FOREWORD

The papers presented at this conference have brought together some of the perennial debates related to the care and conservation of industrial collections. Whilst the debates are familiar - conserve or restore; use or not use; when does the history of an object stop - what is more unusual is the context, a conference in which restorers, conservators and curators have participated on equal terms.

Debates run and run because there are no easy answers. It is possible to list the advantages and disadvantages of any argument, but in the process new issues are thrown up which themselves are worthy of debate. Can we, in the process of conserving material culture, also conserve the skills of the workers who are so critical to any industrial process? As new issues such as these arise they could be used as pawns in the established debates, but it would be a tragedy for them to be sidelined.

The skills of the operators or maintenance technicians are intimately linked with the function of an item. Yet when these operators become museum interpreters and the winding engine becomes a moving display have we really preserved the original function? Are we sacrificing the working parts through wear and tear to achieve a working object almost devoid of its original context or meaning? Defining industrial collections and deciding what role an item has in a museum is a central issue which must be addressed.

The maturity of the papers given reflect the way that such debates are located in the broader issues relevant to all those who work in the museum and heritage sector. The professional ethics and theoretical base developed in any element of museum work must be relevant and applicable to any other. Similar issues to those raised in Cardiff would echo around any gathering of individuals with responsibility for the care of collections, whether they be musical instruments, stately homes or contemporary art. The values of access, accountability and standards that have been developed should be seen not as weapons to throw at restoration minded engineers but as tools to finding common solutions.

Compromise can seem alarming, but does it inevitably lead to a drop in standards? The Health and Safety standards required for those museums which operate in industrial conditions can be seen to have positive benefits rather than as a threat to collections care. Equally, standards of interpretation, access, accountability and training can all be seen as beneficial for the conservation of industrial collections. When grappling with the complex, and sometimes heated, debates in industrial conservation we should make every effort to resolve issues by referring to the broader standards. Even working with the best intentions mistakes can be made, but how serious will the consequences be? Detailed and accurate documentation can ensure that the reasons behind the decisions and the precise actions taken are preserved. Papers in this publication outline how this process can be further improved by opening up the debates to the scrutiny of colleagues, trustees and even the public. At the very least let our children learn why we made our choices and leave them the information to retrieve what they can from the situation.

The community interested in conserving our industrial heritage operates in a climate which may not always be favourable but is very dynamic. Currently we have an opportunity to combine traditional skills with advanced analytical techniques and modern equipment and materials. We can predict an object's tolerance to the strains of operation in a heritage environment and can happily, or gloomily, forecast the future. We also have a potential to alter that future. Industrial collections are more than just big shiny machines. There is so much sentiment that they can evoke, whether through an underground experience or by witnessing the last ever spitfire. The public care about whether these collections survive and we should harness this to our cause.

The conservation of industrial collections is beset by difficult debate, but whilst the scale of industrial collections is unique, the issues rarely are. We should all operate to widely held standards and open up the issues to debate and scrutiny. An informed public, that wants access to the collections, is surely the future for us all.

Jane Henderson

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Diane Dollery

RHAGAIR

Mae'r papurau a gyflwynwyd yn y gynhadledd hon wedi dod â rhai o'r dadleuon diddiwedd ynglyn â gofal a chadwraeth casgliadau diwydiannol ynghyd. Er bod y dadleuon yn gyfarwydd – cadw neu adfer; defnyddio neu beidio; pryd bydd hanes gwrthrych yn dod i ben – beth sydd yn fwy anarferol yw'r cyd-destun, cynhadledd lle y cymerodd adferwyr, gwarchodwyr a churadwyr ran gyfartal.

Mae dadleuon yn parhau byth a hefyd gan nad oes atebion hawdd. Mae'n bosibl rhestru manteision ac anfanteision unrhyw ddadl, ond yn y broses bydd materion newydd yn codi sydd yn haeddu trafodaeth eu hunain. A allwn ni, wrth gadw diwylliant materol, hefyd warchod sgiliau'r gweithwyr sydd mor angenrheidiol i unrhyw broses ddiwydiannol? Wrth i faterion newydd fel y rhain godi, gellid eu defnyddio fel teganau yn yr hen ddadleuon, ond byddai'n drasiedi iddynt gael eu hymylu.

Mae sgiliau'r gweithredwyr neu'r technegwyr cynnal a chadw yn perthyn yn agos i swyddogaeth eitem. Eto, pan dry y gweithredwyr hyn yn ddehonglwyr amgueddfaol, a'r peiriant weindio yn arddangosfa symudol a ydym wedi cadw'r pwrpas gwreiddiol mewn gwirionedd? A ydym yn aberthu'r rhannau gweithredol trwy draul er mwyn cael gwrthrych gweithredol heb ei gyd-destun neu ystyr wreiddiol bron? Mae diffinio casgliadau diwydiannol a phenderfynu beth yw rôl gwrthrych mewn amgueddfa yn fater o bwys mae'n rhaid ei drafod.

Mae aeddfedrwydd y papurau a gyflwynwyd yn adlewyrchu'r modd y lleolir dadleuon felly o fewn materion ehangach sy'n berthnasol i bawb sy'n gweithio yn y sector amgueddfaol a threftadaeth. Mae'n rhaid i'r foeseg broffesiynol a'r sylfaen ddamcaniaethol a ddatblygir mewn unrhyw agwedd ar waith amgueddfaol fod yn berthnasol ac yn gymwys i unrhyw un arall. Byddai materion tebyg i'r rheiny a godwyd yng Nghaerdydd yn debyg i unrhyw grðp o unigolion â chyfrifoldeb dros ofalu am gasgliadau, boed yn offerynnau cerdd, plastai neu gelfyddyd gyfoes. Dylid gweld gwerthoedd megis mynediad, atebolrwydd a safonau a ddatblygwyd fel modd i ganfod atebion cyffredin yn hytrach nag arfau i'w taflu at beirianwyr sydd â'u bryd ar adfer.

Gall cyfaddawdu ymddangos yn frawychus, ond a yw'n anochel yn arwain at gwymp mewn safonau? Gall safonau Iechyd a Diogelwch sy'n angenrheidiol ar gyfer yr amgueddfeydd hynny sy'n gweithredu mewn meysydd diwydiannol fod o fudd yn hytrach na bod yn fygythiad i ofal casgliadau. Yn yr un modd, mae'n bosibl gweld safonau dehongli, mynediad, atebolrwydd a hyfforddiant fel pethau o fudd i gadwraeth casgliadau diwydiannol. Wrth fynd i'r afael â'r dadleuon dyrys, a chwyrn weithiau, mewn cadwraeth ddiwydiannol dylem wneud pob ymdrech i ddatrys materion trwy gyfeirio at y safonau ehangach. Mae'n bosibl gwneud camgymeriadau wrth weithio gyda'r bwriadau gorau hyd yn oed, ond pa mor ddifrifol fydd y canlyniadau? Gall dogfennu manwl a chywir sicrhau bod y rhesymau y tu ôl i'r penderfyniadau a'r gweithredu penodol yn cael eu cadw. Mae'r papurau yn y cyhoeddiad hwn yn amlinellu sut y mae'n bosibl gwella'r broses hon ymhellach trwy agor y dadleuon i gydweithwyr, ymddiriedolwyr a hyd yn oed y cyhoedd eu harchwilio. O leiaf gadewch i'n plant ddysgu pam y gwnaethom ein dewisiadau a gadael y wybodaeth iddynt adennill yr hyn a allant o'r sefyllfa.

Mae'r gymuned sydd â diddordeb mewn cadw ein treftadaeth ddiwydiannol yn gweithredu mewn hinsawdd nad yw bob amser yn ffafriol, ond mae'n ddeinamig iawn. Ar hyn o bryd mae gennym gyfle i gyfuno sgiliau traddodiadol gyda thechnegau dadansoddol datblygedig a chyfarpar a deunydd modern. Gallwn ragweld i ba raddau y bydd gwrthrych yn goddef straeniau gweithredu mewn amgylchfyd treftadaethol a rhagweld y dyfodol yn hapus, neu yn drwm ein calon. Mae gennym hefyd y gallu i newid y dyfodol hwnnw. Mae casgliadau diwydiannol yn llawer mwy na pheiriannau mawr disglair. Gallant ennyn cymaint o deimlad, trwy brofiad tanddaearol neu drwy fod yn dyst i'r 'spitfire' olaf un. Mae o bwys i'r cyhoedd a fydd y casgliadau hyn yn goroesi a dylem gymryd mantais o hyn er mwyn ein hachos ni.

Mae cadwraeth y casgliadau diwydiannol yn llawn o ddadleuon anodd, ond er bod graddfa casgliadau diwydiannol yn unigryw, prin bod y materion yn unigryw. Dylem oll weithredu gan goleddu safonau a gydnabyddir yn eang ac agor y materion i'w trafod a'u harchwilio. Yn sicr, cyhoedd deallus, sydd am gael mynediad i'r casgliadau, yw'r dyfodol i ni oll.

Jane Henderson

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A PERSPECTIVE ON THE NATURE OF INDUSTRIAL COLLECTIONS

Neil Cossons

Industrial collections occupy a unique if largely unrecognised place as material evidence of the nation's history. Their significance derives from the fact that Britain was the first industrial nation and industry held a pre-eminent position at the heart of her economic success for some five generations. It is arguable too that the overwhelming threat of industrialisation and, in particular, the effect it had on society and the landscape, prompted widespread interest, especially during the nineteenth century, in archaeology and antiquarianism, in rural values, and in the protection of great buildings and landscapes.

So, we view the period that in Britain has come to be called the Industrial Revolution with ambivalence. On the one hand the economic and social changes that it brought about created immense wealth and prosperity which in turn sanctified many of our great institutions. They also gave birth to the English middle class, a powerful cultural elite who have finally achieved political recognition. At the other end of the spectrum the new urban, working classes experienced by and large appalling working and living conditions. Industrial collections in museums need therefore to be seen in a broad cultural context. Their messages and metaphors are as yet unexplored but they lie much deeper in the national subconscious than a simplistic taxonomy of machines might lead us to believe.

The concept of the preservation of things of archaeological or historical value is well established in the pre-industrial era and the pattern of our museums, and the nature of the collections they contain, pays scant acknowledgement to the concurrent processes of industrialisation. It has been only in recent years, during the period of Britain's deindustrialisation, that widespread attention has been paid to preserving remnants of industrial culture. This movement is reflected in the rapid development of industrial archaeology from the mid 1950s and the creation of new industrial museums in the decades following. What has been caricatured as a ‘feeding frenzy’ of collecting since, say, 1970 might be more accurately portrayed as a rescue mission, albeit unfocussed, of the residual evidence of the age of industry.

We need I believe to see our industrial collections within the historical context not only of the phenomenon of industrialisation itself but in the light of the development of museums over the last two centuries or so. We need to see them too as the late arrivals on the museum scene; perhaps cuckoos in the nest might be a more accurate analogy. But we must remember that industrial collections are, in essence, no different from those of other cultures. Although they present new and often intractable problems from the point of view of their conservation they are essentially material evidence and should be viewed as such through the same eyes and using the same criteria with which we understand the remains of pre-industrial periods. Increasingly, we are beginning to understand the true archaeological and archival value that much of this material holds so our duties towards it, as curators and interpreters, are no different from the responsibilities that we have for all types of archaeological and historical material held in museums.

Let me examine first what lay at the root of this instinct to collect industrial artefacts. It is something of a paradox that the first museum in Britain to pay specific attention to the preservation of things industrial assumed that role almost by accident. The Science Museum in London owes its origins to the movement in the middle years of the nineteenth century to improve scientific and technical education. It came into being in the aftermath of the Great Exhibition of 1851, the profits from which were used to purchase land lying south of Kensington Gore. This area was laid aside for institutions concerned with 'the useful arts and manufactures', with education and instruction. One of these, which opened in 1857, was the South Kensington Museum.

The driving force behind the Great Exhibition, Prince Albert, set out 'a general plan for the buildings it is proposed to erect on the newly purchased ground at South Kensington', including what were described as 'Museums or Schools of Science and Industry'. The other immediate outcome of this movement, also urged by the Prince, was the setting up in 1853 by the Government of the Science and Art Department. Lyon Playfair, chemist and scientific administrator, was appointed Science Secretary. He was among those who recognised that Britain's world leadership in industry was due both to her natural resources and her head start, but that she would 'recede as an industrial nation, unless her industrial population became more conversant with science than they are now'. The aim of the Science and Art Department was to 'increase the means of industrial education and to extend the influence of science and art on productive industry'. Its plans included 'museums by which all classes might be induced to investigate those common principles of taste which may be traced in the works of excellence of all ages'.

In other words, the South Kensington Museum, out of which grew the present Victoria and Albert Museum and the Science Museum, was concerned more with education and ensuring the future through a scientifically literate population than with preserving evidence of the past. Those objects that were acquired for the South Kensington Museum were concerned predominantly with instruction and included models of machinery and industrial plant, collections illustrating foods and animal production, examples of structures as well as educational material - books, models and apparatus for use in primary education - that would help in maintaining Britain's pre-eminence as an industrial power. Some of that material has of course assumed historical importance in its own right with the passage of time. But although during the 1860s and 1870s collections of important historical material were acquired, most notably from the Royal School of Naval Architecture and Marine Engineering, the South Kensington Museum was predominantly concerned with contemporary science and engineering and with demonstrating the fundamental principles of both.

The credit for establishing the pre-eminent collections for which the Science Museum is now recognised worldwide, goes to one man, Bennet Woodcroft, Assistant to the Commissioners of Patents from 1852 and founder of the Patent Office Library. Woodcroft had been apprenticed as a silk weaver and spent his first forty or so years in the north of England, apparently devoting much of his time to inventions in fields as diverse as textile machinery and marine propulsion. In 1845 a screw propeller to his design was fitted to I K Brunel’s new iron steamship *Great Britain* which had just completed its first return passage to the United States. Woodcroft was clearly well regarded by his engineer contemporaries, notably Fairbairn, Eaton Hodgkinson, Whitworth and Nasmyth, and in 1847 he applied successfully for the professorship of the Mechanical Principles of Engineering at University College, London. In recommending him Graham, the Manchester chemist wrote, ‘he is extensively acquainted with the history and uses of machines’. It was not a statement that could have been made of many engineers then or now.

From University College Woodcroft became, in 1852, Assistant to the Commissioners of Patents and effectively head of the first office for handling the technical side of patents to be established in England. In this capacity Woodcroft became involved in the debate, after the 1851 Exhibition, on the setting up of a museum. When he arrived at the Patent Office he had already a large collection of ‘models’ - later reported as numbering some 900 - and in 1856 they were described as forming the nucleus of a ‘National Collection of Models of Invention’. This was the Patent Office Museum, essentially a private and wholly unofficial venture of Woodcroft's own making, and it found a home in buildings adjoining the newly opened South Kensington Museum.

Woodcroft was a relentless but selective collector. At first the idea of a patent museum was linked with the models submitted as part of the process of patenting, as was the established practice in the United States. But it is clear that it was the historically significant invention and the educational demonstration of principles that were his prime concerns. In this farsightedness Bennet Woodcroft occupies a position of profound importance in the origins of the Science Museum’s collections and in our wider understanding of the importance of historic machines as the material evidence of industrial culture.

It was at Woodcroft’s insistence that both *Puffing Billy* and Stephenson’s *Rocket* were preserved. He pursued and successfully captured Symington's marine engine and, in 1864, arranged for the contents of James Watt’s home workshop to be acquired. Finally, in 1884, some five years after Bennet Woodcroft’s death, the collection of the Patent Office Museum passed to the South Kensington Museum. To quote the official history, ‘the Museum might then be said to have begun to assume the form of a National Museum of Science and Industry’. In collecting celebrated machines, and thus immortalising their inventors, Woodcroft made a major contribution to the development of museums. At a time when Britain was not only the world's leading imperial power but was widely seen as ‘workshop of the world’, Woodcroft had established the value and validity of acquiring machines as historical evidence. Thereafter the South Kensington Museum had two strands to its work. One was the use of models and demonstrations to educate in the principles of science and engineering; the other was the preservation of the great works of scientists and engineers.

By the end of the nineteenth century the collections of the South Kensington Museum, embracing art as well as industry, had outgrown their buildings and the decision was taken to separate the two, a stinging denial of Albert's vision of art and industry united for the common good. A new art museum, to be known as the Victoria and Albert Museum, was opened by King Edward VII in 1909. It was now time to build a home for the 'non-art collections' as they were initially known. Work started on a new building on Exhibition Road in 1913 but with the coming of the First World War and the years of austerity following it construction was slow and the Museum was not opened until 1928.

It is, I believe important to place the development of the National Museum of Science & Industry in Britain in its broader international context. We think of museums as being places of culture, enlightenment and education. But the role of museums of science and industry in the early part of this century was perceived to have deeper political and even strategic significance. The developments in South Kensington had not gone unnoticed in Germany where Oskar von Miller, a civil engineer and government administrator who had organised trade fairs in Munich and Frankfurt as well as visiting Paris and London, founded in 1903 what was to be called the Deutsches Museum von Meisterwerken der Naturwissenschaft und Technik (German Museum of Masterworks of Natural Science and Technology). A central feature was the Ehrensaal (Hall of Fame) in which portraits of famous German scientists and engineers were displayed. The term 'masterwork' in the Museum's title provided the criterion by which historical objects were selected. The laying of the Museum's foundation stone by the Kaiser was symbolic. If Germany was to be seen as a major world power then, like Britain, she needed a national museum in which to display her industrial achievements.

Across the Atlantic developments in Germany and Britain were being keenly observed. Although the Smithsonian Institution had acquired some industrial material, partly resulting from the 1876 Centennial Exhibition in Philadelphia, it had no museum devoted specifically to science or engineering. Despite the fact that it had opened in 1881 the Arts and Industries Building it was still felt that this gave an inadequate picture, to the American population and to the rest of the world, of the new-found industrial prowess of the United States. By the 1920s a vigorous campaign had gathered momentum in which it was stated that the nation needed 'a South Kensington and Deutsches Museum rolled into one as befits it size and wealth'. The proposal, for a National Museum of Engineering and Industry, might well have come to fruition but for the Crash of 1929 which killed it outright. Had it been built it would have been the largest museum in the world, then and now, and a more than adequate demonstration of the industrial and manufacturing authority of the twentieth century's greatest world power.

It was not until 1976 that the Smithsonian Institution added a museum to its portfolio that adequately reflected at least one aspect of American scientific and technological pre-eminence - flight and space exploration. The National Air and

Space Museum opened in bicentennial year, coincidentally only a few months after the opening of its direct equivalent here, the National Railway Museum in York, Britain's own museum devoted specifically to a national achievement the consequences of which ultimately spread throughout the world.

Before completing this brief historical review let me refer to two other aspects of what might be called the first generation of industrial museums. Both, in their own way, had immortalisation as their creed. The first, the Henry Ford Museum in Dearborn, Michigan, reflects the desire of one man to pay tribute to his friend and mentor, Thomas Alva Edison, by creating a universal repository of important machines. The museum he opened in the late 1920s holds collections that are by far the most significant in their field in the United States and stand only behind those of South Kensington and Munich in the world. At the same period, in Britain, Newcastle-upon-Tyne opened its own museum of science and industry in a pavilion on the Town Moor, a remnant of the exhibition of 1929. Here was housed an outstanding collection reflecting Tyneside's extraordinary achievements in shipbuilding and engineering, a collection that stands today as one of national and international importance. Birmingham too felt similar urges and in the years after the Second World War the Birmingham Museum of Science & Industry grew to present to an enthusiastic audience the evidence of the city's worldwide importance in manufacturing and engineering. All three of these museums in their own way have fallen victim to another influence which is felt with peculiar acuteness in the industrial preservation field. More of that later.

These first industrial museums had reached maturity, and perhaps even showed the first signs of senility, by the time the second generation was born. Beginning in the 1960s and reaching a crescendo by the 1980s, the desire to capture the residue of industrial Britain before it was swept away led to the establishment of innumerable new museums which reflect an entirely different impetus and philosophy. As the industrial landscape changed, first with post-war modernisation and renewal, followed some thirty years later by the virtual extinction of the traditional industrial base on which much of Britain's nineteenth century prosperity had been founded, so grew a widespread popular desire to collect and preserve. At its height, this movement had all the characteristics of a frantic rescue mission; save everything at all costs, before it is too late, and sort out the consequences later. It has been this phenomenon that colours our contemporary view of industrial collections in museums and, I suggest, lies in part behind the reasons for the holding of this conference.

Distinct trends can be traced in the structure of the new generation of industrial museums. They might be categorised as:

i) the preservation *in-situ* of iconic places: Coalbrookdale and the Ironbridge Gorge, Cromford, New Lanark,

ii) the recreation of 'living landscapes' of industry: Beamish, Blists Hill, the Black Country Museum,

iii) the extension of existing museum collections to embrace industrial material: Leicester, Bristol, Bradford,

iv) the creation of new free-standing museums with regional industrial history as their theme: Birmingham, Manchester,

v) single theme technophilia: innumerable steam pumping stations and much of the transport preservation movement,

vi) the local history of extinct industrial communities: Uffculme, Ruddington,

vii) the preservation by landscape management of industrial areas: the Trevithick Trust/National Trust in West Cornwall, the National Trust in South Wales.

There are of course numerous variants and sub-species within and across these groups but, almost without exception, these projects have a number of characteristics in common. Generally speaking they stand outside the framework of museums as it has become established over the last century or so; they are predominantly operated by trusts or societies fuelled by strong, often locally-based, enthusiasms; they have acquired more stuff than they find they can now look after; the average age of their core adherents is increasing; and the interests of their audiences, which initially they shared, have moved on as the generations change. They are, like Newcastle, Vienna or Dearborn before them, strongly 'generational'. This is endemic in museums of this genre and, in particular, in areas such as industrial history and archaeology where the academic and scholarly base, beyond the museums themselves, is weak or non-existent. By contrast, the extraordinary success of archaeological preservation rests on the shoulders of a large, well-established, academic elite.

It is all too easy to caricature the extraordinary explosion of interest in industrial preservation as the eccentric behaviour of people whose narrow enthusiasms overwhelmed their common sense. It would be at least as accurate to suggest that the uninhibited and uncoordinated rush to set up new industrial collections and museums was an indictment of the inflexibility and unresponsiveness of the museum establishment in a period of rapid social and economic change. Neither view stands up under close analysis. Almost inevitably museums of longstanding become introvert and self-obsessed. Their concerns are focused on survival and the wellbeing of what they already have rather than the challenge of uncharted territory for which they have little established interest or understanding, no expertise, and perhaps scant regard. To those whose passion drove them to frenetically collect when they saw all that was familiar in their community disappearing, we owe a great debt. Sustaining that view will be difficult, for their legacy provides one of the biggest generic challenges faced by museums in the next twenty years.

There is, I suggest, no magic to the technology of conservation. We all know what has to be done. The issues are more to do with establishing a rational framework of support and management, of reinvigorating the vision and energy of these collections, of ensuring that disposal - when, inevitably, it occurs - takes place in an orderly manner. For professional conservators the management of mass preventive conservation, perhaps based on large climate-controlled centralised stores, will be of greater long term strategic significance than the important, but infinitely more captivating, challenge of conserving by remedial conservation the new materials so frequently found in twentieth century industrial machines and products.

The age of industry, as it became established in Britain, is over. Within twenty years the last generations who remember and were part of it will have gone. The collections and museums they created, sometimes through simple motives of nostalgia, more often with more cerebral beliefs and visions, we will need to accommodate within the museum culture of the new century. It is unlikely that the structures of independent governance that brought these museums into being will survive intact. They are too dependent upon a finite - and perhaps diminishing - supply of people with passion as well as experience. Equally, the structure of national and local authority museums is ill-placed to offer more than token support. While professionals pondered the new museology, with its emphasis on messages and meanings, a parallel generation, driven by the imminent extinction of landscapes and machines at once both familiar and reflective of a new world order, took into captivity all they could. The dilemma for the rest of us is what do we do with it all.

CONTROLLED OPERATION OR WRECKING ?

THE USE OF OBJECTS FROM THE NATIONAL RAILWAY MUSEUM'S COLLECTIONS

R Gibbon

Abstract

Controlled Operating or Wrecking - The National Railway Museum believes that a small part of its two hundred and eighty vehicle rolling stock collection should be demonstrated under controlled conditions, so that the operating machines can be seen and enjoyed by the widest possible audience.

The assessment process that goes into deciding which objects can be considered for possible operation is discussed as part of a much wider collection categorisation scheme which the Museum has devised and found useful.

The curator who bears responsibility for keeping the object in 'as received' condition is often in direct conflict with the large and frequently vociferous body of railway enthusiasts. This body, given the right incentives and direction, can provide the solution to the long term care of large railway objects, using the huge volunteer labour resource that they have at their disposal.

The paper uses case studies which show how mechanical engineering imperatives cut across good museum practice, and how the curatorial dilemmas are resolved.

Introduction

'In the current financial climate, all museums and galleries are forced to find more and more of their own funding, and for most of us, it means hiring out museum spaces or using our museum objects as income generators. etc.'[1]

This was the summary on the flier for a seminar run by the UK Registrars Group in March 1997 and gives a feel for the changing climate in which museums find themselves today. Using museum objects as income generators does not necessarily mean that they must be operated, but it can do.

This is in marked contrast to strongly held views of curators in the 1980's when operation of some museum exhibits was unthinkable, and only indulged in by those who had not got their volunteer support bodies under control! [2]

There are several stakeholders who hold strong views over whether objects from the National Railway Museum's Collections should be operated or not. Each of these groups holds different levels of influence. In any museum which strives to increase its visitor numbers, it is the role of the curator to juggle the various influences without compromising the care of the collection with which they are charged.

Figure 1 sets out the various influences on the NRM's rolling stock collection and which way they pull. It is interesting to see how the influence has swung over recent years so that decision making is more than ever determined by the Museum's need to market itself, and can be strongly influenced by sponsors. It becomes more important than ever for curators to be sure of what is acceptable use of their collections. It becomes progressively more difficult to say 'thanks but no thanks' to a sponsor bearing gifts which might provide the means to salvation for hard pressed budgets. It is interesting to see the decision-making processes moving from the curator alone, to the curator having to take account of the marketing department, customer satisfaction, and the sponsors themselves.

Why operate technology collections?

I would like to break away from my specialist subject to engage in an exercise with you, which I hope will convince even the most hardened sceptic, of the value in choosing to operate certain artefacts.

In the case of technology collections I believe that we need to examine very carefully the relationship between the way the artefact appears to us, and the way the function of that artefact appears to us.

I would like you to try and imagine you had no prior knowledge of how things work. For example we can examine a pair of scissors and we can easily imagine their function. Also a hammer is unlikely to produce any surprises when it is used. But if we look at a referee's whistle with a pea in it, a mechanical musical box, or a weaving loom, it is hard, if not impossible, to judge and appreciate fully what each item does, without actually operating it. The NRM has taken this argument to its extreme position by sectioning a steam locomotive and then motorising the remains. As an interpretative tool and an attractive exhibit, this object is one of our most important icons. It satisfies the curiosity of those who wonder what is inside a locomotive, and serves as a teaching aid to experienced operators who need detailed knowledge. We recognise of course that this particular locomotive type is well represented on the preservation scene; there are no fewer than nine extant examples which means the criteria for partial destruction suggested by Mann, are well satisfied. [3]

Curiosity plays an important part in this argument. We feel as curators we must rise above the temptation to use the device because of the potential damage we might inflict, but it is that very same curiosity that burns within our visitors and causes them to want to find things out! 'Unlocking the magic' within our collections and sharing it with our public is a major part of our task. Being a curator in a technology- based museum makes me feel privileged to be able to use my ability as a professional engineer to communicate complex mechanical concepts to our users. It is not enough to merely have knowledge about the object to enthuse today's visitors. A deep and thorough understanding of the principles on which that object operates, together with the ability to demonstrate it, is often enlightening.

The NRM has no problems of conscience in being proud to operate certain parts of its collections. Surely no-one would question the long term operation of examples like Stalybridge Station Clock, platform ticket machines, replica locomotives *Rocket* and *Iron Duke*, and the Museum's original locomotive turntable, in the Great Hall. All of these objects bring demonstrable pleasure to our visitors, and enhance the public understanding of railways.

The argument described above must be used with caution however. I think it is vital that a further constraint be imposed that relates to the type of task the device was designed to accomplish, and how stressed the machine is when accomplishing that task. For example, aircraft (during take-off), firearms, lifting equipment and say light bulbs, are all designed to operate near to the point of failure, whereas sewing machines, bridges, looms, telephones and railway equipment, (even whistles!) were invariably designed to perform many millions of cycles without distress. That is why it is perfectly proper for the kitchen ovens at Hampton Court to be lit, and used, on special occasions. [4] I suppose the best examples to illustrate the non-operational argument in this group would be a Christmas cracker or a railway fog detonator.

Collections care & operation at NRM

Let us return to the NRM's rolling stock collection. It consists of some two hundred and eighty vehicles, one hundred and twenty on display at York, eighty on loan, and a further eighty stored in various locations in varying conditions.

The collection ranges from the extant remains of Stephenson's *Rocket*, through to Queen Victoria's saloon of 1869, on to an example of the modern coal hopper wagons that work in 'merry go round' trains feeding Britain's power stations. The care that is afforded to each item in the collection varies widely. Not all vehicles need to be kept indoors for example.

Six of our steam locomotives, seven of the diesel locomotives and eleven of the passenger/freight vehicles are operated from time to time. Whilst the individual arguments for each case had been articulated separately, it was decided two years ago that the Museum was in a position to draw up a categorisation scheme which would inform our reaction to requests for a particular item to be allowed to operate. This came about in a curious way.

A potential sponsor approached the Museum with a view to restoring the 1907 classic passenger express locomotive *Lode Star* to steam on the main-line. The deal included the removal of large quantities of asbestos as part of the plan, which was attractive to the Museum. It was decided however, not to proceed with the scheme, as everyone agreed that the locomotive in its ex-Swindon Works condition, represented important unique surviving features that would be destroyed for-ever by restoration.

This gave us the confidence to develop our categories for future care of the vehicles which are shown in Table 1. They take account of rarity of the vehicles, robustness, storage conditions and the NRM's willingness to loan such items. The conditions for agreeing to return the vehicle to operation are set out clearly, and hopefully will dispel for ever, the idea that the National Railway Collection, is a queue of locomotives waiting to be restored in rotation, or a 'toy box' into which preserved railways can dip!

Each of the first four categories is subdivided to obtain a ranking within the category. Each rank will demand its own care regime, will determine whether the vehicle can be operated or loaned, by whom and under what circumstances.

Table 2 shows examples of how we have categorised the collection. These rankings can be adjusted, if necessary, as knowledge of the object increases. Also there will be cultural differences between institutions as to appropriate rules. I noted with some surprise that the Boulton and Watt ex-Whitbread Brewery steam engine of 1784 is steamed 364 days per year at the Powerhouse Museum in Sydney, Australia. Those totally opposed to running museum machinery will draw cold comfort from the following extract from the visitor's leaflet;

'A major conservation decision was made as far as possible to retain the external appearance of the engine while using modern components to avoid wearing out its unique internal parts. This philosophy has proved highly successful. The only assembly to which it was not applied was the air-pump where signs of wear were detected in 1990. The affected piston and valves have since been replaced and the originals will be conserved for future displays.'[5]

Even I would have had this as a category 1 exhibit, and doubt whether the changes that have had to be made to use 'modern components' are truly reversible.

Active disposal as collections care

Category 5 provided us with a surprising amount of food for thought. The title of this paper suggests that by operating a part of our collection we might be risking wrecking it. The truth of the matter is that by having a larger collection than we can appropriately store, and by keeping valuable vehicles outside in all weathers, we are certainly wrecking certain items without them even being considered for operation. This led us at the NRM on to a policy for active disposal, which took into account the 'wider national collection'. That meant any vehicle which duplicated another similar one in a registered museum that could be earmarked as the type-example, should be considered for Board of Survey (Disposal).

The surprising effect of this move is that vehicles for which scarce resources were unlikely to be allocated by NRM (because there was another better vehicle elsewhere) were gifted to registered museums. These museums were able to make the commitment to restore the vehicle for operation or display, which they would never have felt able do as part of a loan agreement. This way the vehicle survives because we have disposed of it! An example of this procedure is the disposal of vehicle number M30272M from the National Collection. The vehicle is a travelling Post Office which was declared surplus to the National Collections, and is now being restored at the Nene Valley Railway.

The benefits of operation

There is a presumption generally that museum objects will not be operated. However, as I intend to show, there is an overwhelming public benefit from the operation and demonstration of certain types of artefact which can over-ride that presumption.

There is of course no text book answer to the question of whether we should or should not operate an artefact, but for the sake of those who are to follow us in caring for the collections we leave behind, it is important that the arguments that lead to the answering of that question are well thought through, sustainable and properly recorded. It is reassuring and clear that this process has been followed thoroughly in the 1784 steam engine example given above.

Thus there are items at both ends of the categorisation scale where there is likely to be general consensus, and it is the middle ground over which the most careful arguments must be pursued. Let us take the example of the Great Western Railway's *City of Truro*, Britain's first machine ever to travel at over 100 mph in 1904. [6] It is strongly built and capable of operation without damage under sensible conditions. Indeed, it has operated in preservation for at least 25 years with no apparent harm, and yet it is an icon with the same sort of standing as *HMS Victory* or the Bleriot *Monoplane.* Are we to encourage the return of this locomotive to Britain's main line railway network in the year 2004 so that the Centenary of the first 100 mph can be celebrated? One thing is certain, there will be a high proportion of rail fans out there who would want to see the locomotive try and do the record-breaking run all over again.

The hapless curator, swelled with self importance by having agreed to allow the 100 year old locomotive to be returned to steam, finds nothing but abuse and scorn when the maximum speed for such a venture is limited to a perfectly reasonable 60 mph!

This is where the control of what goes on is essential, and where a good technical understanding of what is actually happening inside the machine from both an engineering and museological standpoint is necessary. A steam locomotive is in fact a self-limiting machine, with smooth steel wheels on smooth steel rails. In the event of being overloaded the wheels will slip on the rails. It is far more likely to sustain damage through ignorance and abuse than through over fast or hard running.

I have a fine photograph taken with a powerful telephoto-lens camera, showing a steam locomotive in preservation, working hard with a heavy train, breasting the summit of the Settle and Carlisle line at Ais Gill. I showed the photograph to three museum curators, and three railway enthusiasts, asking each of them what the picture suggested to them. The curators all suggested 'potential damage occurring', and the enthusiasts all expressed approval. I do not believe that any quantifiable damage was being done at the time of the photograph. We must however distinguish between a very limited number of controlled runs, and regular everyday use.

