Abstract

At the regional conservation centre in Vejle County, Denmark, conservators took the initiative to raise money and build a new shared storage facility for 16 museums and archives. The store was built in 2003 using the principles of passive climate control. Deep concrete walls, thick isolation and floors using the ground's natural heat, offered minimal running expenses. A large building erected by industrial building contractors meant very low costs of construction.

Keywords

preventive conservation, storage, shared storage, passive climate control, survey

Building a new shared storage facility for 16 museums and archives

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Identification of a problem, and making the public and decision makers aware of it

At the regional conservation centre in Vejle County, Denmark, the conservators had known for some time that the storage facilities of the museums were inferior. It is pointless to treat objects in accordance with the best conservation standards if the objects are then stored in a place where, for instance, the roof is leaking.

In 2001 the conservation staff made a survey of the existing storage facilities as a first step towards improvement. The purpose of this survey was to make decision makers aware of the problems of inadequate storage by investigating the quality of the storage facilities. It was a statistical survey of the existing stores of 12 museums, where each quality parameter was made up in square metres of the total area. For instance, the survey revealed that in 87 per cent of the storage area it was difficult or impossible to clean the floors because they were too packed with objects or because they were made of porous and hard to clean material; in 46 per cent of the storage area the objects had damp-related damage; and in 48 per cent of the storage area there were water pipes. In total, 11,178 m^2 of storage space were investigated. The archives came into the project later and their storage area was not calculated.

Photographs of nameless examples showing the poor conditions in the stores were a main component in the documentation. These appeared to be indispensable in the following argument and negotiation with decision makers at all levels. If one wants to change storage conditions it is necessary to demonstrate the necessity, without denouncing anyone. As conservators are only advisers and have no authority, it is very important to be aware of the delicate situation in which we act. It is important to be aware of the reasons why museums have neglected poor storage conditions. Our survey revealed, for instance, that there is a clear connection between the museums, which are always in need of more funds and more storage space, and their municipalities which have spare rooms, in the basement of a school for example. It is difficult for the museum's staff to make demands about the quality of the rooms, when they are offered for free, and the museum has no other possibilities.

We did not put forward a calculation of the museum's need for storage. It was better to let the museums' leaders and politicians themselves decide how much

Figure 1. Vejle County Cultural Heritage Centre. Left, shared store for 16 museums and archives; middle, loading area, freezing unit for disinfection and staff facilities; right: conservation laboratory

area they needed and could afford. In this way all involved partners shared the ownership of the project, and the conservators did not stand as the opposition setting standards that were too high. Furthermore, this ownership will be invaluable in future as we further improve the collection management. We have opened the possibility of continuing awareness and willingness to improve, instead of just being content with a desired level.

The conservation centre is an institution under the county council. This has been a great advantage, as the council has supported the project with manpower, such as building technicians, legal advisors, economists and fundraisers. It is also important to notice that the conservation centre is an independent institution, which means that we conservators can act politically as the 'solicitors' of the collections; but of course with due consideration to our loyalty towards the museums.

Figure 2. Erecting the walls in June 2003. The climate is stabilized by solid walls of 240 mm open-pored concrete. Note the 250 mm isolation on the outside of the wall

A solution

Having identified the problem, the regional conservators initiated a process where the economic consequences of building a shared, central storage facility as opposed to renovating existing buildings were investigated. It was established that even if old, existing buildings were given free, it would still be better and more economic to build new facilities, if those facilities comprised a large, shared storage unit using passive climate control and industrial building techniques such as large prefabricated modules.

As the regional conservation centre had to move at the same time, it was decided to build a combined conservation centre and storage facility – Vejle County Cultural Heritage Centre – on a central site near the motorway. The conservators would then be close to the collections and could monitor the climate and supervise the museums.

At first, we were convinced that it would be possible to raise at least half of the building expenses from private foundations. A major professional effort was made, but the applications were turned down because storage facilities were considered basic elements of the running of a museum. However, the county council, the local municipalities and the Danish Ministry of Culture saw the value in the combined conservation laboratory and shared storage facility, and the finance for the project was secured by a combination of public funds and loans.

The organization

The development of a suitable organization was a major task. The result was that an independent institution was founded, with a council of all the museums, the archive leaders, the leader of the conservation centre, and representatives from Vejle County Council and Vejle City Council. A board was elected to take all decisions about the building. The conservators were the main point of contact with the architect and engineers about the practical planning of the centre, and they liaised between these contractors and the authorities.

Planning the shared storage

In the planning process of the storage facility, many parameters were taken into consideration. A list of objectives was formulated for each part of the project. The lists can be seen below with the outcomes for each one.

