TECHNICAL NOTE No. 49
June 1992
Updated January 2006

Ferrous Metals

Historic Note

Iron has been available for building construction from very early times, but until the Industrial Revolution smelting from the ore was a tedious business carried out on a small scale. All the resulting products, down to the smallest of nails had to be hand-wrought. In consequence the material was used sparingly.

However, as supplies of good quality timber ran short improved methods of smelting developed and iron in the form of straps, coach screws and the like, gradually replaced the fine timber joinery of earlier constructions.

Unfortunately for us today it was sometimes used instead of more stable metals like bronze to make cramps and ties for masonry work, with consequent failures that have proved very costly to correct.

Casting iron has also been a technique known for many hundreds of years. In building, castings were not in common use until the Industrial Revolution of the late 18 th century. Methods had been developed mainly in the production of military ordnance but by the 1770s a wide variety of standard castings were available to buildings including, firegrates, chimney pots, railings, windows, sash weights, locks, latches and hinges, and many others.

The structural use of iron was developed at the same time both as wrought and cast work. Such was the demand for structural ironwork that in the 1840s rolling mills were built to produce standard profiled sections, thus eliminating the time consuming cutting and rivetting that had previously been necessary to build up structural sections. The expansion of the railway system and the building of iron ships resulted in enormous expansion of the industry. Complete iron buildings were constructed – the great train sheds, and conservatories everywhere with of course the most famous of all being The Crystal Palace (1850). The prime example in Northern Ireland is the Palm House in the Botanic Gardens, Belfast. Standard buildings were shipped all over the world and every town of any size could boast its public lavatory, bandstand and its decorative street lamps.

Techniques of blending in other minerals to give increased strength and durability were perfected and in 1866 the first standard rolled steel joists were available.
In recent years welding has taken the place of rivetting.

Faults and Repair

Corrosion:
Old wrought iron is very pure and when exposed to the weather forms a skin of black oxide which protects it against further decay.

However, when it is kept continuously damp, for example in the core of a wall where it has been built in as a cramp or lintel, then it forms red oxide which eats deeply into the body of the iron causing lamination and expansion. The forces released during this expansion are enormous and will burst stones and erupt the surrounding masonry. Once this corrosion has begun it may be aggravated by electrolysis set up as an interaction with run lead which was originally poured to exclude water. As cracks in the masonry open more and more water can enter so that the process gradually accelerates.

Modern steel corrodes in the same way but very much faster and must always be given a protective coating.

Mild corrosion can be arrested; all oxide and scaling must first be cleaned off. Shot-blasting in a workshop is the most effective way otherwise a portable blasting unit must be used. Alternatively the surface must be pecked and wire-brushed by hand. The surface can then be pickled using phosphoric acid, followed by paint priming, galvanizing or other durable protective coating.

If corrosion is really bad then replacement in whole or in part is the only course of repair. When repairing old iron work try to use old iron scrap, possibly salvaged from one of the mass of old farm gates that sadly little the hedge-rows.

Fracture:
Wrought iron fractures only if it is continually subject to changing stresses, but cast-iron fractures very easily. Provided the object is non-structural it may be possible to glue it back together using epoxy resins. If the component is structural it may be possible to carry the load in some other way and then effect a repair using epoxy resins. If this is impossible then a new casting is the only remedy. Quite a variety of 18th and 19th century casting designs are still available as standard items. Fractured steel can usually be repaired by welding.

All external ferrous metal surfaces should be inspected regularly every three years. If local defects are attended to at this frequency serious decay is unlikely. If not attended to, a very expensive scheme of repair is likely to follow.

Notes on the Preparation of Contract Specifications
Identify the items for replacement, repair and cleaning. Specify what work is to be executed ‘in situ’ and what is ‘shop work’ requiring dismantling and transportation.

Specify protection and storage

Describe the methods to be used in replacement, repair and cleaning and any special protective treatments which will not be covered in the section concerned with painting. If any of the work is to be carried out by specialists make this clear.

Name the standards of workmanship and finish that is required and state if any items are to be approved in the workshop before they are brought to site.

Sources of Relevant Information.

History

Hoever, O, 1975, A Handbook of wrought Iron from the Middle Ages to the End of the Eighteenth Century, London Thames and Hudson

Maintenance

Ashurst John and Nichola,1988,Practical Building Conservation volume 4: metals. , London English Heritage

Building Research Establishment Digest
No. 70 - Painting: Iron and Steel.

Evans VR, 1972, The Rusting of Iron: Cause and control, London Edward Arnold

Lister R, 1960, Decorative cast iron work in Great Britain, London G Bell and Sons

Owner Guidance notes by other advisory organisations:

Conservation Guidelines: Ironwork. Department of the Environment, Republic of Ireland 1995

Period Houses a conservation Manual Dublin Civic Trust 2001. Chapter 19 Ironwork,

Chapter 4.15 Repair of Ironwork. The Repair of Historic Buildings in Scotland Historic Scotland

Contractors

EHS cannot recommend specific contractors for restoration work. However, this is a skilled field and owners and their agents should satisfy themselves that those they employ have the required skills. Previous examples of their work should be inspected and recommendations sought.

There are currently two publications that list Northern Ireland contractors who claim to have restoration experience. The publishers do not check these claims:

The Directory of Traditional Building Skills, Fourth Edition 2004, published by the UAHS in association with EHS.

Heritage Excellence in Northern Ireland LEDU, 2003

The Irish Georgian Society publishes a list of specialist contractors based mainly in the Republic of Ireland.

Environment and Heritage Service
Built Heritage
Protecting Historic Buildings
Waterman House
5-33 Hill Street
BELFAST
BT1 2LA
Tel: 028 9054 3145