It is important to remember that the youngsters of today are growing up in an age when travelling by rail is an unusual activity, and that the steam locomotives they do see potter about on preserved branch-lines. The sight, sounds, smell and feel of a powerful steam locomotive working hard but well within its capacity, hauling heavy trains on the trunk routes of Britain, can still be made available for those youngsters to sense, and allow them to better appreciate, one of Britain's most truly interactive inventions. The NRM believes it has a part to play in that interpretation.

Conclusion

I would like to conclude by suggesting that there is another slightly less tangible but nevertheless very significant factor in our assessment of how we can enjoy interpreting the operation of old machines. I have picked a subject outside my own sphere of activity, deliberately to try and neutralise my own preferences. Let us take the example of the *Supermarine Spitfire*, displayed in a museum, awkwardly sitting on its wheels like a swan out of water. Yet once airborne, the true excellence and beauty of this fine machine comes to assail our emotions. We all know how unreliable elderly machinery can be, but a power failure through even the smallest fault can have catastrophic effects on an aircraft. We know, I am sure, of the destruction of the last remaining *Bristol Bulldog*, *Bristol Blenheim* and recently the *Mosquito,* whilst in preservation. At least land based objects generally come gently to rest when they break down, rather than falling out of the sky!

If you were the curator of the museum with the last airworthy spitfire, would YOU ever allow it to be flown again? Can I make the dilemma worse by suggesting your museum might be in deep financial trouble and a potential benefactor has offered a massive bequest which will sort things out for the foreseeable future. His only condition is that the Spitfire is flown on his sixtieth birthday . . . ?

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Figure 1

Influences On Decisions To Operate Items In the National Rolling Stock Collection

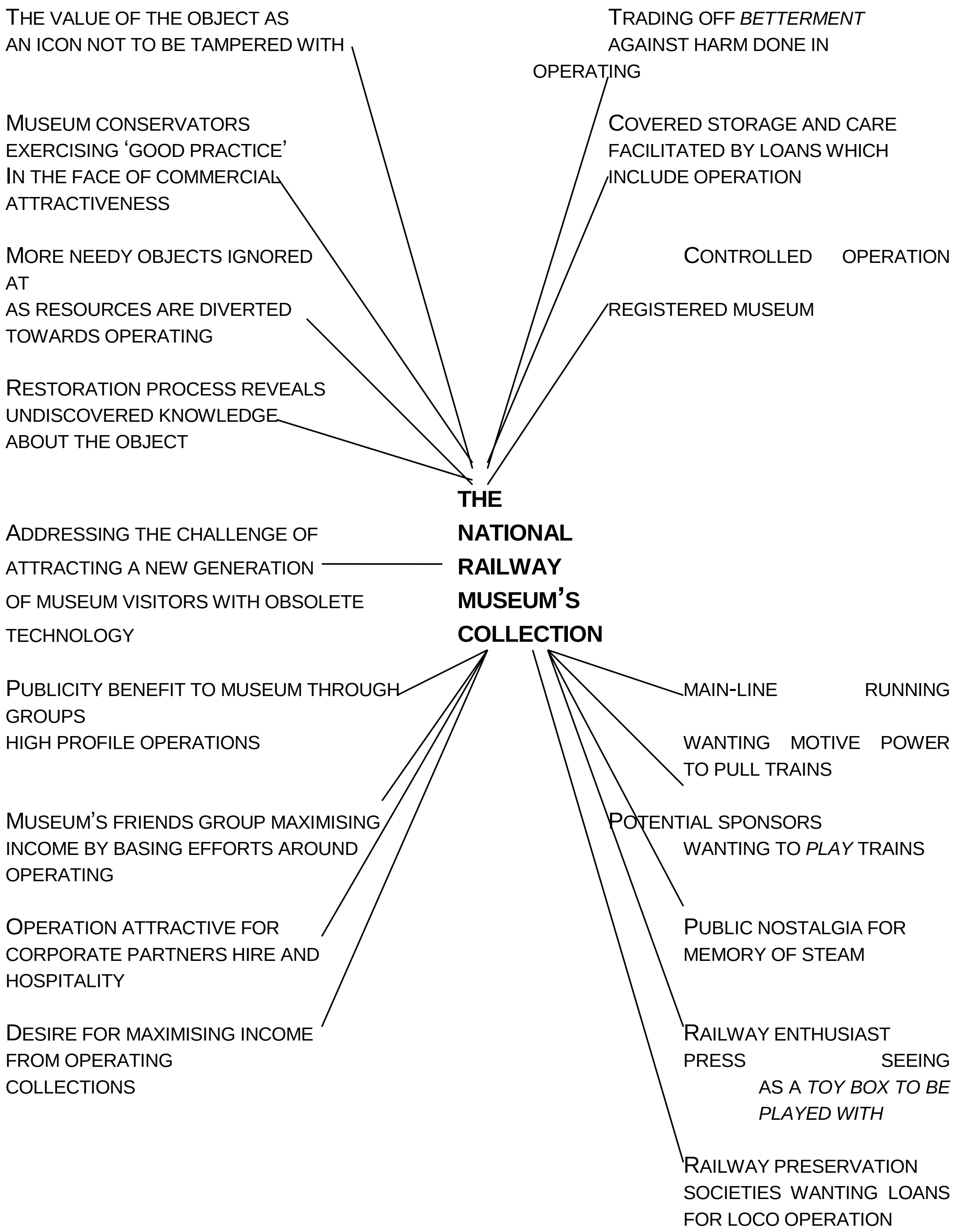

Table 1

Locomotives and Rolling Stock in the National Collection
Definition of Status Categories

1.1	a. Precious object b. Icon c. At risk from operation d. At risk from poor environment	Not to be loaned long term. Needs environment suitable for wooden components/thin rusty metal.
1.2	a. Nationally significant object b. Requires special care c. At risk from operation d. Unique and not to be restored	Could be loaned with special conditions. Needs special environment.
1.3	a. Nationally significant object b. Could be operated under special conditions c. Unique and restored	To be kept under cover when not operating. Operation under NRM supervision.
2	a. Important link in story of railways b. Object not necessarily to stay in York c. Could be loaned out for static display	To be kept under cover.
3	a. Enhances story of railways b. Could be loaned/restored/ operated without compromising object	To be kept under cover.
4	a. Interesting but not unique b. Could be loaned/restored/ operated	Could be lent for betterment. Could be stored outside with care.
5	Should not be in National Collection	

Table 2

Locomotives and Rolling Stock in the National Collection

Date	Description	Inv.No	Location	Status
1813	Wylam Colliery 0-4-0 'Puffing Billy'	1862-5	ScM	1.1 L
1847	LNWR 2-2-2 No 3020 'Cornwall'	1975-7026	Crewe	1.2 L
1857	Wantage Tram 0-4-0WT No 5 'Shannon' (formerly 'Jane')	1978-7013	Didcot	1.3 L
1945	SR 4-6-2 Battle of Britain Class No 34051	1978-7042	NRM	2 D
1951	BR 8 Ton Cattle Wagon No B893343	1978-7111	NRM	3 D
1941	LNER 20 Ton Goods Brake Van No 246710	1994-7392	NYMR	4 E
1950	BR 12 Wheel Well Wagon No KDB 901601 'Trestrol'	1992-7293	ELR	4 L
1955	BR China Clay Tip Wagon No B743141 (fitted)	1995-7146	NRM	4 D
1952	BR 30 Ton Bogie Bolster C No B943139	1978-7112	NRM	5 PD

Definition of Location Categories

D On display at York or required for display in York
L Mutually agreed loan to outside body
E Extraordinary loan e.g. enforced by closure of Motive power depot / vehicle store, e.g. Kineton, ELR
O Stored outside at NRM, Hessay, Foundry Lane
PD Proposed disposal

LEARNING THROUGH CONSERVATION : THE *BRADDYLL* LOCOMOTIVE PROJECT

M R Bailey and J P Glithero

Abstract

An unrestored 1840-built locomotive, Braddyll, at the Timothy Hackworth Museum in Shildon, County Durham, provided a special opportunity to learn about materials and workmanship of the time. Largely unrebuilt as a locomotive, Braddyll was modified for use as a snow-plough in the 1870s, for which duty some components were removed and others added.

A feasibility study began with a survey of component age and condition. [1] *The largely original wrought and cast iron components varied from remarkably good to badly corroded. The study considered the ethics and techniques for conservation and long-term display, leading to the objective of conservation of surviving materials without replacement of missing components.*

Techniques for cleaning, surface preparation, conservation and painting were each carefully considered, as was the strengthening of insecure components. A slurry-blast technique was adopted, which was new to conservation of historic iron-work, and which did not harm it. Cleaning revealed many original and mid-life features, the nature of which were not recorded in contemporary engineering books.

Some traces of paint-work were recorded, colour-matched and the components correspondingly re-painted. Other components have been painted in a sympathetic colour scheme, which also aids the visitor not familiar with early locomotive practice.

The Museum and Galleries Commission Standards for Larger and Working Objects (1994) were followed, and a comprehensive survey record, both textual and photographic, was taken. [2,3]

Introduction

For many years the world's oldest surviving steam locomotives have been in the care of transport and technology museums. Many of them were re-built, sometimes more than once, during their working career, and thus present latter-day materials and construction practices. The exception was the locomotive, known as *Braddyll*, built circa 1840, which remained unconserved until the 1995 project which is the subject of this paper. Although an incomplete artefact, *Braddyll's* main components, especially the boiler, remained largely as built, and the conservation project was a remarkable opportunity to learn about early locomotive materials, construction and repair practices.

It is most likely that the locomotive, largely of wrought and cast iron construction, had remained in the open air since the 1870s, when it had been converted into an unpowered vehicle fitted with a snow-plough. In 1948, after being abandoned for many years, it was recognised and retained as an historic artefact, but, pending arrangements for its long-term care, it remained in the open until December 1994. The only protection it received during that time was the occasional application of coats of road tar to the easily accessible exterior components.

Braddyll was acquired by the Timothy Hackworth Victorian and Railway Museum in Shildon, County Durham, in 1978. Funding difficulties led to delays in considering the locomotive's future. Its deteriorating condition gave rise to the possibility of it being scrapped and efforts were made by the Museum Manager to secure its long-term conservation. At the same time, the authors of this paper drew the attention of the wider museum world to the research and display opportunities that would be made possible by its conservation. This initiative came in the wake of their experience gained through consultancy work which preceded the conservation of the similar but more complete locomotive, *Samson*, retained in the Museum of Industry, Nova Scotia, Canada. [4] The *Braddyll* conservation project, undertaken by the authors on behalf of the Timothy Hackworth Museum, was funded by grant-aid, including Science Museum PRISM funding.

Known history of the locomotive

Braddyll was a strong and sturdy steam locomotive of the Hackworth school, well-suited to heavy trains of chaldron wagons of coal and other minerals, hauled at modest speeds, in the north-east of England and elsewhere. In the absence of any provenance, circumstantial evidence suggested that the locomotive may well have been made under Timothy Hackworth's direction at his Soho works in Shildon. There is no other example of a Soho works-built locomotive in Britain, although another locomotive of the Hackworth school, *Derwent*, made by W. & A. Kitching in Darlington in 1845, is on display in that town's Railway Centre and Museum.

Braddyll was one of possibly four locomotives first employed at the South Hetton Colliery in County Durham, and was converted there into a snow-plough in the 1870s. It is possible that the locomotive is that known to have been named, by 1841, after Colonel Thomas Braddyll, the founding proprietor of the South Hetton Colliery.

Condition of the locomotive

In 1994, the authors were consulted on *Braddyll's* condition and, following a thorough survey, reported accordingly to the Timothy Hackworth Museum with recommendations for its conservation. [5] The locomotive looked in poor condition through lack of attention, and showed structural weaknesses that would need urgent attention. It was clear that conservation of the artefact was well merited, and that it would make a worthy display for the Museum, (Plate 1).

The several coats of tar applied to the accessible exterior parts, which had offered protection over the years and deterred surface deterioration, were, in the absence of recent applications, breaking up and allowing water ingress. The less accessible parts had not been coated at all and had suffered varying degrees of corrosion. In particular, some areas of the bottom of the wrought iron boiler barrel had wasted away, whilst the steel springs had corroded badly beyond any function and the boiler support brackets had become weakened. As presented, therefore, the locomotive was a hazard and the Museum was advised that, prior to any move under cover for the conservation work to commence, an internal support strut should be installed to carry the weight of the boiler.

The two buffer beams, of substantial timber baulks, had deteriorated badly in the absence of any treatment, and their wrought iron cladding reduced in thickness from corrosion. The cast iron wheels, water pumps and other smaller components had shown remarkable resistance to corrosion and were largely unaffected, as were the few remaining brass and copper components.

A number of prominent components were missing, notably the cylinders, the drive and valve motions and the chimney. It is most likely that these had been removed in the 1870's during the snow-plough conversion. This conversion had required the installation of substantial wrought iron brackets and bracing, both at the front-end for the plough, and at the rear for an additional buffer beam. Although the plough itself had been removed about 1948, the brackets, bracing and buffers remained.

Following acceptance of the authors' report and recommendations, arrangements were made to make the boiler secure by the installation of the recommended internal boiler support strut, which had been prepared by arrangement with the National Railway Museum. Once fitted and made secure, arrangements were set in hand for the locomotive's removal from outside to inside the Museum's 1830-built Soho engine shed. The move was carried out in December 1994, using the resources of the Territorial Army's Royal Engineers Tank Recovery Unit. To avoid undue strain on the locomotive's weaker components, *Braddyll* was lifted on a length of track, which was itself supported by two rolled steel joists. Two cranes lifted the combined load with spreaders and slings onto the RSJs, and turned it through 180°.

Conservation programme

Consideration was given to the several options for stabilising *Braddyll's* condition and preparing it for long-term display. The options included:

i) a complete dismantling, removal of the remaining snow-plough components, conservation of the vehicle and replication of the missing locomotive components in order to restore the locomotive either to its as-built 1840 condition, or its 1870s, end-of-service condition,

ii) a complete dismantling, repair, conservation and re-assembly of all components, without replacement of missing components,

iii) conservation of all components *in situ*, without replacement of missing components.

Although there were strong arguments to replicate missing components (option (i)) to assist in the interpretation of the artefact for the benefit of Museum visitors, this option was turned down on three grounds, namely:

- the extent of replication required, which would detract from the artefact itself,
- the design of the replicated components would be speculative, in spite of the good understanding of their fixing and geometry which was derived from the artefact itself,
- re-conversion to a locomotive would require the removal of the snow-plough components, which themselves form an important part of the story of the artefact.

Option ii) was turned down on the grounds that dismantling would require surgery to separate corroded components, resulting in a loss of original material, a weakening of the structure and the requirement for additional stiffening members. Option iii) was therefore pursued, and conservation work was undertaken with the strict objective of stabilising the condition of all surviving components and preparing them for long-term display. This included the straightening of distorted components and the introduction of a few support brackets to stabilise hazardous or weak fittings.

The next part of the conservation work was to clean out the half tonne or so of accumulated debris from within the boiler and its support brackets. This was done with hand tools, a powerful vacuum cleaner and a high pressure washer. Special tools were made to reach into less accessible areas, such as between the fire tube and boiler shell. The material removed included secondary artefacts which fell into three broad categories:

i) boiler components, probably dropped by the boiler-makers during construction, or repair of the locomotive. These include the stub-ends of taper screwed copper repair plugs, bolts and rivets,

ii) boiler scale in four different forms,

iii) sundry iron pieces, such as colliery track spikes, nuts, bolts, broken castings (one weighing about 15kg), and some iron rods. Together with part of a 'stone' mineral water bottle and general litter, these were probably tossed into the boiler by the colliery staff or others during the locomotive's many years as a snow-plough, or when subsequently parked in a siding.

The tar-coating and some of the compacted debris and de-laminated iron were removed by slurry-blasting with water and grains of calcium carbonate, (Plate 2). The grains were medium-grade (0.30 - 0.70 mm, 3 on the Mohs hardness scale) and the blast pressure was between 1 and 1.4 bar. The plant was powered by a diesel driven air compressor (3.5 m^3 per minute at 8 bar). The authors wore water-proof clothing, hard hats and visors. The requirements of the COSHH Regulations were followed. [6]

The slurry blast equipment was fast and effective in removing the tar and loose rust from plain surfaces such as the sides of the boiler. Great difficulty was experienced with angled surfaces, such as those on the wheels. The slurry splashed back over the operator and obscured his vision totally, requiring his colleague to hose his visor with water to keep it clear. A long lance with an angled nozzle was made up to reach into inaccessible areas. The parent metal was revealed without erosion, and the blast was controllable to allow some small areas of residual paintwork to be revealed from under the tar coats.

Nine days of slurry-blasting, using just over two tonnes of calcium carbonate, were necessary to complete the surface cleaning inside and outside the locomotive. About 98% of the tar had been removed at the conclusion of this phase.

The locomotive was washed over thoroughly and allowed to dry before being winched back into the engine shed for final surface preparation. Although some of the corroded iron was removed by the slurry-blasting, significant quantities of hard rust remained, both on the surface of the boiler barrel and fire-tube and, particularly, in compacted form within the boiler support brackets.

Over the years water had penetrated some of the wrought iron plate edges and de-laminated them. It was therefore necessary to remove the corroded layers to minimise moisture traps. Due to the varying stages of penetration, considerable time and effort was necessary to remove, with hand and rotary power tools, the residual compacted debris and corroded layers of iron. Judgement was required regarding those layers that should be removed, and those that should be left for the long-term benefit of the component, and the locomotive as a whole.

The locomotive's wheels, with their complex castings formed of multi-faced segments, were cleaned with a compressed-air needle gun. Tar still remaining, particularly on the corroded foot-plate patches, was burnt off with a blow lamp or removed with a soluble degreasing solvent. All surface areas were given a final wire-brushing to prepare them for acid treatment, and the vacuum cleaner was again used to remove residual debris and dust. A further 50kg of debris was removed during this phase, making a total of some two-thirds of a tonne since the commencement of the project.

Treatment and presentation of the locomotive

The timber of the rear buffer beam had mostly rotted away and was replaced, with the added advantage of stiffening up the rear end of the locomotive. The front beam, though partly rotted, was left as it was because it was playing no structural part.

Several wrought iron components, notably foot-board and footplate brackets and a brake standard, required straightening. The appropriate part of each component was brought to a dull red heat with an oxy-propane torch and then bent by hand force, clamping or cooling with a wet cloth. Bent plate edges and a tear in the dome hole were carefully straightened cold with hammers. Mild steel brackets were inserted to support the vulnerable boiler feed pumps and brake cross shaft.

To ensure that future museum management and students of *Braddyll* are not misled, the new brackets and bolts have been stamped 'THM 1995' (Timothy Hackworth Museum 1995). This practice has been carried out in accordance with the MGC Guideline 5.23. [7]

The cast iron exhaust pipes posed a problem. Cleaning revealed that the right hand pipe had cracked right through and was in a dangerous condition. Mild steel reinforcing bars, bent to shape, were put inside the pipe and the void was filled with expanded rigid structural foam.

On completion of the surface preparation, all iron and steel was treated with two coats of tannic acid, and then given two coats of zinc phosphate/zinc chromate undercoat. Two coats of alkyd gloss top coat, mixed with a clear matting varnish, were then applied. The wooden buffer beams were treated with a suitable preservative. The copper and brass components were polished and coated with a clear varnish.

It was necessary to paint all surfaces for their protection against moisture and the consequent risk of deterioration. This requirement raised the question of a colour scheme which would be both sympathetic to *Braddyll's* history and satisfactory for the understanding of museum visitors. This introduced a novel problem, because the internal surfaces of the locomotive had not been painted during its service years. A rust-brown for the interior of the boiler barrel, and ash-grey for the firebox interior were selected, in order to blend with and not detract from the main external colour scheme.

The small areas of external green and red paint-work, revealed during the slurry-blast cleaning, were identified as being similar to the livery of the former North Eastern Railway, namely light green with red trimming. The top-coats were carefully matched to reproduce the same colours, and the base colour proportions recorded in the Conservation Report for future reference. The top coats were applied without any rubbing down, in order to preserve the rugged, work-horse appearance of the artefact, rather than a smooth, gloss finish suggestive of a well-preserved ex-service locomotive.

The outside of the boiler itself was painted in North Eastern green even though, in service, this colour would probably only have been applied to the boiler's outer wooden lagging. Lacquering was not considered to be adequate for the long term protection of this element. The smokebox was painted black in keeping with normal locomotive practice (Plate 3).

To help the museum visitor distinguish between those components which were part of the locomotive, and those which were fitted in the 1870s for the snow-plough conversion, the latter were painted in a darker shade of green which blended with but could be distinguished from the main colour scheme. The new support brackets, bolts and washers were painted brown to signify their separate identity.

Learning about the artefact

The conservation work revealed much evidence about the materials and construction methods used in *Braddyll's* manufacture and periodic repairs, as well as the design concepts. Indeed, something of the history of the locomotive could be deduced from the archaeology. The evidence showed that some modifications had had to be carried out to correct design faults. The pumps had initially supplied feed water to the boiler through short pipes connected into the front tube plate. These pipes were short and awkward to fit, and had been replaced by longer pipes fitted to the boiler barrel. The footplate had begun to sag and an additional support fitted.

Modifications had also been needed because of changes in service requirements. Large, square buffer pads, bolted to the front beam and braced with forged iron bars bolted to the smokebox sides, had been added to match the buffers of main line wagons. At some time more power had been required, or an attempt made to compensate for reduced steam pressure due to the condition of the boiler. Stepped keys and marks left on the axle by set screws show that the valve gear eccentrics had been set at different angles. After several attempts, some more logical than others, the eccentrics were returned to their original positions!

When *Braddyll* was converted to a snow-plough, the rear springs were taken out and crude brackets made from old railway lines bolted in their place. These brackets supported a buffer beam taken off another locomotive, the arrangement to take the thrust being ingenious. Brake gear from another rail vehicle was fitted to the rear axle. The snow-plough, fitted to the front end, was made from second-hand plates, probably by the colliery blacksmith.

Evidence of the repair work on *Braddyll* was very clear. The boiler shell at the front had been 'stitched' with 12mm taper-screwed copper plugs and there is one small patch on a bottom plate. However, it does not seem as if any boiler plates had been renewed as was the case with *Samson.* The fire-tube must have been a continual worry. It is of flattened circular section, about 0.9m wide and 1.8m long, made of wrought iron plates joined together with Adamson-type anti-collapse flanges. The roof of the tube was further stiffened by four girder stays. These must have been inadequate as an additional stay had been added later. This too was insufficient, and the roof bellied about 15mm between the stay bolts, giving a 'quilted' appearance. Repairs had been carried out to the flanges by 'stitching' with copper plugs, and some of these repairs were, in turn, covered by copper patches, (Plate 4). The boiler working pressure was probably reduced in the later years of operation. The underlying cause of the problem might have been the hard water, as the 10mm thick layer of scale found on top of the flue tube would have caused overheating. Regular cleaning might have prolonged the life of the boiler.

It was apparent from minor differences in the castings of the wheels that some had been replaced during the working life of the locomotive. Indeed, no two were exactly the same, and some contained small flaws, such as blow-holes and a displaced rib. Other maintenance work included replacing some of the axle boxes, which have different shaped oil reservoirs. Hammer marks round some of the rivets on the smoke box indicated that they had worked loose and had been tightened. They might have worked loose because of the racking strains imposed by the cylinders mounted on the smoke box.

The stubs of broken-off fittings and fixing bolts found in the boiler shell revealed the precise locations of each boiler fitting, including the regulator, water gauge and drain plugs. Every hole was matched with all known boiler fitting requirements. All the rivets (apart from the countersunk heads under the cylinders) were of the same conical shape, except for those used on the repair patch. String packing found in the feed-water pump glands was a particularly noteworthy find.

Identification stamp and punch marks of different styles were found on a number of components. All were carefully recorded and photographed.

Several things had thus been learned from the conservation programme. A good idea of the original appearance of the locomotive was gained, and something learned of the craftsmen who built and maintained it. It was particularly rewarding to see their repair techniques, such as stitching with taper screwed copper plugs, and changing the valve timing with stepped keys, such detail not being recorded in contemporary literature.

Conservation report

The standards and practices contained in the document 'Standards in the Museum Care of Larger and Working Objects', were followed throughout the project. [8] A detailed photographic and written record was made, which, at the conclusion of the project, formed the conservation report and its appendices that were sent to the Timothy Hackworth Museum [9]. This included a full description of procedures that were carried out, with details of all suppliers, specifications and materials. This document will be available to curatorial staff in future generations, should further remedial work be necessary.

Detailed drawings were produced for the conservation report. They show the size and location of every hole, rivet, plate edge, nut and bolt, etc. Using these, conjectural views of the locomotive as built and as modified were constructed. The exact inclination and fore and aft position of the cylinders, were deduced from the holes in the smoke box sides. The lateral position was determined by (computer) calculation and confirmed by measuring the width over the crank pin bosses. Figure 1 shows the locomotive as now conserved, whilst Figure 2 is a view of *Braddyll* as it probably looked during its later years in service. The conjectural view has been based upon contemporary drawings of North East colliery locomotives, for such items as the chimney top, coupling rods, and the dome top.

It will be important for the long-term stability of the locomotive's ironwork, to maintain a satisfactory temperature and level of humidity in the Soho Engine Shed, which houses the locomotive and other historic artefacts. The Museum has taken steps to preserve and monitor the correct environmental conditions, as laid down in Section 3 of the Museum and Galleries Commission Standards. [10]

Conclusion

The *Braddyll* project has been an unique undertaking in the recent history of locomotive conservation. Not only did its condition call for new techniques to be adopted, but the conservation programme has added much to our knowledge of materials, construction and maintenance practices for early locomotives. These practices were, in their time, the preserve of the tradesmen who passed down their skills to succeeding generations and who rarely committed them to paper. The conservation techniques adopted worked particularly well, and they may well find application with other projects for conserving historic machinery and structures.

Safety

Specialist operations, such as heavy lifting and component straightening with an oxypropane torch were carried out by appropriately trained contractors listed in the acknowledgements.

Both the acid and paint were accompanied by the manufacturers data sheets, covering the Health and Safety requirements for use. These were closely followed to meet the recommended ventilation and personal protective equipment requirements.

Acknowledgements

The authors gratefully acknowledge the help given by the management and staff of the Timothy Hackworth Victorian and Railway Museum, and also the following organisations:

- The Territorial Army Royal Engineers Unit (Catterick) carried out the lifting,
- The special bolts for the rear buffer beam and the support brackets for the pumps and other parts were provided by Cleveland Bridge Company of Darlington,
- The paint was provided by Courtaulds Coatings and Sealants Ltd. (Aerospace) of Shildon,

- Blue Diamond Machine Tools Ltd of Shildon straightened the footplate brackets and flattened the rear buffer plates,
- D. J. Camp Ltd and Dunn's (Shildon) Ltd helped with handling materials,
- British Flowplant Group Ltd gave support in operating their slurry blast equipment,
- The steel struts for the front of the boiler were provided by the National Railway Museum,
- The North of England Museum Service provided environmental monitoring equipment.

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5. Bailey and Glithero (1994) *op cit*.
6. Health and Safety Commission, **Control of Substances Hazardous to Health Regulations 1988,** HMSO, London (1988).
7. Paine (1994) *op cit.*
8. *ibid.*
9. Bailey and Glithero (1995) *op cit*.
10. Paine, C (1994) *op cit.*

Materials

1. Jizer soluble degreasing compound. Deb Chemical Proprietaries Ltd, Belper UK.
2. Tripor 100A compound. Trident Foams of Stockport UK.
3. Tannic Acid. Fertan Chemicals High Wycombe UK.
4. Alkyd gloss top coat, specification PP607/216. Courtaulds Coatings and Sealants Ltd. (Aerospace) Shildon UK.
5. Clear matting varnish. Courtaulds Coatings and Sealants Ltd. (Aerospace) Shildon UK.
6. Clear varnish. Roncraft Ltd Sheffield UK.

Plate 1. Braddyll before conservation.

Plate 2.
Slurry blasting.

Plate 3. Braddyll after conservation.

Plate 4.
In service repairs
to the flue.

Figure 1. *Braddyll* Side view as now.

Figure 2. *Braddyll* Conjectural side view as at end off steam service

THE NEW 'ART AND INDUSTRY' GALLERY AT THE NATIONAL MUSEUMS OF SCOTLAND: A CASE STUDY OF CONFLICTS BETWEEN TWO DISCIPLINES.

K Nissan and C Stable

Abstract

A new gallery opened at the NMS in May 1996 displaying objects from two different curatorial departments. Traditional artefacts and engineering objects are displayed side by side, and an artefact conservator was employed to carry out all the conservation. This paper presents a number of case studies of engineering objects conserved for the gallery and examines the differences in ethics and approach which emerged between the two disciplines.

Introduction

A new permanent gallery, *Art & Industry Since 1850,* opened at the Royal Museum of Scotland, the largest museum of the National Museums of Scotland (NMS), in May 1996. The gallery aims to illustrate ways in which art and design combine with the manufacturing process to shape everyday objects. There is a very large range on display including: small household objects, transport and communication artefacts and shoes - almost everything, including the kitchen sink!

This is the first time since the Victorian period that an inter-departmental gallery has opened at the Royal Museum. Objects were selected from the collections of two curatorial departments, *History and Applied Art* (HAA) and *Science, Technology and Working Life* (STWL); the intention was to put on a display which would cross over and draw together two diverse disciplines. Visitors would be stimulated to consider aspects of art and design encountered in their everyday lives by the juxtaposition of art and engineering collections.

Traditionally, conservation work for the two departments has been carried out by the artefact and engineering conservation sections respectively. Prior to the employment of a conservator to work on this project, conservators from both sections carried out condition reports and proposed conservation treatments. Differences in approach soon began to emerge: from the engineering section, there were recommendations of *replacement, repainting* and *restoring to a working condition*, whereas the reports of artefact conservators proposed *consolidation* of existing features and, predominantly, a policy of *minimum intervention*.

Although every treatment proposal is specific to a particular object, and not based solely on the ethics of the profession, it could be suggested that the main differences in approach come about primarily as a result of differences in training. Take, for example, the issue of repainting the original surface of the object: when faced with an artefact with a flaking paint surface, the priority and possibly the only consideration of the artefact conservator would be to preserve that layer as part of the history of the object. It would not be an option to remove that layer or to cover it with another paint layer, regardless of the originality or date of the existing paint surface. However, it may be argued that, since most industrial objects are regularly maintained during their working lives, such maintenance should not necessarily stop because the object becomes part of a museum collection. In the conservation of artefacts, on the other hand, practice dictates that from the time the object enters the museum, history stops and preservation begins. Replacement of parts, in the view of the artefact conservator, should occur only when required for structural rather than aesthetic reasons. Even if the part requiring replacement is not completely original, it is still part of the history of the object.

In the case of the new *Art & Industry* gallery, treatments were proposed very early on in the development of the project prior to the design of the gallery being established and were independent, on the whole, of curatorial input. As the design brief evolved, individual objects were inspected by curators and designers and treatment proposals had to be modified to take account of the requirements of the brief. Conflicts between conservation ethics and curatorial/design needs arose, mainly due to the curators' desire to show the objects as they would have looked when new. To show the objects as they appear now would not effectively present the curators' picture, although it would comply with the intention of the artefact conservator, who would regard restoration to the original state as the loss of an object's history.

Before these differences in approach between artefact and engineering conservators had been fully appreciated in a practical context, it had been decided to employ only one conservator for this project in order, theoretically, that the same approach could be adopted for all the objects in the gallery. An artefact conservator was selected: the gulf between the artefact conservator's view and the engineering conservator's view turned out to be unbridgeable. The decision to employ only one conservator was made for financial reasons; it was not feasible to employ two conservators, one in each discipline. The aim initially had been to treat the technological and industrial objects in the same way as historical material, that is, to retain the history of the object. But the difficulties resulting from this approach, and the differences between the two disciplines, soon became apparent and the conflict insoluble. It was necessary, eventually, to adopt the curators' and engineers' viewpoint.

Summation and comment

In the case of the *Art & Industry* gallery and the conflict of views that developed, one can examine the reasons and might suggest a route for avoiding such a situation in the future. Of course, this would represent an ideal, which it is rarely possible to achieve because of the constraints of practicality and the way in which projects tend to evolve, but experience may help to prevent a similar situation developing in the future.

In a gallery such as this, where the public is being offered an opportunity to see the evolution of design over a given period, the curators' desire should be paramount. It does not make much sense to display an object dating from and representing the 1950's with a 1970's addition which would confuse the viewer as to the contemporary appearance of the object. This point of view correlates very neatly with the traditional approach of the engineering conservator or, more accurately, restorer whose ethical standpoint embraces the original function of the object.

It is probably fair to say that, though a broadly-multilateral approach unifies conservation disciplines, each discipline has its peculiar requirements, which are defined by the historical purpose of the object and its social and cultural context.

In the opinion of the authors, the ideal as far as constructing a new gallery is concerned, in this and other similar contexts, would be that because of the understandable differences in approach between conservators in a variety of disciplines, the objects particular to each department should be treated by the appropriate conservation sections and contributed to the pool of objects chosen for inclusion in the new gallery. A problem that could arise as a result of this might be a discernible difference in final appearance of objects or the inability of the conservators of certain classes of objects to adhere to the requirements of the design/curatorial brief, either from an ethical or a technical point of view - again, we are back to purpose and training - perhaps the endless and archetypal dilemma of the museum conservator.

Object case studies

The case studies presented here feature objects from the STWL collections. Some of the objects have been in the collections for a considerable time whilst others were specifically acquired for inclusion in the Gallery.

It was proposed that in most cases, a policy of minimum intervention would govern the conservation treatment of the objects, and they would not be required to be in working order. This seemed the most ethical approach to carrying out the work as consideration had to be given to time constraints and the limited experience of the artefact conservators dealing with the industrial collections.

The majority of objects selected for the gallery were in good condition. Problems did arise where objects were in extremely poor condition or requests were made to improve appearance. Treatments had to go beyond minimum intervention and work, on occasion, had to be carried out by local contractors.

K2 Telephone kiosk - T.1989.64

The K2 telephone kiosk was the winning design of Sir Giles Gilbert Scott in a competition launched by the Post Office in 1924 and judged by the Royal Fine Arts Commission. The K2 was made from cast iron and produced by the Carron Iron Company. [1]

Condition

On the whole, the kiosk was in good condition, although it had been received as a shell without any telephone apparatus. There was some minimal corrosion of the ironwork mainly around the base and areas where protective coatings had not been applied, for example the top ventilator grills.

At the base of the kiosk the cast iron appeared to have been broken at one corner and subsequently repaired by seam welding. Welding repairs also appeared to have been made to the exterior of a lower side panel.

Glazing in the panels had not been finished properly. Putty work had been left unpainted and in most areas it had been built up too high and was clearly visible from the exterior above the beading.

The paint work on the kiosk was on the whole in a good condition. There were only minor areas where there was evidence of deterioration of the paint finish. However, this finish could be described as dull.

