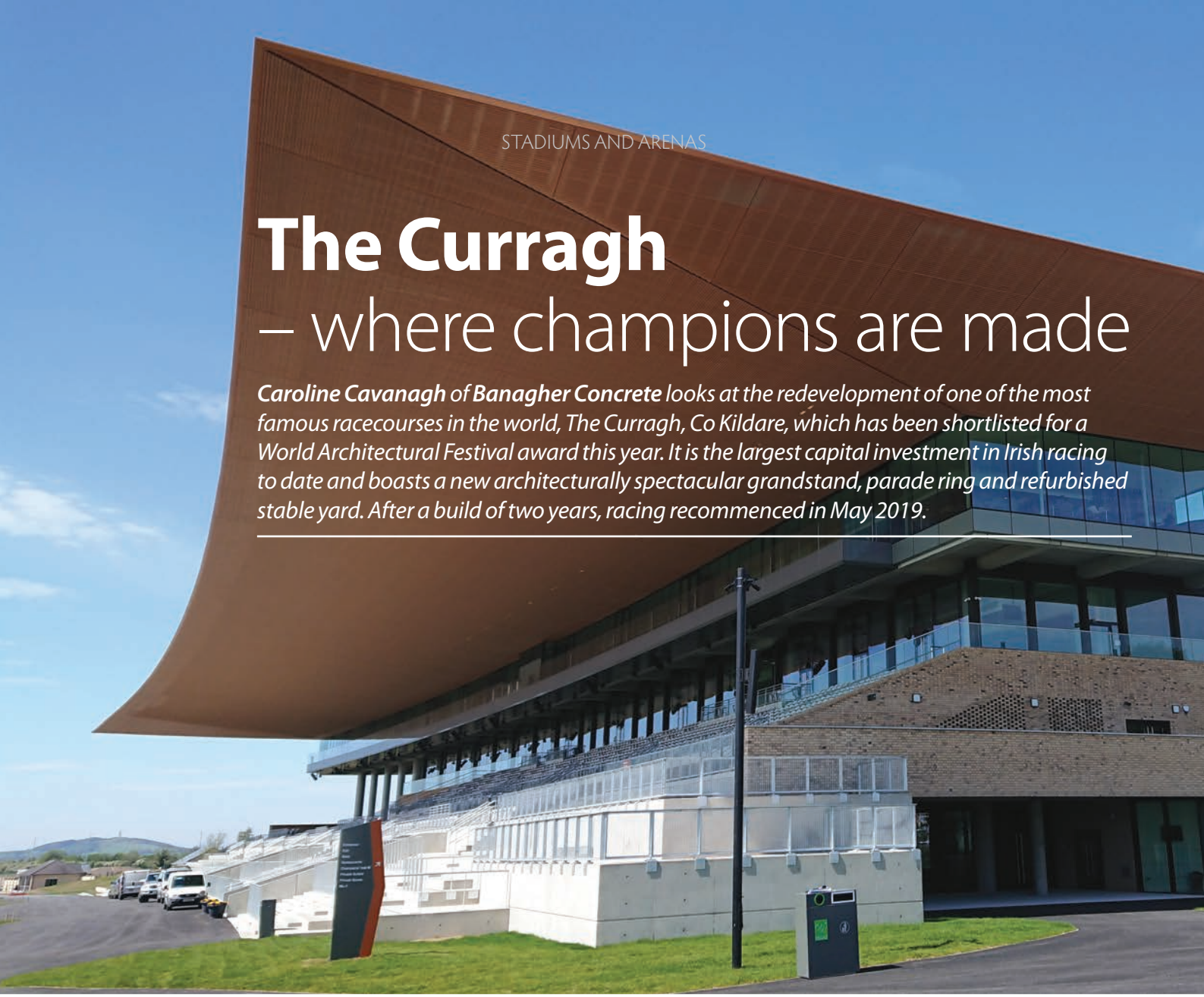
Floors and screeds
Dry-shake coloured concrete