Siting

Objectives

- Central location to every museum or archive so they have shortest possible distance and driving time
- easy access from the motorway
- close to fire and police stations
- location in an area with low air pollution
- easy to enlarge the store in the future.

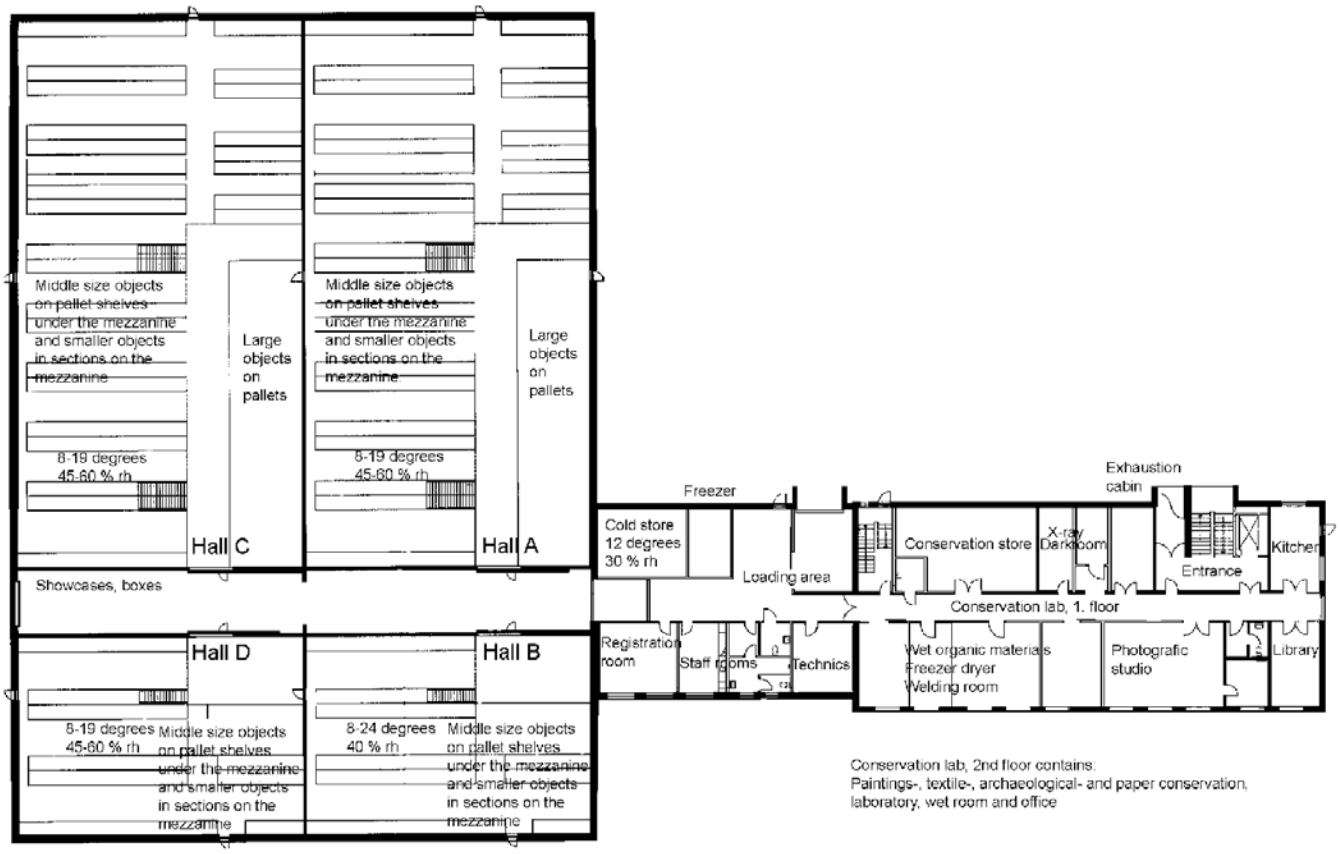

Figure 3. Plan: left, shared store prepared for further enlargements towards the west; right, the conservation laboratory

Reality

There are environmental restrictions for future neighbouring plant or facilities: there will, for instance, be no polluting factories in the area as the site is placed on a spring. The general pollution of the area is low even though the distance to the motorway is only about 1 km. (The motorway has relative light use compared with many other European motorways.) The maximum driving distance from all the museums and archives is 36 km. The distance to the police station is 7 km and to the fire station 2 km. The site is situated in a new industrial area close to a forest. As our site is the only one occupied in the area, there is possibly an increased risk of vandalism. We have access to large neighbouring sites, and the way the storage unit is situated on the site and the construction principles used make future enlargements possible.