Treatment and ethical considerations

From a conservation viewpoint, the main concern was to treat and stabilise iron corrosion occurring around the base. Some cosmetic work was required, mainly trimming back the putty work and painting it to match the rest of the kiosk.

A request was made by the curatorial team that the kiosk should be completely repainted despite the paint work being in reasonable condition. The dull appearance was considered to be neither aesthetically pleasing nor adequate for presenting to the public.

The repainting would be in complete contradiction to the minimum intervention policy, raising ethical questions. A case was made for a treatment that precluded repainting of the kiosk. It was felt by the conservators that 'dull' or 'thin' paint could not be considered to be severe damage or deterioration of the object and in gallery conditions the paint would be under minimal threat from any further deterioration.

Recording of this finish could only be achieved by photography as only a thin paint film had been applied and it was not possible to obtain samples.

Despite the alternatives proposed, the kiosk was repainted. Paint was applied by brush rather than sprayed. The existing paint layer was rubbed down and used as a key for the new paint. The work was carried out by outside contractors, who although not professional private conservators, had had considerable experience with architectural iron work.

Arguments for repainting the kiosk included the following and could also be applied to other case studies discussed here:

- it gives an impression of the original look of the object and suits the conceptual philosophy of the gallery,
- the object is visually more appealing to gallery visitors,
- objects were regularly maintained during their working life, for example, parts replaced and surfaces repainted - why stop once an object is in the collection?

Although the repainting improved the aesthetic appearance of the kiosk dramatically, an existing paint finish had been lost and, as artefact conservators, we felt that the recording of it was not wholly adequate and our ethics had been compromised.

Arnold-Benz motor car

The Arnold-Benz car was gifted to the Museum in 1922. The car was constructed in 1897 at Paddock Wood, Kent. The single cylinder horizontal engine was manufactured in Mannheim, Germany. [2]

The majority of the body work on the car, including side panels, engine cover, mud guards and flooring was made of wood. The car had a steel chassis. Fittings and engine components were manufactured from a wide range of materials including: leather, copper alloy and rubber.

Condition

The Arnold-Benz was structurally very sound although, over time, it had suffered from some physical damage, general neglect and poor storage conditions.

It was evident that the car had undergone repairs, with sections of the wooden body work being replaced. Many parts were missing, most noticeably the seat bases, part of the braking mechanism and smaller components such as nuts, bolts and brackets.

The metal elements of the car had suffered badly from corrosion affecting surface finishes: nickel plating peeling from the steering column and black paint from the wheel rims and cooling tanks. In addition varnishes were peeling from the original wooden carriage work.

The rear folding foot plate (used as a foot brace when the engine was being cranked to start) was covered with rubberised canvas. The feet of the vehicle's users had worn this away, revealing the wooden base.

Treatment

Conservation treatment of the vehicle was limited to adequate stabilisation which would allow it to be put safely on open display. The rarity and age of the vehicle greatly elevates its status in motoring history, therefore to carry out more physical improvements would require long careful consideration, recording and research. The time available to complete the car for its inclusion in the new gallery certainly precluded this.

Treatment carried out included vacuuming the car. Major areas of iron corrosion were mechanically cleaned and the metal protected by application of a microcrystalline wax in white spirit.

There had been considerable loss of paint, particularly on the copper alloy cooling tanks. The surviving paint which was badly flaking was consolidated using 10% Paraloid B-72 in acetone.

Morris Mini Minor - T.1990.28

The Mini is a classic car designed by Sir Alec Issigonis. This particular model, the de-luxe version, with a Clipper Blue paint finish, was purchased by the NMS in 1990. It was assembled at the Cowley production line, Oxfordshire, in August 1959, and was one of the earliest to be produced at the plant. [3]

Condition

The Mini was received in good condition. There was very little evidence of corrosion, and paint appeared sound on the exterior body work. There was some deterioration on the chrome work and chipping of enamel on the front grill.

The interior was in reasonable condition although there was natural wear and tear as would be expected on an object that had been in regular use.

However, the car had undergone modifications; wheel arches, sills and the undersides of the body work and bonnet had been over-painted with a Hammerite-type metallic blue paint. [4]

The carpets had been replaced with a rubber foam-backed household carpet. This was stuck down but not properly fitted; edges were loose, poorly adhered and badly frayed.

The engine was in worse condition than other areas. The components were very dirty, paint finishes had flaked and there was substantial corrosion on some parts. Rubber components and seals had also deteriorated slightly.

Treatment

As the Mini was in very good condition, it was agreed that remedial conservation would be kept to a minimum; this involved light cleaning of the body work and interior with Teepol L detergent. Chrome work was polished with Solvol Autosol proprietary metal polish.

Upon discussing treatment with the curator, additional work was requested. The blue metallic sills were to be repainted the original Clipper Blue finish to match the rest of the body work and that the interior carpet would be removed and replaced with replicas of original carpets.

The main argument for carrying out these purely cosmetic treatments was to give more of an impression of the original look of the car as it came off the production line. To emphasise this, the car was displayed alongside other contemporary objects for example a petrol pump and a dressed mannequin.

Like the telephone kiosk, the additional work was felt to go beyond minimum intervention; the Hammerite paint was neither deteriorating, nor was it causing deterioration. As received, the Mini's replacement carpets and metallic paint finishes reflected its use and history, similar to the wear and tear seen on the Arnold Benz. As such, it was felt that the preservation of these features would have been justifiable.

Again, the requirements for display purposes took precedence over pure preservation. The exact Clipper Blue paint could not be obtained, so a close approximation of the colour was formulated using a two-part epoxy car paint system, with British Leyland colour swatch cards as a reference. The information about the fittings and paint finishes that were preserved when the vehicle was acquired by the NMS were recorded in the treatment report.

Avery-Hardell Petrol Pump T.1996.40

Condition

The petrol pump, dating from 1959, was purchased by NMS in 1995; it was in extremely poor condition. The panels had been over-painted numerous times and much of the paint was flaking off due to poor priming or the presence of corrosion products. A number of colour schemes had been applied to the pump, corresponding to various oil company liveries. Red, yellow and black paint were clearly visible from samples of the flaking beneath the most recent white finish. The pump had also been covered with 'BURMAH' adhesive labels.

There were areas of very severe corrosion on the panels, particularly at the bottom edges where sections of the metalwork were missing. The panels were also badly dented, cracked and fitted poorly to the iron framework.

The dial faces were very dirty, badly corroded and had flaking paint. Plastic signing had been obscured by remnants of old adhesive labels and lettering had flaked away.

The interior pump mechanism and the supporting framework was equally corroded with most components covered with a thick crust of iron corrosion.

The globe from the top of the pump and the dispensing hose and nozzle were missing from the pump.

Treatment

Due to the fact that the pump was a very late addition to the gallery, there was limited time to carry out a comprehensive treatment. For exhibition purposes, therefore, the emphasis was on restoration of the exterior shell and a minimum of work to stabilise the interior framework and pump mechanism.

It was proposed that the panels be dismantled and the read-out displays removed. All existing paint work was to be stripped back and corrosion removed mechanically from the panels. New patches were to be welded onto structurally weak and missing areas of the metalwork and dents and kinks removed. The panels were then to be primed and repainted in an appropriate colour scheme. Replacements for the globe, hose and nozzle had to be sourced and fitted once the pump had been reassembled.

The pump had originally been situated at a Shell garage in Musselburgh, Edinburgh. The underlying paint layers found on the pump were indicative of the Shell company liveries. [5] Two schemes were identified; red and yellow, and black and cream. The red and yellow scheme was the chosen option, as this would be contemporary with the globe which dated from the late 1950's.

The dial faces were to be cleaned and the paint stripped from particularly deteriorated areas and then primed and repainted. Some of the original signing would have to be replicated as it was very badly deteriorated.

It was realised that comprehensive treatment of the pump could not be completed in time for the installation deadline and therefore compromises had to be made. The internal working mechanisms that were removed from the pump were placed in storage as it was not feasible to conserve them satisfactorily within the time constraints. It was considered that, for display purposes, these components were not essential for 'reading' the object and so were not a priority for remedial treatment in the conservation programme .

Conclusion

Carrying out conservation on industrial objects for the *Art and Industry* gallery raised many ethical questions. It demonstrated that ethical considerations and approaches to treatments can be dependent on many outside influences. This can make decision-making very difficult. For this gallery, the major influences on the treatments adopted were the theme of the gallery and the design concept.

As artefact conservators, we have a primary objective to preserve as much information as possible on an object; our ethical standpoint may often be compromised when an object has been collected specifically for display purposes, or when the theme of the gallery demands it.

Constraints of time also governed the way in which treatments were undertaken. Most treatments were carried out to comply with the requirements of the curator's philosophy for the gallery and as such were appropriate in this case.

From the authors' perspective, the longer term preservation interests of the objects, particularly the petrol pump, were not considered thoroughly enough. There is potential for these objects to be brought back to working order in the future and in the haste to have the object in displayable condition this potential may have been lost.

Conflicts of interest often arose through the contradictory approach to the remedial treatment of each object and the inconsistencies of the conservation policies that were adopted. Discrepancies started to occur such as with the treatment of the Mini and the Arnold-Benz; very little was done to the latter and it was considered acceptable to be displayed in an incomplete but stabilised form. However, the Mini, which was already in an excellent condition, had to be cosmetically altered due to the additions made during its working life.

The petrol pump was received into the museum in such a deteriorated and incomplete state it was questionable why it had been registered. The treatment of the object from an artefact conservation viewpoint was interventive and it was felt that the ethical dilemmas faced with this object could have easily been avoided if the object had not been accessioned but perhaps registered as a display prop. If indeed there was very good reasons for accessioning the object into the collections (rarity, provenance, etc.) there would have been less acceptance to carry out the treatment described. Many spare parts were sourced for the pump and accessioned individually until the object almost became a 'Frankenstein's Monster' and it is hard to think of any other area of conservation where this would be considered acceptable.

In conclusion, it was found that in many of the cases it was difficult to square the orthodox ethical views of artefact conservation with those of engineering conservation and curator-ship. For instance, the engineering definition and perception of minimum intervention differed greatly from our own and treatments such as repainting were readily accepted, whereas we viewed such proposals with trepidation, even after recording the object before treatment.

We found that during the course of the conservation of these objects we became more and more dependent upon maintaining object record files to accurately document changes made to the objects. It was often the case that the concept of preserving historical information in situ on the object was a luxury no longer afforded to us.

Safety

Two-part epoxy paint systems can cause irritation to eyes, skin and mucous membranes and cause nausea. Therefore goggles, protective clothing and an appropriate respirator should be worn. There should also be adequate ventilation/ extraction provided in the working area.

Acknowledgements

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2. Anonymous, **Original object description,** NMS QUIXIS database.
3. Golding, R, **Mini**, Osprey (1979).
4. *Hammerite is a proprietary metal paint which imparts a metallic hammered finish to metalwork*.
5. Dodds, A, Curator of Transport, NMS, personal communication.

Materials and Suppliers

Contract work on Petrol Pump:
Garvick Services
Dunfermline
Fife
Contract work carried out on telephone kiosk:
WH Banks & Son Ltd
Duff Street lane
Edinburgh

Colour Swatches, Colour Map Referencing and Car Paint:
Stevenson College
Bankhead Avenue
Edinburgh

Teepol L - Biodegradable non-ionic detergent
McQuilkin & Co.
21 Polmadie Avenue
Glasgow

Solvol Autosol
Available from most hardware and auto shops.

THE DIFFERENT CONTRIBUTORS AND THEIR ROLE IN THE CONSERVATION, CARE AND MAINTENANCE OF INDUSTRIAL COLLECTIONS

LES DIFFERENTS INTERVENANTS ET LEUR ROLE DANS LA CONSERVATION, L'ENTRETIEN ET LA MAINTENANCE DES COLLECTIONS INDUSTRIELLES

B Rolland-Villemot and C Forrieres

Résumé

En France de plus en plus de musées conservent des collections industrielles appartenant au domaine des transport ou de l'industrie (machines). Ils souhaitent, dans un soucis de velorisation, les présenter au public; il les conservent et les restaurent. Les machines sont alors présentées soit de façon statique soit en mouvement, la remise en mouvement est souvent estimée la plus satisfaisante pour le public. Si ce choix de remise en fonctionnement est décidé dans un cadre muséal, alors vont se poser de nombreuses questions:

- les conditions de la remise en fonctionnement vitesse, fréquence,
- les acteurs de cette remise en fonctionnement agent du musée, anciens ouvriers,
- la maintenance de la machine en fonctionnement, condition, fréquence coût,
- les acteurs de la restauration, de l'entretien et de la maintenance; les conservateur, les restaurateurs, les ingénieurs, les anciens d'un métiers, les bénévoles et les associations.

Cette communication se propose d'analyse le rôle de chaque intervenant et sa place dans la conservation des collections industrielles dans le cadre d'une institution patrimoniale:

- définition d'une méthodologie,
- rôle de l'etude préalable,
- définition d'un cahier des charges,
- suivi des travaux et encadrement,
- le rôle des savoir-faire.

Dans cette méthodologie, la communication insistera sur l'interdisciplinarité et la complémentarité des intervenants. Ces propos seront illustrés d'exemples pris dans les musées français relevant de la tutelle du Ministère de la Culture: Musée de la Mine de Lewarde, Musée du Textile (Cholet), Écomusée de la Grande Lande.

Introduction

The widening of the cultural world to include the new sectors of scientific, technical and industrial collections has not occurred without forcing the world of conservation-restoration to address new questions. In fact, 'museum' type conservation is a new discipline; man has been repairing, renewing and rebuilding for centuries. Now when an object comes into the museum, to restore is not to repair. Under these conditions, faced with such complex and varied collections, it is important to identify all the skills which may have relevance to a given object. The parties involved in the conservation-restoration field are therefore necessarily diverse. This diversity must be met by an interdisciplinary approach.

Definition of the field

Mass produced industrial objects are what we are used to today.

'From Antiquity to the industrial era, numerous factors have fundamentally changed in relation to production methods'. [1]

Under pressure from technological advances - the harnessing of sources of energy and the perfecting of production techniques, the discovery of new operating and functional principles - the centuries-old handmade object has given way to the industrial object. By expanding aesthetic categories, twentieth century art rejects the conflict between objet d'art and industrial object (Le

Bauhaus). The industrial object has become the foundation of aesthetic anchored in contemporary reality. It is becoming the ‘representation of a language’ and therefore enters into the world of the museum. [2] Thus we have ‘the endless museum’. [3] The fact that the industrial object has entered the museum means that it is also entering another semantic sphere and its restoration therefore takes on a completely different dimension.

Of course, collections of technical and industrial objects existed before the twentieth century. In a letter written in 1675 Liebniz suggests that ‘some people whose interests extend to fine curiosities and above all to machines have agreed to make public shows of such objects’. [4] Liebniz uses the term *show* in this instance in the sense of a theatrical production; his idea was to enhance the value of these collections. In fact, later on he specifies that the exhibition will be made in such a way that ‘everyone would be charmed and excited and the venture could have consequences as amazing and as important as one could imagine’. [5]

Following the creation of the National Museum of Technology, technical museums multiplied in the nineteenth century, under the influence of universal exhibitions and exhibitions of industrial art under the Second Empire. For example, in 1848 an industrial museum was created in Lille. The machinery room of the 1889 universal exhibition has significant museological heritage. Industrialists, like the Schneiders at Le Creusot or the Meuniers at Noisiet, created exhibition areas in their factories. [6] ‘The Cathedral’, in Noisiet had a gallery where important visitors could assist in the grinding of cocoa beans. This was the ‘museum in the factory’. [7] Chambers of Commerce also created their own museums such as the Textile Museum in Lyon.

Until the post-war period, these museums were still part of an economically living environment; there was no break between the use of the object and its exhibition. There was no real action taken to conserve, still less to restore. It was the acceleration of industrialisation during the ‘Glorious Thirties’ in France which brought about a decisive break with the nineteenth century and the entry of the industrial object into the cultural world.

But what is an industrial object?

According to Leroi-Gourhan’s technical classification, an industrial object can be described as follows:

- a manual tool used by a craftsman: hammer, saw,
- an automatic machine: drilling machine,
- a machine tool: lathe,
- a programmable tool: jacquard machine,
- an automatic tool: assembly robot.

This classification is pertinent from a technical point of view and should be taken into account in an act of restoration but other criteria from the cultural world must be added.

Scientific collections

Part of the heritage of the curiosity cabinets of the eighteenth century (Wunderkammer):

i) collections that illustrate the history of a discipline like the Lavoisier Exhibition Room at the National Museum of Technology.

ii) collections used for teaching purposes such as the Physics Exhibition Room at the Victor Duruy

Grammar School classed as an historic monument.

Technical collections

These are often collections of models used for technical research or for the purposes of demonstration or the transmission of skills. The most famous example is the collection created by Vaucanson, exhibited at the Mortagne Town Hall in 1782. It was then taken to the National Museum of Technology. [8] In the same spirit, one can cite the Clair Collection kept at the Crozatier Museum at Puy and at the National Museum of Technology. Pierre and Alexander Clair manufactured models and measuring instruments intended for the practical instruction of pupils in Arts and Crafts Schools. [9]

Industrial collections

These are linked to a branch of industry and represent the whole operating process from extraction, through manufacturing to the finished product. They cover all fields of industry.

Collections concerning transport and communication

Although belonging to the service sector from an economic point of view, they enter into the cultural world as industrial collections: automobile, aeronautical, maritime, railway, space and telecommunications.

The industrial object is distinguished by its nature, its technology and also by its size; it can reach gigantic proportions. [10] The gigantic proportions of these objects - both moveable and immovable - impose limits on the options for conservation. For example while the *Uckange* furnace was saved, in spite of its size, the same did not apply to the *Gusro* crane in the port of Saint-Nazaire; it was destroyed due to the cost of maintenance which was considered to be too high.

So what do we preserve and why?

Conservation in the sense that we use today is a new discipline. In fact according to Littre (1863) 'to preserve' means:

- to preserve from destruction,
- to maintain in a certain condition,
- to prevent loss.

The three accepted meanings of the term describe a continuous process between the object and its environment. The object is not 'restored', but repaired, renewed or rebuilt as are machines in an industrial context which demands that they produce the highest possible output. The act of preserving, according to its current meaning, is the consequence of a 'hidden break' between the object and its working life. [11] There is a need to assimilate the past.

The curatorial assessment of the object

Restoration takes on a critical and historical dimension. Conservation-restoration is there to help to give a current picture of the past. It is essential that the industrial object to be restored is studied beforehand and understood in all its aspects, although one aspect may be favoured later for technical or museological reasons. It is very important to identify the distinctive criteria for each object. These are often multiple and intermingled; a few are listed below:

Scientific or technical history

For example, '*pascalines*'; Pascal calculating machines, even if several copies exist, are all evidence of the progress in mathematics and calculation techniques. But the one kept in the Museum of Arts and Crafts, with its dedication by Pascal to the Chancellor Seguier is also a unique historical artefact. As this object is polysemic (the historical and technical evidence of an emblematic man), one must ensure that any treatment respects all these criteria.

Technical criteria
Preserving a furnace like the *Uckange* furnace presupposes that a complex technical process, such as metallurgy, can be made intelligible.

Socio-economic criteria
Dedicating a museum to the sugar industry at Stella Matutina on the Reunion Island is evidence of the importance of this activity to the social and economic life of the Island.

Aesthetic criteria
Is it possible to have a garden of machinery like a sculpture garden? What difference is there between a *Tinguely Metamechanism*, and a working weaving loom in the Cholet Textile Museum? The difference lies in the original purpose of the object.

In parallel with these criteria consideration needs to be given to the rarity, both in production and in survival, of the artefact.

Unique object
Preserved as a single artefact. For example, in the field of fairground heritage, a single example of a roundabout or a model produced by a specific engineer.

Prototype
Unique by definition since the different versions of a prototype are different because they are used in the development of the mass produced object. One example, recently restored, is the 001 prototype of the *Concorde* preserved at the Museum of Air and Space at Bourget.

Mass produced objects
This category is self evident, for example a car or a machine.

These criteria must guide and influence the conservation options.

How to conserve and restore?

The treatments carried out will depend on a combination of criteria, in accordance with the message that the object must transmit. In fact, one must not reduce restoration to its technical dimension only.

Treatments must be carried which respect the tangible and intangible integrity of the object. Therefore it is necessary to define beforehand the function and value of the object. [12] The level of restoration will necessarily follow on from this, from simple conservation in current condition to reconstruction.

These different levels of treatment require diversified but complementary skills.

Archaeological conservation-restoration
An example of this is the *autochenille* (caterpillar tracked vehicle) which crossed the Sahara. This is at the Saint-Jean d'Angely Museum and was restored in 1994. The aim of this restoration was to retain the vehicle in the condition in which it arrived: passivation of metallic parts, consolidation of the rubber on tyres and tracks, whilst retaining traces of wear and tear. Today this vehicle has for us the emotive value of adventure, the first Citroen expedition. In the

same way, static restorations have been carried out on vehicles belonging to the National Car Museum at Compiegne. This type of restoration is carried out by a restorer.

Technical conservation-restoration
The technical message of the machine is favoured here. Treatments carried out aim to make the technical dimension visible, without necessarily making the machine work again. Thus, machines in the Earthenware Museum at Sarreguemines were restored in a static fashion, whilst interpreting technical features of the manufacturing process. At the Clair Collection of the Crozatier du Puy Museum, restoration has allowed technical and mechanical features to be seen and has even reinstated artefacts into working order where the museological project provides for this.

Operational restoration
In this type of treatment, it is decided to restore the object to working order within a museum context which is fundamentally different from the machine's original environment. The safety requirements of a public institution may modify the appearance of the machine. How should one make a loom operate? At real speed or reduced speed? Using which frequency? Who is going to work and maintain this machine? Who is going to restore it? In fact the skills of industrialists and the expertise of workers are indispensable to carrying out this type of treatment properly.

These considerations lead to the problem of the preservation of skills and the role of people with these skills in the restoration process. For example, the Latin Sailing Museum at Barcares has a collection of seventy boats with a view to the creation of a floating museum. The choice is to restore them as they are or return them to sailing condition. The skills of a marine carpenter are therefore necessary and complement the skills of a restorer of wooden structures who contributes their knowledge of materials and restoration methods.

In the same way, the National Museum of Arts and Popular Traditions intends to restore a Bayol roundabout from the beginning of the century into working order. This process will require collaboration and assistance from a travelling showman. A conservator will draft the specification and manage the treatment process. In fact many trades have disappeared because they have become obsolete; it is hard to preserve these dying skills. Knowledge is therefore being lost.

Curators must concern themselves with the collection of these skills as technical knowledge of an object and as a legacy of the past; a legacy necessary for maintenance in the future. But these cannot be artificially maintained in a sterile way, separated from their original context. Inevitably these skills become modified in a museum environment. It is necessary to keep using this functional knowledge as an aid in the conservation-restoration procedure in an historic approach and a critical interpretation of the object. When reinstating to working order the skills and knowledge relating to a particular machine are indispensable.

Ethnological conservation-restoration
This is a holistic approach which conserves the material aspects of the object as well as the intangible dimensions surrounding it (message, skills, archives) to give all the authenticity and integrity back to the

object. [13] There is still time to collect the skills necessary and useful to the restoration of our industrial heritage by means of investigation or reference to archives. This type of conservation allows one to define the parties involved in conservation-restoration and their role. Their degree of involvement will depend on the museological aims of the project for the object or the site under consideration. This type of treatment is close to the approach used for contemporary art. [14]

Towards a methodology

It is the opinion of the authors that a specialised restorer in the industrial field does not and should not exist. In fact, it is impossible for a single person to possess all the necessary skills. In addition, restoration is characteristically an interdisciplinary procedure; this is even more true and essential for industrial heritage. The restoration of our industrial heritage must therefore be approached through the collective skills of an interdisciplinary team: curators, restorers, technical, industrial and ethnographic historians.

This approach could be based on that of a design department such as in architecture. The chief architect of historical monuments has already attempted to define this concept.

The team must have within it experience in the following areas:

- writing a condition report,
- identifying conservation problems,
- selecting the appropriate treatment,
- identifying the role of each specialist,
- maintenance and servicing,
- preventive conservation,
- collection of archives and skills relating to an object.

This process will culminate in the drafting of a treatment specification.

Some examples of this methodology are given below:

i) the restoration of the 001 prototype of *Concorde* at the Museum of Air and Space, restored between 1993 to 1995. This involved conservation and restoration to allow its display in a hanger, the justification for the treatment. The treatment was preceded by a preliminary study carried out by two student engineers at the Sevenas Polytechnic as part of their military service. The study analysed the aeroplane from every angle; a trip was made to England to compare it with the two English prototypes. At the same time, a documentary, historical and archival study was carried out. A restoration strategy was developed and the treatments carried out with numerous partners (Aerospatial, Air France) but under the control of an engineer employed as Project Manager by the Museum of Air and Space.

ii) the salt stove at the Museum of Salins-les-Bains. A preliminary study was carried out before restoring this salt stove to determine the feasibility of the treatments and their cost. It included a technical and historical study.

iii) at the Sarreguemines Museum of Earthenware, a preliminary study was carried out in order to learn about the manufacturing process of earthenware factories. In order to carry out this study effectively, former workers were interviewed. Restoration was carried out by restorers.

Diversity of skills is a great benefit in the restoration of our industrial heritage. It can be analysed as follows:

- 'active' skills: restorers, industrialists, craftsmen, workers and their expertise,
- 'theoretical' skills: curators, historians of technology and restorers,
- disappearing skills and expertise,
- skills to be rediscovered, by means of oral investigation and archive research because they have disappeared.

Conclusion

The development of advisory and training activities can only be carried out within an interdisciplinary context which includes all the parties involved. In fact, the conservation-restoration of our industrial heritage, just like preventive conservation, is a working framework and a philosophy, not an initiative taken here or there by one or two individuals.

To develop this working framework, it is necessary to determine objectives and perspectives. Initial steps were taken by the Symposium of Company Museums, in 1991 and by Sylvie Vincent's study, within the context of the National School of Heritage, on the restoration of the machines of the Mulhouse museums.

The following themes are emerging:

- drafting of an inventory of collections,
- continuing the investigation into expertise,[15]
- evaluating the requirements of our industrial heritage in the field of conservation-restoration.

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RUST AND THE WORKING SURFACES OF INDUSTRIAL ARTEFACTS

G Prytulak

Abstract

Most industrial artefacts designed for outdoor use have working surfaces of polished bare steel. These surfaces begin to rust when the machines are left idle. Museums face a number of problems when they acquire these artefacts. A polished steel surface is unstable in most conditions, so it requires constant care, whereas a rusted surface, if left outdoors, must be cleaned regularly or painted over to prevent serious corrosion pitting. If a museum brings the machine indoors for display or restoration, it is obligated to tolerate the rusted surfaces, because a working polish cannot be artificially recreated. This paper will address how museum professionals can develop a more appreciative eye for both polished working surfaces and historically appropriate rust; recognising the rarity and interpretative value of the former and judging when it is 'industrially correct' to leave the latter intact.

Introduction

The subject of this paper, 'Rust & the Working Surfaces of Industrial Artefacts,' may seem inappropriate under the category of 'ethical issues'. After all, if there is one thing that conservators, curators and the public all agree on, it is the fact that rust is disgusting and unsightly. Rust is a sign of neglect and deterioration. It has no more place in a respectable museum than mould or carpet beetles.

Furthermore, the working surfaces of industrial artefacts are the parts that are kept free from rust by operating the machines. Rust is scoured away by friction, or it is prevented from forming altogether by heat or regular lubrication. What could be more straightforward than removing the rust to make a machine look operational or, failing that, painting the parts to make the artefact look cared for?

These are all valid points and they reflect a sane, practical approach to dealing with industrial collections. Yet there is still one question that is almost never asked, and that is, should we leave the rust intact? This is where ethics come into the discussion. And this is the question that will be addressed in this paper.

Basically, museum professionals do not like rust for two reasons: 1) they believe it is harmful - that it threatens the well being of the artefacts, and 2) they believe it is inappropriate and it will give museum visitors an inaccurate picture of what the artefact looked like during its working life. The time has come to take a closer look at both of these assumptions.

Assumption No.1: rust is harmful

Rust is almost everywhere in the industrialised world. In fact, it is often difficult not to see rust; step outside and rust will be somewhere in one's field of vision. There is no question that rust is a form of deterioration, but its destructive powers are greatly exaggerated. Rust does not signal the complete destruction of an artefact except in extreme conditions and over a long period of time.

Consider industrial artefacts. Most industrial artefacts spend their working lives outside. Their working surfaces are attacked by, abrasion, fluctuating temperatures, wet and dry cycles, contact with damp soil, aggressive salts and acids, and a combination of water, oxygen, airborne pollutants and dirt. Yet in spite of this, the machines survive for many years of operation. One reason for this is their design.

The working parts can tolerate rust because in order to function properly, they have to be made from thick sections of steel; thin sheet metal would crumple under the same conditions, and because of its thinness it would be perforated by the same amount of rust. A second reason for the high survival rate is the materials. Working parts from as early as the 1880s are usually made from alloy steel. Alloys like nickel steel or manganese steel can withstand corrosion much better than low carbon steels.

Another thing to bear in mind is that atmospheric corrosion is a surface reaction. It proceeds rapidly at first, in isolated patches on exposed metal, until the entire surface is covered; then it levels off to a steady plateau. On a graph of oxide formation against time, the reaction starts out as a straight diagonal line but quickly flattens out. A continuous straight line only occurs with very reactive metals like sodium and potassium; they oxidise violently until all of the metal is consumed. By contrast, oxide formation on bare steel comes to a virtual standstill.

If it were just a matter of oxygen and water reacting with the metal, an artefact made out of steel would probably last for many centuries. Steel has only been used widely for a little over a century, so it is difficult to push this theory. On the other hand, many rural areas are littered with abandoned machines which are almost one hundred years old, and most are still in sound condition.

The real problem is not so much the surface rust as the airborne pollutants and surface dirt that settle on the objects. They act like a corrosive poultice in wet conditions, and this invariably leads to deep pitting of the underlying metal. This is most noticeable with horizontal surfaces, and partially buried areas like wheel rims. The surface rust itself is only a contributing factor in this situation because it can hold salts that absorb moisture. If the rust is kept free of salts (sulphides and chlorides), the corrosion will virtually stop.

In a sense, rust provides a protective oxide layer for the underlying metal. It is not in the same league as the oxides of copper, aluminium or chromium, because it only offers protection in a clean environment. Iron oxide signifies stability, in that a plateau has been reached. Instead of judging rust to be harmful until proven otherwise, it makes more sense to judge it harmless until proven harmful.

There really is no sound physical reason to remove rust. If it is removed, the exposed metal will be vulnerable to rapid rusting until it reaches a stable condition again.

This brings one to the second assumption, one of aesthetics and interpretation. It is the assumption that rust is inappropriate for museum artefacts.

Assumption No.2: rust is inappropriate

When one thinks of exposed steel surfaces, one tends to picture a shiny, silver coloured metal. In reality, though, exposed steel is more often brown than silver; it is normally covered with iron oxide. Shiny, bright steel is an aberration. Its existence is brief and fleeting. Outdoors, it can not exist without regular human intervention in the form of applied petroleum coatings or constant polishing. If museums and interpretative sites want to present industrial artefacts accurately, they should consider rust as an asset, not a liability. It is an original and genuine surface that exists everywhere in the working world.

The challenge is to develop an appreciative eye for rust, or rather, protective iron oxide.

This requires a new mind set. One of the best ways to cultivate this appreciation is to observe industrial artefacts and modern machines in action, both at interpretative sites and in the working world. Conservators and curators should both build up collections of slides, so they can educate museum directors and the public about how industrial artefacts ought to be presented.

There are three major areas dealt with in this paper: railways, agriculture and heavy equipment (construction, road building, etc.)

Railways

Railway collections present some interesting problems. When a train operates, the wheels (i.e., the tyres) of the locomotive and rolling stock are polished by pressure and friction to a brilliant metallic finish, as bright as chrome plating. It is a sight that only seems to exist in the working world; it rarely, if ever, finds its way into a museum. Sitting idle, these surfaces quickly rust. The plateau of oxide formation is reached and rust slows down. When the train runs again, the rust is worn off and so on in a repeating, predictable cycle. There is an entire range of intermediate stages, or degrees, of oxidation between chrome brilliance and dark brown rust.

The same situation occurs with the tracks. Every locomotive, whether on display or in operation, sits on a length of track. In a sense, it is one half of the machine. The steel rails respond the same way as the tyres. Anyone can tell which tracks have been used recently. When trains run, the track is polished by friction; no trains, and the top surface is covered with rust. The sides of the rails, the tie plates, the fasteners and the angle bars are permanently rusted. The ballast is cleaned occasionally to keep corrosive mud and weeds from accumulating, but in general, the tracks are worn out and replaced long before they rust away.

An ethical dilemma confronts conservators and restorers here: the shiny metallic condition on wheels and tracks is impossible to recreate artificially. For one thing, it is rarely an even finish; there are subtle variations all over the metal surfaces. The tracks have longitudinal lines where the wear is lighter or heavier. Even one of a pair of rails may be worn more than the other. The same uneven wear occurs on the wheels. Wear patterns simply can not be faked. Too much depends on genuine historical criteria: the amount of travel on the rails, the number of curves, type of train, the weight of the locomotive and so on. Museums should make a serious effort to collect this kind of information and communicate it to the public in some fashion.

Conservators should be alerted to any wheels and tracks about to come into the collection with a genuine working polish. The finish is rare, and perishable under most environmental conditions, so preventive measures will be required even before the artefact arrives. If at all possible, the wheels of a new acquisition should be coated with a rust preventive compound the moment they stop turning.

Once the working polish is lost, one has a very limited choice of surfaces: either oxide or paint. A painted version of polished steel, using aluminium paint, is a poor approximation of the real thing. Black enamel paint is not much better, because it does not represent a working or an idle appearance: it is strictly a museum or city park condition. To be fair, it is often the only practical course to take against dirt and pollution outdoors because it is a low-maintenance solution. On the other hand, it is a strong argument for not displaying industrial artefacts outside, because it requires creating an unreal appearance that never existed in the object's working life.

For indoor display, it is better to leave the working surfaces covered with an authentic layer of compact surface oxidation. It is an original surface and if it is kept clean, corrosion will not advance deeper into the metal substrate.

A minor working surface can be found on the couplers of railway equipment. Like wheels, tracks and crosshead guides, these parts come into moving contact with other metal parts, so they are alternately rusted and rust-free.

Agricultural Equipment

Agricultural machinery and implements present a whole range of working surfaces. In use with the soil, the metal is scoured clean and polished to a bright 'land polish.' This shiny surface is very reactive and it will begin to flash rust overnight. The cycle is repeated daily throughout the work season, with a predictable - and tolerable - loss of metal. Equipment deteriorates and depreciates year after year until the worn part or the entire object has to be replaced.