Bridge construction
Boxing smart



The Curragh – where champions are made

***Caroline Cavanagh** of **Banagher Concrete** looks at the redevelopment of one of the most famous racecourses in the world, The Curragh, Co Kildare, which has been shortlisted for a World Architectural Festival award this year. It is the largest capital investment in Irish racing to date and boasts a new architecturally spectacular grandstand, parade ring and refurbished stable yard. After a build of two years, racing recommenced in May 2019.*



The new iconic grandstand at The Curragh was designed by Grimshaw Architects in London and Limerick-based Newenham Mulligan & Associates. John Sisk & Son was appointed contractor, AECOM as consulting engineer and all precast was supplied and installed by Banagher Precast Concrete.

Grimshaw's design redeveloped the Irish venue with a masterplan to provide world-class facilities, while respecting the unique landscape that gives The Curragh its identity. Marked out by a soaring linear roof, the new grandstand builds up the anticipation of race day by bringing spectators together in one viewing terrace that directs attention to the spectacle of jockeys and horses.

The unique grandstand roof measures an impressive 7000m^2 and the entire structure contains some 1400 tonnes of structural steel, 8900 tonnes of precast concrete (2162 units) and 4300m^2 of glazing.

Modelling and drafting challenges

All 2162 precast concrete units for The Curragh racecourse were fully modelled using Tekla to create shop drawings but many challenges were encountered along the way.

Collaboration of the various models was required to determine the global co-ordinates for export and import of reference models; it was imperative to have the co-ordinates set up correctly before beginning the model process.

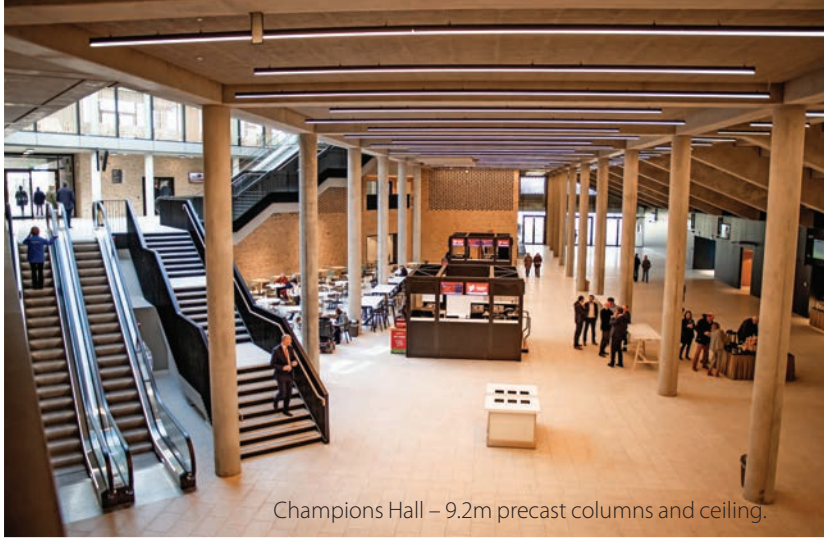
In order to streamline the movement from the lower to upper terrace with step geometry, a review of the terracing step rise was carried out for each level to determine the best dimension to be set out for each precast unit.

Each gridline, for example, was at an angle of 0.193° to the next, which proved a challenge when setting out the columns and beams for the precast frame. Then, due to the complexities of the frame shape itself, it was important that the precast embedded connections were modelled with sufficient tolerance for the steel frame roof.

In some instances, connections were receiving five beams with a top and bottom column split. To overcome this, a hammerhead at the end of the beams was developed with sleeves to give vertical continuity from column to column connection and four recesses to receive the other four beams.

All columns had cast-in shoes to eliminate temporary propping and offer quick installation on-site; the units were lifted into position and once bolted were immediately

Completed 'Aga Khan' grandstand with iconic roof.



Champions Hall – 9.2m precast columns and ceiling.

