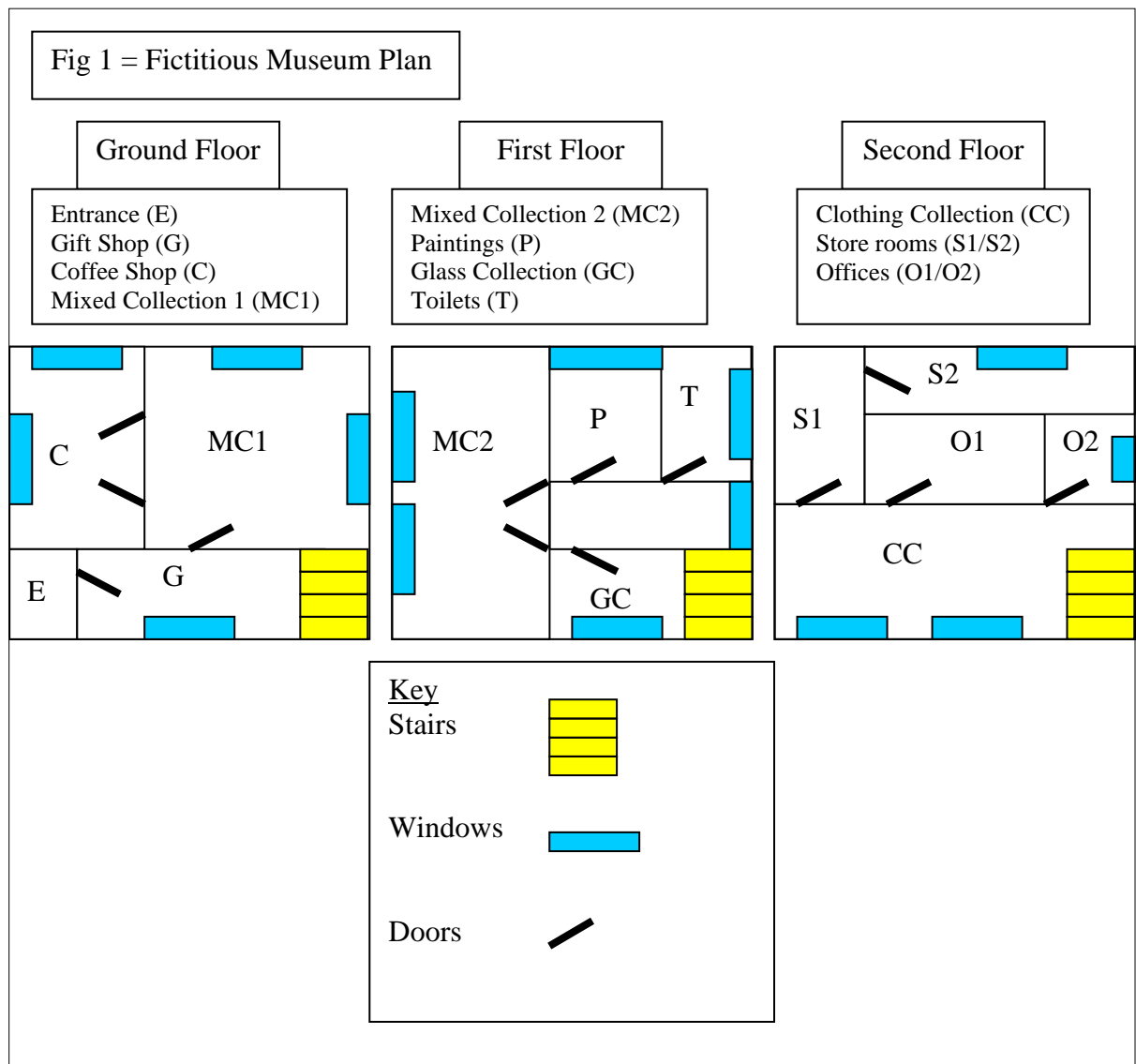


## Aspects of Preventative Conservation within the Museum Environment

Preventative conservation is one of the key skills any museum should be proficient in, through environmental control and often simple techniques the degradation of an artefact can be reduced to a minimum. These skills though are sometimes not employed especially in the smaller museums and the potential for damage is high. This assignment aims to discuss the controlling of Relative humidity, use of MDF in cases, storage facilities and disaster planning. For these purposes a fictional museum will be used as outlined below:

The museum is a converted Grade 2 listed Edwardian building on the outskirts of a large city, it has a flat roof and cast iron drain pipes/ gutters with original sash windows. The collection consists of paintings, glass, clothes, and two mixed collections. There are also offices, toilets, store rooms, a coffee shop, gift shop and entrance area (fig 1). The museum has no set means of environmental control installed and relies of ventilation from the many connecting doors that are left open almost all the time.



