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a Guide to **Historic Ironwork** in Cork City

Eolaí ar Obair Stáinéil Ianarn i gCathair Chorcaí

an action of the **Cork City Heritage Plan 2007 - 2012**

acknowledgements

This publication was produced by Cork City Council Planning and Development Department with the financial support of the Heritage Council.

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Cork City Council would like to express their appreciation to Cork City Libraries, Charles Laing & Sons, Edinburgh, Scotland, Richard Linstead, Blacksmith, David Mitchell, Historic Scotland and the Scottish Ironwork Foundation for their assistance on this project.

Táimíd fíor-bhuíoch dóibh san go léir a thug lámh chúnta d'fhon an saothar a thabhairt chun críche.

COMHAIRLE CATHRACH CHORCAÍ
CORK CITY COUNCIL

An Chomhairle Oidhreachta
The Heritage Council

Prepared by Cork City Council with the Support of the Heritage Council

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Left: Simple wrought iron railings, Gardiner's Hill

message from the lord mayor

I am delighted to be associated with the interesting booklet "A Guide to Historic Ironwork Cork City".

I wish to congratulate those members of staff who prepared this document particularly Niamh Twomey Heritage Officer and acknowledge the support of the Heritage Council.

I hope that this booklet will provide useful information to members of the public and owners of Historic Ironwork in Cork City and help to highlight the distinctive character of traditional ironwork in Cork City.

Councillor Brian Bermingham, Lord Mayor

message from the city manager

Cork City Council is committed to promoting and protecting the Heritage of Cork City through the implementation of the Cork City Heritage Plan. I am delighted to welcome "A Guide to Historic Ironwork in Cork City" which is a valuable addition to the existing series of interesting and worthwhile Heritage publications.

I hope that this publication will give the reader an introduction to the exceptional variety of traditional ironwork that survives in Cork and also offer advice on how best to maintain this important element of the Heritage of Cork City.

Mr Joe Gavin, City Manager

foreword

As Chairman of the Cork City Heritage Forum I welcome the "Guide to Historic Ironwork in Cork City". This publication is an action from the Cork City Heritage Plan 2007 - 2012.

This booklet provides an introduction to the history of Iron production in Cork, the various styles and material properties of Ironwork and the incredible variety of Ironwork in Cork City from railings, gates, balconies, door panels and boot scrapers to post boxes, lamp posts and bridges. In addition this publication gives information on the maintenance and repair of historic ironwork.

I would like to acknowledge the work of Ms Ali Davey who carried out the research for this publication with assistance from Ms Katriona Byrne. I would also like to thank Niamh Twomey Heritage Officer who helped prepare this document and the Heritage Council for their financial support.

Mr Kevin Terry
Chairman of Cork City Heritage Forum
Director, Planning and Development and City Engineer

reamhfhocal

Mar Chathaoirleach ar Fhóram Oidhreachta Chathair Chorcaí fearaim fáilte roimh an "Eolaí ar Obair Stairiúil Iarainn i gCathair Chorcaí." Gníomh is ea an foilseachán seo ó Phlean Oidhreachta Chathair Chorcaí 2007 - 2012.

Soláthraíonn an leabhrán seo tús eolais ar stair tháirgthe larainn i gCorcaigh, na stíleanna agus na cáilíochta éagsúla ábhair na hOibre larainn agus an éagsúlacht dochreidte in Obair larainn Chathair Chorcaí ó ráillí, geataí, balcóiní, painéil do dhoirse agus scríobáin bróg go boscaí poist, cuaillí lampa agus droichid. Lena chois sin, tugann an foilseachán seo faisnéis ar chothabháil agus deisiúchán ar obair stairiúil iarainn.

Ba mhaith liom aitheantas a thabhairt d'obair Ms Ali Davey a rinne an taighde don bhfoilseachán seo le cúnamh ó Ms Katriona Byrne. Ba mhaith liom chomh maith buíochas a ghabháil le Niamh Twomey, Oifigeach Oidhreachta, a chuidigh leis an doiciméad seo a ullmhú agus leis an gComhairle Oidhreachta as a gcuid tacaíochta airgeadais.

Mr Kevin Terry
Cathaoirleach ar Fhóram Oidhreachta Cathair Chorcaí
Stiúrthóir, Innealtóir Cathrach Pleanála agus Forbartha

introduction

Many of the buildings in Cork were developed during a time when architectural ironwork was rising in popularity. This popularity was triggered by technological advancements in the 18th and 19th Centuries which enabled iron to be produced at increasingly affordable prices. Developers and homeowners in Cork at the time were well aware of the growing fashion for architectural ironwork and were quick to incorporate it into their homes and new developments. Many of the buildings and streets in Cork dating to this era display an incredible variety of ironwork, from railings, gates, balconies, door panels and boot scrapers to post boxes, lamp posts and bridges.

There was a strong tradition of wrought ironwork in Ireland, and many fine examples of elegant Georgian wrought iron railings survive around the city. There are also a number of exceptional examples that are of national significance, such as the beautifully crafted overarch on North Mall, or the spectacular turn-of-the-century wrought iron gates at the west entrance of University College Cork. The later Victorian fashion for cast iron is well represented by the many streets around the city lined by cast iron railings. The survival of so many cast iron designs is impressive. Many of these designs are distinct to Cork, while others were once common across the UK and Ireland but were largely lost in the UK to the war effort. So, while ironwork in Cork reflects more general national and international design trends, it also has a distinctive character which sets it apart from ironwork found in other towns and cities across Ireland.

This booklet aims to give the reader an introduction to the exceptional variety of traditional ironwork that survives in Cork and also offers advice on how best to maintain it for future generations to enjoy.

Left: Cast iron columns and window grilles, South Mall

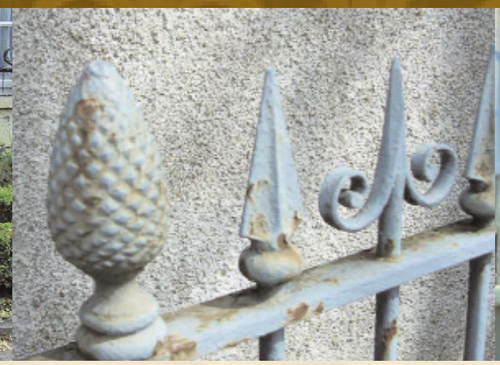
Above: A cast iron street sign Military Road

Above Top: Cast iron lamp standards, South Mall

a stylistic history of cork's ironwork

The architectural ironwork of Cork city is a testimony to the work of craft and industry both at local and international level but also to the prevailing tastes and fashions. It appears to have been remarkably responsive to the local environment and as a body of artistic work exhibits both marked and subtle differences from the ironwork of other towns and cities in Ireland. In this sense it reflects the differences that pertain to the architecture of Cork as set against that of Dublin, but it goes further, so that in several eras there can be said to be a truly Corkonian style of ironwork.

