Civil engineering heritage: country profile – Ireland

Dermot O’Dwyer PhD
Associate Professor, School of Engineering, Trinity College Dublin, Dublin, Ireland (dwoodyer@tcd.ie)

This paper is a review of the civil engineering heritage of Ireland, one of the series of national profiles being published by *Engineering History and Heritage*. It is presented under four headings: ‘Ireland’s major civil engineering achievements’, ‘National and regional recognition of engineering heritage’, ‘Exemplar conservation of engineering structures’ and ‘Information sources for engineering heritage’. This profile discusses engineering structures of heritage importance, including the Grand Canal and the Royal Canal; the Suir and the Boyne railway viaducts; Dublin port and John Rennie’s harbour at Dún Laoghaire; the Dublin and Kingstown railway, the world’s first commuter line, which opened in 1834; the Ha’penny Bridge; the Fastnet lighthouse; and the Ardnacrusha hydroelectric scheme on the River Shannon. The profile lists organisations in Ireland active in helping conserve its engineering heritage, including the Department of Arts, Heritage, Rural and Gaeltacht Affairs, Heritage and the Gaeltacht, the Heritage Council and the Office of Public Works, and concludes with a short list of websites and books giving further information about Irish civil engineering heritage.

Ireland’s major civil engineering achievements

Much of Ireland’s heritage dates from a period when all of Ireland was part of the UK. Many of the key English and Scottish engineers from this period were involved in projects in Ireland, just as many successful Irish engineers practiced throughout the wider UK. As a result, Ireland has a number of nineteenth-century iron bridges that were cast or forged in England and which are important surviving examples of UK civil engineering heritage. Furthermore, the harbours at Dún Laoghaire and Howth, Howth Road and the Dublin and Kingstown railway are best understood as integral parts of the transport links between Dublin and London. The most important piece of twentieth-century Irish civil engineering heritage is Ardnacrusha, the River Shannon hydroelectric scheme that was constructed by the new Irish state shortly after independence.

Evidence of transport infrastructure in Ireland dates back to early Neolithic roundwood causeways (c. 3700 BCE). The earliest timber bridge remains date from approximately 800 CE, and the earliest stone bridges probably date from the twelfth or the thirteenth century. However, engineered civil infrastructure really began in the eighteenth century with Ireland’s first canals. Thereafter the development of civil engineering infrastructure in Ireland followed a similar pattern to that in Britain. This is unsurprising given the movement of engineers between the two islands. Writing in 1776, the Irish engineer-architect-builder George Semple highlighted the close links between the engineering professions in Ireland and England (Semple, 1776).

The Newry canal was first summit-level canal in Britain and Ireland: its construction started in 1732. It was followed by a number of river navigation improvements, including the Shannon. Later, the Grand and the Royal Canals extended from Dublin across Ireland’s flat central plain to meet the Shannon navigation. A branch from the Grand Canal joins the partly canalised River Barrow (Figure 1). The upper region of the River Shannon connects with the Erne waterway by way of the Ballinamore and Ballyconnell navigation, now renamed the Shannon–Erne waterway. These canals formed the backbone of Ireland’s pre-railway transportation network. Ireland’s current canal networks are now maintained and administrated by the joint north–south body, Waterways Ireland.

Chronologically, the next major civil engineering development in Ireland was the work undertaken to improve Dublin port and the harbours at Howth and at Dún Laoghaire, then called Kingstown. John Rennie and his son Sir John Rennie were responsible for the harbours at Howth and Dún Laoghaire and for some of the dockland warehouses in Dublin. Dublin port has had a long history of development that started in the eighteenth century and involved many notables, including Captain Blyth, Francis Giles, George Halpin, Bindon Blood Stoney and Sir John Purser Griffith. The key development of the port in the early nineteenth century involved the construction of the entraining (or Bull) walls forming the entrance to the port. The North Bull wall, built partly at half height, allowed the outgoing tide to funnel through the narrow entrance, thus scouring a channel through the sandbars.