Construction of the building

Objectives

- A building with high performance, limited building expenses and very low operating costs
- best obtainable conditions for mixed collections of moderate use
- fire-resistant building
- rational transport routes and access for pallet trucks in the aisles
- easy access to the loading area and gate for large lorries
- a roof with a minimal risk of leaking
- necessary working lighting, but only on when needed
- easy cleaning
- easy monitoring for insect pests
- low cost but inert building materials
- if possible, use of renewable energy and environmental perspectives considered.

Reality

A solid concrete building with exterior isolation and no isolation in the floor was built on the principles of passive climate control. The walls are made of 240 mm concrete, which offers a climate buffering effect and good security, 250 mm outside isolation and a metal sheet protection (Christoffersen 1995). The building consists of two halls each of 1700 m^2 with a rafter width of 24 m and no columns. This width provides best economic value. We had to enter into a compromise with the roof: its slope is only 4 per cent whereas we would have preferred a pitched roof, but the cost would have been unfeasible. Rainwater drains run through two of the storage rooms, which means a risk of water damage. The rafters are made of TT concrete; metal sheet material connects them and an isolation layer of 300 mm under a double-felted roof that surmounts the house. Inside, the walls are painted with a concrete-based white paint of very low PAM value, and the floors with a water-based epoxy paint.

The lighting in the stores uses fluorescent tubes, 70 lux in the working area. Through infrared detectors the light is only on where someone works.

Climate regulation

Objectives

- Low costs
- suitable climate for storing mixed collections; also if technical equipment breaks down
- very low daily fluctuations of climate
- slow and acceptable fluctuations of the climate during the year
- easy maintenance and ease of operation
- sustainable use of resources.

Reality

According to the requirement of the collections, the storage facility was divided into areas with different climates.

Halls A, C and D: 4122 m^2 basic climate for wooden objects, paintings, and so on; 45–60 per cent relative humidity (RH); high peaks of humidity regulated by a small dehumidifier; 8–19 °C.

Hall B: 658 m^2 area for archaeological finds and metals; 40 per cent RH; 8–24 °C; the basic climate of the store is regulated by a small dehumidifier and supportive heating.

We expect a slow fluctuation of the climate during the year in the four storage halls.

Cold, dry storage: 25 m^2 area for modern media; 30 per cent RH; 12 °C; temperature and humidity are fully regulated. The rooms have 3.5 m high compact shelves, corresponding to a total of 650 m of shelves with a depth of 30 cm.

In the main storage the climate regulator will be the buffering effect of the solid body of the building. The floor is not isolated; it is made of concrete on a gravel layer with a waterproof membrane. The unisolated floor takes advantage of the natural heat of the ground, which is about 9 °C. This makes the floor serve as a heating surface during the winter and a cooling surface during summer; but the lack of isolation also means a risk of condensation on the floor and therefore no objects are placed directly on it. The mezzanine floor partly comprises industrial gratings and partly concrete-based chipboard. The industrial gratings are placed over the aisles underneath: they improve the ventilation of the room and make it possible to reduce the number of fire detectors. The concrete chipboards are placed over the pallet shelves underneath and protect the objects from dust and dirt.

The walls are painted with a white concrete-based, very open pored paint, which allows the moisture to evaporate freely. The floors are painted light grey with a water-based epoxy paint, which is tested at the Danish National Museum.

An artificial daily air change is created in the building by a light overpressure.

To help regulate climate, a sorption dehumidifier was installed. It helps stabilize the climate after construction and eliminates peaks in humidity. In addition, a heating element is situated in the air injection system, which offers another means of controlling the climate. Hall B has a separate air injection system, which allows a lower humidity there.

A disadvantage for people working in the store (but a benefit for the objects) is the low temperature. As the construction is based on passive climate control, the climate is sensitive towards too much traffic, light and people staying in the storage.

Security

Objectives

- Minimize the risk and damage of burglary, fire, water, staff-caused damage, insect pests, mould, air pollution and hurricanes, with due consideration for actual risks and economy
- ease of operation of technical equipment.

Reality

The main area is secured with a burglar alarm, there is access control and access for all security-checked museum employees. The security room (for keeping objects of high value) has high security with a burglar alarm, steel reinforced concrete walls, double locks, extra access control and access for only one person per institution.

A key system that makes a digital record of every user was chosen. As 79 persons from the museums and archives have access to the storage it was necessary to use a key and alarm system as simple and yet as secure as possible.

An automatic fire alarm system was installed. During the planning of the storage unit we realized that the fire authorities are very powerful and that they are not used to paying attention to the preservation of museum objects. We avoided a sprinkler system, as we know about many cases of water damage due to such systems, but we had to install fire hoses in each storage hall. We were also forced to put in roof hatches with devices that will open automatically during fire. An alarm system for water damage was installed: it sends an alarm if there is water on the floor.