Left: Decorative iron overarch on North Mall, a rare survivor



Above: Typical Georgian railings on Dyke Parade where the bars run directly into the plinth and plain finials alternate with scrolled finials; a decorative central panel enlivens the streetscape

Above: In Ashton College, Old Blackrock Road, three types of finial are used with the cast iron pine cones articulating the corners and the stouter bars

Above: The Georgian style endured with this example on the Old Custom House featuring wavy finials as well as the more ordinary scrolled ones.

Georgian

The earliest ironwork identified by the authors is the very distinctive Georgian ironwork that is found along the older streets close to the city centre which were lined by classical terraces in the late eighteenth and early nineteenth centuries, streets such as Dyke Parade and North Mall, where the Georgian idiom of polite townhouses with flush homogenous facades were afforded a degree of privacy and separation from the public domain by the small front gardens protected by railings.

The most popular railing type consisted of square-section vertical bars which were individually fixed into the stone plinth and pierced a top rail ending in decorative finials above. The finials consisted of a pointed end with scrolls which emerged from the bottom of the point and turned upwards, and slightly inwards ending in a point; slightly later examples tended to roll into a tight coil. They were often alternated with plainer finials, either pointed or pinched. Occasionally these railings have a decorative central panel or panels placed at key intervals consisting of some restrained scrollwork. Gates and bootscrapers were seamlessly integrated while elegant backstays often curved to the rear. Although these railings are simple and chaste in overall effect, in keeping with the buildings they were associated with, the rustic charm of the detailing makes them as characteristic of Georgian Cork as lead fanlights are of Georgian Dublin. Both the finial type described above and the fact that the bars enter the plinth directly are not found in Dublin ironwork. There, the standard type has a bottom rail into which the bars run and this rail rests on its own small bases. However there are some good examples in Cork that follow more national trends such as South Terrace with its bottom rail, spear finials and openwork lamp piers. Belleview Villas and Clermont Terrace, both c. 1820, combine the Dublin form with Cork finials.

Another feature from this era which found its most elaborate expression in Cork is the decorative overarch, two of which survive on North Mall. On No. 15, dating to c.1780, flamboyant side panels laced with scrolls and sprouting tendrils support an arch over the threshold of the path leading to the front door; here the ironwork exaggerates the period's tendency to concentrate all the decoration of the façade around the front entrance; originally a lamp would have been set into this arch to illuminate the entrance at night.

There are a pair of decorative gates from the Bishop's Palace which have been dated to c. 1780 and are a rare survivor in Cork of a more national Rococo style, such as flowered in Irish plasterwork c. 1755-80. These combine elaborate cast panels of scrolling acanthus leaves punctuated with rosettes set into a wrought iron frame. It is possible that there are other good examples of this type out of sight in gardens and on large estates in the city and county.

Above: Elaborate railings on Parnell Place guarding the Cork Savings Bank

Above: Typical Greek Revival motifs of palmette (left) and anthemion (right) appear in railings on Wellington Road and Anglesea Street respectively

Above: Gates to a house on Douglas Road

Greek Revival

Cork underwent another wave of expansion a couple of decades into the nineteenth century. This was a period when, in Irish art-historical terms, the Greek Revival was one of the dominant choices of style for the building profession. In Cork it seems to have found a resonance as it endured well beyond a time when it was outmoded elsewhere. In this sense one could say that it became a significant language of the public domain in Cork, at least as far as architectural ironwork is concerned. It consisted largely of motifs, the most common being the palmette (leaf) and the anthemion (honeysuckle), and these usually take the form of finals on railings and gates; examples can be found on Wellington Road, the Marina and Sunday's Well. During this period, as the availability of cast iron improved, more cast iron elements were incorporated as decorative features into ironwork; they appear as finials, and as husks and collars which slot over the bars. Bottom rails become the norm at this time. A set of elaborate gates on Douglas Road, c.1830, is noteworthy because here we see the new Greek details combined with the scrolls and the typical Cork finials that we encountered in the Georgian era. Public buildings, such as banks and offices, also adopted the Greek Revival style, mixing it with other stylistic borrowings. Occasionally it became stylised into a French form with fleur-de-lis finials.

Right: Railings in front of commercial building on South Mall combining French and Greek motifs

Above Clockwise: Victorian railings on top of low wall on Gardiner's Hill, as essential to the character of the house as the mouldings around the window and front door

Two examples of typical Cork wrought iron (left) and cast iron (right) railings from the Victorian period, with Gothic arches

Pedestrian bridge over the railway on the Lower Glanmire Road

St Joseph's Villas, Old Blackrock Road with one of new cast iron name plaques popularised in the Victorian era (center)

Victorian

The Victorian era is characterised by an explosion of decorative detailing, an expansion of building types and a referencing of every style known, from Gothic to Romanesque, Greek to Egyptian, English Tudor to Irish Georgian. It also coincided with another building boom in the city heralded in by the development of the railways and the rise of the middle classes. Although the Greek Revival held a dominant place for a long time in Cork ironwork, various other styles and motifs crept in, particularly from 1870 on, and Victorian suburban developments, such as along Old Blackrock Road, Western Road, Victoria Road, Summerhill North and South, are a great place to look for ironwork from this era. This period also saw a greater division between the public domain and domestic space so front gardens became longer, where the land was available, and railings were exploited to accentuate these boundaries. The variety and inventiveness of the ironwork from this period is astounding.

A key feature of Cork Victorian ironwork was the introduction of the arched form between the top and bottom rails, either round-headed or pointed, and often ogee in shape. Its appearance in wrought form can be quite simple and open yet it has a vigorously architectonic quality to it. Cast finials in a variety of designs including fronds, and a fleur-de-lis which remains popular to this day, were added. This arched form was also adopted in railings composed entirely of cast iron panels which had a greater level of detail – this gave them a different character. Some railings used motifs of croziers and spiked balls, bringing a fashionable antiquarian sentiment, with its obsession with medieval culture, to the streets. There is no doubt that decorative ironwork became a device by the builders of speculative terraces to distinguish their houses from their competitors and to make them more desirable to prospective residents. A walk through the streets to the south and east of UCC sees Victorian and Edwardian lower middle class developments cheek by jowl displaying a cacophony of fanciful ironwork. At this time we see the introduction of closed rather than openwork piers. Decorative ironwork came to be used on window guards, on top of boundary walls, and as cresting to roof ridges. Street name plates also became widespread. Very fine examples of cast iron street furniture such as lamp standards and fountains survive from this era. Even railway bridges were given the full Victorian treatment.