Ireland’s railway network began very shortly after the first English railway lines were completed. The earliest application for a parliamentary act was in 1826 for the Waterford and Limerick railway. Both Alexander Nimmo and George Stephenson were...
involved in developing plans for this route, but a line was not built along this route until the early 1850s. The Dublin and Kingstown railway, which opened in 1834, was Ireland’s first public railway and the world’s first commuter line. By the end of the 1850s, most of Ireland’s surviving railway main lines had been constructed. These comprised lines from Dublin to Cork, Dublin to Galway, Dublin to Wicklow (later extended to Wexford), Dublin to Belfast and Limerick to Waterford, with spurs from the Dublin to Cork line to Killarney (later extended to Tralee) and Kilkenny and Waterford. The Mullingar to Westport and Sligo branch lines were added by the 1880s. Ireland’s topography has been likened to a saucer, with mountains around the coast and a flat central plain that is drained by slow-flowing rivers. As a result, Ireland’s rail network has fewer tunnels than Britain’s. However, Brunel’s Bray Head tunnels, on the section of the line that hugs the coast between Dún Laoghaire and Greystones, add interest to this most scenic route.

Ireland’s rail network has a number of significant railway viaducts. From an engineering heritage perspective, the most interesting are the Suir viaduct and the Boyne viaduct. The Suir viaduct (Figure 2) is one of two Fairbairn box girder bridges that survive on the network, the second being the bridge carrying the Dublin to Galway line over the River Suck at Ballinasloe. The Boyne viaduct, which was designed by Sir John Macneill, carries the Dublin–Belfast line across the Boyne estuary at Drogheda. This high-level bridge, comprising two 43-m side-spans with an 81·4-m central span, was the largest statically indeterminate lattice truss bridge when it was completed in 1855. The original continuous lattice girder was replaced in 1932, but the viaduct remains an impressive testament to Irish Victorian engineering.

The other major railway bridges of particular interest are the Shannon Rail Bridge in Athlone, which was designed by George Willoughby Hemans and completed by Fox, Henderson & Company in 1851; the Chetwynd rail viaduct near Cork, designed by Charles Nixon and constructed by Fox, Henderson & Company in 1850; and the Nore rail viaduct. The current Nore viaduct dates from 1877. It was designed by C. R. Galwey and supplied by Courtney, Stephens and Bailey of Dublin.

The earliest Irish iron bridge of any significance is the pedestrian Liffey Bridge, commonly referred to as the Ha’penny Bridge (it was originally tolled) (Figure 3). The bridge was erected in 1816 and comprises a 42-m single span. This arch bridge is constructed from open cast-iron voussoirs and is elliptical in profile with a rise of 3·6 m, which gives it a very elegant shape. The bridge was cast at the Abraham Darby III foundry at Coalbrookdale.

There are other iron bridges on the Irish road and rail networks, and some interesting bridges, which were originally part of Ireland’s many landed estates, survive. These include an early (pre-1826) pedestrian suspension bridge in the grounds of Birr Castle and a cast-iron arch bridge from 1818 on the Oak Park estate near Carlow.

In more recent years, concrete, in all its incarnations, has been the material of choice for bridges, but a few examples of early concrete bridges survive. Most significant of these is John’s Bridge over the River Nore in Kilkenny. The bridge comprises a single arched span of nearly 43 m. When it was completed in
1912, it was the largest single-span reinforced-concrete bridge in the UK. The bridge used the Hennibique system of reinforcing concrete. Unfortunately, the arch required some work in the 1970s and the once-open spandrels were filled in, which changed the way the bridge carries its loads.

Ireland has an estimated 25,000 masonry arch road bridges. From an engineering perspective, the finest example is Alexander Nimmo’s Sarsfield Bridge over the River Shannon in Limerick. Nimmo appears to have drawn his inspiration from Perronet’s Pont de Neuilly in Paris: Sarsfield Bridge has high span-to-pier width ratios and is complete with an arch opening that has the hydraulically efficient corne de vache. There is also a notable collection of fine eighteenth-century masonry arch bridges over the River Nore and River Barrow in the south-east of Ireland (see Ruddock, 1979).