Implement dealers often display used implements outside. The working surfaces are uniformly rusted. This is not a major issue with potential buyers; they know the surface rust will be scoured clean the first time the implement is used.

As with railway artefacts, a genuine land polish rarely finds its way into a museum. Again, it should be sought after by acquisition committees. Once located, every effort should be made to preserve it and get it into a museum collection intact.

Agricultural machines have many other kinds of working steel finish. One is a belt polish, found on the face of pulleys and flywheels. The friction from contact with an endless moving belt of leather or rubberised canvas keeps the oxide smooth and compact during operation, or wears it off completely, until such time as the machine is idle again.

A similar finish to a belt polish is found on the hand wheels of threshing machines, tractor steering wheels and starting cranks. Continuous rubbing by human hands ensures a compact surface. The chloride contamination from perspiration is negligible and it is washed away by rain; these parts are never noticeably corroded. Hand-wheels are also found on railway freight cars and artillery pieces.

Another kind of working polish occurs on cutting implements, like the blades of mowers and reapers.

One of the most conspicuous finishes is found on the wheels of agricultural equipment. Depending on the conditions of use, the wear can be limited only to the high points (the lugs) or it can cover the entire outer face. The finish can range from solid brown to a dull form of silver land polish. The wheel comes into slow rolling contact with the soil rather than rapid sliding contact; it is more of a slow grinding action than polishing.

Restoring this kind of machine to a like-new condition presents a problem for a museum, because no one really knows what the machines looked like when they left the factory. Trade literature indicates that the faces of the wheels were left unpainted, but the illustrations are hand-coloured and their accuracy is questionable. Working machines are easier to approximate because they can still be seen in action at plough matches and steam shows. The best way to develop an eye for genuine surfaces is definitely to observe and record the machines in action.

A related finish is found on the steel tyres of wooden-wheeled vehicles, like farm wagons, carriages and stagecoaches, as well as artillery pieces. As before, the finish could vary with use and conditions, and records of these machines in action should be kept, with close-up shots of the tyres. The tyres should not be painted under any circumstances.

Another working surface is found on gear teeth. All too often, they are covered with paint on museum artefacts, even indoors. The effect is disturbing. It does not suggest a non-operating machine; it suggests one that never moved and never will.

A final category is exhaust systems. This is the only area which does not involve friction. The exhaust manifolds, mufflers and tailpipes of machines with internal combustion engines reach extremely high temperatures during operation. Most paints are burned off within a few hours. The steel surfaces rust when the machine is idle and cools down. Surface rust is unavoidable, especially when morning dew condenses on the cold metal. Again, this rust is accepted as part of the machine's working state.

In many cases, these surfaces are blasted to white metal, then painted with silver-coloured aluminium paint for museum display and photographs in coffee table books and calendars.

The exhaust manifolds of automobiles present the same authentic rust. They should never be painted. Historically, these finishes were burned off before the vehicle left the assembly line.

Heavy Equipment: excavation, road-building and road maintenance equipment

A land polish can be seen in any modern excavation or road building operation: on buckets and shovels, caterpillar treads, bulldozer blades and the blades of graders. Sitting idle, the machines rust. The machines are only painted when they are new on the dealer's lot. Sadly enough, most museums would probably opt for a showroom appearance over the used condition, although the latter is much more informative and interesting.

Snow-ploughs are a special category of heavy equipment, where the steel of the plough is in sliding contact with ice and snow and grit. The ploughs are only painted when they are new or possibly when they are laid up for the summer. In use, they show a combination of polished and scratched steel, painted areas, and patches of rust: a whole spectrum of working surfaces. How often does this condition find its way into a museum? And how would the public respond to it?

Several other working surfaces occur that are similar to those found in agriculture. They include:

i) wheel finishes, the best example being found on road rollers,
ii) open gear teeth on very old graders,
iii) exhaust systems.

Conclusion

In conclusion, conservators and curators should be aware of the multiplicity of finishes and states of wear that can exist on industrial artefacts. They should aim to bring only genuine appearances into display areas. They should ask themselves the following questions: Is the surface genuine? Did it ever exist in the real working world? Does it exist there now? Or is it a strange hybrid created by museum staff and volunteers? Finally, rather than faking or painting a working surface, one should consider leaving it rusty. A genuine rusted surface is much better than a fake polished one. One should be guided by the image of two diverging railway tracks, one polished, the other rusted. There are really only two legitimate paths to choose between: a real working surface and a real non-working surface. The odds of capturing and preserving a real working surface are extremely low. So one shouldn't shy away from the rusted alternative.

OILY RAGS OR COTTON BUDS?

S Cane

Abstract

The treatment and operation of industrial and working objects has never sat comfortably within the established professional conservation structure. As a discipline it appears to be under represented and poorly researched and there are few if any recognised training courses. There is potential for misunderstanding between the discipline and the establishment caused by fundamental differences in attitudes and approaches towards the treatment of museum objects. The conservation of industrial and working objects probably involves more volunteers who work directly on museum objects than any other discipline. Is the operation of industrial and working objects an acceptable practise, considering the move towards preventive and passive methods of conservation? There is a need for those involved with the treatment of industrial and working objects at a professional level to establish and improve methodology and standards of documentation and to address the problem of lack of reference material through publication, promotion and participation in recognised professional structures.

Introduction

Is it possible to reconcile conservation ethics with the conservation and operation of industrial objects?

In this paper I will examine the complex issues in the sometimes controversial area of the treatment and operation of industrial and working objects and consider the potentially conflicting needs of the object, the visitor and the museum. The conservation profession has difficulty in accepting that objects may be returned to an operational condition, as this appears to conflict with the ethic of preservation. If an object is operated then it will eventually wear out. The problem, I believe, lies deep in the professional psyche. There has always been conflict between conservators, restorers and scientists across the disciplines. Conflicting ethics are probably most clearly defined in the attitudes towards the treatment of industrial and working objects. The protagonists in the debate are suspicious of each other's motives and each can present convincing arguments. Is there a disparity in how we interpret and apply ethics in different areas of conservation? I believe there is common ground and it is time to reassess how and why we apply ethics in this area. Is the practice of operating industrial objects acceptable? Is it a matter of interpretation of ethics or is a double standard at work?

One has to question why this area seems under developed and relatively neglected when 32.3% of museums in the UK hold industrial machinery and transport collections. [1]

The Conflict

Conservation is not an exact science. It requires a wide range of abilities and knowledge. It is also a new profession so it is no surprise that there are conflicting opinions when it comes to the issue of ethics. Debate is not confined solely to this area of conservation, it continues between all levels and disciplines, as illustrated by Caroline Keck:

I am dismayed by the foolhardy waste in the continued bangling between research and applied scientists. Stripped of its trappings this is no more than the age old antagonism between investigators of materials and bench *workers. Each sees each other as a dispensable villain. The majority of our colleagues share basic intelligences and yearn for co-operation among our varied expertise.* [2]

The established professional structure of conservation has developed from the disciplines of fine art and archaeology. I suggest that this creates the potential for fundamental misunderstanding between the established profession and those involved in the treatment of industrial and working objects.

Why is there such misunderstanding? As I have suggested part of the problem lies in the fact that the conservation profession covers an incredibly wide range of disciplines. The range of disciplines obviously require different types of training: those involved with the treatment of industrial and working objects require good engineering knowledge and skills.

Is it the word ‘engineer’ that poses the problem? Mechanical engineers have always been regarded as blue collar in the United Kingdom and I suggest that this ingrained view of engineers, and engineering in general, is at the heart of the problem. It is an anomaly that conservators employed at national and local government levels are treated as white collar. This positioning rightly reflects their level of qualification, though organisations sadly place conservators below administrators and curators. I am not suggesting that anyone involved in the treatment of industrial and working objects is overtly excluded from the profession, but the conservation profession promotes and presents itself in a way which exacerbates the problem. ‘Oily Rags or Cotton Buds’ could easily read as ‘Blue Overall versus White Coat’. This perception does not encourage people involved in the treatment of industrial and working objects to participate in the professional forum. Equally, those involved with the treatment and restoration of industrial and working objects must acknowledge that to some extent they have excluded themselves from the professional forum and must realise the advantages of participation.

The net result of division is that mutual misunderstanding is increased, the chances of open debate and discussion are reduced, and the narrower profile of the profession is maintained. Conservation is a multidisciplinary profession and the membership of professional bodies should reflect this.

Conflicting Ethics

The conservation profession generally aspires to the ethics of minimal intervention and reversibility. If an object is to be returned to a working condition, any conservator could find themselves in conflict with these aspirations. Immediately we see that if we subscribe to ridged and absolute ethical guidelines then we are going to have trouble, a point acknowledged by Andrew Oddy:

So what do we get for the meaning of a ‘code of ethics’? We get a code relating to the distinction between right and wrong. But, in conservation, what may be right for one customer may be wrong for another. So the concept of ‘right’ and ’wrong’ is too restrictive, with one proviso: ‘nothing should be done to an object which compromises any original part of it’. Thus I believe that we should abandon attempts to write ‘codes of ethics’ and instead construct ‘codes of practice’. [3]

Defining compromise in the treatment of industrial and working objects is difficult. Objects are important but they do not represent an end in themselves, they reflect the world people lived and live in. What the object does or did could be as important as what the object is. It is a matter of judgement and interpretation whether the object should be operated. Returning an object to a working condition may require compromise. Compromises may be forced by issues of uniqueness, the availability of skills and parts, health and safety or the context of display. What is important is defining the parameters of compromise. We must make informed and recorded decisions.

If curators wish to contextualise or interpret objects by returning them to working order, the role of the conservator should be that of facilitator and advisor. I am not advocating that conservators should be excluded from the decision making process, far from it. Conservators need to listen carefully to the demands of their customers and be prepared to be flexible and negotiate with them. If they fail to communicate the issues, the customers may choose to disregard their advice, to the detriment of the object, the museum and the visitor.

It should be possible to maintain any object in an operating condition using passive measures such as environmental control and maintenance programmes. As resources come under pressure, the likelihood of implementing full programmes of passive maintenance is reduced. Alternative approaches and strategies towards preservation are being considered.

Thus, it appears that the only successful long term solution would to be to deposit the aircraft in a waterlogged anoxic environment such as the bottom of a freshwater lake, or in a bog, fen, marsh or mire. [4]

This suggestion, by Chris Caple was tongue in cheek, but preventive conservation strategies are accepted as economically prudent and ethically sound.

Can operating an object qualify as a strategy for preservation?

If exhibits are operated to the highest standards, under controlled conditions for defined periods, by trained personnel and maintained correctly, their working life can be extended and the objects can be enjoyed and interpreted. Policy and procedure should be developed and implemented for each object that defines the parameters and standards of operation and states at which point the object should cease to operate. The policy and procedure may take into account such factors as significance, originality, rarity etc. Several systems have been developed to categorise these. The most recent example is that proposed within the Designation process, a part of which was drawn from systems such as the Conservation of Industrial Collections Forum proposed national grading system for industrial and transport relics and the National Aviation Heritage Committee, National Register of Historic Aircraft.[5]

We must accept that working objects carries risks and may bring us into conflict with the credo of conservation. It is our job as caretakers and guardians to assess and reduce the risks and to balance the triangle of the needs of object, museum and visitor.

A Double Standard

Is a double standard at work: are standards applied and judged differently in the area of industrial and working objects?

I see very little difference between, for example, reconstructing a ceramic and filling and colour matching a missing area or the cleaning, retouching and re-coating of an oil painting (both regular practices in modern conservation) and taking a broken down, rusty piece of industrial machinery and returning it to a working condition. Ceramics and paintings are treated in this way to preserve them and to allow interpretation and enjoyment. Exactly the same argument can be put forward for the machinery and the vehicle. On the face of it there seems to be little difference, but there are significant differences and it is these that are at the root of the ethical conflict. The differences are in the methodology, documentation and application of standards; not necessarily the standards of the finished product, but how it was achieved.

The ceramics and painting conservators will have been formally trained. In their training they will have considered the philosophy and ethics of their disciplines. They will have considered their methodology, decided on the correct course of treatment and recorded the whole process in meticulous detail. They will have preserved as much of the original as possible and where new materials have been applied they will have attempted to use reversible materials. In short they will have applied a recognised level of professionalism.

Unfortunately the same could not be said for all those involved in the treatment of industrial and working objects. My personal observation is that the methodology and standards of application and documentation applied to industrial and working objects are variable and may fall short of what I would consider is required both ethically and professionally.

Ethical considerations may be too easily discarded when returning an object to working condition. There seems to be a penchant for making up one complete example from the pieces of several others. Changing specification and design elements may be necessary to achieve the desired result. But sometimes this seems to occur for no other reason than to improve on the original. The problem is compounded by lack of documentation. Museum objects are used as reference points and we should be confident that we are being honest with our customers. Otherwise, we might as well fill our museums with replicas. Originality is important and quantifiable. Examples such as the *F-86A-5-NA 48-Sabre 242*, recently restored for the American Air Museum with the wings from a different specification *Sabre,* an *F-86F*, 'sans fences and with painted lines representing the *F-86A's* leading edge slats' is not the exception. [6] Any museum involved with industrial and working objects will contain similar examples and much worse.

Volunteers are valuable and can offer otherwise unaffordable skills and expertise. Invariably people volunteer on projects that represent their personal interests and though they can offer excellent subject knowledge and specific skills they can be unaware of the broader issues. The challenge for museum professionals is to create structures that educate and inform volunteers and provide the support to help them understand and achieve the required standards.

There is room for much improvement in the methodology, and standards of application and documentation applied in the treatment of working and industrial objects. If we are willing to improve our standards of documentation and operation we will find that we are able to provide evidence to support our arguments for the working of objects as a preservation strategy.

The conservation establishment does not always get it right and eventually even the most revered and respected bodies can admit to mistakes. Oddy described the controversy over the British Museum's treatment of the Coppergate Helmet as, 'a classic example of a failure to communicate between the curators and the conservators'. [7] The point is that the whole process is recorded, published and available for reference so that the same mistakes may be avoided in the future.

It is of course true that different objects have different needs. It is my opinion that it is not necessarily helpful to judge the area of industrial and working objects by the same code of ethics as paintings. However there are basic methodologies, standards of documentation and reference that can easily be adopted.

Conclusion

There is a dearth of reference material available on the philosophy and ethics of the treatment of industrial and working objects for which the profession must take responsibility. How can we expect to improve standards, to influence young conservators and curators and change attitudes towards this area if no reference material is available?

The Museums and Galleries Commission recognises the need to improve and implement standards by the publication of 'Standards in the Museum Care of Larger and Working Objects' [8] and the complementary publication 'Larger and Working objects: A guide to their preservation and care'. [9] As I suggested earlier, these publications recognise that the problem is not lack of technical ability, but with methodology and application of standards.

The emphasis on managing museum collections is shifting towards care and prevention; this necessarily challenges traditional attitudes and approaches towards the treatment of industrial and working objects. I believe that there is still a place for demonstrating and working objects. But if the views and opinions of the discipline are not fully represented within the recognised professional structures, there is the possibility of industrial collections being overlooked in the funding and resource debate at both national and local levels.

The professional structures for debate and communication already exist. The challenge for those involved with the care, management and treatment of industrial and working objects is to establish a professional identity within these structures. This conference, organised jointly by the United Kingdom Institute for Conservation (UKIC) and The Council of Museums in Wales (CMW), is perhaps an indication that the establishment recognises that the area is under represented. I personally would not support the idea of another specialist group; they can encourage exclusivity and discourage broader debate. Instead we should all look to fit in with existing structures. For example, the Metals Section of UKIC would seem to be the most obvious place for most conservators concerned with the treatment of industrial and working objects. Participation in such groups is mutually beneficial, lends credibility and encourages debate. There is common ground: the whole profession is concerned with the preservation of cultural heritage. That heritage comes in many shapes and sizes and requires many and varied solutions.

In 1988 at the UKIC 30th Anniversary conference Mike Corfield summed it up,

An open debate on methods and attitudes is a sign of a healthy profession, a backstairs debate is a sign of a group of individuals who have not come to terms with their responsibilities. [10]

It is time to get off the back stairs and get into the forum. The field is full of qualified, talented, informed, literate and articulate individuals who have a lot to offer. So let's hear from you.

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THE ETHICS OF ACQUISITION AND DISPOSAL

M Davies

Abstract

The Museums Association's Ethics Committee has published its first two Ethical Guidelines. These cover acquisition and disposal. They are intended for all types of museum collections, but include much that is pertinent to industrial collections.

Acquisition:- *Should museums 'rescue' items that would otherwise be destroyed - even if the museum does not have adequate resources to care for the item?*

Is it acceptable to acquire an item, but delay accessioning it - perhaps for several years - until the museum can decide whether it really wants it?

Should museums acquire items with the intention of using them for spare parts or for operation - even if that means that the item will eventually be destroyed?

Disposal:- *How should museums decide whether to keep or dispose of an item?*

What is more acceptable - explicit disposal of an item, or gradual 'disposal by neglect', when an item slowly deteriorates because a museum cannot care for it?

Are there alternatives to disposal?

The following text has been extracted from the Museums Association Ethical Guidelines Nos 1 & 2 (June 1996) by kind permission of Maurice Davies, Assistant Director, the Museums Association. The original guidelines contain further information and should be consulted before any decisions relating to acquisition and disposal are made.

GUIDANCE ON THE ETHICS AND PRACTICALITIES OF ACQUISITION

1 Introduction

Acquisition is the process of obtaining legal title to an item with the intention of using it for museum purposes. Accession is the act of formally including the item in the permanent collection and recording it in the inventory in the permanent collection (accession register).

These guidelines have been prepared by the Museums Association Ethics Committee. They aim to help museums and their staff apply ethical principles when acquiring items for the permanent collection. They include basic principles, which are derived from the Museums Association's ethical codes and also underpin the Museums and Galleries Commission's registration scheme. These basic principles should always be upheld.

The guidelines also include some more flexible advice. You will need to use your judgement in applying these suggestions in specific situations. If you are unsure about a proposed course of action - or feel that it may breach these guidelines - you are encouraged to seek the (confidential) advice of the Museums Association in advance.

The Museums and Galleries Commission supports these guidelines and joins the Museums Association in commending them to museums (although the guidelines are not a formal part of the Museums and Galleries Commission's registration scheme). Many of the points here will already be embodied in your museum's acquisition policy; it may prove useful to incorporate others.

The guidelines do not aim to give detailed advice on the law or on the documentation standards.

2 Basic principles

These basic principles should always be upheld by museums and those who work in or for museums. Further guidance on their interpretation can be found in sections 3,4 and 5, below.

2A A fundamental purpose of a museum is to acquire and preserve items in a permanent collection for the public benefit.

2B A museum should collect under an acquisition policy which should be a public document. The policy should be part of a collections management policy that also addresses issues of access, conservation and disposal. These issues should always be seen within the context of the museum's overarching purposes and aims. The acquisition policy should set out the museum's principles of collecting and relate to the existing collection. It should lay down the criteria for future acquisitions, including the subjects or themes and the time periods and geographical areas.

The policy should take account of the benefits of preserving items in situ and the moral rights of individuals, groups, societies or peoples to hold items. It should take account of the acquisition policies of other registered museums collection in the same or related geographical areas, and other public organisations (such as archives) with a legitimate interest in acquiring items. Co-operative collecting agreements between related institutions are encouraged.

The museum may also have a more detailed programme or strategy for implementing the acquisition policy. This need not be a public document.

2C A museum should acquire and accession an item only after thorough consideration of its long-term value. The museum should intend to retain the item in perpetuity. It should believe that it can provide adequate and continuing care for the item and public access to it (without jeopardising care of and access to the existing collection).

2D The long-term resource implications of proposed acquisitions should always be considered before taking the final decision to acquire. Staff should inform the museum governing body of any conditions attached to a proposed acquisition as it will be responsible for complying with them.

2E Acquisitions outside the scope of the acquisition policy should be made only in exceptional circumstances.

2F Museums should not acquire an item if they know or have reason to believe that the current owner does not have the right to transfer title to the museum or that the item has been exported from, or acquired, sold, or otherwise transferred in, its country of origin (including the UK), or any intermediate country, in violation of that country's laws or any national or international treaties.

2G The museum should have agreed procedures (possibly within the acquisition policy) for taking the final decision to acquire an item.

3 Selecting items to acquire

Museums should discriminate carefully in selecting items to be acquired. Because of the costs of collection care and access, no acquisition is free, and the decision to acquire must be taken with caution.

If you are thinking about whether to acquire an item for a museum's permanent collection consider all of the following:

3A Whether the item falls within the criteria set by the acquisition policy.

3B The relevance, importance and long term value of the item.

3C How the museum will use the item.

3D The condition of the item.

3E The price of the acquisition (including: purchase price, plus VAT, if applicable, transport costs, immediate conservation costs, documentation and research costs).

3F The museum's ability to provide long-term care and access and the cost of providing such care and access.

3G The moral rights of individuals, groups, societies or peoples to hold the item.

3H The possibility of preserving the item in situ; in some cases it may be appropriate to leave the item in situ even if acquiring for a museum collection.

3I The interests of other registered museums and other public institutions (such as archives) which may have a legitimate interest in acquiring the item. The item may be better housed elsewhere for reasons of collections care, public access, use, or context. Take account of the desirability of co-operative acquisition between registered museums within a region or covering the same subject area.

3J The quality of documentation associated with the item, particularly information about its context.

3K The item's provenance:

i) Take reasonable steps to confirm the legal title of the present holder of the item and the right of the holder to transfer title to the museum.

ii) For the acquisition to be ethically acceptable, the museum must also make reasonable efforts to satisfy itself that the item has not been exported, acquired, sold or otherwise transferred in contravention of:

- UK law,
- If applicable the law of the country of origin of the item and the law of any other country through which the item has been passed,
- International law and international conventions on the protection or export of cultural property or natural history conservation (whether the UK government is a signatory to the treaty or not).

iii) You should report it to the appropriate authorities if you know or have reason to suspect that an item has been illicitly obtained.

iv) Under some laws and conventions there may be procedures to give museums consent to acquire an item that contravenes the law or convention. In such cases it is vital to obtain such consent before acquiring the item.

v) It is unacceptable to acquire antiquities of unknown provenance.

vi) It is sometimes acceptable to accession an item of unknown provenance found on museum premises or offered by another museum or public institution. However, attempts should be made to ascertain the ownership and provenance of the item, as the museum may not have the legal title.

vii) Except in exceptional circumstances it is advisable to refrain from acquiring an item if there is any reason to suspect that it has been removed insensitively from its original context (also see 4.2C Fieldwork below).

viii) Do not acquire any item that has been disposed of unethically by another museum unless this is the only way of keeping an important item in the public domain (guidance on ethical disposal see the Museums Association ethical guidelines on disposal).

4 Acquisition procedures

Once a decision has been made to acquire an item, the following procedures are good practice.

4.1. For all types of acquisition

i) Ensure that the decision to acquire the item has been made appropriately within the procedures of the museum and that no one exceeds their powers.

ii) Obtain unambiguous evidence of the original title to the item and of the transfer of title to the museum. Take particular care when acquiring items from minors that they have the legal right to transfer title to the museum. It is normally best to obtain the written agreement of the person's parent or guardian.

iii) Attempt to acquire copyright and other rights in the item. Note that these may not belong to the owner of the item but to the 'author' (artist, photographer etc.). Also see 5.vi, below.

iv) It is important to avoid any risk of conflicts of interests during an acquisition. No person or organisation with any possibility of financial or personal gain from the acquisition should be involved in making the decision to acquire the item. Where a conflict of interests might arise, the public interest should prevail and a written declaration of interest should be made and kept on record by the museum.

Purchasing items from a member of staff or a member of the governing body is discouraged. If a museum does nevertheless decide to purchase an item from a member of staff or a member of the governing body, then it should not pay more that the price the member of staff paid for it.

v) Anyone collecting on behalf of a museum should apply the same standards of behaviour as would the museum itself.

4.2 Extra considerations for specific types of acquisition

4.2A Gifts and bequests

i) Unwanted offers: A museum is under no obligation to accept an offer of a gift or a bequest. If the items offered do not meet the criteria set out above in section 3, the museum should refuse them, firmly and tactfully, explaining its reasons why. Note that a museum that does not wish to accept a gift or bequest must refuse to do so in writing; if this is not done it may inadvertently become the legal owner by default.

Unwanted, unsolicited gifts should be refused in writing and returned, even if the museum has been advised that they need not be returned. However, if the museum is unable to trace the owner of the item it may be legally obliged to take care of it.

Consider informing the intending donor (or the donor's executor) about other registered museums that may be interested in the unwanted items, or suggest that they may wish to offer them to registered museums in general; for example, via a notice in Museums Journal. Alternatively suggest that the donor may wish to offer the items to other organisations such as schools or reminiscence groups.

Do not forward the item to another museums (or organisation) without receiving prior permission in writing from both the museum and the intending donor.

With prior agreement from the donor (etc.) it may be appropriate to accession only a selection of the items offered, if necessary accepting others only on the condition that the museum does not have to retain them. Such items should not be accessioned and there must be no suggestion that they have been part of the museum's permanent collection. Consider imposing a condition to this effect on the new owner, if they are passed on.

ii) Conditions: Make very clear to the donor (etc.) the terms on which the museum is willing to accept the item. To prevent further misunderstanding, stress that the item may not be on permanent public display and that title will be permanently transferred to the museum.

If the donor (etc.) wishes to apply conditions to the gift, the museum must carefully consider the resource and other management implications before deciding whether to proceed with the acquisition. The governing body should agree in advance to accept any conditions as it will be responsible for ensuring that they are carried out, often in perpetuity. The wishes of the donor (etc.) should be recorded and administrative mechanisms should be put in place to ensure that they are complied with.

It is wrong to lead a donor to believe that conditions attached to a gift are perpetual when they may not be. Donor's conditions can be perpetual only when they are in the form of a charitable trust. If the museum is willing to accept perpetual conditions it should suggest to the donor that the gift is made under a deed that constitutes the item with charitable status.

iii) If appropriate, agree the form of acknowledgement that should be made to the donor (and ensure that it is made).

iv) If a donor seems ignorant about the financial value of a proposed gift it is fair to suggest that he or she seeks an independent valuation.

v) It may be appropriate to suggest to the donor that a financial donation would be welcome to support the long-term costs associated with the acquisition.

4.2B Purchases

i) A museum should attempt to purchase for the lowest price possible in cases when the item is on open sale. This includes items offered by private galleries, dealers and auction houses, and at all types of public sale.

ii) However, if an item is offered for sale directly to the museum by an individual member of the public, the museum should make it clear if it does not intend to pay the full market price. It is good practice to suggest that the seller seeks an independent valuation if they have not already done so. Although the widest public interest would be served by paying the lowest possible price, against this must be balanced the duty to deal fairly with individuals. This will enhance public confidence in the museum. (Note that there may be financial benefits to both the museum and the vendor if the item is purchased under the private-treaty-sale system).

iii) If an appeal is made to raise funds to purchase a proposed acquisition, the appeal document should specify the use that will be made of money raised if the acquisition is not made (for example if it proves impossible to raise enough money, those funds raised will be put towards other future acquisitions, collection care, or public services).

iv) If grants or other outside funds, including funds from a friends' organisation, are used to purchase an acquisition, any conditions should be approved in advance by the governing body, and recorded. Administrative mechanisms should be put in place to ensure that they are complied with.

v) If an item purchased for the collection is accompanied by other unwanted items (for example, a mixed lot at auction), these should not be accessioned into the permanent collection and do not have to be retained by the museum. They may be offered to other museums or sold. There must be no suggestions that they have been part of the museum's permanent collection. It may be sensible to impose a condition to this effect on the new owner.

4.2C Fieldwork

Great sensitivity must be exercised when acquiring items from fieldwork. Always consider the desirability of recording and preserving items in situ. Do not acquire an item if there is cause to believe that collecting it damaged the natural, historic, cultural or social environment.

5. After acquisition

Once an item has been acquired, the following procedures are good practice.

i) Confirm that transfer of title documentation has been completed and that the museum intends to retain the item in perpetuity. Accession the item into the permanent collection.

ii) Obtain and record information about the item and its content.

iii) Display or store the item in appropriate conditions.

iv) Make the item and related documentation publicly accessible as soon as possible, consistent with any reasonable research and publication work.

v) If the item was a gift, send a letter of acknowledgement to the donor.

vi) Record information about copyright. It is particularly important to attempt to obtain such information if the museum has not acquired any copyright along with the item. There may also be a need to take account of other rights, such as any arrangements with third parties in respect of reproduction rights in the item. (For more information on copyright see Museums Briefing no 6, Museums Association 1994; Museums Briefing no 11, forthcoming; and Spectrum).

vii) Update the museum's records.

viii) It is good practice to report all acquisitions to the governing body, even if it does not formally approve them. This will enable it to be aware of the long-term resource implications and to satisfy itself that the acquisition policy has been adhered to. It is best practice for the governing body to receive regular reports of what has been acquired, how each item meets the objectives of the acquisition policy, the resources required to acquire the item and the estimated long-term cost of the acquisition.

GUIDANCE ON THE ETHICS AND PRACTICALITIES OF DISPOSAL

1 Introduction

Disposal is the permanent removal of an item from a museum's permanent collection. (This is sometimes called deaccessioning).

These guidelines have been prepared by the Museums Association Ethics Committee to help museums make decisions about disposals and recommend procedures to follow. They include basic principles, which are derived from the Museums Association's ethical codes and the Museums and Galleries Commission's registration scheme. These basic principles should always be upheld.

The guidelines also give some more flexible advice. You will need to use your judgement in applying these suggestions to your specific circumstances. If you are unsure about a proposed course of action - or feel that it may breach these guidelines - then you are encouraged to contact the

Museums Association for specific (and confidential) advice. The public reputation of museums as a whole is harmed if a museum carries out unethical disposal.

The Museums and Galleries Commission supports these guidelines and joins the Museums Association in commending them to museums (although the guidelines are not a formal part of the Museums and Galleries Commission's registration scheme or a substitute for a disposal policy). Many of the points here will already be embodied in your museum's disposal policy; it may prove useful to incorporate others.

The guidelines are also commended to other public institutions that hold collections of artistic, historic or scientific importance.

The guidelines should be followed as far as possible when a museum service is closed down completely or partially.

These guidelines do not give detailed advice on the law and are not intended as a substitute for legal advice.

2 Basic principles

These basic principles should always be upheld by museums and those who work in or for museums. Further guidance on their interpretation can be found in sections 3, 4 and 5 below.

2A Museum collections often represent the generosity of past generations. Acquisitions are made in the expectation that they will be preserved in perpetuity. Museum governing bodies must act as guardians of the long-term public interest in the collection. One of the key duties of a governing body is to balance the duty to provide services to today's public with the duty to ensure that the collection is maintained and enhanced for future generations. As a key function of a museum is to preserve a collection in perpetuity, there is a strong presumption against the disposal of any item from a museum's permanent collection.

2B However, there are circumstances in which disposal may be appropriate. For example, certain items might be better transferred to another museum for reasons of care, access or context. In such circumstances, the disposal would be in the public interest.

2C Every disposal must clearly demonstrate long-term public benefit. Decisions to dispose must be based on clear, published criteria. A museum should develop its disposal policy as part of a collections management policy that also addresses issues of acquisition, conservation and access. These issues should always be seen within the context of the museum's overarching purposes and aims. Disposal must be carried out according to unambiguous, generally accepted procedures, which should be incorporated in the disposal policy.

2D Wherever possible, public collections should remain in the public domain. Priority should be given to offering items by gift to registered museums (this is sometimes called transfer). If this is not possible, gifts to other public institutions should be considered. (This paragraph excludes an item that is damaged or dangerous or is being returned to its place of origin outside the UK).

2E Disposal should never be undertaken principally for financial reasons (either to raise money for any purpose or to reduce expenditure). Selling an item from a museum's permanent collection out of the public domain always risks damaging public confidence in museums and is, therefore, a course of action that the Museums Association Ethics Committee would never recommend. In addition, society benefits from the long tradition of mutual co-operation between museums, Selling, rather than giving, items to other registered museums jeopardises this tradition and is therefore not recommended.

2F However, some museums do undertake disposal by sale. We do not endorse this. In the exceptional circumstances when money is raised as a result of disposal, it should be solely and directly applied to the museum's collection.

2G Decisions to dispose should be taken by the governing body, acting on the advice of staff with appropriate expertise and taking into account all legal and other attendant circumstances.

2H To reduce the likelihood of disposal being necessary in future, acquisitions must be made only with great care and according to an acquisition policy

3 Making the decision to dispose

The decision-making process outlined here should be followed for all categories of item (as set out in paragraph A-G of, section 4, below)

3A Before detailed enquiries are made that may lead to the possible disposal of an item, it is advisable for the governing body to take a decision in principle that staff should investigate the disposal, if it has not previously done so (for example by approving a programme of collections management that includes the active investigation of disposals).

3B Determine whether the museum is legally free to dispose of the item.

It is good practice to have documented the legal status of all items in the collection. (However, some museums have not done this; see undocumented items below). The freedom to dispose of an item will vary from museum to museum and item to item. In particular, some museums are regulated by acts of parliament, or hold collections (or individual items) that are subject to charity law. These guidelines, in their generality, are believed to be compatible with the legal obligations that arise from that status, but museum governing bodies should consider the special legal implications of such a disposal. Preliminary guidance about legal aspects of disposal can be sought from your area museum council, but it may be necessary to take specialist legal advice.

3C Opinions on the proposed disposal should be sought from the following:

- Someone with specialist knowledge of the item. This will normally be the member of museum staff with appropriate specialist knowledge. It is also advisable to obtain an independent outside opinion,

- Organisations that grant-aided the acquisition, if applicable,
- Organisations that grant-aided conservation or display of the item, if applicable.

Note that there may be a legal requirement for money to be repaid to grant-giving organisations if the item is disposed of. This may exceed the amount of the original grant.

3D If applicable, the governing body may wish to seek the opinion of the donor of the item. Opinions vary about the necessity of this. Some museums feel that even in cases where they are legally free to do as they wish with the item, it is advisable to attempt to seek the permission of the donor, for reasons of courtesy and to protect the public reputation of museums. In contrast, others believe that if an unconditional gift has been made, the donor has knowingly given away all rights in the item. (Museums must, of course, always take account of any legal restrictions as a result of a donation or purchase.)

The range of options is:

- Seek the permission of the donor before making any decision to dispose,
- Seek the opinion of the donor and consider it as part of deciding whether to dispose,
- Inform the donor once a disposal has taken place, as a matter of courtesy,
- Inform the donor only if the item is being destroyed or leaving the public domain,
- Do not contact the donor at all.

Some museums set a time limit, only attempting to contact donors who have given items within the past 10 or 20 years, for example.