Above: George Smith & Co's Sun Foundry design on Summerhill

Above: Park Villas, Victoria Road - gate by Waltar MacFarlane & Co of Scotland

Above: Very fine ironwork to a large Victorian house on Middle Glanmire Road

Much of the cast iron work from this era was imported; we can identify several patented designs from Scottish foundries, including two superb examples on Summerhill and Wellington Road made by George Smith & Co's Sun Foundry, Scotland; these have a much tighter lattice of elements and feature lacy fronds. Cast iron work made by Walter MacFarlane & Co, can be seen on Park Villas, Victoria Road, c. 1890, with little round-headed gates, and first floor balconies adorned with floral motifs, and off Military Road - both innovative, almost Expressionist designs.

One-off examples of exceptional quality from the Victorian era can be seen on Middle Glanmire Road and in UCC's western gates. These exhibit a confidence and flamboyance unsurpassed in the city and amongst the best examples in the country.

Early to mid-twentieth-century styles

The Edwardian era heralded in by the death of Queen Victoria in 1901 continued the Victorian penchant for a greater proliferation of motifs. We see quirky grapes and vine leaves on Western Road and apples in flat panels topped by pediments on Highfield Avenue. More innovative ironwork adopted the Arts and Crafts style's emphasis on handmade quality by expressing the elements that held the railings/gates together, referring to the work of the blacksmith who made and assembled them - these elements had formerly been concealed but are now made obvious, appearing most commonly as dome-headed bolts. This brought a new vigour to wrought iron work in the city.

Above: Vegetative motifs on Highfield Avenue (left) and Western Road (right) continue the Victorian era's love of decoration into the twentieth century

Above Clockwise: Classical rail to balcony on Wellington Road

Classical railings and gates on Wellington Road

Bridge over the River Lee

Art Deco railings and gates fronting Honan Chapel, UCC

Art Deco railings on Victoria Road

Art Nouveau railings on the Mardyke and to Fitzgerald Park

Right: The use of dome-headed bolts and connecting collars gave ironwork from this era of an attractive appearance

Below: A nicely designed twentieth century manhole cover

Some Art Nouveau elements crept in just before 1900 and, typically for Ireland, consisted of the faint whiff of the style rather than the full-blown version of the continent. Examples include the railings on the Mardyke and the aforementioned MacFarlane examples. Some Art Deco railings such as those fronting the Honan Chapel in UCD and a 1930s office building on Victoria Road are rare examples of this style.'

However it is the revival of classicism, particularly of the Georgian period, that was the dominant trend of the early twentieth century, probably as a reaction to the excesses of the Victorian era. This was much used in public buildings, such as the railings around the new City Hall. Several bridges across the river Lee utilise a Greek key detail within a much more restrained grid. In housing we see an ordinary house on Western Road using the eighteenth-century motif of a decorative panel enlivening a plain run of railings in its first floor balcony balustrade. The neo-Georgian villas on Western Road are a fine example and use mainly vertical forms with a central shield motif and some simple scrollwork.

Later Twentieth-century

The best ironwork from this era includes decorative manhole covers which use Celtic motifs. Some good restoration work was carried out which served to prolong the life of historic ironwork but unfortunately the replacement of historic railings with fabricated railings, many composed of individual components imported from as far away as China, is widespread. Even ostensibly modern offices are given fake but traditional-looking railings. There is a need to encourage the production of original architectural ironwork which is specific to the existing age and thus continue the great artistic traditions of the city.

ironwork and iron production in cork

The development of the city

Cork city, which sits along the banks of the river Lee, is Ireland's second largest city. The development of much of the city as we know it today coincided with the Industrial Revolution, a period when architectural ironwork was highly fashionable. The 18th Century saw a period of major expansion; the city's harbour had become an important centre for trade, particularly to the West Indies; the butter market was of international standing and the textile industry was also flourishing. It was during this phase of expansion that much of the marshland surrounding the city began to be reclaimed and the river Lee confined within quays.

Though the early 19th Century was beleaguered by economic decline, foreign competition for trade and cholera outbreaks, the population of the city continued to grow. Industries such as brewing and distilling, tanning and shipbuilding continued to prosper. The 1850's saw the introduction of the railway to Cork which also created a building boom.

The rise in popularity of architectural ironwork

Up until the beginning of the 1800's, the cost of producing iron made it a prohibitively expensive material to use on a large scale. The development of new technology through the course of the 18th and 19th Centuries revolutionised iron manufacture, and enabled the material to be mass produced for the first time. This, combined with the innate properties of the material - strength, durability and versatility - meant that iron came to be used around the globe, from Ireland and the rest of Europe to Malaysia, South America and Australia, to enclose property, drain rainwater from the roofs of buildings, to provide services such as street lighting and post boxes and for the construction of bridges and entire buildings. It would eventually change the face of building design forever.

Right: This impressive example of railings made by the firm Perrott survives on Wellington Road

Above Left: An elegant run of 19th Century railings, Wellington Road

Above Middle: Dunscombe Fountain, Shandon Street (now lost). This fountain was cast by George Smith & Co's Sun Foundry in Glasgow sometime in the late 19th Century. Image courtesy of Cork City Libraries

Above Right: Detail of an impressive gate, of national importance, at the West entrance of University College Cork, supplied by the firm John Perry & Sons who were based on Patrick Street

Above: An impressive pair of lamp standards on South Mall were supplied by the Cork firm Harris & Co, and are dated 1882

Ironwork operations in Cork

Ireland was an important producer of iron during the 17th and 18th Centuries due to the abundant supply of cheap fuel (charcoal) for the furnaces. The iron smelting industry reached its peak around the year 1696-7 when 1,692 tonnes of iron were being exported to England[1]. However, by the mid 18th Century much of Ireland's woodland had been depleted. This, combined with a move to fuelling furnaces with coke (processed coal) left Irish smelting operations at a disadvantage and the industry went into a rapid decline. By the early 19th Century Ireland had to import a large proportion of its iron from Britain and other countries, and by the closing decades of the century had ceased smelting iron altogether.

Despite these setbacks to the Irish iron smelting industry, iron remained popular. As demand for the material increased through the 18th and 19th Centuries, fuel, pig iron and wrought iron, as well as finished products were imported from the rest of Europe.

Cork was Ireland's main Atlantic port in the opening decades of the 19th Century, and in the 1820's and 30's was the most important ship building centre in Ireland[2]. However, Belfast supplanted Cork as the leading ship building centre from the mid 19th Century onwards. Nevertheless, Cork had no shortage of smaller industrial companies, iron merchants, foundries, ironworks, smiths and ironmongers in the late 19th Century. A detailed account of many of these operations can be found in Colin Rynne's publication *The Industrial Archaeology of Cork City and its Environs*, Dublin, The Stationery Office, 1999.