Ireland has other notable civil engineering heritage in the form of water towers, dams and reservoirs and harbours. Ireland also has a long history of lighthouses. The lighthouse at Hook Head in County Wexford is considered to be one of the earliest in Britain or Ireland. The lighthouse began as a fortress and lookout in 1172. The Fastnet Rock lighthouse, Ireland’s most iconic lighthouse, is located on a rock 7 km off the Cork coast southwest of Cape Clear (Figure 4). The current lighthouse was designed by William Douglass, the then engineer-in-chief to the Commissioners of Irish Lights. It was constructed between 1896 and 1904 of dovetailed blocks of Cornish granite. The base has a classic elliptic profile, and the total height of the lighthouse is 54.7 m. All Irish lighthouses are now automated.

The most significant Irish civil engineering project of the twentieth century was the construction of the hydroelectric dam and power station at Ardnacrusha on the River Shannon. Ardnacrusha was constructed very shortly after the foundation of the Irish Free State in 1922, and at the time, it was one of the largest civil engineering projects under way anywhere in the world. Its success was very important not only because it provided sufficient electricity to meet in excess of 100% the country’s electricity usage at the time but also because it was a successful flagship project of the fledgling Irish state. Ardnacrusha was followed by other hydroelectric schemes with large dams being built at Pollaphuca on the River Liffey, which created Blessington Lake, and at Inniscarra on the River Lee. Both these dams also served the dual purpose of creating freshwater reservoirs. Blessington Lake provides additional water supplies for Dublin City, which is also provided with water from the Vartry and Bohernabreena reservoirs in the Wicklow Mountains, which were constructed in the 1860s and 1880s, respectively. Water supply has a long history in Ireland, and Balrothery Weir, which was raised in 1244, is probably Dublin’s oldest operational civil engineering infrastructure.

**National and regional recognition of engineering heritage**

The Department of Arts, Heritage, Rural and Gaeltacht Affairs has the responsibility of both Irish national monuments and the wider protection of Ireland’s architectural heritage, as laid out in the Planning and Development Act 2000 (2000). This Planning
and Development Act 2000 places responsibilities on both the planning authorities and owners. There is an official Record of Protected Structures, but protected structures are not graded in the same way that they are in the UK.

Over the last number of years, the Department of Arts, Heritage, Rural and Gaeltacht Affairs has compiled a national inventory of architectural heritage. The results of this inventory are available online, and the department has also published an excellent county-by-county series of books that present and interpret this architectural heritage (National Inventory of Architectural Heritage; Department of Arts, Heritage and the Gaeltacht, 2016). The inventory is very broad and includes many hundreds of non-habitable protected structures, the category that encompasses engineering heritage structures and infrastructure. The department’s guidelines are described in its publication Architectural Heritage Protection: Guidelines for Planning Authorities (Department of Arts, Heritage and the Gaeltacht, 2015). This document and other useful publications, such as the department’s Advice Series, which comprises technical guidance documents on the repair and conservation of elements of heritage structures, are freely available for download.

The Heritage Council is an independent government-funded body that has responsibility of promoting heritage. The council provides grant aid to help fund research and support the maintenance or rehabilitation of heritage properties. The Heritage Council also coordinates Heritage Week, which takes place in the last week of August. Heritage week provides an opportunity for both national and local organisations to organise events to promote Ireland’s natural, built and cultural heritage. In recent years, Heritage Week has included many events that are relevant to Ireland’s industrial heritage and engineering history.

Ireland’s engineering heritage is recognised within the engineering profession, within the related discipline of architecture and among industrial archaeologists and historians. However, while engineering students in Ireland are exposed to best practice regarding the restoration and reuse of older structures, the history of engineering is not taught as a separate subject. This is in contrast to the manner in which the history of architecture is taught to architectural students. Nevertheless, many Irish academics incorporate elements of engineering history within their courses.