If the original donor is dead, some people suggest that descendants should be contacted and that if descendants cannot be traced, it may be appropriate to place an advertisement in a national newspaper to ascertain whether there are any successors or descendants. However, another school of thought argues that no attempt should ever be made to contact descendants as the museum is ignorant of the state of relationships within the family.

The above points may be extended to cover cases in which the item was purchased at a price significantly below the market value.

In all cases, it is vital to be sensitive in any dealings with donors. In the final analysis, a policy that takes into consideration the wishes of the donor through a transparent process of consultation will pay long-term dividends for the museum and hence be one of enlightened self-interest.

3E Consider, too, the potential public and media response to the disposal. It may be necessary to plan the way the disposal is to be presented. Be particularly careful if the disposal could harm public attitudes to museums as a whole. A decision to dispose needs to take account not only of what the museum believes to be in the public interest, but also of what members of the public themselves may perceive to be in their best interests.

If the museum has a friends' organisation, ensure that they understand the reasons for the disposal, otherwise they may become reluctant to raise money for future acquisitions.

3F The final decision to dispose should be taken by the governing body, acting on the advice of staff with appropriate expertise. The decision should not be taken by an individual acting alone. Some governing bodies require a two-thirds majority (or a unanimous decision) in favour of the disposal.

The process by which the governing body approves a decision to dispose of an item will vary from museum to museum, but in all cases it should take full account of the requirements of the Museums Association Code of Practice for Museum Governing Bodies, these guidelines and the Museums and Galleries Commission's registration scheme, and should consider fully all opinions expressed about the proposed disposal.

The governing body may wish to defer final approval of disposal of an item until the future ownership of the item has been fully investigated. This will necessitate carrying out some of the procedures in section 5.

4 Categories of items

4A Items for destruction

The following types of item can usually be disposed of without ethical problems:

- An item too badly damaged or deteriorated to be of any use for the purposes of the museum in the opinion of the member of museum staff with specialist knowledge of the item,
- An item that poses an unavoidable health and safety risk or unavoidable serious conservation threat to other items in the collection.

Badly damaged or dangerous items should normally be disposed of by destruction. However, there may be circumstances in which consideration should be given to the possible interest of other registered museums (and other public bodies). It is therefore advisable to take account of the procedures laid out below in section 5, although it will not always be appropriate to follow them all in detail.

If an item is to be destroyed, the following procedures should be followed:

- The governing body should take independent outside specialist advice (for example, from another museum) about the appropriateness of the proposed destruction,
- The disposal should be witnessed and records of the circumstances of the destruction should be kept, together with other appropriate records (see paragraph 5G below),
- The item's documentation should be retained.

4B Return of cultural property
If an item is to be returned to its place of origin outside the UK then it need not be offered to other registered museums or public institutions in the UK, so some procedures in section 5 will not apply. Attitudes to the return of cultural property vary widely and the Museums Association intends to issue some guidance on the subject. Specialist guidance on the return of human remains can be found in guidelines from the Museum Ethnographers Group.

4C Duplicates
It may be appropriate for a museum to dispose of an item that is a duplicate of another item in the collection. However, in many cases the term 'duplicate' is open to question. For example, items may differ in provenance or be natural history specimens. Therefore, a museum may have good reason to retain items that are apparently identical.

If disposing of duplicates, follow all the procedures set out below in section 5.

4D Items better owned by another museum
Some items may he more appropriately housed in another registered museum. For example, if a museum owns items that it is unable to make publicly accessible or care for adequately, it should consider giving them to another registered museum. In addition, certain items may be better in another registered museum for reasons of context or use. The procedures in section 5 should be followed. The disposal must result in improvements to the care of the item or to public access to it.

4E Archive material
The management of archive material requires special facilities to provide access and care. If the museum cannot provide these, the material is best housed in a public archive or record office. The material can be offered as a gift, in which case the procedures in section 5 apply.

Alternatively the material can be placed on deposit, in which case ownership of the material will remain with the museum so a formal disposal will not take place.

4F Other unwanted items
This category includes accessioned items that are regarded as substandard or irrelevant to the collection. If such items are not accepted by another registered museum or other public institution then ethical problems can arise.

A museum's aims and activities should be linked to its existing collections. It should endeavour to make use of all types of item in the collection, whether or not they are being actively collected under the museum’s current acquisition policy.

It is important to be aware of the risks of making a decision based on short-term considerations. Museums have a long-term purpose. Staff and members of governing bodies should take account of the intentions of their predecessors in developing future priorities. Be aware, too, that future uses for items may not be foreseeable now. In particular, advances in technology may create new techniques for examining material that may give it a new purpose and value.

If a museum nevertheless intends to dispose of items covered by this category it is vital to follow the procedures laid down in section 5.

4G Internal disposal
This category comprises items that are to be included in a handling/loan/education/working machinery/ demonstration collection. Museums have different ways of administering these collections; there are two basic approaches.

a) If the item that is being placed in a handling (etc.) collection remains on the permanent collection accession register, a disposal is not taking place; rather the museum has made a decision to apply a particular standard of care to an item in its permanent collection. Questions of disposal do not arise at the time the item is placed in the handling (etc.) collection. (However, they may arise in the long term if the item becomes badly damaged, and there may be ethical issues about collection care,)

b) If the handling (etc.) collection is separate from the permanent collection (so the item is formally removed from the permanent collection accession register) then this is effectively the disposal of the item and consideration should be given to the possible interest of other registered museums (and other public bodies). It is therefore advisable to take account of the procedures laid out below in section 5, although it will not always be appropriate to follow them all in detail.

4H Items held temporarily

If a museum obtained items with the intention of keeping them for a temporary period, they will not normally be accessioned into the permanent collection.

5 Disposing of the item

This section applies to items in categories C,D,E and F. It should also be taken into account for categories A, B and G. It is recommended that if a museum is considering following alternative procedures, prior advice is sought from the Museums Association and the Museums and Galleries Commission.

Once a decision (or an 'in principle' decision) has been made by the museum governing body to dispose of an item, these procedures should he followed to determine the future of the item.

It is desirable to keep all items that have been accessioned into a museum's permanent collection in the public domain. An item should be first offered to registered museums, preferably by gift. This may be done by 'Open' disposal (a general offer to all registered museums) or 'Closed' disposal (the offer of the item to a single registered museum or a selection of registered museums).

5A Open disposal
The item should be offered, preferably as a gift, to all registered museums by means of a notice in Museums Journal (and other specialist journals if appropriate; ensure that they are circulated throughout the UK), The notice should include the number and nature of the items. At least two months should be allowed from the

date of publication for registered museums to express an interest.

If archive material is to be offered by open disposal the offer should be made in the Society of Archivists mailing to heads of repositories as well as in Museums journal.

5B Closed disposal
A museum may choose to undertake a closed disposal and so offer the item as a gift to only a limited number of registered museums. Consider all registered museums likely to have an interest in the item. For example, a museum may have a local connection or a strong collection of that type of item. Consider in particular:

- The role that the item plays in a regional context. If it is the only item of its type in a region, consider the benefits of offering it only to registered museums within the region. The area museum council may be able to provide advice,

- The role the item plays regionally or nationally within its specialist area. It may be best to offer it only to registered museums with a particular interest in the subject.

It may be appropriate to offer the item to an overseas museum. In this case the museum will not be registered by the Museums and Galleries Commission, so it is important to be satisfied with the standards to which the museum is run.

If a closed disposal proves unsuccessful, the item should be offered by open disposal to all registered museums in the UK.

5C Unsuccessful open disposal
If no registered museums want an item that has been offered as a gift by open disposal, then the following options can be considered:

- Retain the item in the ownership of the museum, but transfer it out of the permanent collection to, for example, a separate handling or demonstration collection (also see paragraph 4G above),

- Offer the item as a gift to a public research, educational or related institution (possibly subject to conditions about the future disposal of the item; see paragraph 5E, below),

- In cases where the item was donated recently (within the past 5-10 years, for example) it may be appropriate to offer it back to the donor. However, proceed with caution as this may lead to requests from donors for the return of items that the museum wishes to retain.

As a final resort, consider either:

- Offering the item outside the public domain (but see 5D below),

- Destruction (see 4A above).

Never give an item to a registered museum or any other organisation without its prior agreement in writing to accept the item.

5D Sale
Decisions to dispose should never be made principally for financial

reasons (either to raise money for any purpose or to reduce expenditure).

The sale of items from museum collections is not recommended, even if the sale is to a registered museum. Society benefits from the long tradition of mutual co-operation between museums. The sale of items to other registered museums jeopardises this tradition.

Selling an item from a museum's collection out of the public domain always risks damaging public confidence in museums and is, therefore, a course of action that the Museums Association Ethics Committee would never recommend.

In addition, decisions are normally made with more clarity if there is no consideration of possible income from disposal.

However, some museums do undertake disposal by sale. In the exceptional circumstances when money is raised from a disposal it should be solely and directly applied to the museum's collection. This normally means the acquisition of new items for the collection, but may exceptionally extend to improving the care of the remaining collections. Prior advice should be sought from the Museums Association and the Museums and Galleries Commission if this is planned.

It is particularly bad practice to sell items from museum collections on museum premises, for example in a museum shop or at a special auction.

5E Transfer of title

Ensure that legal title to the item is transferred to the receiving institution (or individual). A gift could be made under a deed that provides a right of pre-emption in favour of the donor museum if the receiving institution itself decides to dispose of the item within a period of, say, 10 years.

The transfer document should ensure that where possible any rights in the item (such as copyright) are transferred to the new owner. The receiving institution may want to make enquiries if there is no record of who holds such rights. There may also be a need to take account of any arrangements with third parties in respect of rights (such as reproduction rights) in the item.

In some cases it may be appropriate to transfer the item together with any special conditions attached to it. This may require specific legal permission.

Guidance on the transfer of title can be found in Spectrum.

5F Long loans

If another registered museum wants the item, but for legal reasons formal transfer of ownership is not possible, it may be appropriate to consider a loan for a finite but renewable term.

5G Records and documentation

For openness and accountability, records should be kept of disposals. They should include the reasons for the disposal and the opinions and advice considered in making the decision to dispose. The records should be made available to members of the public on request. Records should be to the standards laid down in Spectrum.

Proper arrangements must be made for the preservation or transfer of the documentation relating to the items, including the preservation of photographic records where practicable.

5H Conflict of interest
It is important to avoid any risk of conflicts of interest during disposal. No person or organisation involved in advising on a proposed disposal or in making the decision to dispose should benefit financially or personally from the disposal. Where a conflict of interest might arise, the public benefit should prevail and a written declaration of interest should be made and kept on record by the museum.

5I Unacceptable reasons for disposal
(This paragraph does not apply to items in category 4H)

From the above it is clear that it is unacceptable to dispose of an item:

- Primarily for financial reasons (whether to raise money for any purpose or to reduce expenditure),
- On an ad hoc basis (i.e. other than as part of a long-term collections management plan),
- Without considering expert advice from someone with a specialist knowledge of the item,
- If the disposal would adversely affect the public reputation of museums,
- If the disposal would not be in the long-term public interest,
- Outside the public domain, except in exceptional circumstances.

Undocumented or unaccessioned items

a) Undocumented items
A museum should make exhaustive enquiries if it wishes to consider removing items of unknown provenance. Poor documentation is not in itself a reason for disposal. Documentation about the items may come to light in future. They may turn out not to be the property of the museum and could be reclaimed by the legal owner at a later date. Alternatively, they may in fact be in the accession register, but not recognised as such because, for example, they are not labelled.

Furthermore, some items that are effectively part of the permanent collection may not have been formally accessioned because of an administrative oversight or a documentation backlog. It is advisable to ensure that the collection is fully documented before considering disposal.

b) Unaccessioned items
To avoid confusion, the term ‘disposal’ should be applied only to the removal of items that are part of a museum’s permanent collection. The procedures and principles outlined above in sections 2-5 do not need to be followed strictly when removing other types of items, such as ones in a separate handling or loan collection. However, the guidelines may prove useful because they are sensitive to the possible public reaction and take account of the fact that the items may be of interest to another

museum. (Note that some handling or loan collections may contain accessioned items, which for disposal purposes should be treated as part of the permanent collection.)

Legal note on unaccessioned items:

i) in law there may be no distinction between accessioned and unaccessioned items so any legal restrictions on accessioned items may also apply to unaccessioned ones,

ii) the museum may not have the legal right to remove unwanted items that it does not own (such as unwanted offers for the collection or unclaimed opinions), although the legal position will vary from museum to museum.

Definitions

A **registered museum** is one provisionally or fully registered under the Museums and Galleries Commission's registration scheme.

A museum **governing body** is the principal body of individuals in which rests ultimate responsibility for policy and decisions affecting the governance of the museum.

THE NMGM APPROACH TO SHIP AND BOAT CONSERVATION

J Kearon

Abstract

National Museums and Galleries on Merseyside (NMGM) has three important collections of larger objects that span maritime technology, industrial and land transport. Caring for and conserving objects that range from horse drawn carriages to steel trading schooners calls for a range of expertise not usually found in the average conservation department. The conservation of ships and boats in particular, both of wood and metal, is a relatively new area of conservation that can require often innovative procedures to deal with the complex structures involved. Such objects have traditionally been dealt with in a restoration context, often involving the continuous use of the vessel on water.

At NMGM the approach to dealing with the ship and boat collection is one of conservation first, with restoration undertaken only if the structural integrity of an object demands it. This approach has seen a move away from restoring and floating small boats, to caring for them much as other accessioned museum objects. Likewise, the manner in which we deal with large ship conservation is somewhat different from the usual approach of maintaining and restoring them, as if they were in commercial use. This paper will deal with several very different vessels and examine how and why each was dealt with in a specific way.

Introduction

The National Museums and Galleries on Merseyside (NMGM) have three important collections of larger objects that span maritime, industrial and land transport technology. Caring for and conserving objects as diverse as horse-drawn carriages and trading schooners demands a range of expertise not usually found in the average conservation department. The conservation of ships and boats in particular, both of wood and metal, is a relatively new area of conservation that can require often innovative procedures to deal with the complex structures involved.

The Collection

At Merseyside Maritime Museum (MMM) the collection of ships and boats represents most vessel types, with particular emphasis on craft from, or associated with, the North West of England. There are two steel ships, *Edmund Gardener*, the last Liverpool Pilot Cutter and *De Wadden*, the last Irish sea schooner to trade. Both ships are permanently dry-docked at the museum. There are also two associated steel ships at the museum that are run and maintained by a preservation society that is part of the volunteer group *Friends of Merseyside Maritime Museum*. They are the Liverpool tug *Brocklebank* and *Wincham*, a local motor barge. These vessels are afloat in working order and are used to promote the museum locally and at ports around the British Isles and Europe.

The *Edmund Gardner*, which was built in 1953, is a fine 700ton vessel powered by twin diesel engines that drive generators to power the main electric motor, which drives a single screw. Her structure and interior layout is representative of several ship types, from conventional cargo to ocean liner. When in service, she patrolled the Mersey estuary, acting as a pilot supply vessel to ships entering the river and its ports.

The *De Wadden* is a three masted steel schooner, built in Holland in 1917. She was involved in the Irish Sea trade from 1922 to 1961 and for most of her working life was a regular caller to Liverpool and other Mersey ports. The *Edmund Gardner* is open to visitors from April to October and the *De Wadden* is open as on-going work programmes allow.

There are some seventy five wooden boats in the collection that range in size from a 2m Victorian folding canoe to a 10m sail fishing boat. The boats cover a variety of types, and forms of construction in wood, and are broadly representative of small work and pleasure craft of the area.

Through the 1980s and early 1990s, as part of museum policy, some of the boats were regularly used on the water, in particular the 11m steam launch *Birdie* of 1904 and the 7m sailing cutter *Sunbeam* of 1925. However, the museum changed its policy on using vessels in this way because of the damage that was being done to these very special boats by constant use and refurbishment. The boat collection is now land based and housed indoors.

Caring for the collection

Caring for and conserving such a diverse collection of vessels can be a challenge, not made easy by the two large steel vessels being permanently in the open. The care of the collection as a whole can be a conservators nightmare, with a wide range of materials, including wood, metal, fabric, rope and plastic being part of a vessel's structure. Wooden boats in particular can be difficult objects to deal with when taken permanently from the water. With many built-in stresses, and designed to float on and be supported by water, there can be problems when they are out of their natural environment. These range from corroded fastenings and their effect on surrounding wood, to damage through rot, shrinkage and distortion.

The approach at NMGM with both large steel ships and wooden craft is to conserve as much original material as possible and replace only where structural integrity demands it. While this is a standard conservation aim, the structural complexity of the objects, particularly the ships, requires the specific craft skills associated with the objects in addition to conservation expertise, to deal with these objects in a fully rounded manner. Not only is there a requirement to care for and conserve, but also to replicate components and even full size craft in original form.

To care for the collections, there are seven staff who share knowledge, experience and expertise in the care, conservation and restoration of ships, boats, industrial and land transport objects. In addition to conservation qualifications or experience staff have expertise in other areas including; ship and boat building, rigging and engineering. Staff manage and are assisted by an active volunteer group, who have been closely associated with the Department since the founding of The Maritime Museum in 1980. Work on the ships, boats and other large objects is carried out in a workshop and in two graving docks at The Maritime Museum.

The steel vessels

While work within the department is spread across all three collections, the greater emphasis is on the care of the two steel vessels, primarily because they are in the open. Work on these vessels is long term and combines continuous maintenance with restoration and conservation measures.

The *De Wadden*

The *De Wadden* is undergoing a major programme of work that aims to conserve as much of the vessels' hull as possible and to replicate the masting and rigging in original form. The hull is being stabilised, and plating that has degraded is being renewed in areas where structural integrity demands it. For example the bulwark on the starboard side to which the masts' standing rigging is fixed was badly degraded. The need for sound fixing points for the shroud chainplates resulted in the degraded bulwark being replaced by making new plate sections, using the original plates as templates. Bulwark stanchions had also degraded and despite searching, steel to match the original section type was not available. To ensure conformity, a wooden template was made of an original stanchion and new stanchions were cast in malleable steel. All plating was fixed with hot rivets to match the original fixing process.

The approach with other components that have degraded and have a structural importance is to remove the original for conservation and replace with an exact replica. The bowsprit location box, used to house and secure the bowsprit to the fore-deck, had badly degraded and had insufficient strength to support the new bowsprit. The old location box was removed, a replica of it was formed in the same manner as the original, including riveting, fixed in place, and the new bowsprit fitted. This process is entirely reversible, meeting a conservation ideal, even with such objects as large ship components.

The vessels' masting and rigging is also being replicated. The masts in place when the vessel was acquired were not original, had extensive rot and had insufficient strength to support themselves and the rigging. In short, they were beyond saving, given their structural requirement. However, the vessels' mizzen mast, is being conserved as research has shown it was originally from the schooner *Cymric*, a 'q' ship of the World War 1 and is probably the only such mast to survive.

The conservation and replication of structural components, the production of new wooden masts and booms, rigging and the many fittings needed requires the close collaboration of several disciplines. From research of the subject to inspection and acquisition of materials and the forming of many associated components, all is undertaken within the department.

The *Edmund Gardner*

While the *Edmund Gardner* is structurally sound and in good condition, she still requires considerable care. Routine maintenance is carried out throughout the year, usually running in parallel with specific work programmes. Wooden decks need constant attention as do masts, rigging and the ships' external coatings. Our wet winters can make any kind of outside maintenance difficult. Because of this, outside work is carried out in the main throughout the summer months and the interior of the ship is worked on during the winter. As with the *De Wadden*, the approach is to conserve where possible and replace only when necessary.

Last year leaks were found in the sun-lounge saloon deck-head. This was unsettling, as the deckhead was of steel plate, overlaid with a 70mm caulked and payed wooden deck. The removal of some deck planks confirmed that parts of the underlying steel deck had corroded where water had found its way between the wooden and steel decking. An area of wooden deck approximately 16m^2 was carefully removed. The steel deck was fine grit blasted, both to remove rust scale and to provide a clean surface to which both paint and repair material would bond well. The specific pierced areas were sealed and repaired using ‘Thistlebond’ two part epoxy resin, backed with glass fibre matting, allowing retention of the original steel under-deck. The area was then coated with several coatings of Hempel’s ‘Hempadur’ 1531 epoxy metal protective paint. The wooden deck sections were in the main sound, though some underside surfaces had degraded. To deal with this, approximately 25mm was removed from the bottom of the affected planking. Full thickness was made up by gluing on pieces of iroko, using ‘Cascophen’ resorcinol resin adhesive. The deck planks were then re-laid, following cleaning and treatment. This process allowed retention of the great majority of the wooden deck and did not alter the visible portion in any way.

The work carried out on both *De Wadden* and *Edmund Garner* extended beyond the standard that would be achieved had contractors been involved who are steeped in commercial practice and have little knowledge of conservation. In the authors opinion the difference in approach between the craftsman working commercially and the museum-orientated craftsman-conservator revolves around the level of attention paid to detail. Commercially operating craftsmen in general approach a task with the knowledge that they must achieve a certain amount of work to a reasonable standard and in the event make money for their employer. Conservators face similar constraints but there is more consideration given to the long term effects of their intervention. In essence the long view instead of the short view is taken by the conservator. This statement does not diminish the skills of the commercial worker but is used to emphasise the different approaches taken by people who may seem to be doing the same job.

Wooden boats: three case studies

Work on small boats and other objects is driven by exhibition requirements and by the individual needs of the boats or objects themselves. The treatment of wooden boats can differ widely, depending on the type and condition of the individual boat. There are three basic approaches: conserve and restore, conserve only, and conserve and create a replica. To illustrate this, we will consider three very distinct boats:

i) the Morecombe Bay nobby *Daystar* of 1894,
ii) the pulling gig *Ladies Gig* of c.1880,
iii) the *Bond* dinghy of 1932.

The nobby *Daystar*: conserve and restore

The nobby *Daystar*, the oldest surviving vessel of its type, was taken into the Museum collection in 1974. In very poor structural order and with extensive wood/metal interaction and rot, she had been altered somewhat during her working life, mainly by the addition of a deck-house instead of a standard open cockpit, and by installation of an engine. The vessel had been worked hard over its life and was poorly maintained. During her latter years she was stored in the open, in a boatyard and neglected.

The vessel was in such poor condition that planks were literally hanging from the frames. The steel fastenings had corroded extensively, affecting both the planking and the framing in their vicinity. Following a detailed examination, it was decided to remove all the wood that was beyond saving. This proved extensive, given the structural condition of the vessel. Almost all the framing and hull planking, from the waterline to deck level and including the deck beams and deck, were beyond repair. Years of salt water around unprotected steel nails and bolts had done its work well, with fastenings corroded to needlepoint between planks and frames and surrounding wood destroyed. Left unused over a long period and without maintenance fresh water had permeated through the decks, beams and frame tops to add to the problem. Rot was extensive, with wood largely de-natured following years of immersion and neglect.

The approach taken was to dismantle the vessel into its component parts; save and treat what could be saved, and reassemble using new materials where required. All restoration was carried out using similar materials following the original form. Before the vessel was dismantled, wooden templates were made of all the frames. Oak crooks from which to form the new frames were acquired, as well as the relevant boat-nails and bolts. The vessel had been planked with larch and pine, with repairs done over the years using whatever timber was available. Larch flitches were bought and some pine, recovered from the roof beams of the then just demolished Wapping Dock warehouse, were used for hull and deck planking.

The reassembly followed standard wooden boat building procedures, but with the added attention to detail of the conservator. The vessels' 'backbone', comprising keel, keelson, stem and stern timbers, as well as the lower frames and futtocks had not been dismantled, as these could be treated effectively *in situ*, leaving the basic structure intact. Original frame sections were repaired or consolidated and retained where possible. Where required new frames were formed from the oak crooks using the frame templates. The majority of the lower frames and floorings of the boat were saved, with top-timbers and turn-of-the-bilge sections largely replaced. The after-section of the vessel had fared worse, where some five complete double-frames were needed.

All original wooden components were scraped clean, with hull plank-edges repaired by handplane. The wood was treated throughout with 'Xylamon' wood preservative. 'Xylamon' wood hardening, a popular consolidant at the time, was used for treating soft and degraded areas. With all the frames reassembled and faired, the replacement of the planks began. Approximately 20% were treatable, these in the main being from the lower portion of the vessel. Planks were reassembled from the garboard up, continuing in new wood where the originals had to be replaced. The counter of the vessel, the internal transom, deck-beams, decks and covering-boards, were all replaced, effectively replicating the vessel from the waterline up. The original format of the vessel was recreated by forming the double-round-ended open-cockpit synonymous with the Morecombe Bay nobbies. The completed vessel was then given an additional coating of 'Xylamon' wood preservative, followed once surfaces were thoroughly dry by

International Yacht Paint 'Interlux' International metallic wood primer.

The *Daystar* is in reality more a restored vessel than a conserved one. However, when it was treated, in the early 1980's, wooden boat conservation was in its infancy in the UK. The fact that so much was actually saved and conserved was an achievement at a time when the main emphasis was to renew everything and put the boat back on the water.

Ladies Gig: conserve only

A contrasting approach is the way in which the 8m clinker pulling gig *Ladies Gig* was conserved. Presented to the Museum by Lord Newborough in 1986, the gig was in very poor condition. All the lower timbers on the port side were damaged or missing. This had caused the port garboard plank to separate from its housing. Two thwart knees on the fourth and fifth thwarts had virtually disintegrated due to woodworm. The loss of transverse connection coupled with the separated garboard had caused the boat to come apart along its centreline.

As the boat was a long and slender structure, very lightly built, care in movement was paramount. However, the vessel had to be worked on in every plane, a fact that in normal circumstances would mean man-handling and moving the boat a lot and would certainly result in further damage. This was resolved by designing and making a revolving support frame that would enable the vessel to be turned at will, while reducing the damage potential enormously. Not only that, the vessel could be turned to any plane by one person.

The approach with the gig was to conserve as much original material as possible, and replace only where structural integrity demanded it. A detailed survey was carried out that included analysis of the woods from which the boat was formed, of its coatings and the fastenings used. The coatings analysis showed that the vessel had originally been varnished externally with a clear varnish and painted at a much later date. The paint was an inferior house paint, used primarily for when the boat had been displayed at Lord Newborough's private museum at Fort Belan, Caernarfon. Little remained of the interior coatings, a grey paint that in all probability was original. The structure of the vessel was largely original with just two secondary planks fitted at the turn of bilge on both sides, and an internal transom fitted to give strength to the original. However, there had been a great loss of cohesion because the many of the timber sections that transverse the vessel were missing.

A decision was taken to remove the outer coatings and return the surface to its original varnished state, but to retain the interior coatings and as much of the vessels' structure as possible.

The outer hull coatings were removed by the application of 'Peel Away', a sodium hydroxide paint remover. This process worked extremely well, with the manufacturers' instructions followed to the letter. The interior of the boat was brushed and vacuum cleaned to remove surface dust and debris and then cleaned several times using clean water and cotton cloths, followed once dry, by a final clean with white spirit.

The port garboard plank was pushed back into its rebate along the keel by encircling the boat with web-clamps and tightening gently. Spreaders were fitted across the gunwales between the straps to prevent crushing. Minimum replacement of missing timbers then took place to reintroduce transverse connection. The two badly degraded thwart knees were removed and replaced by new ones in the original form. Locally degraded areas and components were consolidated with Paraloid B72 in solution with trichloroethylene.

Repairs to various plank shakes, and in particular damage to the plank lands at the turn of bilge on both sides, were carried out using pressure from the web clamps and custom made metal clamps, with sets and wedges used locally. The parted surfaces were glued together, with Cascamite ‘One Shot’ UF resin.

On completion of the structural consolidation and repair, the outer hull was coated with Jotun ‘Royal Ultra’ clear Alkyd varnish, while the inner surfaces were coated with a similar but matt finish varnish. A customised metal support base, with fitted wooden chocks, was formed to support the vessel in the long term.

***Bond*: conserve and create a replica.**

Our last vessel to examine is a small clinker sailing dinghy of 1932, built by Bonds of Rock Ferry, and probably the only example of its type from this well known Merseyside yard, which closed in the early 1960s. The dinghy is in good condition and is structurally sound; however, we have no real idea of how it handles afloat and under sail. To do something positive about our exhortation to ‘replicate if you want to see how a valued accessioned object works’, we did just that: we built a replica of the dinghy.

The process had an effect far beyond just producing another boat. To start with, the lines of the dinghy were lifted and line and construction drawings produced. The vessel was then ‘lofted’, that is, drawn full size to allow templates to be made of the various components. Wood was then selected: oak for the stem and timbers, mahogany for the planks, transom and seats. Building started in earnest and extended over two years. Given that the project was a low priority as it was a replica and not an original that was being worked on progress was dictated by other priorities. Several boat-building classes were given using the building of the dinghy as the source of the course. The ‘students’ could then be brought through the whole process from lifting and drawing lines, to seeing how the various parts were shaped and lifted.

The dinghy will be launched in May (1997), when trials will give us all the information we need on its performance. Our gain is a detailed survey of the original boat and research data of its history. In addition we have line and construction drawings for our archives and a replica vessel that can be used, without fear of damage to the original, which can rest assured of its long term care. We also have a full and detailed record of its building. Of equal importance is the fact that several dozen people were taught not only the basics of wooden boat building but the importance of conservation as well. Perhaps this is an ideal way forward when dealing with unique or very special larger objects. Save and protect the originals and slowly but steadily replicate them and in the process keep associated skills very much alive.

Conclusion

Conserving large objects, be they planes, boats or trains, is an area of conservation that is relatively new and challenging. The traditional approach with these objects has been more to restore than to conserve, often with the emphasis on keeping the objects in use. This is particularly true of boats and trains. However, the inevitable outcome of doing this is to loose more and more original material from objects that have usually lost considerable material anyway. Our dilemma is not with the old boat or locomotive of which there are several of a type. It is with objects that are unique or that have a particular significance. Do we continue to sail the boat and steam the train that is perhaps the only survivor of its type? There is much sense in the quote 'If you use it, you loose it'. I would add to that 'If you want to use it, replicate it'.

Safety

The relevant Health and Safety and COSHH regulations apply to the use of the listed products and should be read and applied when using any of the materials referred to below. Specific product Health and Safety guidelines and recommendations for safe use should be requested from the manufacturers or suppliers.

Materials

1. Thistlebond two part epoxy resin. Ferguson and Timpson Ltd, Unit 65, Station Road, Coleshill, Warwickshire, B46 1JT. Available from manufacturer or most ship chandlers.
2. Hempel's 'Hempadur' 1531 epoxy metal protective paint. Hempel Paints Ltd, Llantarnam Industrial Park, Cwmbran, NP44 3XF. Available from manufacturer or most ship chandlers.
3. Cascophen Resorcinol resin wood adhesive and Cascamite 'One Shot' UF resin. Borden (UK) Ltd, North Baddersley, Southampton, SO52 9ZB. Available from manufacturer or most ship chandlers and builders merchants.
4. Xylamon wood preservative, Xylamon wood-hardening and Paraloid B72. Conservation Resources, Units 1-3 Pony Road, Horspath Industrial Estate, Cowley, Oxford, OX4 2RD.
5. International Yacht Paint 'Interlux' International metallic wood primer. International Paints Ltd, Stoneygate Lane, Felling, Gateshead Tyne and Wear, NE10 0JY. Available from manufacturer or most ship chandlers.
6. 'Peel Away', sodium hydroxide paint remover. Langlow products Ltd, PO Box 32, Asheridge Road, Chesham, Bucks, HP5 2QF. poultice. Available from most DIY stores.
7. White spirit. Marine (Chemi-Technics) Ltd Bury Lancashire.
8 Trichloroethylene. Oakes-Eddon Ltd, Scientific House, Dryden Street, Liverpool, L5 5HH.
9. Jotun 'Royal Ultra' clear Alkyd varnish. Jotun-Henry Clark Ltd, 142 Minories London EC3N 1LS. Available from the manufacturer or specialist painting and decorating outlets.

MANAGING OUTSIDE IN BRISTOL

A King

Abstract

There is an inevitable need for certain exhibits to stay outside - in our case, 3 small ships, 4 electric quayside cranes, a Scheduled Ancient Monument steam crane, and almost a dozen railway wagons.

These require constant care and maintenance. With the shortage of staff and money how does one cope with this?

Bristol Maritime Museum has seen the evolution of a volunteer team, and a philosophy of regular operation, which in itself is an excellent way of monitoring decay as well as presenting another aspect of an exhibit to the visitor.

There is a need for a maintenance programming taking into account the variability of volunteers' skills and attendance. This also leads to the involvement of outside agencies, for example, boiler and lifting gear inspectors who would not be needed for static exhibits.

The paper ends with a critical assessment of our success (and failure!) and my aspirations for the future - better training, better record-keeping and fuller integration of volunteers into the Museum's structure and culture.

Introduction

Watching things like Star Trek on the television has introduced me to the concept of the parallel universe, a concept borne out by many of the conferences I attend. I sit open-mouthed with astonishment through presentations about museum projects where conscious policy-making, strategic planning, resource identification, smooth management and quality assessment take place and seem always to have done so. In Bristol, coping with our large-scale outside exhibits owes rather more to serendipity, opportunism, happenstance, the crossing of fingers and the slow evolution of a maintenance regime.

Origins and growth

The origins of the industrial collections at Bristol are similar to those in other local authority museums in the UK. It began in the early 19th century when ship models and industrial art and contrivances were amassed in a small way - items with which to inspire the artisan to greater things, in the spirit of the V&A. In the 1920s and 1930s the Museum Committee Chairman, the last Director of the coach building firm of Fullers, arranged for the Museum to inherit the company's collection of historic vehicles, among the first large items to arrive.

After the war, a number of industrial machines were collected by Miss Joan Lillicoe, first curator of the Bristol Folk Museum at Blaise Castle House. In her time, Bristol's first outside exhibit was acquired, a complete water mill rescued from a reservoir development. This was intended to start Blaise Castle on the path of emulating The Museum of Welsh Life at St Fagans, but *Stratford Mill* proved to be the only uprooted building to arrive. At the same time, a Reading-type gypsy caravan was acquired that was wheeled out for the summer months. The caravan quickly deteriorated in Bristol's temperate maritime climate and was later moved to display inside the City Museum, where it still stands. *Stratford Mill* has presented huge management problems ever since it was acquired, and is currently closed, much vandalised and semi-derelict.

In the early 1960s industrial collecting was encouraged as part of a plan to construct a new museum with room for some very large exhibits. Despite the scrapping of this project in the late 1960's, large scale exhibits continued to be collected. Fortunately, the bulk of them could be housed inside, but in 1973, the first definite outside exhibit was acquired, the *Fairbairn steam crane* of 1875. This passed to the Museum from the Port of Bristol Authority in working, if somewhat dilapidated, condition. The decision to pass the crane to us was at least partially influenced by the impending Health & Safety at Work Act, 1974, which would have made commercial operation of the crane impossible without expensive guarding work. [1] The crane was situated in the heart of the City Docks, which were themselves running down commercially as they began a tentative progress towards leisure use, and the crane was a prime vandalism target. To combat this, Dorothea Restorations were contracted to make the crane weather and vandal-proof, effectively mothballing it, except for a few demonstrations, until full restoration was possible beginning in 1988.