Above: This elegant late 19th Century wrought iron railing, enclosing Bon Secours Hospital on College Road, was made by Buckley & Co (Ironworks) Ltd. of Cork

Above: Brian Boru Bridge ironwork was supplied by the firm of Merrick, Cork

Many manufacturers' names can be spotted around the city; "Hive Iron Works", "Perrott", "Merrick", "Buckley" and "John Perry & Sons" are a few examples. The 1878 edition of the Post Office Directory of The Engineers and Iron and Metal Trades, and Colliery Proprietors listed:

- *8 mechanical engineers*
- *4 iron foundries*
- *5 iron merchants*
- *6 wholesale ironmongery stores*
- *10 retail ironmongers*
- *11 smiths*

A number of firms were listed under several of these categories, such as Richard Perrott and Sons of Hive Iron Works, Hanover Street; Jeremiah Merrick (6 Warren's Place) and John Perry & Sons (89 Patrick Street) which suggests that they may have been larger operations.

Right: The names of Hive Iron Works and Perrott are prominent on many items of ironwork found around the city. This example survives on Wellington Road

The name of the **Hive Iron Works** is commonly seen on ironwork around Cork. Rynne explains that this firm, based at Hanover Street, was set up in 1800 by Thomas Addison Barnes. The foundry manufactured machinery parts and engineering castings and later developed expertise in the production of steam engines. Just over a decade later, new partners were brought into the firm, including Richard Perrott who later went on to set up a foundry on Hanover Street in 1828. **Perrott** is another name that can be frequently spotted around the city. The Hive Iron Works and Perrott's operation appear to have merged some time later, and eventually became the largest engineering works in Ireland outside Belfast. The peak came around the year 1860, and the firm was producing a broad range of products from turbines and waterwheels to agricultural implements and structural elements such as columns and beams, as well as decorative architectural ironwork such as gates and railings. Hive Iron Works was even exporting silk-dressing machines to Australia in 1866 according to Rynne.

[1] JH Andrews, Notes on the Historical Geography of the Irish Iron Industry, Irish Geography, Vol. 3, No. 3, 1956, p.143
[2] Bielenbert, Andy, Cork's Industrial Revolution 1780-1880, Cork University Press, 1992

Above: An impressive gate, of national importance, at the West entrance of University College Cork, supplied by the firm John Perry & Sons who were based on Patrick Street

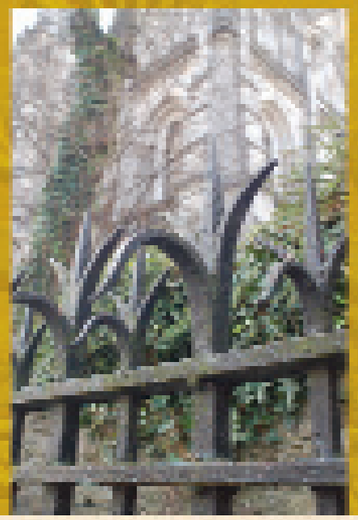
Right: Railings, Summerhill, made by the world famous Coalbrookdale foundry in Shropshire

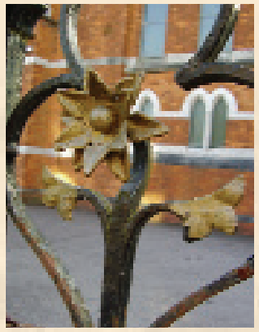
Below: Post box, Wellington Road. Post boxes were generally cast in England or Scotland and many survive and remain in use to this day. This example was cast by the Scottish firm McDowall Steven & Co (based in Glasgow and later Falkirk)

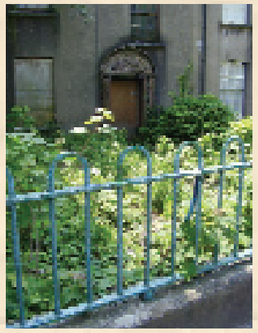
John Perry & Sons is another maker's name that is seen on many gates and railings around Cork, and this firm supplied the stunning set of wrought iron gates found at the West entrance to University College Cork.

While much ironwork was produced locally, a considerable amount of cast ironwork was also shipped over to Ireland from Scotland and England. Firms such as Walter MacFarlane & Co (Glasgow), George Smith & Co (Glasgow), and Carron Ironworks (Falkirk) were supplying ironwork to Cork, and their names can still be found on many railings today. English companies such as the famous firm Coalbrookdale (responsible for casting the world's first iron bridge, which still stands in the Ironbridge Gorge in Shropshire) and Pickley Sims & Co Ltd (in Leigh, Lancashire - a firm better known for its agricultural machinery), were also supplying ironwork to Cork.

A large proportion of the cast iron railings and gates are frustratingly unmarked however, making it impossible to determine whether they were cast by local Irish foundries, or imported from Britain.







Above Top: Wrought iron finials, St Fin Barre's Cathedral. Note the pin below the top rail which held it in position when the railings were being assembled on site

Above: Detail of a wrought iron gate, Military Hill. Note how the pin holding the petal details in place is incorporated into the design

Above: Hoop top railings, Wellington Road, common in Cork

material properties

One of the most commonly encountered problems when looking at historic ironwork is determining whether it is wrought or cast iron. Issues also arise when distinguishing wrought iron from mild steel, a commonly used substitute material for repairs. Wrought iron, cast iron and steel each have distinct properties that differ considerably from each other. It is important to be able to tell one from the other so that the appropriate contractor can be appointed and appropriate repair techniques selected. The following section outlines the properties of the most commonly encountered materials used for the repair of ironwork, and describes how to distinguish cast iron from wrought iron.

Wrought Iron

Wrought iron contains very little carbon and is fibrous in composition due to the presence of long strands of slag contained within the iron. It is malleable (it is easily shaped by hammering and rolling) and ductile (it can be shaped by extrusion through dies to form wires). It is strong in tension, and has good corrosion resistance.

Wrought iron was formed by melting pig iron in a special furnace and "boiling" it to reduce the amount of carbon it contained. The resulting material was rolled into a ball known as a 'bloom', hammered and then rolled into bars. The bars were chopped up, reheated and then hammered and rolled again. The more times this process was repeated, the better the quality of the wrought iron (which could be classed as 'best' quality, 'best best' quality or 'best best best' quality).

Unfortunately, new wrought iron is no longer made in Europe and there are no known commercial sources in the world. There is only one supplier of recycled wrought iron, based in Britain. In fact, 'wrought iron' is currently an over-used term that is often applied to any type of worked steel. It is important to note that wrought iron and mild steel are not the same material.