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Relative Humidity is simply how much water is in the air as a percentage of how much it can physically hold. RH changes with temperature, hotter temperatures can hold more water than cold and when the air cannot hold anymore it is released, this is what causes condensation. For a museum of mixed collections an RH of 45-65% is recommended (i.e. around half of the water it could hold) but this value does differ greatly depending on the source of the information and items to be stored (Gilroy & Godfrey, 1998). It is important to control RH to help limit the deterioration of collections. If RH is too high collections could suffer from swelling, distortion, mildew, mould or insect attacks. Too low and cracking, embrittlement and shrinkage may occur, especially in organic materials such as wood (Bodleian Library) (Fig 2).

Fig 2 – Source Gilroy & Godfrey, 1998

<b>HUMIDITY TOLERANCE OF SOME MATERIALS</b>				
<b>Material</b>	<b>Upper relative humidity limit</b>	<b>Lower relative humidity limit</b>	<b>Dimensional response</b>	<b>Susceptibility to mould</b>
<b>Paper</b>	65% (critical)	40-45%	Rapid. Loose leaves tolerate moderate dimensional change.	Extreme. For safety 60% RH may be adopted as upper limit.
<b>Stretched paper</b>	65% (critical)	45% (critical)	Paper screens, drawings, pastels stretched on frames will tear due to shrinkage under low RH conditions.	Extreme
<b>Fabric (natural fibres)</b>	65% (critical)	45%	Inverted, as twisted fibres shrink when fibres swell and relax when fibres shrink.	Marked
<b>Parchment, vellum</b>	Steady state near 55%	Steady state near 55%	Extremely rapid. Dryness causes loss of flexibility.	Moderate because of inherent alkalinity.
<b>Leather</b>	65%	45%	Variable according to tanning process.	Variable. Marked for many fine leathers.
<b>Bone, ivory</b>	65%	45%	Very slow, except in thin sheets. Avoid hot lamps in cases for emphasis lighting.	Negligible except at very high RH.
<b>Wood</b>	65%	45% (critical)	Slow, varying with size and moisture barrier coating. Affected by weekly cycles and especially by seasonal cycles.	Negligible except at very high RH
<b>Painted wood</b>	65%	45%	Dryness which causes shrinkage of wood is especially damaging to a class of objects in which wood is the structural support for other materials. Buckling, blistering or flaking may result.	
<b>Metal, ceramic, stone, plaster</b>	Greater than 45% may lead to corrosion of metals such as iron, some steels.		Bronze, stone, ceramic and plaster, long buried, may have been infused with or corroded by salts which behave hygroscopically.	

added bonus of removing particles by using an air filtration system but they require extensive maintenance. With high costs and even higher likelihood of it breaking down, an air conditioning system should not be the only method of RH control. Dehumidifiers are electronic units used for removing water from the air by the means of a refrigeration unit. The cold plates on the unit cool the air and force it to condense into a water container below (Meaco). These are excellent for single rooms and cheaper than full air conditioning. Being freestanding they are especially good in museums such as the fictitious museum above, where access and space are limited. The water containers on the dehumidifiers require regular emptying which creates problems with spillage and can dry the atmosphere too much. Some units combine a humidifier to stop this effect but costs with this feature may be beyond some smaller museums. Temperature can be used to regulate RH, this is known as ‘conservation heating’ (National Trust). Conservation Heating involves keeping the indoor temperature no more than 5°C above the outdoor temperature. This method can be very good for collections but often uncomfortable for visitors. If visitors comfort is a high priority it is recommended to maintain a temperature around 20 °C. The biggest problem with temperature is change, this often occurs quickly and erratically and keeping it stable can be a problem. Ultra Violet (UV) light has a great heating effect on the air but can be stopped by the use of UV reflective glass or films. Many manufacturers make the UV protective glass and in generally it is not too expensive, the film may have to be used for listed buildings with original windows.

*“Pilkington OptiView™ Glass blocks over 99% of UV transmittance to protect interiors and contents” (Pilkington)*

If UV protective glass is not an option simply closing shutters, blinds or curtains and turning off lights helps. To maintain an even temperature ventilation must be adequate throughout the museum, ultimately in the form of wall vents allowing air to circulate throughout different rooms. Internal doors could be left open and windows opened when needed (dependant on collection and weather conditions outside). Whatever the circumstances temperature should not be adjusted quickly as this will almost definitely cause irreparable damage to collections. In the fictional museum the painting collection could be greatly effected as shrinkage or cracking of the wooden frames may occur. Zoning or the creation of buffers within the museum can help in preservation by creating a micro-climate independent (to some extent) to the outside environment. Zoning allows individual temperature control and the collections within them, meaning that delicate items can be kept in separate conditions to less specific items. The building itself acts as a control through the insulating factor that the rooms have but also the ability to control people. By creating buffer zones such as the reception area wet clothes can be removed and the outside door will not open onto a collection. This zoning system is easily implemented with minimal cost and some reorganisation. Cases can act as micro-climates in the same way as zoning which is ideal for smaller items and/or valuable items as they can be controlled at their best conditions. Silica Gel can absorb excess moisture and Zeolites crystals can release moisture (EnviroGel). The materials can help maintain a stable environment, wood is known to have good moisture absorbing and releasing properties but beware, the wrong materials could damage stored items more than the RH. Maintenance can be one of the more overlooked controls of RH, water can cause extensive damage on its way into a building but long term, saturated walls, plaster and flooring release large amounts of water raising the RH. Gaps in windows can have the same effect,