In 1977, Bristol Museums acquired a dockside building to develop as an Industrial Museum. Opened in March 1978, the new Museum was only 100m from the *Fairbairn steam crane*, which was operated for the opening, along with the restored locomotive *Henbury. Henbury* settled down to an occasional programme of brake van rides along the quayside to the *S.S. Great Britain*, staffed by volunteers. Thus by accident were the seeds of our current operations sown - operational exhibits manned by volunteers entertaining and, we hope, educating the visitor.

Ever since the 1960s, the Museum had been particularly keen to acquire a ship. This would probably have had to remain outside and afloat. In 1981, the Museum finally acquired its first ship, the derelict steam tug *Mayflower*, built in Bristol in 1861. Little thought appears to have been given at the time to the problems that its maintenance would entail. In the early 1980's, I joined the staff and with my background in china clay and worsted textiles, was considered the ideal person to bring *Mayflower* back to what the press always call her former glory. Looking back, I am sure that my ignorance of what was involved helped us to achieve the result. Had I known what I was letting myself in for, I would have been anything but confident. Six years later, we had a working vessel and a team of volunteers competent to take on the restoration and ongoing care of a string of outside exhibits.

Caring for the collections

The problems of caring for the collections with limited resources became apparent about thirty years ago when the then Curator of Technology adopted the imaginative approach of lending out some of the Museum's exhibits for others to restore and use; prime amongst these were three locomotives. As Bristol had no means of displaying them, there was sense in this decision - certainly, the team of one curator and one conservator was hardly likely to achieve much themselves. The results of the policy were, however, variable. In all three cases it meant moving the engines from undercover accommodation into the open air; one loco was totally restored, one returned a decade later exactly as it had left, and the third, having been dismantled for restoration, was the victim of scrap thieves who stole most of its brasswork. The lesson learned from this was the importance of close supervision of any work left in the hands of others, including, later, our own volunteers.

In 1997, our collection of exhibits that must remain outside numbers three ships (the 1861 steam tug *Mayflower*, the 1934 fire boat *Pyronaut* and the 1935 motor tug *John King*), the Scheduled Ancient Monument steam crane, over a dozen railway wagons, and four electric quayside cranes. These are the items for which there is no likelihood whatsoever of covered accommodation, even in winter. Of the four thousand items in the collection, these twenty or so items require by far the greatest efforts to preserve, in the most basic sense, and are very demanding of my time. Three of them are afloat, exposed to the additional erosion of slightly salt water. All bear the brunt of sou'westerlies throughout the winter, the constant ravages of small children and drunks (who insist on climbing onto them), pigeons and cormorants, and our own staff and volunteers moving them about.

Were we ever ethically correct in acquiring these expensive objects knowing the burden they would place upon our successors? Even in the heady days of the early 1980s, there were indications that the relative affluence of staff and resourcing that museums were enjoying was going to be very temporary. The argument that is invoked for almost anything from *The Three Graces* to yet another railway engine is that, if the object is important enough, one should save it first and then find the resources to deal with it later. There is logic to this, as it does at least allow the later reassessment of the object in calmer circumstances. Certainly two of our outside exhibits, *Mayflower* and the *Fairbairn* steam crane, are unique enough internationally to have justified acquisition with only an inkling as to where their future funding would come from.

Having reached the dizzy heights of two curators and one and a half conservators in the late 1980s, the Industrial Museum staffing now stands at one curator and half a conservator (shared with Social History), lower than it has ever been. The annual expendable budget has decreased in real terms for each of the sixteen years I have worked in the city. None of the outside exhibits has ever had a budget specifically for it, relying for their restoration upon the promise of 50% grant aid from the Science Museum and PRISM funds and the prayer of sponsorship, public support and windfalls.

Working people, working objects

Working people

The major resource for any project is people. Wages and salaries drain any budget with remarkable speed. Finding people with the right skills at the right moment is in the lap of the gods; and there is considerable opposition to the appointment of more staff. Because of these factors, we cannot but look to volunteers to assist with the restoration and care of our exhibits. At first, in the early 1980s, the idea of volunteers was looked on with alarm or distrust by almost everyone, but their involvement is now accepted almost universally. To use them effectively takes an immense amount of work but if one is successful the result repays the effort many times over.

The main advantage that I have found with volunteers is that they want to do the work; at times, this enthusiasm has needed firm control, but by working alongside them as frequently as possible these occasions have been rare. To attract the volunteers in the first place required some sort of aim, and it was immediately apparent that no-one was very interested in toiling on a project which had a stuffed-and-mounted future envisaged for it. Even the vague aim of making *Mayflower* work again, for occasional demonstration tied alongside the quay was sufficient to fire the interest of a number of competent and adaptable individuals. Their hard work, ingenuity and sheer commitment resulted in *Mayflower's* restoration to full working order, her regular trips to Gloucester and even as far as Worcester and her regular steamings in Bristol Docks, giving delighted ‘punters’ a trip round the bay.

Working objects

Our philosophy of regular use stems from a number of roots. One of the major driving forces remains the need to finance the outside exhibits. Thus, although the original idea behind charging for rides on the railway was to cover the cost of fuel, the income now pays the wages of a sub-contractor who is engaged to maintain and repair the track and to develop the railway's revenue-earning capacity. It is undeniable that the best way for the public to see any sort of machine is in action, doing what it was meant to do, another spur towards working our exhibits. In addition, it would be impossible to staff the three boats and crane safely. This would be necessary to make them reasonably accessible to casual visitors on a regular basis. We have thus developed a season-round programme of weekend operations of one or other of our exhibits as the only practicable way of showing them to the public, as well as raising maintenance and upkeep funds and developing further volunteer interest.

Regular use means that decay is seen more quickly. Engine drivers and crew members go into places for operational reasons that one would never conceive of going into under normal circumstances. The familiarity that the crew members develop with the exhibits is, I submit, greater even than that of a conservator working over a long period on a single object. Problems get dealt with quickly. Small problems quickly sorted do not become disasters.

Maintaining the exhibits

Despite this constant inspection, regular use still requires a maintenance regime. Our operational season ceases in November, and the first weekend after the close is usually a time of bustling activity. The exhibits are stripped of all their portable bits, particularly those made of wood or canvas, which are stored indoors for the winter, each removed item being inspected and treated over the next few months. This is predominately damage limitation, to lengthen the lifespan of these parts by protecting them from the worst of the weather; interestingly, these parts are also those most likely to be non-original components anyway. Engines are cleaned, drained, and treated with commercial corrosion inhibiting compounds. The cabins on the boats and the vans on the railway are scrupulously cleaned and lockers opened up for over-winter airing.

The list of all the regular jobs is stored on disc, and is printed out and posted at the start of each winter. The programming of these tasks is my responsibility, and has to take into account the varying skills and availability of volunteers. The list gets longer each year, but the repetition of tasks annually means that each year they take less time. There are other, less frequent but much more arduous jobs, like three-yearly dry-docking for the vessels, which we begin to plan for in the year before docking is due, and ten-yearly inspection of boilers. *Mayflower's* is due this coming winter, when the boiler will be lifted in and out of the tug by the steam crane.

Boiler inspections are one of several areas which involve outside agencies who would not be needed were the exhibits static. On occasion, the requirements of boiler inspectors and others involved in ensuring safety regulations are met give one cause for ethical thought; are their needs leading to unacceptable changes to the fabric of the exhibit? This is always a difficult balance to strike, but I think with exhibits kept outside, the pendulum swings so far away from pure conservation ethics that a more lenient attitude deserves to be taken here. We deal on a regular basis with boiler inspectors, lifting inspectors, marine safety officers, the HSE Railway Inspectorate, the City Council's own safety team and others, and have developed good working relationships by proving that the volunteer staff who allow us to operate all these exhibits are competent, conscious individuals who work well in teams.

How well have we done?

In hospital terms, 'as well as can be expected'. On the plus side, I think one can be proud of the development of a committed team of volunteers who expect to be told what they should do and seldom do anything to give us cause for concern. These people have been responsible over fifteen years for the restoration of three small ships, a steam crane, two railway locomotives and several wagons, in addition to a few exhibits normally kept indoors. Through their efforts, we are able to put on a programme for working exhibits throughout the summer which incidentally helps to ensure that problems with these items are seen early and dealt with. The efforts of these individuals earns sufficient income for the Museum just about to cover the maintenance costs.

On the minus side, we can never generate sufficient income from operating to fully cover the costs of dry-dockings, major boiler overhauls, and so on.

In addition I certainly have cause to regret not recording in more detail those things that have been altered, repaired or replaced as restoration and ongoing maintenance has proceeded. We keep reasonable photographic records and the majority of the people involved in the earliest restoration work are still with us, so if we start now we should be able to record most changes we can remember. It will, however be a long haul.

What does the future hold?

Sooner or later the generation of volunteers from whom we recruit most people will pass into dotage and we will be faced with being unable to work the exhibits unless we can attract new blood. Running the level of activities that we do requires the involvement of about forty people. Sooner or later, the ships in particular will become too expensive to maintain in the water and a decision will have to be taken about their long term future. I am certain that the quality of work that we have always maintained will delay this for some considerable time.

In the shorter term we must look at ways of generating revenue from the outside exhibits which do not entail any more maintenance work than we are already doing. We are currently investigating hiring out members of the volunteer team to private collectors who need assistance with their projects, playing upon the expertise and experience of our people. This may generate income to allow us to buy in trades that we lack - we have no competent joiners or shipwrights on the team at the moment, for instance. I also hope to be able to develop the training that we are able to give to our volunteers, although the continuing shortage of funds is not going to allow us to hire in professionals. Rather, I hope to encourage the team to share their existing skills with their companions in a self-help form of competence development.

We are also faced with the problem, or rather four problems, of the electric quayside cranes. These are very much part of the scenery, being the last remaining in the City Docks and something of a public monument. However, their power supply was long ago removed and they have not functioned since the late 1970s. Their height (about 40m) adds a further dimension to any maintenance work. I am optimistic enough to believe that we will find some enthusiastic climbers with an interest in industrial machinery; the right sort of person has always turned up in the past. Nevertheless, ensuring the survival of these structures is going to be our biggest test so far.

These objectives are going to require the strategic planning, resource identification and quality measurement that I identified at the beginning of this paper had not been apparent at Bristol hitherto. I am confident that the experience we have gained on the rather haphazard progression this far will have given us a secure footing on which to build.

References

1. **The Health & Safety at Work Act 1974,** HSC, London (1974).

DOCUMENTATION FOR TREATMENT : HOW MUCH IS ENOUGH

D Riss

Abstract

In the past, the repair and restoration of machinery and vehicles has been less the province of conservators and more the province of craft workers such as mechanics, boilermakers, millwrights, and machinists. The important task was to keep the equipment in working order, even in museums, and any modifications needed to keep things moving were made, often with little concern for documenting the changes. As a result, we have a substantial body of machinery and vehicles that are now altered in various degrees from their as-built condition by modifications and repairs made during their working life as well as during their less taxing museum life.

As conservators become more involved with these collections, new questions arise in the light of their concern for the object-considered-as-an-historical-document. Any treatments they perform will of course require documentation. The question becomes, how elaborate should the documentation be for these often complicated objects?

I propose to outline several levels of documentation. I suggest we pay particular attention to:

- *what is to be changed (by the treatment)*
- *what we see that will be hidden after treatment*
- *what we see that is different from what was expected.*

In addition, we should take note of:

- *materials*
- *dimensions and tolerances*
- *configuration and methods of construction*

- *finishes*
- *operating parameters.*

Total documentation is not really required for most treatments or repairs, but may be desirable to establish a baseline if previous documentation is sketchy or to provide enough data for part replication. More complete documentation would also be desirable to make historical comparisons with:

- *earlier states of the equipment*
- *alternate designs*
- *related classes.*

Introduction

Conservators may often be the first to deal with an object, and be in a position to help answer questions others may ask of objects, questions not necessarily directly relevant to the task of stabilization and preservation. For instance, of a steam engine, are all the boiler tubes the same size? Not relevant if we are concerned with preserving the engine for static display; of much relevance if we are concerned with the history of engine design. As long as he has the machine apart, should the conservator also be measuring boiler tube sizes?

The question becomes to what level of detail do we carry out our usual examination and treatment documentation? Is the result any good to anybody else? My concern in this paper, then, is with the nature of our routine examination and treatment documentation, and how and when it might be made useful to others.

First let us look at documentation in general. After that, let us look at what constitutes routine documentation and what is beyond.

Purposes/functions of documentation

Artefacts undergo a peculiar change of state when they cease to be useful objects and are taken up by museums and historic sites. They become valued less for what they can do than for possessing the almost holy properties of information and evidence. The worshipers at this altar are: curators who keep the artefacts and make them available; conservators who try to make them last; and historians who try to pry stories from them.

It is not enough to say that the purpose of documentation is to store information. Beyond that, the purpose of documentation is to explain. The newspaperman's *who, what, when, where, why,* and *how* are also the historian's questions. An historian of technology may be less interested in the fact that a piece of machinery is 5.85m long, than the fact that it took three men to operate, and that the design remained unchanged for seventy five years.

On the other hand, restorers of machinery, even today, seem to have a tendency to do whatever it takes to get the device working and worry about documenting their actions later, if at all. They seem less to be generators of documentation than to be consumers, who need for example, accurate dimensions to make new parts.

A documentation system

It may be useful to place conservation documentation in the context of an overall museum documentation system. In museums, there are generally three classes of documentation: initial, item, and control. [1] These are instituted for different reasons. All three are needed to properly account for, identify, and manage artefacts in a museum.

Initially, objects come to a museum primarily for acquisition or loan. Paper and electronic systems are used to track custody, shipping, and ownership. Usually the process is called accessioning.

Information about the object itself constitute the item documentation: measurements, descriptions, photos and histories. Conservation examination and treatment records are a type of item documentation.

Control documentation will record the location and any movements of the object in the museum, from display to storage for example, or out for conservation or loan to another institution. Many of the activities of collection managers are in this phase.

Types of documentation

Another way to look at documentation, in contrast to the functional classification above, is to consider the means of creating the information. Table 1 (below) is meant to be illustrative, not definitive.

Photographic documentation captures on film or ccd plates (for digital cameras) relatively neutral visual aspects of objects.

Observational documentation is the result of human observation (sometimes under low power magnification) resulting in descriptive narratives or checklists of key descriptors.

Documentation Type	Direct Result
Photographic	Photo: day, UV, IR
Observational	Words: Narrative, checklist

Instrumental	Numbers, photos, graphs
Pictorial:	
i) illustrative	Sketch, rendering, painting
ii) dimensional	Numbers, drawings

Table 1

Instrumental documentation arises from sample analysis, x-rays, SEM photos and the like. The results take the form of numerical descriptions of elemental compositions, graphs, micron scale photos, and so on.

Pictorial documentation, created 'by hand', comes in two forms:

i) dimensional - various kinds of numerically annotated drawings which attempt a calibrated pictorial depiction of the artefact.

ii) illustrative - sketches, paintings, shaded perspective drawings, diagrams.

Levels of documentation.

We all have a sense that some documentation reports are more elaborate or complex than others. What constitutes the complexity? It would be easy to answer: 'more.' Well, more of what?

Let's re-sort the kind of data included in documentation, as outlined in the previous section, and get some sense of general levels of complexity.

Considering only objects themselves, at the most simple level, for the purposes of inventory and accountability, we may only count things. A preliminary site survey may only record that a shop had fifty four machines, of whatever nature.

One step up, and we identify the general class: 'here is a lathe.'

The goal is to do a lot better and come up with a definitive descriptive label: 'second generation *Blanchard* gunstock lathe.' Associated with this would be the usual feature descriptions in narrative text or a checklist.

Beyond the descriptive level, we are faced with a variety of choices. We can do some, all, or none of them. In brief, the choices are:

- photos,
- drawings,
- physical/chemical analysis,
- history,
- operational experiments to determine capacities and performance.

In addition to all of the above, which apply to information about the particular object or machine, there is a secondary level we can call the contextual level. This is where we can tell the story of the artefact in the full context of history and society, finding its place in the web of culture. [2]

Let's simplify the above scheme, and see how the levels appear:

i) descriptive.
ii) pictorial, analytical, historical.
iii) contextual.

Each of the levels can be done more or less elaborately, as we choose. Is there any guidance?

AIC guidelines and commentaries

With the above as background, it will be easier to bring some order to our sense of what is routine documentation for conservators and what is not. One approach, is to look at how documentation is specified by others, for example, The American Institute for Conservation. A rather concise set of *Guidelines for Practice* are in turn supplemented by a series of commentaries. [3] The Commentaries set out to define both a minimum level of practice, as well as a more elaborate recommended level.

For any type of documentation, the Commentaries state that at the minimum level, records need to: indicate their purpose, the name of the writer, the date of the record, and enough object identifying information to uniquely identify the object. Whereas the Guidelines merely require descriptions of structure, materials, condition, and relevant history 'as appropriate,' the Commentaries are more specific. Examination reports will have: observational data, parts and associated elements will be noted, examination methods will be recorded and present condition described, including evidence of past treatments and the situation that appears to require treatment.

The Guidelines mainly refer to written documentation. They specify the addition of pictorial documentation only 'when appropriate.' Not much guidance there.

The Commentaries state that at the minimum level, pictorial documentation is required only in those cases where treatment will alter the appearance of the artefact. However, recommended practice is to include pictorial documentation 'necessary to illustrate condition and relevant details accurately,' whether appearance is to be altered or not. It is also recommended that photos include a grey scale, a light direction indicator, and a colour scale for records made on colour films. Drawings would need size scales to be complete.

Exceptions can be made for such situations as dealing with emergencies or large numbers of similar objects.

When it comes to the documentation of treatment the Commentaries provide particularly pointed guidance in specifying what to include. In addition to the object data, one is encourage to provide documentation of:

i) procedures,

ii) materials added,

iii) materials used,

iv) removed materials,

v) materials obscured by treatment,

vi) new information about objects revealed during treatment (including features hidden by assembly),

vii) changes in the artefact as a result of treatment, including its state after treatment,

viii) deviations from proposal.

This is familiar territory for conservators, so we need not discuss much of this scheme in detail. Point (vi) however, is more open-ended and leads to issues I would like to explore further.

The Commentaries recommend that we document any new information about the object which is revealed during the course of treatment. This would include such things as marks previously hidden by grime or corrosion. I would add that, in my view, this also implies documenting to a certain extent features hidden by assembly (or reassembly). Since industrial equipment, machines, and engines can be endlessly complicated, documenting the disassembled artefact could be quite time consuming and involve a lot of effort not directly related to the task of preservation. This information however could be of much use to historians or mechanics who need to have access to the insides of things.

If a conservator is not working directly with others who may want this information, the conservator has to consider whether the needs of others could also be accommodated while treatment proceeds. To help make the decision, conservators should consider a couple of factors:

i) can the object be disassembled again relatively easily when others need access? If so, then documentation need be only as deep as the need to document the treatment itself. If it is too time consuming, costly, complicated, or damaging to disassemble the artefact again, the conservator should make plans to complete additional documentation.

Ii) is the object a wasting resource or not? Equipment outside, for example, is notoriously subject to erosion by the elements as well as by visitors. Important parts can be thinned or perforated by corrosion, or removed entirely by vandals. Vulnerable objects will need more complete documentation.

If the object is fairly well protected, one could decide that any documentation beyond that needed for recording treatment could wait until a later time because the object is, in effect, 'self-documenting.' By that I do not mean that the object records itself, but that it embodies its features and measurements. It will more or less always be available for future documenting by those who desire to do so.

In truth, these considerations need evaluating whether or not the object needs disassembly to reveal the hidden. Many important features are right out in the open.

Potential users

If we decide that our situation is such that we are going to have to provide some level of documentation for other users, we need then to be clear on who the other users are, and what use they are going to make of the information we provide. Our level of effort depends on it. We may not be able to accommodate all potential users.

Collection managers may want only to store the object. In that case, they may only need a set of rough overall dimensions of the object or of each of its dismantled parts. No precision is called for. A picture would be nice, so as to tell one object from another.

Restorers, mechanics and engineers may have more complicated needs. They may want to make a machine work again (or keep working), or they may need to replicate a part for another machine. In either case, they must have very detailed information about the part. But, in other cases, measurements will have to be made, to quite high precision for parts which 'mate, slide, rotate or mesh and must do so accurately for the machine to function properly.' [4] Disassembly of structures will often be required. This gets into machinist territory and a knowledge of tolerances (for example, ±.0002m) and fits (for example, running, locational, sliding, and force), and other craft details. This may be more than many conservators can handle, and so their usual documentation may not be of much use to the craftsman.

The study of machines

As we are finding out, the question of how much documentation is enough can only be answered in reference to the kinds of questions people ask artefacts to answer. For the historian or the historian of technology the questions have varied over the years. At first the questions were basic: who invented what, and how did each invention 'evolve.' Typology and lists of significant features were a big concern. [5] Building on this, other historians became interested in systems of processing and manufacturing. Recently, a few historians have looked in detail at individual machines to assess their capabilities and the sophistication of their makers.

If the concern is interchangeabillity of parts, then a close look is needed at such details as the marks left by milling or hand filing. [6]

For the last twenty years or so, the main concern of historians of technology has been 'context.' [7] They might be interested in the role of the machine in the factory system in relation to, for example, the hierarchy of skills, or technology transfer from one industry to another as experienced workers move around.

Documentation of machines

The historian needs information from the conservator at two levels. At the first level, the concern is with the details of the machine, equipment, or engine: how the parts are organized, the nature of the finishes, how it operates, and so on. Good clear photos are a start. But, to go the extra mile, good drawings are ideal, whether they are dimensioned like shop drawings, or merely pictorial, to show the arrangement of parts, or even schematic, to show process. With technological artefacts of the last century and a half, we may have, with any luck, original drawings to start with and compare. The machine may have been modified during the production run, almost certainly changed to some degree during its life, and perhaps is now showing some losses. Each machine, piece of equipment, or engine has developed a unique character which is not preserved in 'original' drawings. Drawings showing the current state are the goal here.

A second level of machine documentation by historians of technology is that of a detailed measurement and analysis of particular machines with the end of determining their operational characteristics and of the craftsmanship of their makers. One example is an analysis of a metal planing machine from the 1845-51 period by Robert Gordon. [8] Here he measured critical surfaces to as precise as a ten thousandth of an inch. He went on to discuss his interpretation of the measurements in determining how the machine was built, the adequacy of the design to do the job it was intended for, and an assessment of the skills of the mechanics who designed and built it.

An analysis at this level requires measuring tools capable of much greater precision than those used in making the machine. '*A general rule of thumb is that any instrument used for checking a part should be ten times as accurate as the requirements of the part.*' [9]

Drawing Types

If one is lucky, there may be period drawings available. Typically, especially as the 19th century progresses, each project would use several kinds of drawings, for example, for design, construction and presentation. Since the different types often were kept in different locations, chances are that at least part of one set survives.

However, even if original drawings exist, remeasurement is called for. Things change, wear, and are replaced.

In addition to the usual measured drawings other types of drawings, some with minimal or no dimensioning, could prove useful to the historian. For example, complex process flows are much easier to grasp with a clear schematic drawing. Involved gear and lever constructions may appear confusing in photos, but may be made comprehensible in a good illustrative 3-D drawing.

Measurements

Taking measurements for as-is drawings need not be done to the degree of precision as for measurements done for part replication. In fact, measurements need not be done to any greater precision than will show up in the finished drawing. [10]

Field notes, however, can preserve a record of greater precision than can show up in the drawing:

'Accuracy is a matter of definition, tape graduations, purpose of your drawings and the precision to which the structure or object was built. As a matter of definition, 'accuracy' really refers to the error tolerance permitted or realistically achievable in the field. There is a point beyond which narrow error tolerances become counterproductive in terms of time and information content. Common sense indicates that you would not try to measure a fifty-foot high pumping engine to the nearest millionth of an inch, or the length of a rough stone wall to the nearest sixteenth of an inch. But neither should you settle for simply the nearest inch or foot when conditions permit and demand finer work, especially where precision has some bearing on the significance of the object or structure being recorded......................as for the instruments used for measuring--tapes, stick rules, machinists' scales, transit verniers, etc.--the accuracy can be no better than ½ of the smallest graduation on the instrument.' [11]

The manual, Recording Historic Structures, has guidelines for the documentation of buildings, engineering structures, and machines for two US government programs: The Historic American Buildings Survey, and the Historic American Engineering Record. [12] Conservators of industrial material will find much of interest in these standards and recommendations for the production of both photographs and drawings. Some helpful tips:

'When measuring to shafts, gears, wheels, or levers, for example, measurements are conventionally taken to their centers of rotation .....
...it is of great importance to record the sectional dimensions of rolled and built-up shapes in bridges to within at least 1//16 of a inch. Such accuracy is vital in determining the proper size, weight and other physical properties of the members necessary for structural analysis that may be conducted by future users of the drawings.'

They recommend that the rotational direction of moving parts, as well as speed, be indicated. For gears, we should note the diameter and number of teeth. For pressure cylinders, note bore, stroke, and psi. For crankpins, note relative phases.

All this seems to me to be well within the scope of conservator abilities, if it is desired to help the historian, and time and funds allow.

Photographs

It may seem that conservators take a lot of photographs, but in practice it often turns out that there are too few views of each individual object to really record all the important visible details. If conservators have the first and best access to all sides, including the insides, of an object they should take as many pictures as possible. With not much extra effort, conservators can take photos that can provide useful information to historians, as well as document their own treatment.

Conclusion

How much more conservators might document, beyond the minimum required for treatment, depends on the end use of the documentation. We can summarize by saying, it depends on whether you want to store it (the object), draw it, preserve it, replicate it or study it:

i) to store an object requires only overall dimensions of the object or its parts, perhaps total weight, and such variables as the status of fuel and lubrication tanks. Collection managers are the primary consumers of this general level of documentation.

ii) to draw an object may require measurements only to the resolution of the final drawing, though notes can preserve more precise observations. Some kinds of drawings can be made from good photographs. Historians of technology, in particular, will find good drawings helpful for their work. Conservators should have no trouble in being involved at this level if they choose.

iii) for preserving objects, the AIC Guidelines/Commentaries provide a good set of features for the documentation of examination and treatment. More photographs of features and details are better. Physical or chemical analyses are usually only required for industrial objects if there is a very specific question and are not usually done on speculation.

iv) replication will usually require precise measurements and the craft knowledge of machinists, among other trades. In most situations I believe that this level of involvement is beyond what can normally be expected from conservator's normal practice. Even very good conservation documentation is likely to be inadequate for this purpose. A great deal of extra effort would be required.

v) to study the ways a machine is built and designed will need the above noted documentation levels to start with, but will require special precision techniques practiced to a much finer resolution than needed even by the craft workers. Comparisons with 19th century techniques may require application of good present day practice. Comparisons with 20th century techniques may require use of the best present day practices to yield useful information.

In summary, I believe that with a little extra effort, conservators can produce documentation useful to historians of technology, but which is unlikely to be precise enough to satisfy the needs of the restorer. Restorers, for their part, need to pay more attention to documenting their actions. Conservators could be less rigid about the machine-as-document in some cases, and allow restorers to make some changes, as long as the documentation is sufficiently detailed. In this way each may move closer together, and we can have a well documented artefact that also works and moves.

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IDENTIFYING FACTORS CAUSING DAMAGE TO WELSH COAL MINING COLLECTIONS

J Henderson and C Thompson

Abstract

A Burning Issue, is the Council of Museums in Wales' survey of coal mining collections held in Welsh museums. The research undertaken offered a unique opportunity to research historical and technical details of the collections. It was also possible to investigate the condition of the objects and the factors which may have contributed to this.

The paper outlines the survey method. This includes an assessment of the validity of the data collected and a discussion about identifying the critical factors from the survey affecting the decay of the collections.

Analysis of the results allowed comparisons of object condition with a number of criteria. This comparison leads to a demonstrable correlation between physical protection and environmental conditions and the level of damage to mining collections in Wales.

Introduction

I saw the riches of the earth crumbled before picks and taken away by the shovel. It came to me presently, as with all other things, those riches would have an end. The money would not be paid, for there would be none for master or man. The pick and shovel would rust. The collieries would be left to flood water and rats. The men would go. The houses would empty. The chapel would be dark. The grass would try to cover all, out of pity.

And I was afraid.

How Green Was My Valley
1939 [1]

A Burning Issue, the Council of Museums in Wales survey of the coal mining collections held in Welsh museums, is the latest in a small group of such reports which have been responses to the rapid UK colliery closure programme of the 1980s and early 1990s. [2,3,4,]

The need for a survey of Welsh coal mining collections was raised by some members of the museum community in the early 1980s. [5] The Welsh coal industry had contracted during the 1960s and further closures seemed inevitable during the 1980s. A comprehensive handlisting of items held by various organisations would be needed so that gaps in collections could be identified and, hopefully, filled from closing collieries.

In the event the pit closure programme was more rapid than anyone had predicted. Most museums had financial problems; lack of staff meant that even simple handlisting was often out of the question. There was little discussion between museums about collecting policies. Museum staff, realising that this was the last opportunity to collect mining equipment, accepted almost everything offered to them.

It was not until the early 1990s, when only two deep mines remained in Wales, that a small working group was set up, under the auspices of CMW, to explore the feasibility of undertaking an in-depth survey of coal mining collections.

The Researcher

From the start it was agreed that any survey should not be desk-bound but ‘hands on’, with the researcher visiting as many organisations, and viewing as many objects as possible. With this in mind it was decided to appoint a person with a good knowledge of the mining industry as research assistant.

The Survey

Aims and structure
The main aims of the survey were as follows:-

1. *To research, create and make available a comprehensive computerised data base of museum coal mining collections.*
2. *To assess the nature of individual collections.*
3. *To identify gaps and advise on an integrated collecting policy.*
4. *To evaluate collection management.*
5. *To examine financial and marketing strategy.*
6. *To review the future.* [6]

The Welsh survey differs from its companions, in that its primary aim was the creation of a computerised database. [7,8] The research undertaken for the database offered a unique opportunity to ask as many questions as possible. As well as researching historical and technical details of an artefact it was possible to investigate its condition and where it was stored.

Collections were located by sending out a simple questionnaire asking various institutions if they held coal mining related material.

The visits comprised an informal interview with the person responsible for the collection, examination of the accession registers (if applicable), and a viewing of all storage and display areas. Because of the ‘hands on’ nature of the project permission was sought to inspect all coal related artefacts in the institution’s collection - this had two aims:

i) To ensure that the documentation had correctly identified the object.

ii) To determine the condition of the object.

The database covers all items directly connected to the coal mining industry, except buildings, photographs, archive and published material.

The data base now contains details of four thousand five hundred and thirty six items held at twenty-six institutions - major collections being located at *Bersham Ironworks & Heritage Centre, Big Pit Blaenafon, Cefn Coed Colliery Museum, South Wales Miners’ Museum, Rhondda Heritage Park and the Welsh Industrial & Maritime Museum*.

Constructing the conservation survey

Scale and scope
It must be stressed that conservation was not the primary objective of the survey and that the researcher had a background in coal mining and Welsh history rather than in conservation. Therefore, in order to fulfil aim 4, ‘To evaluate collection management’ a simple guide to asking questions and recording information was required. Areas of study were considered which could provide indicators on the condition of collections and on the range of factors which may have

contributed to that condition. This may also help to identify measures which could be implemented in the future and contribute in a small way to aim 6, ‘To review the future’.

Two areas which we thought could be surveyed relatively easily, and would provide useful information, were the object condition and quality of the storage environment. *

Condition

A number of condition surveys have been developed by museum staff, and a common factor is the use of a 1-4 condition grade. [9,10,11] These overall grades are normally based on an aggregate score from a number of sub categories of damage. Inconsistency in ascribing a value may be reduced by this breakdown of damage categories but this technique was not employed for a number of reasons, two of which are worth elaborating on.

The first is that most published work on the results of collection surveys concentrates on the interpretation of the condition grade alone rather than a detailed discussion of the sub categories. Neither the resources nor the inclination were available to collect data which would not be used subsequently.

The second reason was that a single person was to assess all items over a relatively short period of time, so there was no need to collate results of researchers with different perceptions. [12] Descriptions of collection condition are not intended to be absolute but in these circumstances are made on a subjective but reliable basis. These definitions should therefore create a scale which allows a general comparison of the condition of items; and so allow an insight into the factors which affect their condition. As condition was assessed by a single researcher (following discussions with conservators) the relative values of the categories were assumed to be valid. The condition of an item was categorised as simply as possible;-1= good, 2= fair, 3= poor, 4= bad.

It is usual for some mining museums to retain original dirt and refrain from repairing any damage associated with the original function of the object and this policy was taken into consideration in the condition assessment. The condition grade was based on damage that had been caused within the museum rather than on the coalface. An extreme example of this is a lamp which survived the Abercarn explosion of 1878 and was recovered when old workings were explored during the 1920s. The gauze and pillars were missing, the base of the oil vessel was burnt away and the glass showed the effects of great heat. However, this object was given a ‘1’ on the database. On the other hand a perfectly useable NCB issue rubber kneepad which had suffered the effects of a leak of corrosive battery acid in the museum store was given a ‘4’.

It may be impossible for this process to be entirely accurate, but the researcher’s comprehensive understanding of the original functions and history of the artefacts should ensure a high level of reliability. By discounting as much intrinsic damage as possible, the results should be a better indicator of current threats to museum mining collections.

The existing documentation of the collections was often very basic and did not always contain enough

* For the purpose of the survey store describes conditions both in store and on display.

information to adjust the assessment based on the age of the artefacts or their condition as they arrived at the museum. Neither of these factors were therefore taken into consideration.

Storage
In describing the quality of the storage of an item, two questions were used as indicators. One addressed the environmental and the other the physical protection of the item.

The first question looked at the building, or lack of it, in which the collections were held. Conditions could range from open air, and therefore uncontrolled light, humidity and pollution etc. to a closed building where the humidity changes would be buffered, and light and pollution levels reduced. The two intermediate options were artefacts in the open air but sheltered (OC), and artefacts held in what was described as an open building (OB). An open building, one with permanent or daily openings in the building fabric, whilst sheltering an artefact, would closely replicate outdoor conditions.

The second question looked at the quality of storage of an item. The indicator of the quality of physical protection was whether objects were stored individually or were piled up on top of each other. Items which were piled on top of each other without enough space were described as ‘yes’ piled up. Where an item was free standing or had a distinct space on a shelf it was entered as ‘no’, not piled up. Objects which were correctly packed and supported in boxes were recorded as a ‘no’. Although not an absolute guide it is reasonable to assume that objects which are piled up are not being handled with the same level of care as objects which had been stored more thoughtfully.