Right: A simple wrought iron gate held together by means of pins and mortise and tenon joints. Military Hill area

Wrought iron is shaped by hammering, rolling, punching and machining. All of these processes influence the shapes and designs that can be produced. Wrought iron cannot be cast.

Designs in wrought iron often tend to be lighter than cast iron; leafs, scrolls and collars are typical motifs. Wrought ironwork is also usually composed of several individual pieces fitted together and because it is shaped by hand, matching elements will rarely be identical.

Wrought iron railings usually fit together by means of bars piercing rails. The ends of bars which pierce through flat rails are usually hammered into a domed head at their base to hold them in place (a process known as bradding or riveting). Other sections of wrought ironwork are typically held together using collars, mortise and tenon joints, and other traditional techniques (many of which are based on joinery).

Above: Cast iron railings, cast as a panel, Military Road

Above: Moulder using pattern to make mould in sand. The patterns are often made in two halves, as shown in the image on the right
Image couresy of Charles Laing & Sons, Edinburgh

Cast Iron

Cast iron is higher in carbon than wrought iron, and crystalline in composition. It is strong in compression, but weaker in tension than wrought iron. Its high carbon content means that it is hard and strong, but also brittle (i.e. it will shatter under the force of a blow, rather than bend as wrought iron does).

Grey cast iron (the most commonly used type of cast iron for architectural castings) is formed by re-melting pig iron (when iron ore is first smelted, pig iron is the resulting material) in a furnace, skimming off the slag (waste material) which floats on the top, pouring this molten iron into a mould made of sand and then allowing it cool.

Traditionally, moulds were made using green sand (a natural type of sand that has clay coating each particle which helps the sand to form a good bond during the moulding process). A pattern, usually made of wood, was used to make the required impression in the sand. Great skill was required to produce green sand moulds, and because the sand did not set hard, moulds could only be used once. However, green sand enabled a crisp and detailed surface finish, perfect for decorative castings. The type of mould used to cast

iron will affect the quality of the detail and surface finish of castings, therefore where new castings are required to repair traditional ironwork it is important to produce them using well designed and made patterns and the traditional green sand moulding technique so that they are of a good quality and their finish is in keeping with the original ironwork. Grey cast iron is still commonly available. However, there is currently only one foundry in Ireland that casts iron using traditional green sand moulds. A number of foundries in the UK are also in operation which cast in the traditional way.

Top from left: Railings, Gardiner's Hill (left) and North Mall (right). These images show the difference between cast iron and wrought iron designs. Cast iron is often much 'heavier' with identical repeating motifs (although the above design mimics the collars that were often used to hold pieces of wrought iron together). Wrought iron tends to be lighter in design, and small differences can be spotted between matching elements

Above: Gate, Old Youghal Road. Palmette typical of cast iron which has been made using a pattern which can be reused

Right: Typical interlocking arrangement to join individual cast iron railing panels together

Below: A 20th Century mild steel gate, Gardiner's Hill

Cast iron can only be shaped by casting. Designs tend to be heavier than wrought iron, and matching elements are usually identical because patterns can be reused to make each mould. Bars and rails can be cast together as one panel, without the need for bradding elements into place or using collars. Cast ironwork is usually assembled in sections using pins, bolts, flanges, lugs and other interlocking arrangements. Cast iron structures such as fountains are often hollow and held together internally by the use of flanges and bolts. Manufacturers often included the company name on their castings, and these can frequently be found at the base of columns or on other flat sections.

Mild Steel

Mild steel is a type of carbon steel. It is homogenous in composition, and is also malleable and ductile and so can be shaped in similar ways to wrought iron. Mild steel can also be cast. However, it is generally considered to be less corrosion resistant than wrought or cast iron. Steel is made by pumping oxygen through molten iron at supersonic speed. The steel is then cast in a casting plant and then passed into a rolling mill to be shaped.

corrosion & deterioration

For corrosion to occur there must usually be both moisture and air present. This is why ironwork is painted or coated; it helps to prevent moisture and air gaining access to the surface of the iron. Corrosion will usually develop when iron remains wet or damp for long periods of time. This is often caused by damaged or decaying paint coatings, or occurs to areas where water cannot easily drain away, such as the flat surface of rails or cupped decorative details (such as leaf-work or cast iron husks and collars).

Above: Corroding wrought iron often 'delaminates' where the corrosion material takes on an almost fibrous appearance, similar to the texture of wood

Right: Gradually developing corrosion can lead to the eventual loss of decorative details

Far Right: The development of delaminating wrought iron corrosion is causing the slam bar of this gate to buckle and bend

Because wrought iron has a fibrous composition, it tends to delaminate as it corrodes, often resembling the texture of wood fibers. Wrought iron will usually bend and distort as the corrosion material develops and exerts pressure on the surrounding iron.

Developing corrosion on cast iron tends to flake, rather than expand into a fibrous mass. If the corrosion is trapped between two planes of cast iron, the cast iron will not bend but will often fracture under the pressure. Wrought iron will often give advance signs of an imminent failure, whereas cast iron can fracture without warning.

Right: Cast iron will usually shatter when hit with a sharp blow

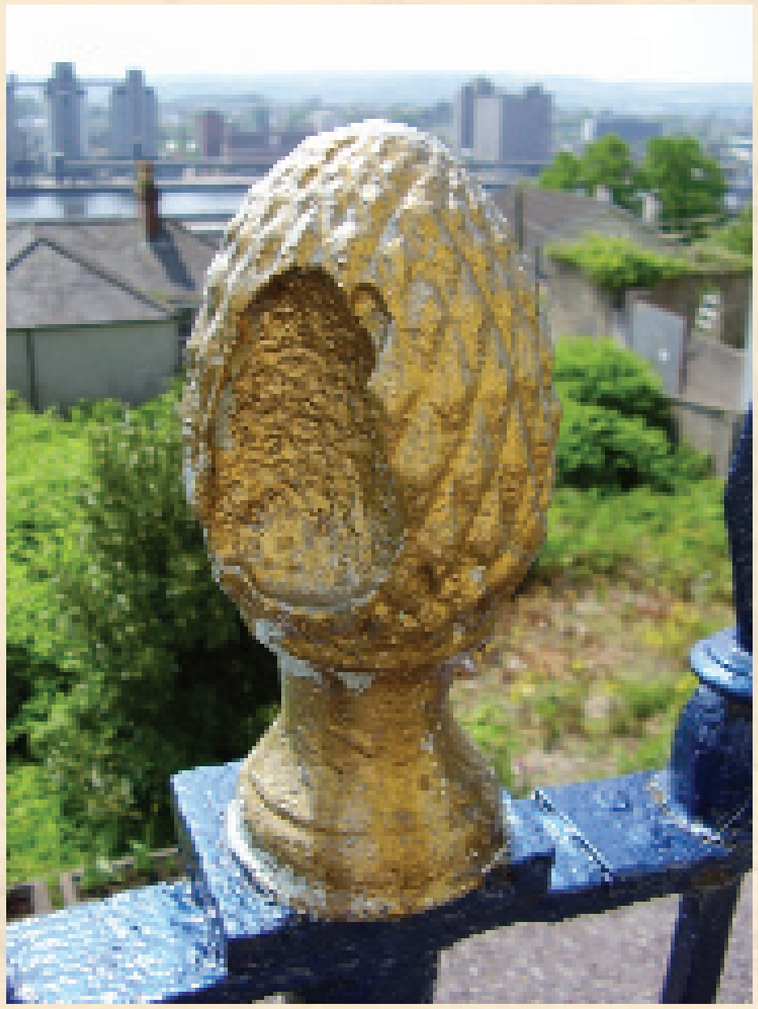
Below: Surrounding materials can also be damaged by developing corrosion. Where the feet of rails have been fixed into masonry, the pressure of developing corrosion can fracture stone and even cause portions of it to break off entirely. Concrete has also been used in this example below in an attempt to stabilize the corroding bases of the rails. However, the concrete will often crack, allow water to seep in and will aggravate corrosion of the ironwork, eventually leading to fracturing of the concrete itself