therefore gutters should be cleared, and windows sealed and checked for cracks and gaps. Flat roofs are a major problem so these must be checked regularly and repaired immediately. Remember once water has entered a building it is difficult to get rid of, it is far better to spend time on maintenance than to ruin an entire collection.

Medium Density Fibreboard (MDF) has long been used for constructing display cases in museums. Its cheap cost and ease of working has made it a popular material especially in museums with a small budget. It can be purchased to almost any specification from thin sheets to huge boards allowing its use in most situations.

MDF does have numerous problems that must be considered before use.

Formaldehyde is one of the main problems, this chemical was developed for use in a range of situations from embalming fluid to adhesives (US Department of Labour).

MDF also contains this chemical and when off gassing occurs the items on display can suffer especially metallic or calcareous collections. Special MDF boards have been developed to combat this by using alternative chemicals in manufacturing, these in theory do not off gas therefore will not damage the collection. One problem though with this is that the levels of acetic acid (vinegar) tend to be higher, replacing one problem with another (Advanced Buildings). MDF can be coated with special varnishes which aim to stop the off gassing effect, this relies on a sufficiently thick coating without any gaps. Normal 'household' varnishes should not be used as an alternative as many contain formaldehyde or similarly damaging chemicals. In some cases a thin layer of non-reactive material such as aluminium or Perspex can be used to line the inside creating a barrier to the chemicals. Plywood and chipboard also contain dangerous chemicals as do natural woods. The peroxides, acetic and formic acids naturally released by the wood can cause extensive damage, teak has been known to cause rust in stainless steel and other rust resistant alloys (Scottish Museums Council). If wood must be used spruce, pine, walnut, elm or magnolia which has been air dried rather than in a kiln will have less off-gassing. Aluminium is a widely used alternative to MDF, this metal is un-reactive to most commonly used cleaning products and has no off gassing effects. Some discolouration can occur when left in a damp environment but with correct RH control this will not occur. Other metals can be used but would need treating to stop corrosion (rust) which could cause damage to collections. Plastic coatings can be used on metals but often crack easily exposing the metals below, a better method is to use a baked enamel finish but this increases the potential cost (Scottish Museums Council).

Glass is an excellent material for display cases being un-reactive and having no off gassing effects, it can be purchased in most sizes and is scratch resistant. It is expensive and extremely heavy therefore unsuitable for extensive use within a museum. Plexiglas, a type of acrylic sheeting may be a good alternative to normal glass. It is extremely strong, light, scratch and UV resistant, and made to any specification. Plexiglas is expensive, fig 3 a small cube storage container costs around £75 (Archival Supplies) which may be beyond smaller museums. Whatever the chosen material it should be tested with the collection to double check that there will be no harmful effects associated with its storage. The ODDY TEST allows this by using small samples of each material (case and collection) put into test tubes with distilled water and heated. After around 30 days the samples are removed and the effects observed, if detrimental to the collection an

Fig 3 – Plexiglas display case  
[www.archivalsuppliers.com](http://www.archivalsuppliers.com)



alternative material can be investigated. This method is best suited for metals but has been developed for testing other materials (Museums, Libraries & Archives Council). Museum storage especially in the smaller establishments is often poorly organised and located in inappropriate areas of a building. The fictitious museum above is a good example with the store rooms located at the top of the building on external walls with large windows, and a flat roof. RH control is one of the main aspects of good storage, if this is stabilised the life of the collection can be extended. All the factors discussed earlier such as ventilation, light, location and maintenance will need to be considered. In smaller museums with limited space the reorganisation of rooms may be the best option. For example in fig 1 the store room for the more delicate items would be better in O1, this is the most stable environment on the top floor being buffered by other rooms and no windows. The remaining store room could be improved by placing racking or cupboards against internal rather than external walls. If not possible the following ideas may help limit damage to the collection, these are appropriate for all museums and budgets.