Champions Hall, showing raker beams and terrace units.

stable. Precise drawings, reinforcement bar construction and casting ensured that all the column shoes and grout tubes in the beams lined up correctly and achieved programme savings.

Most of the precast beams also had different geometries, which meant a specific production drawing for each unit that required a vast quantity of drawings over a few months. This was achieved by identifying efficiencies during the process of making drawings, good planning and a lot of hard work.

Installation

The first installation crew started on-site in December 2017, with a 130-tonne crawler crane, then a second crew moved onto site in February 2018 with a 110-tonne crawler crane. Both crews were finished by September 2018. With a ten-month programme, all 2162 precast units were installed efficiently, with the two crews running simultaneously.

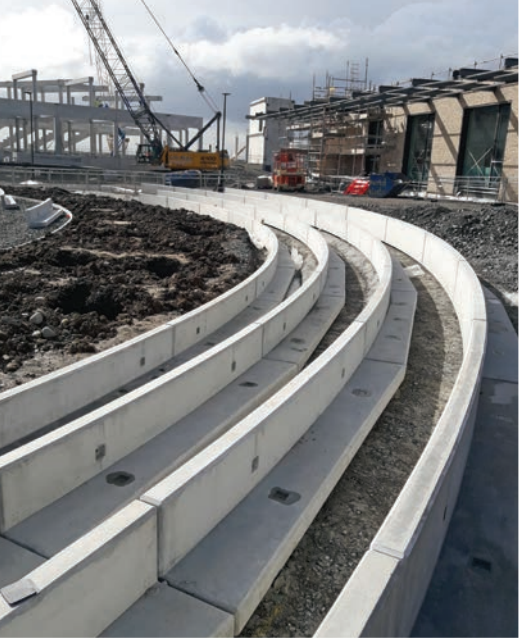
Co-ordinating the production and delivery of precast units was critical to meeting the installation programme and to prevent obstructing the progress of other site works. Co-ordinating with the main contractor and subcontractors was a daily operation.

The entire structure had to be installed without placing any cranes within the footprint of the building, which meant that it had to rise from ground level to roof in each area, so it was installed in grid sections and the building was finished as it progressed.

As the structural frame was installed completely from top to bottom, the flooring had to be installed during this phase also. There was a small time window allowed for this so as not to hold up the frame installation and also to allow the screeds to be poured as soon as possible, opening up works for trades following on behind.

To allow full access around the building during construction for all trades, the lower bay of terracing along the whole front of the grandstand couldn't be installed until after the structure was built. This area proved to be a challenge when being installed, as the steel frame roof was completed at this stage, so a smaller crane and co-ordination of crane location through this area was critical to getting the terracing installed.

As can be seen in the photos, the third-floor level at both ends of the structure were cantilevered, so all precast-to-precast connections were modelled with installation sequence in mind. As the precast concrete floors hang from the steel frame structure, they could not be installed until after the



Precast installation on-site.

Above: Bespoke column moulds at Banagher Precast Concrete.

Top: New parade ring with curved precast terracing units.

roof support was completed. It was not possible to use a conventional crane for installation as there wasn't sufficient space between the precast and the steel frame roof. Consequently, a large loader crane had to be used to install in these difficult areas, with great care taken to avoid any clashes.

Due to the intricate nature of the design, there were many bespoke units that were critical to synchronised installation and had to be produced on time to avoid a delay to the installation of other units. Co-ordinating the production of units to meet the installation programme from design through to delivery was critical.