Galvanic corrosion (also known as bi-metallic corrosion) occurs when two dissimilar metals are placed in direct contact with one another in the presence of moisture. One metal will corrode more quickly than the other due to their different abilities to lose or gain electrons more or less readily.

Galvanic corrosion frequently occurs between wrought iron rails and bars and the decorative cast iron husks and collars that are attached to them. It will also occur where mild steel repairs come into direct contact with the original ironwork.

Mechanical action can also cause damage to ironwork. An unstable supporting wall may distort and fracture ironwork, or pull sections apart. Impact damage can cause deformation (in the case of wrought iron) and shattering (in the case of cast iron).

Above: Mild steel is generally considered to have inferior corrosion resistance to wrought or cast iron. This detail shows the base of a 20th Century mild steel repair to an earlier19th Century iron lamp. The base of this mild steel leg has completely corroded away. It is unlikely that either wrought or cast iron would have eroded to such an extent so quickly



Above: Occasionally damage is not caused by corrosion, but may be an original casting flaw. Such flaws were frequently disguised by filling them with a mixture of wax and iron shavings before they left the foundry

maintenance

Regular maintenance is the key to preserving ironwork, so routine annual inspections are advisable to check for signs of developing corrosion.

Above Top: Flaking paint can act as a water trap and will lead to the development of corrosion

Above: It is especially important to inspect balconies regularly; extensive cracking of the stone floor on this balcony has made it unsafe

Right: Rainwater goods such as gutters, downpipes and hoppers should be cleared and inspected annually

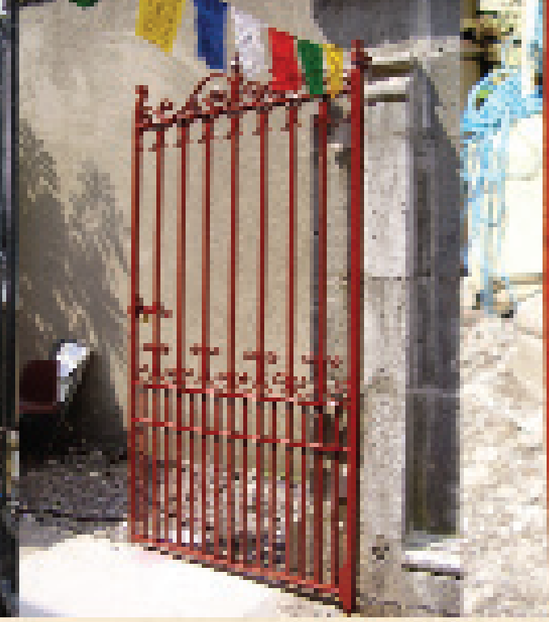
Any areas of corrosion should be removed as thoroughly as possible to prevent them from developing further, and then the cleaned iron should be painted. Water traps, such as the flat surfaces of rails that do not shed water efficiently, unfilled joints, pinholes in castings or flaws in the design of the ironwork are prone to corrosion. Joints, holes and depressions should be filled with a polysulphide mastic filler so that water is shed more effectively, although this should be done with care to avoid altering or detracting from the character of the ironwork.

Blistering or flaking paint will no longer provide protection to ironwork; in fact it is likely to cause accelerated corrosion by trapping moisture. Railings should therefore have a fresh coat of paint applied at least every five years.

If paintwork is badly deteriorating, or corrosion is widespread and severe, it may be necessary to seek the services of a professional to clean and repair the ironwork before it is painted.

Given their location and the likelihood of people standing on them, it is especially important to inspect balconies, balconettes and guard rails regularly to ensure that they are safe and in good condition. The services of a structural engineer may be required to make sure that a balcony is structurally sound and securely fixed to the building.

Rainwater goods such as gutters, downpipes and hoppers play an important role in draining rainwater away from a building. If they become blocked, this can cause water to back up and gain access to the interior of the building which will lead to more serious problems in the future, such as rotting of structural timbers. It is therefore advisable to clear and inspect rainwater goods (including the ground drains they drain into) annually to ensure that they are kept in good working order.



repairing ironwork

Above Top: Unless done by an appropriately skilled blacksmith, repairs and replacement of wrought iron sections are likely to be unsuitable and not in keeping with the character of the original ironwork

Above: Original ironwork should be retained wherever possible. This image shows a repair that has retained the original bars despite the corrosion that had occurred to their bases. Even where the wasted base of a bar must be removed, the rest of the bar above is normally salvageable and should be retained. New material should be forge welded in place

Repair work and replication should always aim to use the same material and techniques of shaping and assembly as those used to make the original ironwork. The use of substitute materials and techniques can create problems not only visually, but also for the durability of repairs. It is important to retain as much of the original ironwork as possible when inserting new material into traditional ironwork. Only sections that have corroded beyond repair should be replaced.

There are a wide range of repair techniques that can be used to repair and replicate ironwork. As a general rule, traditional repair techniques are best, i.e. the methods used to make the original ironwork in the first place. There are a number of modern repair techniques which can be used, however these are not always suitable for traditionally made ironwork, and may even cause damage in the long term. Nevertheless, certain modern techniques may be necessary at times, although they should be chosen with care and with a full understanding of what their long-term effects will be on the surrounding ironwork.

