

Legend on the Lee: the redevelopment of Cork's Pairc Ui Chaoimh Stadium

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Seamus Kelly outlines the structural design and construction considerations behind the spectacular €80 million redevelopment of Pairc Ui Chaoimh, which will be the first stadium in Ireland to be set within an unenclosed municipal park

The reopening of Páirc Uí Chaoimh on 22 July 2017 realised a long-held ambition by the Cork County Board (CCB) of the Gaelic Athletic Association (GAA) to upgrade and redevelop the stadium, providing enhanced facilities, capable of serving the 14 county teams and clubs, colleges and schools in hurling, Gaelic football, camogie and ladies football.

Malachy Walsh and Partners was appointed as design project manager in January 2012, with responsibility for managing the project through to construction completion. The firm also had responsibility for all engineering disciplines, fire engineering, disability access and environmental assessment. The other project members were:

- *Architect:* Scott Tallon Walker
- *Planning:* Cunnane, Stratton, Reynolds
- *Archaeologist:* Lane Purcell
- *Quantity surveyors:* Michael Barrett Partnership

CCB appointed a steering group of five personnel who were Frank Murphy, Bob Ryan, Ger Lane, Christy Cooney and Pearse Murphy. Part of their role was to direct the project and to advise and liaise with the design team on all matters.

Páirc Uí Chaoimh will be the first stadium in Ireland to be set within an unenclosed municipal park, called Marina Park, currently being developed by Cork City Council (CCC). It is understood that Phase 1 of the park, extending between Centre Park Road and the Atlantic Pond (Fig 1), will be completed in 2019.

The section of the park incorporating the provision of access and exit to and from the stadium was included in the planning development from the outset, to ensure that the stadium construction was self sufficient in all aspects. This was necessary because the timetable for Marina Park was later than the planned stadium completion of June 2017.

History of Páirc Uí Chaoimh

Páirc Uí Chaoimh is a long-established sports ground and has been the headquarters for Cork city and county GAA activities since it was established in 1898. It was constructed on reclaimed land, originally existing as mudflats of the River Lee, in close proximity to and north of the stadium. It is located 2km from Cork city centre, within the city docklands, and is part of the scenic area of the Marina.

The ground was redeveloped in June 1976 to provide for a single storey, part seated/part standing bowl-shaped stadium,



Photo: Dennis Horgan



(<http://www.engineersjournal.ie/wp-content/uploads/2017/09/Figure-1-PUC-Aerial-view-2017-08.jpg>)

CLICK TO ENLARGE Fig 1: 1. Stadium Central Street
2. Marina Park between Centre Park Road and Atlantic Pond
3. Centre Park Road
4. Monahan Road
5. The Marina
6. River Lee
7. Atlantic Pond
8. Second playing pitch
9. 13m-wide walkway
10. Event Control Centre
11. South Stand
12. North Stand
13. City Terrace
14. Blackrock Terrace
15. Podium walkway with seating tier to second playing pitch (image: MWP)

with a capacity of 50,000.

Revised stadium safety criteria and the implementation of the *Irish Code of Practice for Safety at Sports Grounds* in January 1996 (*The Blue Book*), and later other codes (including the *UK Guide to Safety at Sports Grounds 2008 (Green Guide)* and the *Northern Ireland Guide to Safety in Sports Grounds 2007 (Red Book)*) and guidelines, resulted in a progressive reduction of the stadium capacity to 40,000 by 2013. If left intact, the stadium could no longer attract major games because of insufficient capacity.

In addition, player and spectator requirements for enhanced facilities and levels of comfort meant that the stadium was no longer fit for purpose. However, CCB ambition could not be realised without the acquisition of land.

Planning of the stadium redevelopment

Extensive discussions were held between CCC and CCB to discuss how the objectives and requirements of each party would be achieved. The key issues were:

- Floodlit stadium provision with a capacity of 45,300 for games, and up to 47,000 for concerts;
- A full-size 4G synthetic floodlit second playing pitch with viewing accommodation;
- Connectivity between the stadium and Marina Park, which will be a linear west-east wetlands-style development;
- Need to provide for a 13m-wide public walkway between the stadium and the second playing pitch;
- Cork City Council requirement to provide flood relief storage for Cork South Docklands through an enlarged Atlantic Pond and for 5,300m³ of an attenuated surface water storage volume underneath the second playing pitch, achieved by storm cell storage;
- Safeguarding the stadium perimeter to a level of 0.7m OD, consequent to the decision to provide for flood relief storage to the south of the stadium;
- Providing for the diverse usage that would allow for access and egress for spectator attendance on match days and for meeting the needs of the users of the Marina Park on match days, and non-match days.