Quality challenges

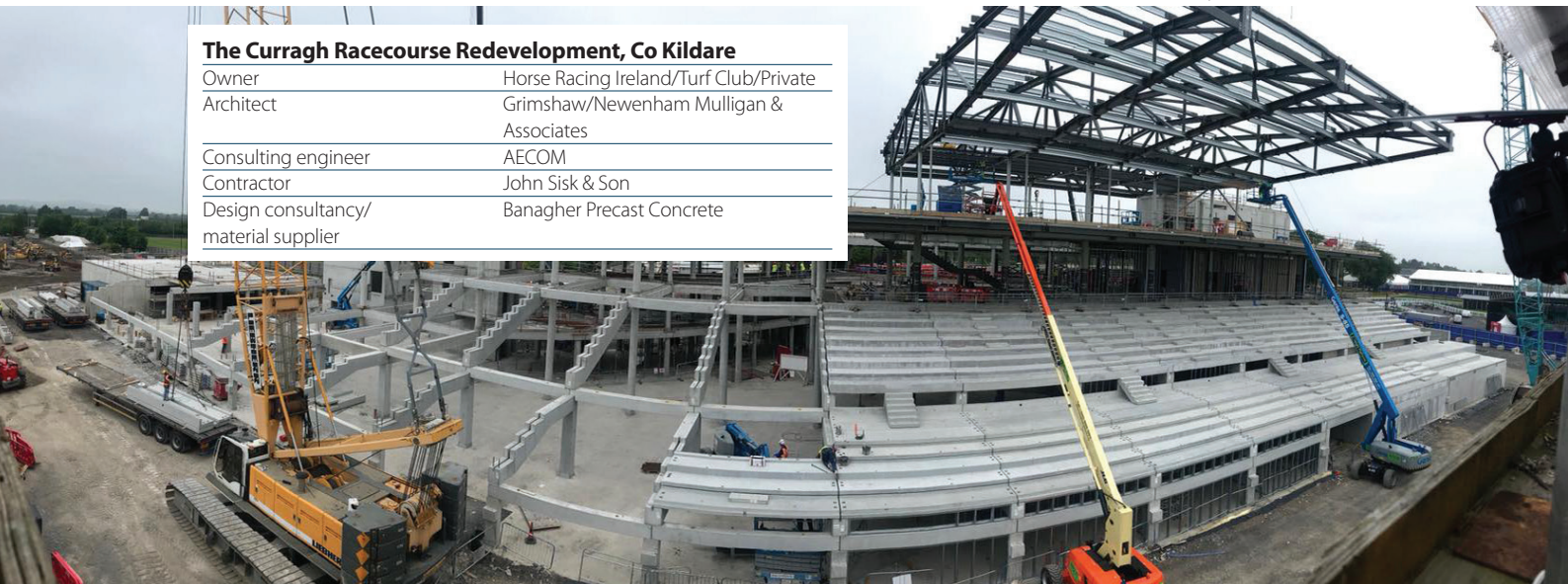
The tallest columns were 9.2m high and measured 1m in diameter, with the design calling for an exposed concrete finish to form part of the aesthetic of the Champions Hall. This meant that achieving a first-class finish on the vertically poured round columns, while maintaining a safe working environment, was paramount. High-quality moulds were commissioned from Construx in Germany and high-strength self-compacting concrete (SCC) was chosen because it has excellent durability properties and offers an enhanced concrete finish, imperative for such a prestigious project. Other benefits of using SCC included its superior flowability, the fact that it bonds well to reinforcing steel and it eliminates external vibration for compaction, which in turn offers enhanced personnel safety and efficiency during casting and therefore accelerates manufacturing time.

Sustainability was also a feature in the precast manufactured, so high-performance polycarboxalate superplasticisers were used to reduce the cement content, which led to significant reduction in the embodied energy footprint.

Using a precast off-site solution gave the clients a maintenance-free structure with sound dampening characteristics; it also reduced the construction team on-site and increased site safety.

The Curragh Racecourse redevelopment has been deemed a resounding success by the client, the public and relevant stakeholders. All parties involved in delivering this project are extremely proud to have been part of building history with this iconic structure. ■

Precast installation on-site.



The Curragh Racecourse Redevelopment, Co Kildare

Owner	Horse Racing Ireland/Turf Club/Private
Architect	Grimshaw/Newenham Mulligan & Associates
Consulting engineer	AECOM
Contractor	John Sisk & Son
Design consultancy/ material supplier	Banagher Precast Concrete