During research the amount of objects in the open air under shelters was discovered to be negligible and these results have been merged with open air. Also only three items were categorised as bad so the categories of poor and bad were merged.

Results

Working with the database it is possible to compare the condition of the objects with any of the other criteria. Several relationships were investigated and rejected as the results were not considered relevant or meaningful.

Comparison by museum was not considered to be useful for two main reasons. The first is that different museums had acquired collections from different periods of mining history. Therefore, some museums have archaeological items whilst others had collections which had only recently passed out of use. The second reason is that most of the items assessed were ones which had been accessioned into the museum collection. Where not all items in the museum are accessioned the process had often begun with the best material. In contrast museums with no accessioning backlog were more likely to have accessioned the poorer items of the collections. Consequently, a well managed museum could appear to have a collection in worse condition than a museum with documentation backlogs.

Comparisons of object condition by date of manufacture could have been a useful exercise. Unfortunately within the scope of the research, and working with the existing museum documentation this was not possible.

In contrast other correlations were investigated and found to produce meaningful and useful results.

The effect of storage on condition

The correlation of condition against storage, attempts to quantify what must be a common sense assumption that the quality of the storage environment will affect the condition of the collections held there.

Results are summarised in Figure 1 which compares object condition with storage environment for all of the collections surveyed (by August 1996). Along the horizontal axis the six different storage conditions are listed (open air/piled up, closed building/not piled up etc.). The vertical axis represents the amount of objects in each condition category (good, fair, poor) as a percentage of the total in that storage environment. Total numbers in the categories are included as data labels on top of each bar.

An initial review of the results demonstrates quite clearly a continuous improvement in the condition of the collections as the quality of their environment is improved. In the best environment, a closed building with enough space for each item, nearly 90% of items are described as being in good condition. In the worst environment, of objects piled up with no shelter, less than 10% of items are in good condition.

There are however other, more subtle, trends which can be identified. Comparing the poorer environments (open air, OA, and open building, OB,) it is the quality of the physical protection which is the crucial factor in collection condition (Are the objects piled up? Yes or No). Table 1 separates out the figures to look at this point in more detail. Comparison of the percentage of objects in good or fair condition with the different types of storage conditions demonstrates fairly similar results for both open air and open buildings. This indicates that when the environment is poor the physical protection is the more critical factor.

Items categorised as Good or Fair

	Piled up	Not piled up
Open Air	21%	80%
Open Building	25%	93%

Table 1

Moving to the closed building where environmental factors would be expected to be more favourable to the artefacts they are in much better condition. Physical protection, although still important, is a less decisive factor.

Items categorised as Good or Fair

	Piled up	Not piled up
Closed Building	95%	98%

Table 2

In the poorer storage environments, (OA OB.), the percentage of the items classified as good did not exceed 18%. In the closed building 65% of the items which were piled up were classified as good, and 88% of the items not piled up were classified as good. This is a clear indicator of the relationship between the environment in which the collection is held and its condition.

It is worth noting that the closed building described in the survey does not necessarily provide ideal environmental standards. [13] To be described in this way a building merely had to provide continuous shelter. Better standards such as stable RH and low U/V and light levels should also be an objective when housing important or vulnerable collections. [14] Nonetheless, a closed building where objects are stored with moderate physical protection, can be seen to provide significant levels of protection. This could be a realistic benchmark for minimum standards of care for all but the largest objects.

When survey results agree with previously held assumptions it is tempting to view them uncritically. We wanted to avoid this and challenge these results. In particular we asked whether the results prove that damage is the direct result of poor storage, or if items which arrive at the museum in poor condition (damaged) are put into poor storage.

Working with the existing database an attempt was been made to check this. There were no reliable records of object condition prior to acquisition so a more imaginative solution had to be found. We attempted to identify objects which may have been in good condition on arrival, which would then have been allocated the best storage environment. This was done by identifying a group of ‘emotive objects’. These artefacts are ones which are easy to sympathise with; for example, symbols of the mining industry, valuable items or artefacts likely to be used in displays and interpretation. A selection was made from the database categories. Categories chosen are fully listed in Appendix 1 but included flame safety lamps, items associated with pit ponies, trade union activities (for example banners) and personal items (such as tobacco tins and watch cases).

The condition of the group of emotive items was then compared with the collection as a whole. As can be seen from Figure 2, the patterns of condition are strikingly similar for each group. The results of this comparison would suggest that the most valued objects receive no significantly better care than other parts of the collection. This would indicate that there is no initial sorting of items as they arrive at the museums to allocate different levels of care. Even those items which may have been assumed to have been valued on arrival at a museum are degrading at a comparable rate to the rest of the collection. Damage to the collections that is not attributable to the items previous use can then be attributed to the care, or lack of it, in the museums.

Summary of results

- Failing to provide basic storage is a significant cause of damage,
- Items of perceived high value are likely to degrade at similar rates to the rest of the collections,
- Where a good building is not possible, physical protection may be a better investment than minimal environmental protection such as canopies or shelters,
- All items, regardless of perceived value, held in good buildings and with adequate physical support, are likely to be preserved in good condition.

Conclusions

We can conclude that the survey shows that the failure to provide adequate storage provision is the cause of damage to all sections of the collections. Basic preventive conservation measures can have an enormous impact on the rate of damage to collections. Physical support should be a basic minimum standard for any item collected by an industrial, or indeed any, museum, even if the future use of the object is not clear. The combination of physical protection and a building which buffers the weather should be a realistic target for all but the largest of objects which the museum intends to preserve for the future.

Mining museums face the challenge of caring for large collections of complex items of varying sizes with limited resources. In this context there are still realistic and practical measures which this paper demonstrates will make a measurable difference to collection condition, even over a short period of time. It does not require enormous technical expertise to implement basic preventive conservation strategies.

Guidelines on basic care are available from a number of sources including the MGC and the Area Museum Councils.[15,16] The fact that even items which may be perceived as being important are not receiving any better level of care may suggest that many of those responsible for the collections are do not feel that strategies to implement basic preventive conservation measures are pertinent to their field. This may indicate the need for training in the core functions of museum work in particular, collections care.

Mining collections have, by and large, been collected over decades, yet museums must now try to care for them for centuries. Even during the relatively short time that some collections have been exposed to 'curatorial neglect' the statistics show the damage is already being done.[17] Poor storage as a short term problem, initiated by limited resources, will ultimately manifest itself in damage to the collections, generating conservation and access problems for the long term.

Those with responsibility for collections cannot afford to see conservation simply as a debate about levels of restoration between conservators and engineers but as an issue of collections management and resource allocation. Policy makers should consider 'not damaging' items as their first priority in providing conservation for their collections and invest in basic preventive conservation. Resources found to restore damaged objects should be re-directed for this purpose. Collections should be considered as a whole and the scope of industrial conservation extended far beyond individual restoration projects.

Appendix 1

Emotive items

Mine Lighting
- mobile (naked flame)
- mobile (flame safety)

Production and Development
- hand tools
- transport
- horse

First Aid / Rescue / Recovery / Disasters
- first aid and medical
- rescue and recovery
- fire fighting
- disasters

Signs and Notices

Clothing / Personal Items
- work ware
- protective clothing
- food / drink containers
- tobacco and watch containers

Trade Union
- banners

- tokens / badges
- strikes and lockouts

Fine Art
- paintings
- sculpture

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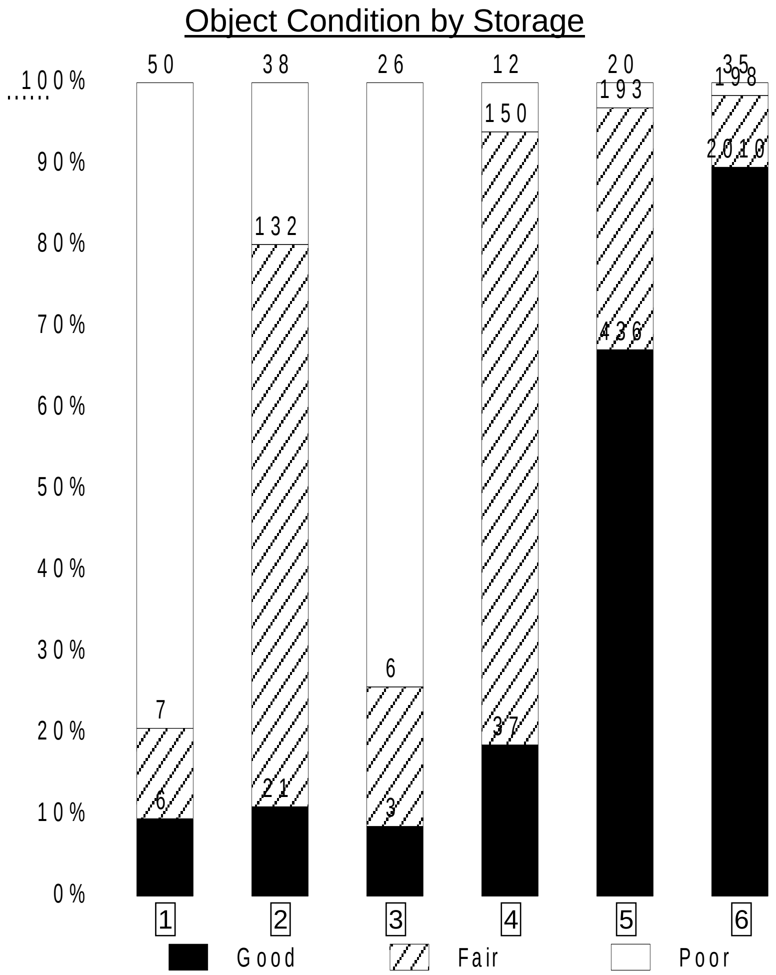
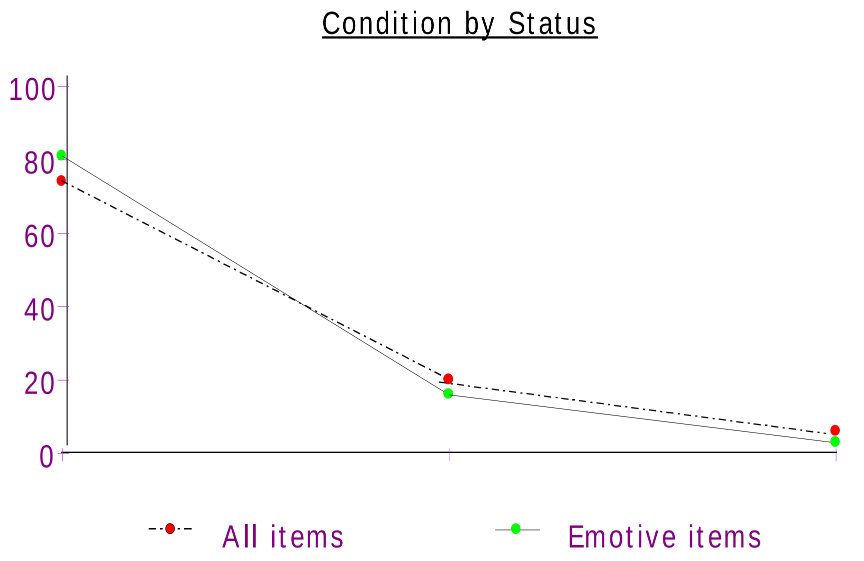
Figure 1



1=Open Air / Piled up
2=Open Air / Not piled up
3=Open Building / Piled up
4=Open Building / Not piled up
5=Closed Building / Piled up
6=Closed Building / Not piled up

Figure 2



MAINTENANCE OF WORKING OBJECTS AT BIG PIT MINING MUSEUM

P Walker

Abstract

Museums have long recognised the fact that demonstrating an object in motion can add immeasurably to the understanding of its purpose and significance. At Big Pit the daily operation of historic mining machinery is not only desirable but is in fact essential to the continued operation of the museum. As Big Pit is still classed as a working mine by the Health and Safety Executive, however, the requirements of mining and other health and safety legislation must take priority over the normal curatorial concerns of operating historically significant objects.

This short paper seeks to demonstrate how the standard of care of working objects at Big Pit is nevertheless comparable with, if not better than, the current best practice used in many traditional museums. The system of maintenance at Big Pit will be explained and it will be shown that the requirements for ensuring the continued safe operation of an item of mining equipment are similar to those for ensuring its continued preservation as a museum object.

Introduction

Mining is an ephemeral activity. Geological strata are ripped out in their entirety, often with scant regard for the surface environment. Machinery, tools and, at one time, even the lives of men were treated as expendable in the quest for valuable minerals. Once reserves have been exhausted, mines are closed, expensive equipment is often abandoned underground, shafts are filled and capped, tips reclaimed and surface areas, workshops, offices and headgear demolished for redevelopment.

There is not much room for sentimentality in a miner's working life. The dangers and hardships of the job and the constant pressure for high output at low cost see to that. In the case of coal, even the final product of this barbaric activity is burned to provide transient heat and light or to allow 'nerds' to surf the internet.

It might therefore be seen as ludicrously arrogant for a mining engineer to talk about good practice in conservation. But, ironically, the mining industry's enforced concern for the health and safety of its workforce in an inherently dangerous and hostile environment has led to the adoption of maintenance systems which have a rigour and thoroughness which will appeal to the professional conservator. In particular, the concern for meticulous documentation and a complete maintenance audit path for each item of equipment from acquisition to disposal means that MODES or Spectrum might well have been copied from the record-keeping system that the mining industry has been working to for decades. [1,2]

This paper sets out to give a brief overview of some of these systems and to illustrate how well they have served in the transition of a working colliery to a 'working' museum of the coal industry.

The Big Pit Mining Museum

When the National Coal Board colliery at Big Pit closed in 1980, there were still some forty collieries working in the South Wales Area, employing around twenty five thousand men. Not even Cassandra would have seriously predicted the virtual extinction of this industry with in the next quarter century. Although called a 'museum' from the outset, Big Pit's primary purpose was to be a job-creating tourist attraction based on the unique appeal of an underground tour of a 'working' colliery. Ostensibly, at least, for that reason the mine was leased to an independent charitable trust and never provided with public revenue funding, forcing it to exist by its own capacity to generate income. In doing this, Big Pit has become the most visited mining museum in Britain. Since it opened to the public in 1983, some one and a half million people have travelled down the shaft, around 30% of whom have been overseas visitors.

In addition to the two miles or so of underground roadways, the curtilage at Big Pit includes a surface area of approximately 54.7 acres containing a unique range of buildings. In 1995, Cadw: Welsh Historic Monuments listed twelve buildings and structures on the Big Pit site and yet none of these is of exceptional architectural merit!

Most are described on the schedules as 'included for group value with other listed items at this exceptionally complete colliery site'. [3] Cadw have taken the view that the site's value to the nation's heritage lies in the fact that 'Big Pit is regarded as being the most functionally complete colliery complex remaining in South Wales and its underground accessibility and presentation is of outstanding importance'. [4]

Cadw's view of the importance of the underground sections of the mine appears to accord with public perception of the site for some 95% of visitors take the underground tour and cite this as the main reason for their visit. The underground tour is also the reason why, despite its relative inaccessibility, high admission prices and underdevelopment, Big Pit has consistently been among the most visited museums in Wales throughout its fourteen year life.

The transition of the South Wales coal industry from major employer and mainstay of the economy to a slice of our national heritage has placed great pressure on Big Pit to respond by becoming a 'proper' museum with resources and professionalism commensurate with the importance of what it preserves of the history of Wales.

That process has begun but is still in its early stages. In the meantime we are very aware of our shortcomings as a museum, not least as regards our inability to care adequately for the large amount of material that we have acquired in the wake of closure of other British Coal collieries. Whereas we are able to provide reasonable curation for small objects, the considerable scale of the large object acquisition has been well beyond our current resources to manage adequately. Fortunately, they are all quite robust and we had no option other than to take them when offered or they would be lost.

I shall therefore move rapidly on from the non-working objects with the consoling thought that they help to add to the realism of a colliery environment! The treatment of our working machinery and the 'live' parts of the mine is a different matter entirely.

Maintenance procedures at coal mines

A great deal of Big Pit's appeal as a visitor destination derives from the fact that it is an authentic 'deep' mine, with genuine underground workings which are reached by means of a shaft rather than an adit. It is therefore classed as a working mine by the Health & Safety Executive and is required to meet the stringent standards set by mining legislation and health and safety regulations just like any other coal mine.

Under the Management and Administration of Safety and Health at Mines Regulations, 1993, which replaced previous long-standing legislation, the manager of every mine must ensure that underground workings are regularly inspected for adequate ventilation, support, etc., and that all plant and equipment is safely installed, commissioned and operated.[5] Furthermore, the manager is required to prepare and maintain a suitable written scheme for the systematic inspection, examination, testing, maintenance and, where necessary, repair, renewal or decommissioning of the said plant and equipment. All this must be done under the direction and management of suitably qualified, competent and authorised persons. This is called the Manager's Scheme of Maintenance and it must take account of numerous requirements which are imposed by law as well as of practices designed to ensure compliance with proper standards of engineering.

The Maintenance Scheme

Maintenance falls into two broad categories:

i) curative or breakdown maintenance,
ii) planned preventative maintenance (PPM).

Because of the additional hazards associated with the mining environment it is normal for maintenance arrangements to be of the PPM type, although curative or breakdown maintenance may be acceptable where no reduction in safety occurs as a result of the breakdown. At Big Pit maintenance is of the PPM type. Acceptable PPM arrangements may be either 'time-based', in which equipment is examined, checked and maintained at intervals based on work done or calendar time, or 'condition-based', in which the equipment is maintained only when its condition deteriorates to a pre-determined level which is indicative of impending failure. Like most mines, Big Pit's PPM scheme includes a combination of both time- and condition-based maintenance.

The manager's PPM scheme identifies every item of plant and equipment and specifies the nature and frequency of the inspection, examination, test or action required. Like every colliery PPM scheme, Big Pit's scheme is tailored to the individual needs of the mine and ensures that the plant is kept in safe condition and that it is serviced to maintain its operating performance and continued compliance with relevant safety standards. The scheme includes:

- those examinations, checks and necessary tests or renewals which are specified in relevant legislation - winding equipment examination and testing, suspension gear changing,
- those examinations which can be identified as necessary for safety - to identify wear or deterioration on critical safety components,
- examinations and tests which are necessary to demonstrate that the system is and continues to be safe - braking systems, insulation levels on electrical equipment,
- examinations and tests on protective devices to ensure reliable operation - overload protection, thermal protection, overspeed or

overtravel protection, signalling systems and emergency stops,
- examinations and tests which experience has shown are necessary for safe operation or are recommended by manufacturers or industry codes and rules,
- specialist inspections and tests by outside personnel - insurance tests on boilers and pressure vessels,
- regular external examination by a competent person for abnormal conditions,
- taking and analysing samples of fluid or other material which may indicate the internal condition of critical plant,
- a system for reporting and dealing with defects found in plant and equipment.

The frequencies of certain examinations specified in statutory instruments (for example Pressure Vessels and the Shafts and Winding Regulations) cannot be varied by the manager's PPM scheme and must be carried out as specified in those regulations. [6,7] The frequencies of the non-statutory examinations are left to the discretion of the manager of the mine who generally follows established industry norms and best practice. The frequencies laid down in the manager's scheme are usually as follows:

- weekly (W),
- monthly (M) - one week's tolerance is allowed for non statutory maintenance,
- three monthly - two week's tolerance is allowed for non-statutory maintenance,
- six monthly - three week's tolerance is allowed for non-statutory maintenance,
- twelve monthly - four week's tolerance is allowed for non-statutory maintenance,
- three yearly,
- five yearly,
- seven yearly,
- ten yearly,
- twenty yearly.

Renewal and replacement

It is not only the frequency of statutory tests, examinations, etc., which are laid down in mining legislation but also the frequency at which specific items must be renewed or replaced. Examples of such items would be winding ropes and guide ropes, which, regardless of their conditions of service, must by law be replaced every three and twenty years respectively. Replacement of such critical components at such periods was rightfully deemed appropriate for operational mines where the conditions in which these ropes operated could be extremely harsh. The conditions at Big Pit are mild by comparison and it could be argued that in practice the working life of the ropes could be significantly extended. However, the legislation governing the life of critical items makes no exceptions for mining museums and must therefore be complied with in full.

Manager's PPM scheme

The following is a simplified description of those documents used in the manager's PPM scheme at Big Pit which can also be seen to have a significance in a curatorial context.

Form M.E. 1 - Maintenance Schedule

Without this primary document there is no maintenance scheme. It identifies every type of plant at the mine and details the type and frequency of the examinations to be carried out.

An understanding of the importance of this document can be gained by using the mechanical maintenance of the winder brake callipers as an example.

For the purposes of maintenance the winder is not considered as a single machine. It is divided up into dozens of sub-sections or systems each of which is individually dealt with on the M.E.1. The brake gear is identified with a mine number (101/82) and a Check List Number: MF001. More or less every type of item in the system requires its own maintenance checklist and all the check lists are kept together in the form of books which are referred to as and when required.

The M.E.1 then calls for an A type examination to be carried out on a daily basis: a visual examination of the various parts and for the performance of the brakes to be checked by carrying out a brake hold test.

Then as the frequency of the examinations decrease from daily to weekly, monthly, six monthly etc., the examinations and tests become more comprehensive, until we get to an F type examination, which is carried out on a ten yearly basis. It involves exactly the same maintenance as called for in A,B,C,D,& E type examinations plus non-destructive testing, with ultra sonics, of every component part of the callipers.

Form M.E. 2 - Plant Specification
The specification of each item of plant will be individually recorded on this form. Together with the plant history card (M.E.3) it forms the basic plant record. The technical specification, manufacturer, purchase price and maker's plant number will be recorded along with any other relevant information.

Form M.E. 3 - Plant History Card
This card lists all relevant events in the plant's history including any repairs, modifications etc. carried out during the life of the plant. Both the M.E.2 and M.E.3 cards are kept for the life of the plant.

Table 1

FORM. M E.1
MAINTENANCE SCHEDULE

MINES AND QUARRIES ACT 1954
The Management and Administration of
Safety and Health at Mines Regulations 1993

Manager's Scheme for the Mine
for Big Pit Mining Museum

Department: ***Mechanical*** Location: ***Winder*** Sheet No.1 of 5 Sheets

Mine	TYPE OF PLANT	CHECK LIST	Indicate type of examination by code									REMARKS
			FREQUENCY OF EXAMINATION									*Non-Destructive Testing*
Number		Number	D	W	M	3M	6M	A	3y	ET		
101/82	**Brake Gear Callipers**	**MF001**	**A**	**B**			**C**	**D**		**E**	**F**	**10 yearly**
101/83	*Blacks Hydraulic System*	*MF002*	*A*	*B*			*C*	*D*		*E*		

101/84	*Emergency Generator*	*MF016*	*A*	*B*		*B*						
101/86	*Blacks Pony Brake*	*MF001*	*A*	*B*			*C*			*D*		*10 yearly*

Form M.E. 4/5E and M.E. 4/5M - Routine Work Instructions and Reports
These essentially consist of: written work instructions for one week's daily and weekly examinations for one craftsman; and the craftsman's subsequent report on that work. If the man is absent the form must be issued to his replacement and must be completed as a record that the work has been carried out.

Form M.E. 4 (E)P and M.E.4 (M)P - Major Notifications
These are for periodic (major) electrical and mechanical examinations of a more comprehensive nature than either daily or weekly examinations. The form has room for a written report from the craftsman on each examination.

Form M.E. 6 - Defect Action Sheet
This is used when action is required because a report is received identifying a defect which could not be corrected at the time. These defects are also recorded in Statutory Defect Books M&Q 267 and 268.

Form M.E.7 - Application for Temporary Amendment of Manager's Scheme
The use of tolerance periods gives the engineers a certain flexibility by allowing them to schedule their maintenance for the most convenient time. If circumstances are such that they believe that they will be unable to carry out the maintenance within the tolerance period, they must apply to the manager for an amendment to the scheme so that they can delay the maintenance for a short period. No amendment to the scheme is allowed without the manager's approval and only non-statutory maintenance can be delayed. As a general rule, amendments to the scheme are not used at Big Pit and if the examination is scheduled for an inconvenient date it is more likely that the examination date will be brought forward rather than delayed.

Forms M.E. 10 - Record of Tests
A variety of forms is used to give a continuous record of the results of tests on various items of equipment. Records of examinations and tests are stored for a period of at least three years. Reports on the commissioning of major plant are kept for the life of the system as are the Plant Specification (M.E.2) and Plant History Cards (M.E.3).

Summary of M.E. records
The documentation is designed to ensure that the key requirements for any effective maintenance system are met. There must be a primary document that says what will be maintained and how and when it will be done. There must be a record of the detailed technical specification of every item in the system. There must be a means of recording the technical history of every item. There must be a means of issuing instructions, recording defects and recording that the specified maintenance has been carried out. There must be a means of monitoring the performance of the scheme itself. Finally both the scheme and the maintenance must be managed and carried out by suitably competent and authorised people.

Planned Improvements to the Scheme

The scheme of maintenance described above has been used in coal mines for many years and, although it has since been adapted for use in many other industries, those who conceived it can have had little idea that it would one day be used in a museum. Naturally the scheme makes no allowance for Big Pit's Museum function but there are nevertheless simple ways in which this can be remedied.

For example, as the scheme is primarily designed for health and safety reasons, it monitors operational equipment but not spares, be they either complete items of equipment or parts thereof. Big Pit has salvaged a large amount of material from closing collieries over recent years, which would have been duly accessed into the collections of many museums. We, by contrast, have acquired these items in order to provide essential spares for Big Pit's operational equipment. So, having been checked and cleaned, most of this equipment presently sits on shelves awaiting the day when it will be needed. It is our intention to extend the scheme to include these and similar items that will be acquired in future.

Naturally at production mines the scheme no longer monitors items once they cease to be operational as they are then normally consigned to the scrap bin. At Big Pit, however, once an item's operational life has ended, it can begin a new life as a traditional museum object. Thus the scheme will be modified to reflect this.

Despite the need to modify the scheme to take Big Pit's museum function into account, it can be seen how closely the requirements of the scheme match the standards for the operation, maintenance and repair of working objects laid down in the Museums & Galleries Commission publication, 'Standards in the Museum Care of Larger & Working Objects'. [8] Chapters five and twenty four of the above publication are of particular relevance to Big Pit and most of the guidelines set out in these chapters are more than adequately met in the museum's existing procedures.

The rationale for operating the collection

The museum world has long recognised the fact that demonstrating an object in motion can add immeasurably to the understanding of its purpose and significance but none of the equipment at Big Pit is operated simply for display purposes. Every item that is operated is essential to the museum's continuing function as a mine. The principal function and value of the museum's working machines is to provide visitor access to the underground areas of the mine and allow the continued maintenance of these areas by the museum's workforce. The fact that they exist as objects and can be viewed in operation by the public is incidental to their primary purpose.

In operating historic mining machinery on a daily basis Big Pit faces a similar dilemma to that of a number of other museums. Although our equipment is capable of incremental repair and refurbishment, its continued operation will almost inevitably lead to its deterioration in the long term as various parts wear out and need replacing. We take the view, however, that the maintenance of visitor access to the underground workings must take priority over the normal curatorial concerns of operating historically significant objects.

Conserving the conservators?

High engineering standards and comprehensive documentation are essential parts of any effective maintenance scheme but the standard of care of a working object is ultimately determined by the quality of those staff charged with its maintenance.

The standards of engineering currently in place at Big Pit reflect the quality of personnel that the museum has been able to recruit from amongst those leaving the mining industry during the past decade. Having gained the basic technical qualifications and experience required, during their careers with British Coal, the museum staff receive additional training as and when required in order to augment their existing skills and update them in line with current best practice. The technical competence of its staff is now vital to the museum because its increased isolation from the rest of the mining industry means that it needs to be self-contained in terms of all appropriate skills.

The museum is thus not only preserving historic machinery but is also preserving the skills and expertise necessary to keep them functioning.

Conclusion

In describing the maintenance system used at Big Pit this short paper has sought to demonstrate that the standard of care that it demands is at least comparable with current best practice in more traditional museums and that the requirements for ensuring the continued safe operation of an item of mining equipment are therefore compatible with those for ensuring its continued preservation as a museum object.

The interesting debate about how best to preserve historic machinery is likely to continue for some time. The experience gained from fourteen years of operating Big Pit as a museum inevitably leads us to support those museum professionals who contend that operating an historic object is very often the best way of preserving it. That experience also leads us to the view that whatever the object is and for whatever reason it is to be operated it must be maintained and operated in a professional manner and to a standard at least as high as that to be currently found in industry.

References

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ONTARIO HYDRO'S CORPORATE HERITAGE

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Abstract

Ontario Hydro is the major producer and supplier of electricity to the people of Ontario, Canada. Since its founding in the early 1900s the corporation has amassed a rich cultural heritage, including a wealth of large and small industrial artefacts. As part of its many mandates and management practices the corporation, has recognised that it has a responsibility to conserve those heritage resources it either owns, or affects, in the course of its day-to-day and longer range operations. To further its heritage conservation mandate, the corporation retained a multi-disciplinary consulting team of heritage conservation professionals to undertake a review and assessment of Ontario Hydro's corporate heritage resources. The consultant team's approach to the study process and the resulting conservation management strategies included: devising a comprehensive typology of heritage features; establishing themes of corporate history; providing a system of evaluation criteria; and recommending a number of management strategies to manage and plan for the conservation of heritage features.

Introduction

Ontario Hydro, one of the largest publicly owned corporate utilities in North America, is the major producer and supplier of electricity to the people of Ontario, Canada. The Corporation produces over 30,000 MW of electricity supplied through a system of five nuclear generating stations, eight fossil fuel generating stations and sixty-nine hydro-electric generating stations with two hundred and eighty eight associated dams and structures. Electricity is supplied through 29,000 km of transmission lines, 105,000 km of distribution lines and two hundred and forty five transmission stations. [1,2] The Corporation has recognized that it has a responsibility to conserve those elements of its operations that constitute heritage resources it either owns or affects in the course of its day-to-day and longer range operations. This recognition had been spurred by studies undertaken in the early 1980s.[3,4]

To further its heritage conservation mandate, the Corporation retained a multi-disciplinary consulting team (1992-1997) of heritage conservation planning consultants, a conservator, corporate historian and archaeologists to undertake a review and assessment of its corporate heritage. The study process was determined in large part by the terms of reference for the project established by the client. The consultants undertook a number of discrete activities:

- devised a typology of heritage features including non-movable heritage such as cultural landscapes and built heritage (dams, spillways and surge tanks), movable heritage (turbines, dynamos, gantry cranes and vehicles,) and intangible heritage (reminiscences, stories and other forms of oral histories),
- reviewed existing data bases and then carried out representative sampling of all identified types of corporate heritage resources to determine the quality of the cultural heritage, as well as its condition, care and maintenance,
- established themes of corporate activity that placed the development of buildings, structures, artefacts, and documents in a broad historical context understandable to the lay person or non-specialist manager responsible for heritage in their management activities,

- derived a system of evaluation criteria that could be used to determine the heritage value of identified resources both in the short term and long-term activities of Ontario Hydro,
- proposed a number of management strategies to integrate and incorporate preservation of heritage features, including movable heritage, into Ontario Hydro's long term planning activities.

Ontario Hydro: a summary history

A brief overview of Ontario Hydro's operations and its historical development is useful in understanding the scope and scale of some of the heritage management issues.

Ontario Hydro's birth in 1906 as the Hydro-Electric Power Commission of Ontario (HEPCO) was the result of considerable lobbying by Adam Beck, a successful manufacturer and mayor in South Western Ontario. As minister responsible for the power issue, he introduced legislation to create HEPCO as a Crown corporation to distribute power generated by existing companies at Niagara Falls. By the end of the first year of operation (1910), HEPCO was supplying power from Niagara Falls to twenty-one communities in Ontario as well as to Ottawa and Port Arthur, with electricity bought from local private suppliers.

HEPCO remained a distributor of power until 1914 when it bought its first generating station and later that year completed construction of the first Commission-built station. Under the pressure of demands for electricity to sustain World War I production, a series of other stations were built or purchased. This culminated in 1917 with the acquisition of the large Ontario Power Company station at Niagara Falls, and the commencement of construction on the giant and innovative generating station at Queenston which came into production in 1921. In the same year HEPCO also acquired the Toronto Power Company, a major supplier of electricity from Niagara Falls and, until then, one of the most vocal opponents of public power expansion in Northern Ontario. Throughout the 1920's successful campaigns were mounted to promote rural electrification and the greater use of electricity in the home and by industry.

The Second World War placed a strain on Ontario Hydro's ability to supply power, with approximately a quarter of its production needed to support the war effort. Due to materials and labour shortages, new generating facilities could not be built until 1945. Meanwhile, there were power shortages that reached a peak in 1947-48, about the same time that Ontario Hydro began building the first of two fossil-fueled generating plants in Windsor and Toronto.

After 1960 when the last big hydroelectric sites were developed, it became clear that the province's requirements for electricity would have to be met through additional large-scale, fossil-fuelled generating stations in some combination with the less proven alternative of nuclear technology. Ontario Hydro, with the government's blessing, opted for both. Construction of five more coal and oil-fired plants commenced during the 1960s and early 1970s. Concurrent development of major nuclear generating stations occurred, based upon the heavy water technology pioneered at Rolphton and Douglas Point, in partnership with Atomic Energy of Canada Limited.

The total hydroelectric generation capacity of Ontario Hydro now accounts for just under 25% of the utility's energy production. Yet the corporation's collection of mostly older and smaller hydroelectric generating stations are a wealth of heritage resources.

Ontario Hydro's heritage: a typology of heritage features

The legacy of nearly ninety years of human activity in the production of electrical energy has resulted, not surprisingly, in a diverse and rich variety of heritage features including:

- entire landscapes,
- individual buildings and structures,
- work areas,
- specialised places and furnishings within buildings,
- machinery and mobile equipment,
- technological devices,
- tools and miscellaneous equipment,
- archaeological remains,
- documentary materials,
- people and their reminiscences.

The consultants organised these diverse heritage assets into what they termed a 'typology' of heritage features.

This reflected not only the expertise of the consultants but also developments that were occurring in the Ontario heritage field in the early 1990s, namely a review of the Ontario Heritage Act, the prime piece of provincial heritage legislation. Literature at that time suggested that 'heritage' could be divide into four major categories: movable, immovable, tangible and intangible. These subdivisions were used in reviewing the corporate holdings of Ontario Hydro and are summarized in Table 1: Typology of Heritage Features below.

In the management study a profile sheet was compiled for each feature describing:

- whether the feature is movable or immovable,
- the category of the feature, for example cultural landscape, built heritage,
- the subclass of the category.

Further to these subdivisions information was collected on the following:

- a general description of the fundamental form of the feature,
- its constituent material elements describing the component parts of the feature,
- inherent conservation issues including corrosion, deterioration and adverse alterations.