One of the first things to improve a storage area is to have all items documented, organised into sections based either on the type of collection (i.e. clothing, paintings, fossils) or by how often it is needed for display. All items should be logged and any special conditions for storage identified before long term arrangements are made. The location of the item can play a big part in its protection, if old clothing is brushed past every time the room is entered it will wear quicker than if it is stored out of the way. Items should be easily accessible otherwise there is risk of increased damage to the artefact and the person collecting it. All items should be within a case or box for protection, the casing material as discussed above will play a very important part at this stage. The boxes need to have internal padding to stop physical damage to the item, this itself has potential to damage the object. Acid free tissues are often used to 'pad out' the collections, this is good practice on the whole but individual manufacturer specification must be carefully studied. Often the tissues are made using chemicals that actually make it nearer to pH 8.5-9 rather than pH 7 (neutral) this has the potential to harm certain objects (Museums, Libraries & Archives Council). Calico cloth which is an unbleached, untreated, very light fabric can be used to cover textiles and tapestries and only require a yearly wash. If the museum has a greater budget Tyvek sheeting may be used to store textiles, this is designed to allow water to move only in one direction (away from textile) keeping it dry (Scottish Museums Council). Photographic materials and paper can be stored in Melinex sleeves, a type of polyester sheeting. Small items can be stored in polyethylene bags, with self sealing ends. For delicate items bubble wrap can be used to create a protective barrier, this should then be lined with acid free tissue to limit the abrasive effect of the plastic. The control of pollutants within the store rooms may decide whether objects survive for 50 years or 50 months, some chemicals given off by certain materials or simple air pollution can devastate collections. Charcoal cloths can help to remove atmospheric pollutants such as acetic acid and formaldehyde given off by wood. The cloth is cheap and inert meaning that it can be used for most objects without causing damage (Museums, Libraries & Archives Council). The use of a vacuum cleaner will remove particles that could damage collections, by regularly and carefully cleaning the room the life of the artefacts can be prolonged. Simple changes can make a huge difference and items such as the clothing in the fictitious museum would benefit by simply padding the shoulders and covering with a cloth. Common sense is also needed when storing items, paintings need to be kept dark, paper not folded and antique furniture not used for storing things on. Zoning can help by placing delicate items in one area,

regularly used items in another, textiles in a special cabinet etc. Staff training plays a large part in the long term survival of a museum collection, if just one careless employee takes a cup of tea into a store the potential for damage increases as well as the RH. The storage of collections is an ongoing process and monitoring and regular audits will be needed to ensure all objects are being stored in the best possible conditions on the available budget.

The first principle of disaster planning is to realise that disasters do happen! By accepting this and having adequate facilities and training to deal with it, damage can be limited if not avoided. Disasters come in various forms from flooding, fire and vandalism to full structural collapse. No museum can plan for every eventuality but by carefully considering the environment, location, building type and collection the main problems can be accounted for. Flooding can illustrate this well, if your museum is next to a river it could flood so must be planned for. When the plan has been made numerous copies need distributing to authorities and placed in locations accessible to members of staff and emergency crews. These need to be secure, remember these plans list all the rare and valuable items in the museum. Check and update these plans regularly in case of changes in phone numbers or collections. The disaster plan should be comprehensive yet understandable by all, the first step in its creation is to know the museum and the collection. All staff should know where the collections are stored and displayed, where the fire exits, extinguishers and stop taps can be found. Emergency kits can be made to supplement the legally required equipment such as extinguishers, these can contain items like screwdrivers, cloths, first aid kit, and of course a copy of the disaster plan. These can be placed in key locations easily accessible but secure from the public. Building plans with locations of fire extinguishers, emergency kits, first aid kits and fire exits could be included in the plan but should not be complex. The plan should record all museum items, their location and importance. It is unlikely that in an emergency all items could be saved so a priority structure must be made, usually this will state 'Imminent damage (High Priority), Damage if Moved, and which can be left (Low Priority)'. This should be very easy to understand in case it is needed by emergency crews, and listed not just by item but by location, photographs would be of great help. Staff should be trained for specific jobs but be capable of doing all of them. In an emergency situation such as a fire certain staff can deal with the public getting them out of the building, whilst others save high priority items, phone the fire brigade, or if possible fight the fire. In these situations it must be remembered that safety is the key, NO collection is worth risking your life for. A recovery plan for after the danger has passed should be recorded, special freezing or alternative storage locations need planning for. Advance emergency preparations can be made such as easily removable casings and frames etc, this should be weighed against the security of the museum. Disaster plans contain extremely large amounts of information, they can be broken down and the process for each listed. Below are some key aspects that could be included:

Identify the Disaster/ State the Probability of it happening/ State the Probable damage/ Details of Next action and What is required/ Phone numbers etc:

Preventative conservation in its many forms is the key to caring for any collection. With the control of RH, carefully designed displays, suitable stores and emergency plans the collections can be protected. Ultimately the collections will slowly deteriorate with the simple effect of age, but if the worst problems associated with viewing them can be managed the life of the objects should be prolonged.

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