Wrought Iron

Wrought iron is now a difficult material to acquire, making it all the more important to save as much original iron as possible. Only those parts that are corroded beyond repair should be removed, and new wrought iron should be pieced in to adjoin what remains of any sound material.

Because there is currently no known source of new wrought iron in Europe, mild steel is more commonly used for repairing wrought iron. The use of mild steel is problematic because it will cause galvanic corrosion to occur when it is placed in direct contact with wrought iron. For ironwork of particular historic value and importance any replacements or repairs should therefore be done in wrought iron.

At times however, budget restrictions may require a compromise for ironwork of less historic importance. Stainless steel may be a preferable alterative as it is less prone to corrosion. Wherever possible, any dissimilar metal should be isolated from the original ironwork, although this is impossible for weld repairs.

Above: The Unitarian Church gates before and after repair. Original detailing such as mortise and tenon joints, scrollwork and pierced rails form part of the character of traditional wrought ironwork and should be retained in any repair or replication work

Care should not only be taken in the choice of material for repairs, but also the professional contracted to carry out the repairs. Unless done by an appropriately skilled blacksmith, repairs and replacement sections are likely to be unsuitable and not in keeping with the character of the original ironwork.

Wrought iron was traditionally assembled by means of collars, piercing sections, mortise and tenon joints and fire or forge welded (heating sections of iron and then hammering together). Inappropriate or poorly executed weld repairs using modern welding techniques can be particularly damaging to ironwork, both visually and in terms of the durability of such repairs. Weld splatter left around the weld joint can act as a moisture trap and will also cause corrosion to begin.

In some cases modern welding techniques are unavoidable, for example when ironwork must be repaired on-site. However, this should be a last resort only. Nevertheless, a skilled blacksmith may be able to use modern welding techniques to produce a visually acceptable welded joint. Rods with a high nickel content are preferable.

Cast iron

Because it is a hard and brittle material, cast iron will only accommodate a minimal amount of movement or pressure before fracturing. Pressure exerted by expanding corrosion, movement of foundations, or impact damage can cause cast iron to fracture or shatter. Where a fracture has occurred there are a number of options that can be taken: the ironwork can be left as it is; the fractured section can be re-attached; a new portion of ironwork can be cast to match the missing portion or the ironwork can be recast completely.

Where new castings are required, it is preferable to have new patterns made. While existing ironwork can be used as a template for a new pattern it is usually undesirable that it be used as the pattern itself as this may affect the surface finish and quality of detail of the new casting. Replacements should be made in grey cast iron which is still widely available today. Aluminium is not an appropriate substitute as it may cause galvanic corrosion to occur. In addition, paint does not adhere as reaily to its surface unless an etching primer has first been applied. New castings should be produced by green sand casting. There is one foundry in Ireland and a number of foundries in Britain that can produce castings using this technique.

Right: Welding mild steel to traditional ironwork is likely to cause corrosion to develop

Far Right: Conspicuous strap repairs such as this greatly alter the appearance of traditional ironwork

Cast iron weld repairs may not always be successful and only an experienced contractor is capable of undertaking this sort of repair. More mechanical means of repairing cast iron, such as pinning, are usually preferable to welding. However, where this repair technique is unavoidable, brazing, which is a similar process to welding but uses a brass or bronze rod, may be a more successful means of repairing cast iron.

There are a variety of other repair techniques available such as pinning and stitching, although the suitability of their application will depend on the ironwork being repaired. An appropriately experienced professional would be able to advise on the most suitable method for a particular project.

Above: Where replacement castings are required, new patterns should be made to match the existing ironwork. The replacement cast steel railings (above right) bear little resemblance to the original finials above left

Fixing ironwork into masonry

Traditionally, ironwork was fixed in place by pouring molten lead into the stone sockets. This is still a common method. However, pouring hot lead should only be undertaken by an experienced practitioner and caution is recommended particularly if the stone is damp as this can cause the lead to spit.

Where stone sockets have an unnaturally large diameter (which can be caused for example when railings are drilled out of the stone), new stone can be pieced-in and a new socket cut to receive the foot of the ironwork. Alternatively, while not an ideal solution, crushed stone in lime mortar can sometimes be used to blend more naturally with the colour and texture of the stone. Cement mortar should never be used as it will damage stone and is likely to crack over time and admit water. This method should only be used in exceptional circumstances however.

Resin is not recommended to fix ironwork into masonry as it is difficult to remove and will cause damage to the stone due to its hardness.

painting ironwork

The gradual build up of many layers of paint over the years also provides increased protection to ironwork although it has the disadvantage of obscuring detail. Historically, lead-based paints were generally used and were a highly effective form of protection. However, care should be taken when removing old layers of paint due to the toxicity of white lead.

Surface preparation

Original layers of paint often survive beneath modern coatings. If ironwork is to be cleaned and re-painted, it may be worth taking samples of the existing paint layers for analysis, particularly if the ironwork is of particular historic significance or merit. Analysis may be able to determine the colour and type of paint that was used for earlier coatings.

Good surface preparation is essential to ensure a long-lasting, durable coating; iron should be clean and free of corrosion, grease and dirt before paint is applied.

If corrosion is not severe, it can be removed using a chisel, wire brush and sandpaper. Old, sound layers of paint can form a good basis for new coats, but should first be cleaned using water or by rubbing down with white spirits and rinsing with water. Ironwork should be allowed to dry thoroughly and then be sandpapered so that the new paint can adhere well to the surface (any residue from the sandpaper should also be cleaned off before applying paint).

If corrosion is severe, the assistance of a professional may be required to prepare the ironwork before it is painted. The choice of cleaning method will depend on the level of surface preparation required. There are many cleaning techniques available, ranging from manual techniques to the use of more aggressive methods such as hand tools or blast cleaning.

Above: Applying paint too thickly will obscure detail and will reduce the effectiveness of the paint. When paint is applied over corrosion material (rust), corrosion is likely to continue to develop beneath the paint surface

Blast cleaning is the most common method of cleaning cast ironwork but should only be conducted by an experienced professional. An inert mineral grit is generally recommended (although other mediums such as plastic beads, glass beads and crushed walnut shells are also used and can be effective). Chilled iron and copper slag are not recommended.

Blast cleaning may not be suitable for use on delicate or fragile wrought ironwork however as it might cause damage. Flame cleaning or cleaning by hand may be a more suitable method of cleaning in such cases.

Chemical cleaners and acid baths should be used with caution. Where used, great care must be taken to ensure that ironwork is thoroughly washed afterwards to prevent corrosive chemicals from seeping into the ironwork and damaging it in the long term.

Choosing the right paint system

When it comes to re-painting traditional ironwork, there are generally two options; either a traditional paint system or a modern one can be used.