Exemplar conservation of engineering structures

Ireland has two UN Educational, Scientific and Cultural Organization (Unesco) World Heritage sites: Sceilg Mhichíl, the early monastic site on Skellig Michael, and the Neolithic burial sites of Knowth, Newgrange and Dowth, collectively called Brú na Bóinne, which is located on the banks of the River Boyne. Unlike the UK, Ireland has no Unesco sites associated with industrial heritage. However, the Straffan Steam Museum in County Kildare and the Lee Waterworks in Cork City are two sites that would be of particular interest to engineers visiting Ireland.

The conservation of built heritage has come much more to the fore in recent years in Ireland. The Planning and Development Act 2000 (2000) introduced comprehensive measures to conserve architectural heritage. Hand in hand with the act came a system of grants for protected structures and support for the employment of conservation officers in local authorities. The focus on best practice in the area of engineering conservation is best exemplified by the recent agreement between Engineers Ireland and the Conservation Register for Engineers (Care). Care is a joint register supported by the Institution of Civil Engineers (ICE) and the Institution of Structural Engineers and administered by the ICE. The need for this agreement reflects the number of Irish engineers and engineering firms that are engaged in conservation work in Ireland, the UK and further afield.

The range of engineering-related conservation is well showcased by three relatively recent examples: the restoration of the Turner curvilinear range of glasshouses in Dublin’s Botanic Gardens, the commercial redevelopment of Rennie’s Stack A warehouse in Dublin’s docklands and the development of the Great Western Greenway between Westport and Achill.

Turner’s glasshouses in the Botanic Gardens were restored by Ireland’s Office of Public Works. Whereas Turner’s Palmhouse at Kew was effectively replaced, his glasshouses in Dublin were dismantled, each piece of ironwork restored, and where necessary new components were hand forged. Similar care went into the refurbishment of Dublin’s Liffey Bridge in the early 2000s.

The reuse of Rennie’s Stack A warehouse, now called the CHQ Building, is an excellent example of engineering conservation in the commercial sphere (Figure 5). The warehouse was a bonded warehouse built in 1820, a few years after Rennie’s London warehouses. It was constructed from non-flammable material; hence, the internal columns, roof trusses and rafter members were all formed from iron, predominantly cast iron. This roof is a very early iron roof, and the connection details echo carpentry practice. The redevelopment of this building, which rescued it, was executed very sensitively, and the project won the Royal Institute
of Architects of Ireland the Best Conversation/Restoration Project award in 2008.

Maintaining non-building civil engineering heritage can be problematic. Luckily, much of Ireland’s civil engineering heritage is in the form of bridges on roads and railway lines that still carry traffic. Although this infrastructure needs constant maintenance and sometimes modification, this work is being undertaken with due consideration of the heritage dimension. Irish Rail’s engineers have recently described the excellent work that has been done to maintain and strengthen some of Irish Rail’s finest bridges without detracting from their appearance (McCaron and McAdam, 2014).

The recent development of the Great Western Greenway shows the potential to redevelop redundant civil engineering heritage. The Westport to Achill railway, which closed in the 1930s, has recently reopened as a segregated cycleway. The route is 42 km long and has been such a success that plans are under way to establish new cycleways along other stretches of Ireland’s disused railway lines.

**Information sources for engineering heritage**

Engineers Ireland, the operating name of the Institution of Engineers of Ireland, is the body responsible for maintaining the register of chartered engineers in Ireland. Engineers Ireland has a number of discipline-specific sectors and regional divisions that organise evening lectures and seminars. Engineers Ireland also has a heritage society that organises an annual programme of evening lectures on engineering history and heritage topics. The Irish Academy of Engineering, which serves a similar role as the Royal Academy of Engineering in the UK, has a committee which is concerned with engineering heritage.

Ireland was part of the UK during the eighteenth, nineteenth and early twentieth centuries. During this period, engineers and engineering companies from Ireland and the rest of UK practiced in all parts of the UK. Thus, it is sensible to consider Irish engineering heritage in the overall context of UK engineering heritage. Engineers Ireland has close ties with ICE and maintains its database of historic engineering works in the same format as the Historic Engineering Works (HEW) database maintained by the ICE. In fact, the Republic of Ireland database is incorporated in ICE’s HEW database and Engineers Ireland is represented on ICE’s Panel for Historic Engineering Works (PHEW). Thus, the ICE’s HEW database is the primary reference for historic engineering works in Ireland, and the three-volume series of biographical dictionaries published by ICE is the principal source of information on Irish engineers. Ireland’s Civil Engineering Heritage is the principal work on Ireland’s civil engineering heritage (Cox and Donald, 2013). This publication had its genesis as part of a series of regional guides produced by ICE’s PHEW.