Compared with the previous stores in which the collections were kept, the good transportation access and planned routines of the new storage facility reduce damage related to transportation and handling. In addition, the users' handbook (see later) helps counteract human-related damage.

The storing system

Objectives

- A storage system with room for very large, medium-sized and smaller objects
- easy access to the objects
- best and most economic storage system possible
- easy and safe transporting systems using truck and pallet-lifting devices
- no movement of objects on staircases.

Reality

A mezzanine construction placed upon pallet shelves was the most economic choice. The mezzanine floor over the aisles consists of industrial gratings. Over the pallet shelves, however, concrete-based, chemically inert chipboard was placed to prevent dirt from falling on the objects on the pallets. The industrial gratings offer good ventilation, better fire alarm warning with fewer detectors, and they reduce the costs to only 80 per cent of those of a concrete mezzanine. Furthermore, one gets the pallet shelves 'for free' because they carry the mezzanine.

Figure 4. Textile boxes after cleaning and disinfection by freezing ready to be moved to their shelves

Figure 5. Storage system in one of the main halls of the store

Only the pallet shelves under the mezzanine were included in the construction costs, as many of the museums already had many small shelves to reuse on the mezzanine.

The mezzanine is 2.7 m high, which means that a simple pallet-lifting device can place the objects on the mezzanine.

The fire authorities only allowed a mezzanine of three-quarters the size of the floor space. Therefore the total area of each hall was divided into a main path and an open floor space for large objects placed on pallets. This area was one-quarter of the floor space area. On the remaining three-quarters area the mezzanine was raised. Pallet shelves were installed under the mezzanine for medium-sized objects, and the mezzanine was reserved for small objects.

A unique address system for every shelf was chosen before moving in the objects.

Collection management in the shared storage facility

From a conservator's point of view, it would have been ideal to store the objects according to their materials and size. However, that turned out to be unrealistic. The museums had some reservations about mixing their collections, and to make the project succeed it was agreed that the museums should have their own areas.

To make sure in advance that everybody using the storage facility would behave with due consideration for the demands of the collections, the conservators produced a users' handbook. In this handbook, we have tried to predict situations where the preservation of the object could be in danger, and set regulations on how to act, as well as to give practical advice on the proper use of various machinery, packing, handling and cleaning of objects, and so on. For instance, only registered objects can access the storerooms; no objects are allowed on the floor and in the aisles; smoking is only allowed outside the building; instructions of cleaning procedures; instruction on what to do if an alarm starts; information on who to call night or day if something is wrong, and so on. The board of the institution adopted the handbook before any trouble arose, which seems to be a very advisable strategy. A disaster plan will be outlined in the future.

Size and finances

The shared storage is a 5500 m^2 floor and will house about 250,000 museum objects from 16 museums and archives. The facilities of the storage are: air lock, package room, 9 m^2 freeze compartment (–40 °C for freeze disinfection), 25 m^2 cool, dry compact storage, staff room (kitchen, bath and toilets), and a registration room; 2172 m^2 floor for medium-sized objects on pallet shelves; 2172 m^2 floor for smaller objects on shelves; 376 m^2 floor for large objects on pallets; 20 m^2 of very high security area and 36 m^2 with a less stable climate used for showcases and items that are not museum objects. The conservation centre has a 1200 m^2 floor. It has facilities for conservation work such as social history/ethnography, archaeology, paper, textile and art conservation. The cost of the storage was €2.14 million all inclusive. The costs without the property plot were about €1.96 million. In Denmark, the normal annual cost of renting a warehouse without climate control and special rooms exceeds the annual repayment on the loan plus the running expenses of the shared storage.

A thorough investigation was done during planning to estimate the running expenses of the shared storage. The result was close to €6/m^2 of floor per year. The working expenses and the annual costs of the shared storage have proved to be so low that the project became very attractive for the authorities, even at state level.

The project was financed and supported by the city councils housing the museums, the County of Vejle and The Danish Ministry of Culture, which has promoted it as a model for other Danish institutions in need of more storage space (Ministry of Culture 2003).

Conclusion

The regional conservators were initiators and liaised on a building project, where shared storage for 16 museums and archives combined with a new building for the conservation centre was established. The reason why this project succeeded was – according to the users – that the initiative came from the conservators, who had no other interests than the preservation of the collections.

Our approach to storage problems at the museums has changed. Previously, we were often seen as the indignant consultants, who pointed at the insufficient storage and demanded improvement. Often it was difficult for the museums to meet our standards: they tried or they ignored them. By taking the lead, providing the finances and building the shared storage we are now in a better position to advance the preservation of the collections. Politicians and museum leaders are now focused on preventive conservation, and this is a very good starting point for the further raising of the standards of collection care in our region.

Acknowledgements

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