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The British Library new storage

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Abstract:

This paper discusses how the British Library is seeking to increase its green credentials whilst at the same time ensuring that its collections are housed in optimal environmental conditions. It will give an overview of current library buildings, including the two new high density storage facilities at Boston Spa, and highlight some recent initiatives to improve efficiency in maintenance and running costs. Triggered by prohibitive costs this paper outlines our change in strategy for the treatment and housing of the library's master microfilm assets and will touch upon the debate surrounding British Standard 5454:2000 "*Recommendations for the storage and exhibition of archival documents*".

Introduction:

The British Library is one of the largest institutions of its kind in the world. With multiple sites in London and a large document supply centre in the North of England, it comprises over 150million items and over 2,000 staff. The collections require an estimated 625 kilometres of shelving and continue to grow, as does the body of users.

Not surprisingly, all space – for storage, readers, public and staff – remains at a premium and high on the British Library's list of strategic priorities. One of the first major building developments pertinent to this issue occurred in 1997, when the British Library moved from its historical location within the British Museum into a new purpose built home at St. Pancras in central London. With a total floor area of 112,000 sq metres spread over fourteen floors (nine above ground and five below) this building was the largest public building constructed in the UK in the 20th century,

The majority of the library's collections are stored below ground, in the climate controlled basement areas (17^{o}C – 50% RH).

St. Pancras:
The design and construction of the St. Pancras building took over twenty years at a cost of £500m. From the beginning it was a very efficient model with a building design lifecycle of over one hundred years – double the normal design life of a UK building. However, this does not include the mechanical plant and associated hardware, which during the course of one hundred years would be expected to be replaced about three times.

Because St. Pancras was a new build, there was plenty of control over building specifications, such as the construction and fire resistance of the internal and external fabric of the building. The building is protected by an analogue addressable fire alarm and detection system, believed to be the largest system currently in use in the UK. There are 3,000 combined obscuration/ionisation and heat detectors plus beam, smoke and flame detectors. The Fire Alarm and Detection System (FADS) is interfaced with the Building Energy Management System (BEMS) which, in the event of fire, shuts down the air-conditioning system in affected areas to prevent the spread of smoke. There is a wet sprinkler installation - which replaced the original dry system - plus Inergen in the basements, the strong-rooms, transformer rooms and electrical substations.

As a public body we are constantly working to reduce the impact of the Library's operations on the environment and have a written statement of environmental policy available on our website. We strive to improve our environmental performance by ensuring that

- All relevant and foreseen statutory regulations and official codes of practice are met.
- Energy, water, paper and other resources are conserved.
- Waste products are reduced through re-use and recycling.
- Ozone depleting substances are phased out and greenhouse gases, Volatile Organic Compounds (VOC's), etc are minimised.
- Discharges and emissions to air, land, and water are monitored to assess what action is necessary to reduce pollution or the risk of pollution.
- Service providers are encouraged to work in an environmentally responsible manner.

The library's green agenda does not, however, apply only to its physical infrastructure, but also works to promote the environment with its staff. For example, the library actively supports and promotes *Lift*share, an online network which matches individuals with others who have similar journeys to work. This not only saves staff members money by enabling transport and its costs to be shared, but also helps to cut their carbon footprint. Our environmental policy's future aims are to produce cycle routes for visitors and staff and, in addition to a cycle-purchase loan, we also plan to investigate the use of cycle couriers in London.

Recently, we have explored the environmental benefits and impact of smarter lighting and have installed Light-Emitting Diode (LED) lighting in certain areas of our buildings where colour rendering is not critical, for example, public eating spaces, King's Library Tower. LED technology is improving all of the time so what is on offer this year is better than last year. Future work being considered is the use of motion sensors to dim lights in other areas where there is regular but not continuous access, which will reduce existing energy costs in those areas by approximately 10%.

Boston Spa: Building 31

Despite the digital revolution, our analogue collections continue to grow and we acquire approximately three million new items every year, which equates to about twelve linear kilometres. The issue of storage is ongoing and consequently figures prominently in the library's strategies.

The British Library's Strategy 2008 – 2011 has seven strategic priorities, one of which (strategic Priority 6) focuses solely on storage for the collections and its integration with their long term preservation. Within this priority are the objectives to:

- Complete the new storage building at Boston Spa

and

- Update BL property Strategy – fundamentally moving to a two-site operation and addressing growth and storage needs over the next 25 years.