On the topic of bridges, the best general references are Ireland’s Bridges (Cox and Gould, 2003) and Across Deep Waters: Bridges of Ireland (Barry, 1985), while Irish Stone Bridges is the definitive reference on Ireland’s masonry bridges (O’Keeffe and Simington, 1991). Regional guides include Bridges of Dublin (Black and Barry, 2015) and Heritage Bridges of County Cork (Heritage Unit of Cork County Council, 2013). Ruth Delany is the principal author on publications on Ireland’s inland waterways, and she has written a number of books on the Grand Canal, the Royal Canal and the Shannon navigation (Delany 1992a, 1992b, 1995, 2008). There are many books on Irish railways, but Tom Ferris’s The Gleam of the Lines: an Illustrated Journey through Two Centuries of Irish Railway History is a good place to start (Ferris, 2011).

Engineering Ireland covers the history of engineering of all disciplines in Ireland (Cox, 2006), and Colin Rynne’s Industrial Ireland 1750–1930: an Archaeology is an excellent reference that looks at Ireland’s industrial heritage (Rynne, 2006). This book also covers engineering in Ireland very well and is particularly well referenced. Finally, Called to Serve presents a history of the presidents of the Institution of Civil Engineers of Ireland from 1835 to 1968 (Cox and O’Dwyer, 2014). A pdf of this publication is available for free download at the websites of Engineers Ireland and the Irish Academy of Engineers.

The principal periodical resource is the Transactions of the Institution of Civil Engineers of Ireland. These transactions began in 1845 and were published until 1969, when they became the Transactions of the Institution of Engineers of Ireland. The transactions are in the process of being digitised by Trinity College Dublin’s library and can be accessed by way of the library’s digital collections website (The Library of Trinity College Dublin, 2016). The Irish Railway Record Society publishes a journal that is of particular interest to anyone researching on Irish railways. The Proceedings of the Royal Irish Academy are a potentially useful source of information on the development of infrastructure in mediaeval times. The Irish National Archives and the archives of the Office of Public Works and Waterways Ireland are also valuable sources of information. So too is the Public Records Office of Northern Ireland, which also holds some material pertinent to early works in the Republic of Ireland.

Ireland has an active community of local history societies, and the transactions of these societies are a potentially valuable resource. The Federation of Local History Societies has a web page that links to the individual societies. The Irish Architectural Archive (IAA), which is located on Merrion Square in Dublin, is a most useful specialist archive for architectural and engineering heritage. The IAA also holds the archives of Engineers Ireland and the Industrial Heritage Association of Ireland (IHAI). IHAI has an active interest in Ireland’s civil engineering heritage, and the association frequently organises field trips to civil engineering heritage sites. Details of the IHAI’s activities can be found at its website (IHAI, 2016).
Further detailed advice on locating information on Ireland’s engineering heritage can be found at the website of the Civil Engineering Heritage Archive (Trinity College Dublin, 2016).

The following is a limited selection of publications on Irish civil engineering heritage; a more complete listing, including biographies, is available on the Irish Academy of Engineering website (Irish Academy of Engineering, 2016) and the Engineers Ireland’s Heritage Society website (Engineers Ireland, 2016).

REFERENCES
Delany R (1992a) Ireland’s Inland Waterways. Appletree, Belfast, UK.


FURTHER READING
Cumberledge J (2002) Inland Waterways of Ireland. Imray Laurie Norie & Wilson, St Ives, UK.
Mulligan F (1983) One Hundred and Fifty Years of Irish Railways. Appletree, Belfast, UK.

Shepherd WE (1994) *The Midland Great Western Railway of Ireland*. Midland, Leicester, UK.


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