Table 1

TYPOLOGY OF HERITAGE FEATURES

Category	Class	Type	Sub-type
Tangible:	Immovable	Cultural Landscape Units	Settlement and construction camps
			Generating stations: hydraulic, fossil fuel
		and nuclear	
			Transmission routes
			Electrical facilities
Tangible:	Immovable	Built heritage Features	Power Houses
			Dams and appurtenant features
			Intake works and water conductors
			Transmission lines
			Transformer, distribution and switching stations
			Administrative and maintenance facilities

			Dwellings, schools, community halls and stores Access routes
Tangible:	Immovable	Archaeological resources	Sites
Tangible:	Immovable	Large artefacts	Turbines Generators Governors Exciters Transformers Mobile equipment and vehicles Cranes
Tangible:	Movable	Small artefacts	Tools Furniture Scientific equipment Assorted objects
Tangible:	Movable	Documentary collections	Textual records Architectural and engineering records Cartographic records and surveys Photographic records Moving images Sound recordings Art work
Tangible:	Movable	Archaeological resources	Artefacts
Intangible:		People	Reminiscences Skills and crafts

Themes of corporate historical activity

One of the keystones in identifying, evaluating, planning and conserving any kind of heritage feature is the placement of the feature in its historical context. Typically, detailed research is often undertaken on a case-by-case basis to determine the historical context and to identify particular associations with people, events or activities. To assist all those staff who come into contact with, and who have to make decisions affecting Ontario Hydro's corporate heritage, the consultants developed a thematic scheme for Ontario Hydro's historical development. This enabled the establishment of a comprehensive, systematic and cogent overview.

The division of Ontario Hydro's corporate history into themes and sub-themes relates directly to the process of evaluating heritage resources. There was no attempt to rank the theme segments. It is assumed that by virtue of its identification, the theme is deemed of some significance to the corporation's development. Of greater importance in the assessment of heritage resources is consideration of the capability of a resource to illustrate a particular theme rather than ranking the importance of the theme itself.

The history of Ontario Hydro from 1900 to 1965 is outlined through a set of inter-connected themes. When taken together they portray a spectrum of the corporation's activities that has resulted in the creation of an important array of heritage resources. An index of the themes and theme segments of Ontario Hydro's corporate history is described in Table 2 below. More recent activities are not included as only with the passage of time can an objective assessment be made of them. Some activities that will perhaps be worthy of future consideration are the conservation of electricity, environmental impact assessment and nuclear generating stations.

For each sub-theme presented the consultants described the following:

- a time span for the activity, a general description of the theme segment including important personnel and technical contributions,
- the Ontario Hydro regions affected by the activity (based on five regions of the province: Central, Eastern, Western, Northeastern and Northwestern),
- associated theme segments,
- a range of the types of heritage features produced or associated with each of the activities.

This latter component of the thematic overview was particularly key. It enables a non-heritage specialist or non-historian, to place an identified heritage resource within a historical context. This in turn provides the basis for further evaluation.

Evaluation criteria

The determination of appropriate care, conservation, planning and management for Ontario Hydro's cultural heritage required use of a conservation decision-making process that evaluated the significance of cultural heritage.

The primary purpose of evaluation is to clarify where significance (or value) lies in cultural heritage and how that significance is expressed. Evaluation should not be used, however, to screen out or otherwise dismiss cultural heritage of 'lesser' value from conservation care.

Table 2

THEMES AND SUB-THEMES OF HISTORICAL DEVELOPMENT

Corporate Development

Building a mandate for public power (1902-1914)
Expansion and consolidation (1914-1929)
Retrenchment (1930-1935)
Power crisis (1939-1960)

Distribution of Power

First transmission lines (1908-1911)
Development of power systems (1920-1930)
Standardization (1945-1960)

Generation of Power

Hydraulic: pioneering (1880-1900)
Hydraulic: experimentation and innovation (1900-1920)
Hydraulic: expansion and standardization (1920-1940)
Hydraulic: large-scale (1940-1976)
Thermal: large-scale (1948-1977)
Nuclear: prototypes (1952-1968)

Promoting the Use of Electricity

Electric railways (1912-1920)
Rural electrification (1912-1939)
Domestic use (1912-1930)
Industrial growth (1915-1960)

Effective conservation provides comprehensive treatment appropriate to the significance of cultural heritage in all circumstances.

Accordingly, the consultants recommended that for effective evaluation of cultural heritage the use of specific criteria should be adopted. Several criteria were eventually derived based upon four general areas of evaluation:

- the *associative*, essentially related to strength of contributions to significant historic themes,
- the *intrinsic*, attached to the quality, uniqueness, representativeness, or influence of the physical forms and substance of the type of cultural heritage,
- the *contextual*, essentially related to the contribution of a resource to the larger corporate entity of Ontario Hydro,
- the *perceptual*, related to the perceived and intangible value of a resource to the larger corporate entity of Ontario Hydro.

The categories and types of features described previously (Table 1*)* also contributed to the development of evaluation criteria (Appendix 1). Specific and unique criteria were developed for each type of feature in order to recognize the inherent physical differences amongst the resources. This grouping also recognized the variations in the information collected and assessed for the different types within the classes and categories. Each criterion was further divided into individual indicators.

Any evaluation process requires supporting documentation. The criteria indicators are presented in a way that each poses a specific question. Each indicator was assigned three grades: A, B or C, each representing how well or poorly the feature fared in response to the question posed. Accordingly, for each indicator there must be supporting research, including historical documentation, field survey and/or personal interviews. It is envisaged that written documentation would be prepared so that responses could be developed for each of the relevant criteria and indicators. The written documentation would serve as a record as to the process followed, sources consulted and the conclusions reached.

The evaluation framework for Ontario Hydro's resources focuses primarily on identifying resources that are of value in illustrating the important aspects of Ontario Hydro's corporate history. The evaluation criteria were anticipated to be used either on a long term basis as part of a continuing programme of survey and assessment work or on a case-by-case basis. In order for it to be applied in a consistent and systematic manner across the corporation, the consultants advised that evaluation should be undertaken as a centralized function so that an expertise in applying the criteria could be developed.

Industrial artefact evaluation

The consultants were aware that most of the large artefacts within Ontario Hydro relate to the generation and transmission of electricity. They include machinery such as turbines, generators, transformers, governors, overhead cranes and motors. This type of machinery is usually contained in some type of enclosure or housing. Large mobile equipment and vehicles used in the construction, operation, maintenance and repair of facilities were also included in the typology (Table 1) as large artefacts.

Large artefacts have often been assessed as part of a broader evaluation of a built heritage feature in which the machinery or equipment is housed. However, evaluation processes and procedures for built heritage features are not always transferable and applicable to large artefacts. Accordingly, the consultants identified large artefacts as a group of heritage resources that required individual evaluation in their own right, with a corresponding development of management strategies.

Little work has been done in Canada to develop criteria to determine approaches to documentation, cataloguing and preservation of industrial artefacts (although some work has been undertaken in the United States). [5] The criteria developed for Ontario Hydro are considered provisional and are open for modification as experience is gained in their application. The proposed criteria were grouped into five general areas of interest for prospective evaluation, namely:

- historical associations,
- technology,
- environment,
- integrity,
- social value.

It was recommended that the evaluation criteria be used by those involved in the planning for change to machinery that could be of heritage interest. It was advised that any large artefact greater than forty years old be considered of potential heritage interest.

As with other criteria the consultants emphasized that the proposed criteria should only be used to compare like or similar large artefacts. In using and applying the criteria it is important that the particular types of large artefacts are valued each for their inherent character and consistently evaluated and compared with similar or the same type of feature.

Large and small artefact conservation and management: issues

Following the development of criteria the consultant team identified a number of pressing conservation issues and a resulting management strategy. As part of these activities the conservator focused on those industrial artefacts related to hydroelectric generation of power. The following issues were readily apparent:

- corrosion of metal components,
- degradation of plastic and rubber components,
- disposal of equipment once it is retired or decommissioned,
- selective vandalism and or cannibalism that affects the integrity of the object,
- improper storage if retained.

During its working life all equipment is subject to a maintenance schedule that includes regular inspections, maintenance and replacement of worn parts. A detailed maintenance record, documenting work carried out, usually accompanies these objects. Unfortunately, once decommissioned, regular inspection and maintenance stops. In addition, the inherent instability and sensitivity of plastic and rubber components make long-term preservation challenging and call for special care and storage conditions.

In addition to the finite life span associated with most equipment, technological advances and upgrades have resulted in entire groups of artefacts being discarded. For example, exciters are now considered an obsolete technology and an unnecessary adjunct to a generator; the conversion from 25 to 60 cycle service at several hydroelectric facilities resulted in a number of obsolete generators and turbines. Most of this equipment was discarded and sold as scrap (a ‘cost recovery’ mechanism).

Selective vandalism whereby brass nameplates and other attractive components are removed from equipment as souvenirs or retirement gifts, is common. Cannibalising components from retired machinery to repair operating equipment is considered expedient and cost-effective. In many cases it is also a necessity as parts for old equipment are no longer available.

Equipment that is not discarded (either by accident or design) is more often than not stored in an inhospitable environment. The artefacts left behind in the Toronto Power Plant (a hydroelectric generating station sitting at the head of Niagara Falls) are a good example of this. Toronto Power was abandoned but not ‘mothballed’. No steps were taken to prepare the building and its contents for closure. As a result, the inherent high ambient humidity caused irreparable damage to the structure and the equipment stored within.

Large and small artefact conservation and management: opportunities

It is important to remember that Ontario Hydro is a corporation whose main mandate is the production and delivery of electrical power to their domestic and corporate customers. Throughout its lifetime, it has taken steps to commemorate its history and educate the public through the establishment of visitors’ centres and a now defunct museum (the collections are newly housed in the National Museum of Science and Technology in Ottawa). Their sponsorship of a corporation-wide heritage assessment is in itself precedent setting and signifies a corporate recognition of Ontario Hydro’s rich cultural heritage.

Of the conservation issues identified, disposal (or retention) of industrial artefacts was found to be the most pressing. We found that although individuals within Ontario Hydro were very aware of the significance of these objects and the need for their preservation, the collective corporate consciousness was less so.

As part of the management strategy the consultants identified those assets of Ontario Hydro that are considered to be of heritage value and that have been identified as being ‘endangered’, ‘at risk’ or ‘sensitive’. In the absence of ongoing inventory work or a comprehensive corporate heritage resource database the consultants sought to flag certain features in order to highlight the potential for critical care and management by Ontario Hydro. The consultants advised that all artefacts identified as having potential significance be subjected to a heritage assessment prior to their disposal. It was recommended that the assessment be carried out by a team that included a curator specialising in industrial collections, an industrial historian and a conservator. The consultants also urged that Ontario Hydro employees should be included in this team wherever possible. Long-time employees are a valuable resource offering an insight into the corporate history and culture which cannot be obtained from an outside consultant.

In order for this to be an effective and viable conservation management strategy, heritage assessments need to become a 'budgetable' item within the corporation. They need to be treated in the same manner as environmental assessments (carried out when Ontario Hydro activities have potential impact on the environment). The consultants recommended that heritage assessment of industrial artefacts be incorporated into long-range plans and costing. This would identify the need for an assessment and ensure that monies would be available and earmarked for this activity.

Conservation management statements were provided for each type of industrial artefact. These statements defined the conservation issues affecting the object and recommended specific conservation management strategies for dealing with these issues. In addition, detailed guidelines were provided for the documentation, collections management, storage and long-term preservation of these collections.

The consultant team also provided extensive guidance and information on heritage conservation principles, practice and other measures useful in managing Ontario Hydro's corporate heritage in a responsible and diligent manner. An overriding principle was to ensure that where evaluation and the resulting significance is linked to the material substance of cultural heritage, appropriate conservation and planning will be guided by respect for the principles of caution. Caution is necessary in order to reduce risk, damage or harm to the fabric of cultural heritage including component parts and settings.

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Appendix 1
An Assessment of Ontario Hydro's Corporate Heritage Resources
Evaluation Criteria
DRAFT

2.3.3 Evaluation Criteria for Cultural Landscapes

Historical Associations

Thematic: How well does the cultural landscape illustrate one or more historical themes representing cultural processes in the development and/or use of land in the context of Ontario Hydro?

This criterion evaluates the cultural landscape in the context of the broad themes of Ontario Hydro's corporate history developed in the previous section of this report. In assessing the landscape, the evaluator should relate the landscape specifically to those themes, sub-themes and material heritage features identified previously, e.g. transmission corridors, generating stations or office complexes.

Rating:
A Very good example.
B Typical example.
C Obscure example.

Person/Group: Is the cultural landscape associated with the life or activities of a person, group, organisation or institutions that has made a significant contribution to the community, province or nation?

This criterion evaluates the cultural landscape respecting its direct association with a person or group i.e. ownership, use or development of the cultural landscape. The significance of the person/group must be considered in the context of impact, scale and duration of activities.

Rating:
A Person/group of outstanding significance directly associated with the landscape.
B Person/group of moderate significance directly associated with the landscape.
C No associations.

Scenic Amenity

Sense of Place: Does the cultural landscape provide the observer(s) with a sense of position or place?

This criterion attempts to evaluate the sensory impact to an observer either viewing the cultural landscape from within or viewing from an exterior viewpoint. Such landscapes are generally recognisable as having some common, identifying character derived from buildings, structures, spaces and/or natural landscape elements and that relay to the observer(s) the sense of "hereness" or "thereness".

Rating: A Strong and definite sense of place by easily definable cultural landscape features.
B Moderate sense of place provided by definable cultural landscape.
C Poor or absent of place.

Serial Vision: Does the cultural landscape provide the observer(s) with opportunities for serial vision along paths of pedestrian or vehicular movement?

This criterion attempts to evaluate the visual impact to an observer travelling through the cultural landscape(s). Roads or water routes often provide an observer with a series of views of the landscape beyond or anticipated to arrive within view.

Rating: A Particularly interesting and attention-catching series of views.
B Moderately interesting and attention-catching series of views marred by interruptions along path travelled.
C Poor or absence of interesting and attention-catching views.

Material Content: Is the cultural landscape visually satisfying or pleasing to the observer(s) in terms of colour, texture, style and scale ?

This criterion attempts to evaluate the visual impact to an observer of the content of the cultural landscape in terms of its overall design and appearance, however formally or informally, consciously or unconsciously planned. Unlike integrity which asks: 'is it all there?', material content assesses whether the landscape is pleasing to look at irrespective of historical completeness.

Rating: A Very well executed.
B Well executed.
C Poorly executed or absence of visual interest.

Environmental Integrity

Integrity: How well has the cultural landscape retained its character over time from its origins to the present day?

This criterion evaluates the cultural landscape in the context of the degree of change accruing to the landscape as it has developed since its origin. Those landscapes that have undergone little change may be considered to be of greater merit than those that have been radically altered.

Rating: A Little altered with majority of character defining heritage features intact.

B Altered with some character defining heritage features intact, with some intrusion of recent or contemporary features.
C Radically altered, either abandoned or redeveloped, with few or no heritage features surviving.

Social Value

Public Perception: Is the landscape regarded as having importance within the area?

This criterion measures the importance of the landscape as a cultural symbol. Examination of popular tourism literature and artefacts, public interviews and local contacts may well reveal potential landscapes of value.

Rating:
A Importance generally recognised.
B Importance occasionally recognised.
C No importance attached.

Plate 1.

The *DeCew* generating station was put into service in 1898 by the Cataract Power Company to supply electricity to the industrial city of Hamilton (the original buildings appear to the right); it was acquired by Ontario Hydro in 1930. Water to the plant is supplied by a feeder from the Welland Canal to penstocks that carry water over the Niagara Escarpment to the powerhouse 79m below.

Plate 2.

At Nipissing, a 700m wood stave pipe feeds a 38m long steel penstock that enters the powerhouse to supply the turbines of two generating units, manufactured respectively by the Canadian Westinghouse Co. and the: General Electric Company of Sweden. The plant was established in 1909 and acquired by Ontario Hydro in 1916.

Plate 3.

Hound Chute was brought into service in 1910 by the Cobalt Power Company Ltd. to serve the northern Ontario silver mining centre of Cobalt. It was acquired by Ontario Hydro in 1994. The plant and all hydraulic machinery were designed and engineered by the Ontario firm of William Kennedy & Sons Limited of Owen Sound, with four generators furnished by the General Electric Company of Sweden.

Plate 4.

The *Cameron Falls* generating station is a grandiose, imposing structure on the Nipigon River and was built by Ontario Hydro and put into service in 1921. The powerhouse incorporates the gate, screenhouse, penstocks and transformer station all in one structure. There are seven units that were brought into service at various times between 1920 and 1958.

Plate 5.

The machine shop at *High Falls* attests to the remote location of the generating station and the continuing need to provide traditional, 'low-tech', on-site, repairs to machinery. The shop and its collections of tools and equipment are an interesting assemblage of industrial heritage features and artefacts.

Plate 6.

Governors control the power system and automatically control the speed of generators if they become separated from the main power system. Many of these governors, together with older devices such as exciters, are now redundant. These examples of obsolete technology should be evaluated and conserved as part of Ontario Hydro's management practices.

THE TEXTILE FACTORY MÜLLER AS AN EXAMPLE OF CONSERVATOR CONSULTANCY

K Götz

Abstract

The textile factory, Müller, in Euskirchen-Kuchenheim is a branch of the Rhineland Museum of Industry. It is of outstanding historical significance, both technically and socially, and is, regarded as particularly important from a contemporary point of view. The last owner maintained the factory, which was closed in 1961, until it was taken over by the Rhineland Museum of Industry in 1988.

In contrast to the large and unusual scope of the collection - sixty large-scale machines and an inventory of approximately five thousand artefacts or groups of artefacts - only one and a half years was available to the complete the necessary conservation work. Since the Rhineland Museum of Industry does not have enough staff at its disposal for such an extensive project, it was decided to contract the work to external specialist firms. For the planning and supervision of this project, the Rhineland Museum of Industry engaged the services of a consultant conservator whose function can be compared to that of an architect during the renovation of a building.

Introduction

The textile factory *Müller* in Euskirchen-Kuchenheim is a branch of the Rhineland Museum of Industry. It is of outstanding historical significance, both technically and socially, and is regarded as particularly important from a contemporary point of view. The last owner maintained the factory, which was closed in 1961, until it was taken over by the Rhineland Museum of Industry in 1988; he hoped to be able to go back into production by getting more orders.

The factory survives as an 'integral factory cosmos with many facets'. [1] It comprises the complete textile plant, the technical infrastructure, the office, tools, and smaller equipment from weaving shuttles, oil cans and spanners to objects left behind by the workforce such as coffee pots, lottery tickets, work clothes....

The restoring of the textile factory *Müller* will safeguard the complete picture in all its glory, from the small artefacts to the large production machinery. As the entire life in the textile factory is documented, the machines are not simply the centre of attraction as technical and historical rarities. The concept includes the proposal to operate some of the machines.

The aim in restoring the historical inventory of the textile factory *Müller* is to return the factory to its condition at the time of its closure in 1961. The aims of the project are listed below:

- all of the renovations, repairs, alterations etc. which took place before the factory closure, will be retained and preserved as they are considered to be an integral part of the history of the collection,
- typical traces of usage in the collection are similarly preserved,
- irreversible damage (for example, corrosion or infestation) is controlled at its cause and the rate of the damage is slowed down.

The collection is to be transformed into a state which can be described as a 'maintained state of usage'; i.e. as far as it is possible, all of the alterations which have taken place since 1961 are to be carefully identified and reversed. The aim is to achieve the conditions which were prevalent in the factory just before the weekend break.

The parameters which affect the management of the project include:

- the majority of the work on the sixty or so machines must be carried out at the factory itself,
- the diversity and quantity of the collection - sixty large-scale machines and approximately five thousand artefacts or groups of artefacts,
- the short working period of only one and a half years is available to complete the necessary work,
- the Rhineland Museum of Industry does not have enough staff at its disposal for such an extensive project.

Considering these factors it was decided to assign the work to specialist outside firms. The Rhineland Museum of Industry engaged the services of a consultant conservator for the planning and supervision of this work. The consultants function can be compared to that of an architect during the renovation of a building.

Consultant conservator

In this case, the following tasks were undertaken by the consultant conservator :

- converting the clients' objectives for the restoration into a feasible plan for conservation and restoration work,
- investigating and selecting suitable (conservation) firms,
- the drawing up of specifications and schedules, as well as the checking and evaluation of offers,
- ascertaining costs,
- specialist supervision of the objects during treatment; quality audit and documentation.

In the authors experience this is different to the usual organisation of the conservators role in projects in that:

- converting the restoration objectives into a feasible plan is separate from the actual concrete task of carrying out the restoration and conservation work,
- a conservator is to be empowered as director of the project.

From the authors experience of this project there are distinct advantages to this approach. The advantage for the conservator is that:

- self-employed conservators are supervised by specialist colleagues with the relevant knowledge, who make precise demands,
- the work described in the specification corresponds to professionally recognised specialist standards which can be quantified and enforced,
- more work is allocated to self-employed conservators,
- a new professional field as a consultant conservator is developed in the medium term. Until now this role has traditionally been undertaken by people foreign to the subject for example, engineers, architects, art historians etc.

The advantage for the client is that:

- they have specialist knowledge from the experts at hand, irrespective of the interests of those firms carrying out the work,
- they can get different costings for individual tasks, in contrast to allocating the work to a single firm; this may prove be more economic,
- any conservation work arising from a short term project can be carried

out without having to employ and train personnel on a long term basis,

- self-employed conservators can be more flexible in their employment. They may be able to obtain equipment and materials more effectively than public authorities and can therefore work faster and more efficiently. This is a considerable advantage especially for the 'mass problems' in restoring technical cultural assets.

Conclusion

Only a certain type of project is appropriate to the conservator consultancy. For example for the restoration of a single object it is not usually viable to differentiate between the planning and carrying out of the treatment. In such situations the model of the all inclusive conservation practice is certainly more applicable. Furthermore conservator consultants should not be used for routine and regular work; employing conservators as regular members of staff is an appropriate solution here.

If, however, the current trend of privatising public services continues, an increasing need for self-employed conservators, and the conservator consultancy can be envisaged.

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CONSERVING SCIENTIFIC AND INDUSTRIAL HERITAGE: A PRAGMATIC APPROACH.

H Newey

Abstract

Conservation of industrial artefacts has been traditionally carried out by engineers, toolmakers or craftsmen, many of whom worked in the industry that originally made the objects. They have the necessary practical skills and experience to know the method of construction or the use to which the object was put during its lifetime. Their approach to preservation, however, may be very different from that of the conservator whose brief is to preserve as much of the object as possible. When dealing with collections of this type it is essential to adopt a pragmatic approach using a series of criteria which this paper will seek to identify. If conservation and restoration are seen as the two ends of a scale then the methods chosen will lie somewhere along the line that joins them.

When approaching the preservation of such collections, the basic treatment of the individual materials of which the objects are made is the same as in other conservation disciplines. The difference is due to factors such as size, weight, complexity and the final 'role' or function of the object. Is it to be part of a study collection, a working exhibit, a demonstration model, an outdoor exhibit or a stationary iconic display in the entrance hall of a museum? The requirements of the curator may be different from those of an archaeology or ethnography collection. The examination and conservation of every single piece of the original artefact may not be necessary for a 1950's computer which is acquired with its circuit diagrams, manuals and software. However an analytical approach will be essential for a nineteenth century engineer's model, if no other documentary evidence exists.

Finally the paper will consider the conservation aspects of collections management as it relates to scientific and industrial collections.

Introduction

Conservation as a discipline developed from the repair and restoration of antiquities and art objects by skilled craftsmen using techniques and materials associated with the manufacture of such objects. Late nineteenth and early twentieth century archaeologists and scientists working with artefacts from excavations realised that many of these techniques were not preventing further deterioration but in some cases were actually causing it. From this experience it evolved that only materials and techniques which were reversible should be used in conservation. Conservators began to think about the long term effect of the materials and techniques used on the original objects. They started to test their materials for stability to light and heat.

Conservators also looked more closely at repair and restoration. The latter often involved removing damaged, irreparable areas, replacing them with new materials and then touching in or overpainting to conceal the repair. Conservation is concerned with the preservation of the original object and its physical and historical integrity. Excessive restoration can result in loss of scientific information, the introduction of misleading materials, or loss of evidence of manufacture, provenance and use. Each branch of conservation has tried to resolve their approach to restoration. The publication 'Restoration, is it acceptable?' from a conference held in 1994, shows how the difference in approach can vary from discipline to discipline. [1]

It is obvious that documentation of treatments is essential, to record what chemicals or techniques have been applied to the objects, so that this information can be added to the objects history. Conservation is a partnership with curators, archaeologist, and scientists who discuss and agree the outcome of any treatment and record information found on the objects during the conservation process.

The environment in which the object is displayed or stored can affect its preservation. Certain levels of heat, moisture, light and pollutants can all cause accelerated deterioration of the materials of which objects are made. Physical damage can arise from poor storage or display methods, clumsy handling or moving of objects and biological damage from pests and mould. The increase in importance of preventive conservation to all conservators is demonstrated by the increase in conferences and meetings devoted to the subject. Preventive conservation is an important part of the wider discipline of collections management.

The purpose of this brief and very basic introduction to the history of conservation has been to try and establish why conservators think as they do. Like any other discipline, conservation is constantly evolving and changing to meet the requirements of the times. Conservators find themselves part of a strategy based approach to collections care - attempting to raise the condition of the total collections rather than focusing on interventive treatments on smaller number of objects.

Conservation of artefacts

The conservation of any historic artefact must take into consideration a number of factors before any decision is taken on interventive treatment. It may even be that at the end of the planning or discussion phase no interventive treatment is selected at all. Instead the artefact may be stored in a suitable environment pending future decisions about its fate.

An artefact is not solely defined by the materials of which it is made and the shape or form it takes. It has a historical or cultural context which must be preserved. In deciding how to care for an artefact these factors must also be taken into consideration:

Artefact = materials of manufacture
+ shape/form
+ provenance
+ historical/cultural significance

Materials of manufacture
Individual materials that the object is made from: wood, metal, plastic, glass etc. These may be coated or embellished in some way, for decorative and protective effect - inscribing, etching, painting, lacquering, chemically patinating and heat treating.

Shape or form
Methods of construction of individual components and their assembly to form the whole object. The form can further be defined by its dimensions of size or weight and its complexity of construction.

Function
What was the object used for originally? Was it modified during its working life? Were there modifications after the end of its working life?

Provenance
Where was it found? Was this its original location? Are there any associated materials/documentation /artefacts?

Context
What is the object's significance within cultural/industrial/technological history?

Is it the only one of its type in existence?

These all relate to the object as it stands now, but there are further factors which will affect the choice of conservation treatment. These address the question of why it is being conserved rather than how.

The future of the object

The object can be conserved for a number of reasons:

- Preservation,
- Exhibition,
- Research/publication,
- Storage/public access,
- Education/interpretation.

It is at this stage that other interested parties, apart from the conservator and curator/owner, begin to get involved in the decision - making process. These can be designers, interpreters, education staff, marketing staff and sponsors. In the majority of cases decisions are being made on behalf of a group of people who have not been mentioned before. These are not only the visitors who come to see the preserved heritage, but everyone for whom it is being preserved!

The final criterion to be mentioned are the resources available: time, money staff numbers and expertise. However, these will probably not be last on the list for consideration when planning a piece of work.

Expectations of conservation treatments

The people mentioned above may all have different expectations of the conservation treatment of any artefact. It has been recognised that conservation can only slow down the deterioration to which all materials are subject. A minimalist approach to interventive treatments involving cleaning, stabilisation and little or no restoration can lead to an object that is difficult to interpret and display. It may be visually unappealing and, to a non-conservator's eye, look untreated and uncared for. Archaeological conservators and curators have had to deal with the problem for years of making rusty ironwork look interesting and exciting. There has been a great deal of time and effort expended on educating people about conservation of archaeological artefacts and what conservators achieve in preserving heritage. Interventive conservation, especially on large objects, is very time consuming and therefore the expectation is that the artefact will be preserved for ever and be pleasing to the eye. Lastly people expect types of objects that are familiar to them to look well cared for and in good condition. This is especially true of vehicles, machinery and other technological objects where the visitors may have first hand experience of owning or using them.

Restoration

The majority of all conservation treatments will involve a degree of restoration, usually in terms of adding to the original material in some way to stabilise the structure of the object. Sometimes it may be possible to do this by adding a support mount made of a suitable material. On some occasions the mount can be visibly obtrusive and detract from the object as a whole. Consequently the object itself has to be reinforced or gapfilled and the repairs masked by paint. Sometimes areas of original material are so badly damaged that they have to be cut away and replaced with new. The question arises then at what point does the conservator, in consultation with the curator, make this decision? How much of the original material must remain before the object is called a replica? Restoration has become an emotive issue because of the dangers of altering the original object and making it appear to be something it is not.

The question of ‘originality’ is one that constantly occurs in discussions between curator and conservator. What is meant by the word ‘original’, especially if the object has been modified structurally or decoratively during its lifetime? Material present may not be ‘original’ but may be evidence of use or modification. Careful thought should be given to what is removed and what is left during the conservation/restoration process and all actions thoroughly documented.

Scientific and Industrial Conservation

Industrial artefact conservation is a comparatively recent addition to the group of conservation specialisms such as ethnography, archaeology and applied arts. This is not to say that industrial or scientific artefacts or remains were not preserved in the past. Much of the work was carried out by engineers or other craftsmen who worked in the industry where the objects were originally made. The brief from the industrial curator was to repair or to restore the objects to a condition which reflected some period in the object’s working life. This may, or may not, have included getting the object to run again. The work carried out would probably be to a very high technical standard. In some cases it was even higher than when the object was made, carefully correcting faults in the structure or mechanism. This was, and is still, not necessarily done from a wish to change historical evidence but rather to improve a faulty or poor piece of work: a matter of professional pride rather than deliberately faking a piece.

Another reason for the extent of repair or restoration is to aid the interpretation and display of the objects. This is certainly true of many of the large scale objects which, once they had fallen into disuse, were stored outside and left untouched to corrode or deteriorate. The amount of work required to return them to an exhibitable condition was considerable and frequently undocumented. Many objects were totally repainted as part of the preservation process, stripping off the remains of old paint, preparing and priming the surface first and then applying traditional paint finishes or modern equivalents where applicable. It should be said that for objects that will spend most of their lives out of doors and not under cover repainting may be the only practical way of protecting the metal or wood underneath. The colours or livery may be changed from that removed because the final appearance selected is that of a different period in the object’s history.

The final issue raised in this section is that of the skills required to work on mechanical or engineering items. The practical expertise to repair or restore such objects is not taught as part of a standard conservation course, which usually focus on the deterioration and treatment of the materials from which artefacts are made. Many people have commented upon the loss of engineering and craft based skills because of changes in manufacturing industries. One could also view it as part of the role of conservation to try and retain traditional engineering and other skills so that industrial history may continue to be maintained.

Working exhibits and replicas

The interpretation of artefacts that were originally intended to perform a task can be made easier by seeing them in operation. The obvious way to do this is by restoring the original object to working condition and then operating it. This produces inherent problems of repairing or replacing damaged or missing components in order to get the object running again and maintaining it in that condition. Gradually all the parts wear out and the object ceases to be the original and effectively becomes a replica. An alternative to this is to build a replica in the first place and operate that instead. Thus the original is preserved and a reasonable impression can be gained of how such a machine operated. In many cases, however, it is not just the appearance of operation that is important, but also the visual impressions, sounds and sensations that make up the experience. Again there may be an argument for operating the original on a limited basis for experimental reasons, bearing in mind that this will depend on the amount of intervention required to make the object run.

If a historic object has been returned to working condition it must be operated and maintained correctly. This includes the choice of suitable lubricants and maintenance schedules as well as observing all the necessary modern health and safety criteria.

Finally it should be said that there will always be objects that will never be made to run again because of their historic, iconic value. This assessment must be made jointly by curator and conservator, using the criteria discussed earlier. The conservation of the first petrol-engined motor car to run on British roads, the *1895 Panhard et Levassor,* is an example of this from The Science Museum's own collections. The car was conserved as a static exhibit to reveal the original paintwork and the condition of the engine, both concealed beneath layers of linseed oil applied in 1950's. Following the completion of the project, some World Wide Web pages were compiled as part of the process of publicising the conservation and to bringing it to the attention of world of vintage and historic vehicle collections. [2]

Preventive conservation

The care and maintenance of any artefact is vital to its preservation. There is no point in expending time and effort conserving or restoring artefacts if they are then stored or exhibited in such a way that deterioration is allowed to continue. This can be caused in many ways, not just by poor environment but also by poor maintenance, neglect and careless handling. There is an assumption that many scientific and industrial artefacts are physically robust and endlessly replaceable because they are relatively modern. They do not need the care and attention that, say, antiquities merit where the historical, cultural and financial value are accepted. The resource implications of caring for industrial collections becomes higher than anticipated because of the cost of storage, maintenance and display. The importance of maintaining machinery still in commercial use is recognised but it is often difficult to extend that care to items stored in a museum and no longer used. Many industrial museums rely heavily on the skills, expertise and enthusiasm of volunteers to assist with the restoration of exhibits. If some of this willing help could be diverted into the storage areas the overall standard of the collections could be raised.

Collections management

At the Science Museum the conservation section is part of the Collections Management Group, which includes; storage and public access, documentation including the registry, handling and moving of objects, collections systems, and the management of the site at Wroughton, the museum's large object store. This means we operate as a team to cover all aspects of collections care and information management. Proposed acquisitions are notified to us by the curators so that, in theory, we can assess the conservation and storage needs before the objects actually enter the museum collections. If the storage space for objects or collections is not available then in theory we do not acquire them. It is all part of a strategic approach to collections care which also includes condition surveys and audits. These all ensure that in a time of limited resources, money and staff can be used to best effect.

Conclusions

The conservation of industrial artefacts can be approached in the same way as any other type of heritage objects. Using a checklist compiled from the factors listed earlier it should be possible to select a treatment or set of treatments for each artefact taking into account its preservation, interpretation needs and conservation ethics. The treatment may be a combination of conservation and restoration, using science-based theory together with engineering knowledge or craft-based practical skills. It is important to realise that everyone should understand the viewpoint of others; there has to be an element of compromise; so the appearance of the final product may not be as highly finished as when the object was first made. Conservators employed by museums have also to respect the objectives of the institution that they work for and may be expected to carry out work which appears on first sight to be unethical. Consequently, it is vital to try to educate non-conservators not to expect to see all objects in pristine, 'as-new', operating conditions and to involve all staff in caring for the collections. Conservators may find themselves, alongside their collections management colleagues, making routine but essential tasks like documentation look glamorous. By getting others to recognise good storage as a necessity, not a luxury, the preservation and understanding of the scientific and industrial heritage will be ensured.

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Additional Reading

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