In moving this priority forward, the library successfully secured funding from government for a new storage facility and planning permission for a single building to store monographs (primarily) and low use material at Boston Spa was subsequently granted in February 2006. The aim was to deliver a building that would last for seventy years, be sustainable in terms of running and life cycle costs and meet UK directives on green issues, in addition to delivering additional safe storage at best value for money.

The building for monographs/low use material (known as ASP [Additional Storage Programme] Building 31) is an innovative design with an automated storage and retrieval system and ground-breaking fire prevention and will provide housing for approximately seven million collection items when full.

During the planning stage for this build, a range of storage options was considered, including established conventional systems with combinations of low and high racking, fixed and mobile racking. However, none of these solutions were able to provide the quantity and quality of storage for the funds that were available and high-density storage was the next option to be explored. High density storage is becoming increasingly commonplace in research libraries worldwide, and is not new technology, but the British Library wanted to marry the high density solution with a fully automated system; a combination used frequently in warehouse management but rarely in libraries and archives on the scale the British Library was proposing.

The system relies on automated software for all aspects of the operation. Staff do not work in the storage voids, but in 'picking stations', which are physically separate from the storage voids. This construction allows the vast storage space to remain dark and stable with emergency lighting only.

The system installed in Building 31 directs automated cranes up and down the storage aisles to 'pick' specific storage containers (know as 'totes) from their allocated storage space and deliver them to a conveyor belt, which transports them out of the storage void to the manned picking stations. Here, staff can retrieve the requested items in a normal working environment. The process is reversed to return items to storage.

With such a dramatic shift away in storage solutions from more traditional library systems, the impact on, and risks to collections were thoroughly explored and debated.

A decision was made early on in the design stage to use an aspirated fire detection system (Very Early Smoke Detection Apparatus - VESDA), which is most commonly used in high density stores. However, with such a departure from conventional

storage, there was an opportunity to investigate and test a wide variety of fire prevention and suppression systems, including sprinklers and high-pressure misting and, for fire prevention, low-oxygen. Extensive analysis of these options combined with a comprehensive risk assessment led the library to adopt a low-oxygen (OxyReduct) system for fire prevention in the new building.

The low oxygen environment system operates at 15% oxygen and works by reducing the oxygen content of the atmosphere by adding nitrogen. At this oxygen level it is possible to breathe normally but flammable substances will not burn and a fire cannot start. The usual mixture of gases that we breathe contains 21%-22% oxygen with most substances needing at least 16.5% oxygen to ignite and burn.
A test carried out by the library in a controlled simulated environment demonstrated that it was impossible to set alight paper and burn paper using an Oxyacetylene torch. In the test cell the ratio of oxygen to nitrogen was reduced from 20:80 under normal conditions, to15:85, close to what it would be in the new storage building.
The biggest challenge in using a low-oxygen environment system is to ensure that the building is air-tight. If it is not, then the conditions which are essential to avoid potential fire hazards are compromised and the collections are at risk.

Boston Spa: Newspaper Storage
Another of the strategic priorities (strategic Priority 3) also focuses on storage, but in a more specific context – that of the preservation of and access to the library's newspaper collections. Again, a new build underpins this priority - the construction of a purpose-built facility at Boston Spa specifically for newspapers.
In November 2009 the UK government confirmed a commitment of £33m to fund the British Library's Newspaper Strategy. This assurance enabled the library to plan for the long-term preservation of the newspaper collection by constructing a dedicated newspaper storage facility at Boston Spa. The newspaper library at Colindale will close in 2013, after which access to the newspaper collection will largely be via surrogates (both microfilm and digital) in a dedicated reading room at St Pancras.
The new newspaper building will accommodate some 128 kilometre of newspapers, again in a low-oxygen environment. The proposed building has a footprint of 3924m^2 and is a high density automated system operating with a temperature of 13°C and 40% relative humidity.
Retrieval for the newspapers will be via an automated, computerised picking system, with the capacity to retrieve at 45 complete cycles per hour (both in and out). Unlike the monographs stored in Building 31 which are retrieved in totes the newspapers will be placed on specially designed base boards, or 'trays' ,where stacks of various sizes will be assembled, flat and strapped together between boards – (the board and strap method). When a stack is 'picked' and is delivered through to the picking station, it will be turned mechanically from the horizontal to the vertical and unstrapped, so that volumes can be retrieved in the same way as they would from a standard shelf.
The benefit of this new storage environment can be measured by the improved change in the newspapers' Preservation Index (PI). PI is a concept introduced by the Image Permanence Institute in 1995 to express the "preservation quality" of a storage environment for organic materials. PI has units of years. The higher the PI, the better conditions are for preservation of organic materials.
The new building's environment will result in an increase in PI from 50 to 140 years before deterioration is first noted. The library is preparing well for the move and the transformation of its services, a key element of which is access by digital and microfilm surrogates.