Agreement was reached for the purchase of 2.59 hectares (6.39 acres) by CCB from CCC, realising the ambition to redevelop the stadium. The way was cleared for the submission of a Planning application, made in November 2013 to CCC. Key requirements in the project, other than those already mentioned, were:

- Creation of a venue that was multipurpose, with flexibility in the south-stand layout where needed to provide for functions, seminars and meetings, realising a layout that could not be constrained by column obstructions due to the need for large open-plan space at different levels;
- Need for a premium level with 2,200 seats in an open-plan arrangement. A decision had been made by CCB not to provide corporate boxes;
- Traffic management;
- Environmental protection to the Atlantic Pond, streams and nearby housing.



(<http://www.engineersjournal.ie/wp-content/uploads/2017/09/Figure-2-PUC-Section-2017-08.jpg>)

CLICK TO ENLARGE Fig 2: Revit model (image: MWP)

The stadium playing area was retained as had existed and the stadium design provided for self-contained sectors with seated accommodation of 21,300 and terraced accommodation of 24,000. The original covered south stand and the uncovered north stand were demolished in their entirety, and were replaced by a three-tier covered south stand, the principal stand and facilities area, accommodating 13,300 and a single-tier covered north stand, accommodating 8,000.

The existing precast concrete frames to the terraces were retained and extended to support a new single precast concrete tier, accommodating an unchanged capacity from that previously existing of 12,000 at each of the west (city end) and east (Blackrock end).

Mention has been made previously of ongoing regulatory change to stadium design. The adoption of the European Code of Practice BSEN 13,200:2012 by Ireland in 2012 included the requirement henceforth that for all new stadia, the exit capacity on level surfaces was reduced from 109 persons/minute to 83 persons/minute. On stepped surfaces, this was reduced from 73 person/minute to 66 persons/minute. Páirc Uí Chaoimh is the first stadium in Ireland designed to this more onerous requirement. A key design factor also was the implementation of an emergency evacuation time of 6.5 minutes from the entire stadium.

The design of the south stand retained the bowl concept of the previous stadium by the matching of the perimeter parapet level around the single-tier section with the middle-floor premium level of the south stand.

A key requirement also was the separation of the players and officials from spectators. Accordingly, all players, officials' facilities and associated services were provided at ground-floor level, served by a central 'street' (Fig 2.) This enables team buses to enter the stadium and deliveries to be made without interaction with spectators.

Design features

Access on designated match days is from Monahan Road and otherwise is from the Marina. This is to ensure that the area within the Marina Park, south of the stadium, functions as a public park free from traffic on non-designated match days. Outside-broadcasting (OB) vehicles are catered for within and outside the stadium.

A fourth level, a BMS-controlled plant room level, above the level of spectator accommodation in the south stand, was designed to accommodate all equipment and services, facilitating the stadium operation.

The architectural design of the south stand provided for separate stairs access to each of the three suspended spectator levels. Two 'scissors' staircases were used either side of the south elevation to provide for separate access to the middle premium and upper levels.

The lower level is accessed through external staircases, using an external podium that also provides access to the stand that serves the second playing pitch. The podium can also accommodate the public who may wish to stop and have a snack on their walk through the Marina Park.

The staircase are complemented by 'book end' staircases at either end of the south stand elevation, facilitating also the availability of additional exits for emergency evacuation in addition to the primary provision of access to the CCB offices at the western side and to the proposed museum at the eastern side.

A major factor in the terraces design was the desire to relocate the vomotries from the positions as existing to a higher level, thereby ensuring greater dispersion of spectators on entering the terraces and alleviating the problem arising from spectators entering at a relatively low level within the terrace.

The tendency has been for spectators to remain in close proximity to the entry point, promoting congestion and inhibiting other patrons from accessing higher levels within the terrace.

Some 220 spaces each for wheelchair users and their companions were provided incorporating all levels, all sectors. Each level of the south stand is served by four passenger lifts, in addition to the kitchen and waste goods lift.

The planning application accompanied by an Environmental Impact Assessment was approved by Cork City Council in April 2014. Subsequently, it was appealed by third parties to An Bord Pleanála, which conducted an oral hearing in September 2014. Permission to proceed was issued at the end of November 2014.

Spectator facilities

There was a requirement that each level would be serviced by self-contained facilities and also by bars, shops and hot-food kiosks. There had been many complaints from spectators about stadium design, such as inadequate concourses and the queuing time required to access facilities during games. Particular attention was paid to this aspect and concourses provide for between 40-60% of the sector capacity at each level, with a space allowance of 0.5m²/person.

Space requirements for spectators were a key factor. A width of 800mm was provided for all seating at all levels in the south stand and 760mm width was provided in the north stand.

Measurement of the ease of viewing is obtained through what is known as a C Factor. C60 was adopted as a minimum requirement..

There are 14 bars, seven hot-food kiosks and ten confectionary shops throughout the stadium. There is also a central restaurant at premium level, capable of accommodating up to 450 persons at any time, serving carvery food on match days. Smoking areas for spectators were provided in open-air sections of the concourses at each level. Alcohol is not permitted in spectator viewing areas.