Red lead primer was the most common form of primer for iron, and was usually painted over with oil-based paints containing lead. Nowadays the use of lead-based paint is restricted due to its toxicity. However, red lead, which can be used as an effective primer, is still available (particularly from chandlers) and there are no restrictions on its use as a paint because it is less toxic than white lead.

For some projects, a modern paint system may be more suitable. There are many types of modern coating systems on the market, many of which are highly effective. Hard shell epoxy paints are not recommended however as they are not flexible enough to allow for the natural thermal expansion and contraction of iron.

Current best practice recommends the following system for painting bare metal:

- *Two coats of a zinc-based primer*
- *One or two coats of micaceous iron oxide (MIO)*
- *One or two coats of gloss paint*

A dry film thickness (DFT) of no more than about 250 microns is generally recommended. This is the thickness that the layers of paint dry to - DFT measures can be bought from many hardware stores.

Below: Paint cannot fill holes. Casting flaws such as those pictured above should be filled to prevent water becoming trapped and causing corrosion to develop.

Paint application

Whether ironwork is painted outdoors or in workshop conditions, it is important that it is absolutely dry before paint is applied. If there is any moisture within the iron (due to rainfall, dew or even high relative humidity) this will be trapped beneath fresh layers of paint and is likely to cause corrosion within a short period of time.

Painting ironwork outdoors should generally not be carried out in the middle of winter as damp conditions and low temperatures can hinder the curing of paint. Painting in windy conditions should also be avoided as wind-blown dirt and dust may damage fresh coats of paint.

Paint cannot bridge gaps, so fillers and sealants are an integral part of any coating system. They waterproof joints and seams, and can re-profile water traps and casting defects so that they shed water properly. Traditionally, red lead paste (still available from chandlers) was used to caulk large joints. Putty and white lead paste were often used for smaller joints. Modern polysulphide mastics can be an effective alternative to traditional fillers. Cupped sections of ironwork which trap water should also be filled to prevent water lying for long periods and causing corrosion to develop.

glossary

Backstay - An arm of iron which stabilises railings by running from the top rail into the ground

Bar - A single shaft of metal placed vertically in a piece of ironwork

Blacksmith - Works with wrought iron and mild steel. Capable of forging and fire welding. Traditionally blacksmiths made a wide range of products from agricultural equipment to architectural ironwork such as railings

Bradded/Bradding - Also known as 'riveted' / 'riveting'). A bar of iron is slotted through another piece of iron, and the end is hammered into a dome to secure it in place

Brazing - Brazing is a form of welding that uses an alloy rod, commonly brass or bronze, to join two sections of iron or steel together

Cast iron - A hard and brittle form of iron which is higher in carbon than wrought iron and crystalline in structure. Cannot be forged. Can only be shaped by casting

Collar - Cast iron collars are decorative cast elements that usually slot over wrought iron bars. Wrought iron collars are bands which fit around two or more elements of wrought ironwork to secure them together

Coping stone - A stone topping a wall

Cover plate - Also known as a 'slam bar'. This is a flat plate of wrought iron on the non-hinged side of a gate frame. It often prevents the gate from swinging beyond the gate post or adjoining leaf (in the case of a double-leafed gate)

Farrier - A craftsperson that shoes horses

Finial - A decorative element placed at the top of something, for example at the top of bars forming a length of railings. Can also refer to a decorative element placed on top of a roof, dormer window, ridge, or other portion of a roof

Fire welding - Also known as forge welding. Traditionally done by heating two pieces of iron and then hammering together to form a seamless join

Forge - Verb: to shape using a hammer. Noun: the workshop of a blacksmith / the fire at which the blacksmith works

Forge welding - See 'Fire welding'

Founder - A craftsperson who works in a foundry and makes cast iron items

Foundry - A workshop with a furnace where castings are made

Gudgeon - A 'gudgeon' (also known as a 'heel cup') is the hole that receives the pintle or heel of the gate so that it can swivel open and closed

Heel - A heel (also known as a 'pintle') is the round-section foot or bar that projects from the base of the hinged side of a gate frame. It slots into the gudgeon or heel cup and enables the gate to swing open and closed

Heel cup - See 'Gudgeon'

Husk - Made of cast iron, often in the shape of a bell-flower, nut-shell or wheat ear. Similar to a cast iron collar but longer in length, it is an element which slots over bars to add decoration

Ironworks - Traditionally ironworks was where wrought iron was made and processed

Mortise (or mortice) and tenon joint - The end of one piece is stepped to form a tongue (to form the tenon) which is narrower than the main body of iron. This tongue pierces through a corresponding hole (the mortise or mortice) in the second section of iron

Mould - A depression is made in sand into which molten iron is poured to produce a casting. Moulds were traditionally made of green sand and were formed using a pattern to create the desired shape

Newel - Vertical post usually used to anchor and stabilise railings or handrails. Normally placed at intervals or key points along a run of railings or other ironwork

Pattern - Used in the making of cast iron. Patterns were traditionally carved in wood and were used to create the shaped depression in sand to form a mould into which molten iron would be poured

Pig iron - One of the crudest forms of iron. It is obtained from the first smelting of iron ore

Pinning - A repair technique for holding sections of iron or steel together. Fractured sections can be joined together by drilling one or more threaded holes into each fractured face and screwing them together using a threaded or plain stainless steel bar

Pintle - A pintle (also known as a 'heel') is the round-sectioned foot or bar that projects from the base of the hinged side of a gate frame. It slots into the gudgeon or heel cup and enables the gate to swing open and closed

Plating - A repair method which uses a strap or plate of iron or steel to hold fractured sections together

Pure iron - A very pure form of iron, which is homogenous in composition, low in carbon and without the slag content found in wrought iron. It is malleable so can be forged

Rail - The horizontal (usually flat) member of a railing or gate, often pierced by vertical bars

Rivet/riveting - See 'bradded/bradding'

Slam bar - See 'Cover plate'

Steel - An alloy of iron and carbon. Homogenous structure, strong in tension and compression, but generally considered to have lower corrosion resistance than iron

Stitching - A repair method for holding sections of iron or steel together. A series of holes are drilled along the length of a fracture, and another series of holes is drilled perpendicular to the fracture. A series of metal keys are then inserted into the holes across the fracture to hold the sections of metal together

Terminal - Ornamental item placed on the highest point of a roof. Similar to a finial, but differs in that it is placed on the highest point of the roofline

Welding - Traditionally fire (forge) welding was done by heating two pieces of iron and then hammering them together to form a seamless join. Modern welding uses a variety of techniques which involve melting a rod of metal into the joint to hold two sections of iron or steel together

Wrought iron - A malleable form of iron which is low in carbon and contains strands of slag which give it a fibrous composition. Cannot be shaped by casting. Usually shaped by forging

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