Microfilm collection & acetate

The benefits and long-term access qualities of microfilm are well documented. The library first began microfilming in the 1950s and has invested heavily over the years in the creation of microfilm surrogates of many of its collections, and particularly of newspapers. Microfilm - largely, (and possibly only) because of its physical format – is seen increasingly by many as a poor first choice as a preservation medium compared to digitisation. However, that does not mean that we can ignore the microfilm assets that we have created – either their storage or their use – and there is still a need to provide resource and proper storage to manage microfilm collections and ensure their long-term survival.

One of the major risks to the library's microfilm holdings is posed by acetate film. This film base was introduced in the 1920s to replace highly unstable nitrate film and was most widely used from the 1930s right up until the early 1980s. It was marketed by Kodak as 'safety film', because it was much safer than nitrate. It was not, however, inherently stable. While it will not ignite and combust like nitrate, the film base will break down naturally over time, slowly releasing acetic acid, which then acts as a catalyst to speed up the chemical degradation. Acetic acid is commonly known as vinegar, which is why the advancement of degradation in acetate film is known as vinegar syndrome. The effect of this reaction is the physical deterioration of the film to the point where it may become completely unusable. In 2005, the British Library took a proactive approach to the problem by adopting a short-term strategy of transferring or copying the most vulnerable acetate film onto a new polyester film base. However, due to the sheer quantity of acetate in the collection this was not a cost effective option in the long term. As a long-term strategy, the library decided to adopt cold storage for its master negatives, it being widely accepted that storing film, particularly acetate film in cooler, drier temperatures is the best long-term solution for acetate collections, as this inhibits significantly the rate of decay. In February 2009 after three years of research and consultation, the British Library awarded, through the EU tendering process, an external contract for the off-site provision of microfilm storage at 5^{o}C and 35% RH.
It is interesting that the company that won the contract is not from the heritage sector and has no history of heritage storage. The company *is* a storage company, but one specialising in providing secure cold and cryogenic storage for the science and pharmaceutical industries.

Under the contract, a suite of 10 cold rooms has been built, in a space dedicated to the British Library, each with its own independent monitoring system. This gives huge flexibility for the storage of the collection should certain parts of it need to be in changed conditions in the future. The shelving in each room is perforated to allow maximum exposure to the conditioned air. Also constructed as part of the suite was an acclimatisation room, so that film coming in or out of the cold rooms is brought to the relevant temperature slowly and safely.
Moving the film to a much improved environment has resulted in the following benefits:

- For degrading acetate film (about one third of the collection), we have increased the time in which free acidity will double from about 10 years to approximately 200 years and for polyester film we have increased the Preservation Index from 63 years to 488 years[1]
- There have been other collections management benefits of this move. With every can/reel in the collection having to be handled to be bar-coded, some for the first time in many years, we have been able to do some much needed housekeeping.

[1] These figures are estimates based on the pre-existing storage conditions and derived by utilising as far as possible the ranges of figures given in the IPI Storage Guide for Acetate Film and the IPI Media Storage Quick Reference

Currently we have over 28,000 x 1000ft cans and more than 120,000 x 100ft reels of master microfilm of newspapers stored in this new facility.

British Standard BS 5454

Most of us in the heritage sector in the UK are familiar with and have historically worked to BS545 when assessing and or creating non specialised storage environments for archive materials. This BSI (British Standards Institute) standard has provided an accepted benchmark for storage across the sector. It is however, a standard of many years standing, and perhaps now not as flexible and evidence-based as today's agendas, economies and heritage strategies demand.

This has been recognised by BSI, which is developing - with sponsorship from several leading cultural organisations - a new specification for the environmental conditions (including temperature, relative humidity, light and pollution) in which to store our collections. PAS 198 (Publicly Available Specification), it is due to be published in May 2011.

According to BSI, the aim of this new document is "to provide an updated set of requirements for the environmental conditions for cultural collections in the UK, which take account of the need for a more responsible use of energy and the need to move from a prescriptive to an evidence-led approach that allows for risk-based decision making in the management of environmental conditions"[2]

Certainly this a welcome development in a sector which, in the UK at any rate, is coming under enormous pressure to be as flexible and efficient as possible in preserving and providing access to heritage collections of enormous variety and appeal, neither of which can be fully achieved without appropriate and cost-effective storage.

Thank you very much for your attention and patience.

[2] BSI Private Circulation, (IDT/2/9 10 0018), June 2010: Announcement of a new PAS project