Structural design and construction considerations

Subsoils consist of impermeable silt/clay overlying gravels at a depth of 3m varying, below surface level, influenced by artesian water. It dictated the use of bored piling and suspended slabs throughout. CFA piles of average depth of 16-18m were used and varied in diameter from 450-900mm.

A decision was made that the stadium would be predominantly a reinforced concrete structure, incorporating precast elements where possible. The fire resistance required for the structure was 60 minutes. The architectural and engineering detailing was carried out using three-dimensional revit, generating views of every aspect of the stadium and enhancing clash detection.

- **Roofs:**

The cantilevered roof over the main south stand is 40m long and consists of structural steel trusses in a latticed tower arrangement with a topmost level of 43.15m above ground level. A key requirement was that there would be no internal columns obstructing spectators' viewing.

The trusses were fabricated by Zeman, the Austrian firm, and transported to site, assembled in pairs complete with purlins and bracing and then painted prior to erection, all to reduce erection assembly at an elevated level. A 750t crane was used to lift each assembly, weighing 67.3t.

Counterbalance to the trussed structure was provided by a tower arrangement and by a colonnade of columns at the south elevation accommodating the compressive and tensile forces arising in a tied structure, transmitting these forces to the supporting reinforced concrete columns and foundations.

The north single-tier stand roof was constructed using castellated steel cantilevered beams, 21m long, supported by reinforced concrete columns along the north elevation.

- **South stand transfer truss:**

The design brief for the south stand required two areas of column free space. This significantly interrupted the otherwise uniform 7.6m structural grid.

The first area was within the 590m² conference room at the middle premium level two, requiring a completely unobstructed space. Achieving this meant omitting structural columns, thereby creating a clear span of 22.8m that had to be bridged.



(http://www.engineersjournal.ie/wp-content/uploads/2017/09/mainMediaSize537x291_typeimag)

CLICK TO ENLARGE View from the redeveloped Pairc Ui Chaoimh City End Terrace. Pic: Jim Coughlan

The solution that was adopted was a form of reinforced concrete vierendeel-type truss. This utilised all of the available height from the upper level to the underside of the roof, approximately 12m. This concept provided a stiffer solution thereby eliminating excessive load shedding to the remote edge columns.

The second column free area was at ground level, within the service road, where one column was to be omitted to provide a parking area for the buses and OB vehicles. This created a clear span of 15.2m where the loads of the lower level concourse floor slab had to be transferred to other columns. Furthermore, height restrictions allowed only a 400mm structural zone beneath the slab soffit.

Incoming services

Particular features were:

- **Electrical:**

The incoming electrical supply is 150 KVA and suffices for non-match-day event activity. When the electrical level exceeds this threshold, four generators, capacity of 3.2 MW, serve the stadium. These are located in the fourth-floor plant room.

- **Surface water:**

All roof surface-water is collected and discharged to storage tanks, used to service the stadium playing-pitch sprinkler system, installed as part of the project. Attenuated water is discharged to an underground holding tank to the Atlantic Pond and, ultimately, through controlled conditions to the River Lee.

- **Floodlighting:**

Floodlighting of 1500 lux in the stadium playing pitch was provided. This is the first time that LED lighting has been provided in a stadium in Ireland and significantly reduces glare and eliminates flicker in comparison with the more frequent current use of metal halide lighting. The latter is being used in the second playing pitch with a lux level of 500. Particular care was taken in the design to ensure control of light spill levels to the adjoining roads and nearby housing.

- **Traffic and transportation:**

A detailed study was carried out by MWP into improving the spectator use of available transport, parking at appropriately designated areas. A mobility management plan was prepared and is considered as an ongoing live document.

Construction and conclusion

Demolition of the Stadium commenced on 25 March 2015 and was carried out by Loftus Recycling and Demolition Ltd. Piling of the south and north stands, as a separate contract, advanced during the period June-October 2015 and was carried out by PJ Edwards Ltd during the main contract tender period, which culminated with the appointment of John Sisk & Son (Holdings) Ltd as main contractor. They commenced on 7 December, 2015.

The grassed stadium playing pitch was retained, provided with new drainage, a sprinkler system and reseeded, other than a 6m perimeter width, which accommodated craneage during the construction period. Incessant rain fell during the period December 2015 to April 2016, within which time over 30 days of rainfall – in excess of 2 x 5 year average – was recorded.

The redevelopment of Páirc Uí Chaoimh provides for a stadium within public parkland. It has been designated as a hub venue for the Rugby World Cup in 2023, if Ireland's application proves successful.

The playing pitch is the focus of activity within the stadium, enhanced by the facilities provided in the new stands and terraces, creating a wonderful player and spectator experience on the banks of the River Lee.

Author:

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**Legend for Fig 1*

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