

# DISASTER SALVAGE TEAM

## Working Towards Saving Cultural Collections

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# NEWS LETTER

## No 17 - April 1998



PACKING OBJECTS FOR TRANSPORTATION

Guest Editor: Lynn Campbell

### Executive Committee

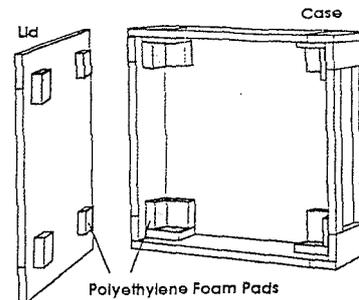
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# Introduction

*The desired increase in public access to art via loans and travelling shows has meant that collections may and often do deteriorate more rapidly because of transit stress.*

*The aim of the lenders should be to assess the physical structure of the object, and to devise a packing, transportation and exhibition care continuum to minimise the stresses which tend to cause deterioration.*



Each stage may be thought of as a cycle wherein occurs a *handling phase* as the object is loaded, a *distribution phase* where the object is transported within the carrier, and an *unloading/handling phase*.

Inside a carrier vehicle, the work requires more protection against vibration

and shocks while it is moving. Throughout the transit, the appropriate temperature and relative humidity levels should be maintained as closely as possible, even though the cargo may travel through varying climates and rest in different carrier environments.

## Preparation

When considering the packing for an object, one should:

1) *Assess the physical state of the object to be packed, to establish the artwork's protection requirements.*

2) *Consider the environments which will be encountered in the chosen carrier and transit stages. From these one can establish the protection which the packing design must provide.*

3) *Importantly, also consider the resources available for packing in your establishment (For transit etc).*

## Assess The Object

When assessing the object, look at its condition and points of vulnerability. Consider the work's materials, shape, size and fabrication. The object must not be too fragile to travel.

## Consider The Transit

When considering the packing and protection requirements for the work, *consider the chosen transit*. Assess the likely conditions and risks which the artwork will be exposed to on the planned transit route, at the likely handling sites, and in the chosen mode of transport.

### The Transit Phases

A transit may involve one carrier stage or several stages where the article travels in different modes of transport (e.g. by truck, to a plane) before it reaches its destination.

### Museum Truck

If a museum has its own truck, it can be fitted to carry artworks or objects safely with reduced packing. Poles, straps and movable dividers can be used. The truck should be fitted with a fire extinguisher and possibly with alarms. Temperature regulation in trucks is not common in New Zealand. It is best to try to keep the vehicle temperature close to the desired museum level.

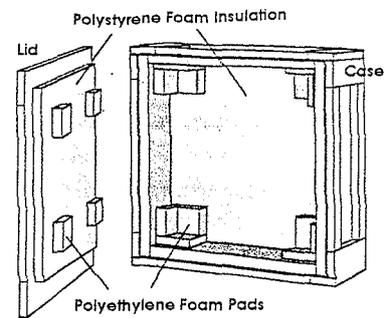
### Air Transit

Air transport is the *safest* form of long distance carriage, because the object is out of one's surveillance for the shortest period of time. Additionally *the aircraft environment can usually be controlled*. Containers for air transit are often smaller and their shape and contours may be designed to fit the aircraft. Very small shipments may be able to go in the passenger luggage hold.

During air travel, the air in a tightly closed case will remain at its initial air pressure, while the outside air pressure changes. Therefore the case needs to be strong. A pressure release valve may be a good idea. It will help to equalise the altered air pressure in the case. When the lid is opened later on the ground, a rapid inrush of air could damage the contents or upset RH control. This is best guarded against by acclimatising the case at its new destination for twenty-four hours before opening.

## Temperature And Relative Humidity Protection

When the temperature and/or relative humidity of its environment changes, an object responds *dimensionally*, especially cellulose materials such as paper, and organic matter like leather, skin, feathers and bone. This response can have damaging effects if the materials in a work respond at different rates from each other.



facilities and manpower available at the institutions to be visited in transit.

## **Making a Crate** —————●

### **Edge and corners**

Bevel to reduce splinter danger

### **Strapping, cleats, runners**

Use top grade white pine (stronger and less waste than cheaper grades)

### **Nails**

Use only quality nails, with large, coated heads. Smooth surfaced box and cemented nails are good as they hold well. This means that a smaller diameter nail can be used, which is less likely to cause splitting. Drive nails into the side, not the end grain, so that they hold more strongly.

### **Screws**

If the case is made of harder woods, use screws, and pre-drill holes if need be. Strip after repeated use.

### **Interior lining of a crate**

The inner surfaces of a crate may be lined with a coating or film which is impermeable to water vapour and which will isolate the cargo from harmful woods and exterior agents e.g. polyethylene film.

A case can have skids at its base, for moving and standing, and handles for lifting and moving. Handles may be made of wood, rope, plastic or metal. The number of handles on a case depends on the weight of the case and how many people should ideally carry it. They should lie flat into or within the case's body lines, or should be protected by battens above or below. Place the handles at heights which allow the case handler to lift the case without straining themselves.

Quick release closing devices may be scraped with screws and plates. They are strong and easily opened and fastened.

Cover fastening screws. No nails. Suggested if travelling use plate and bolt fasteners (because screws may need to be stripped after repeated use.)

Labels should be firmly attached, and glued onto both faces of a case. Despite labels, mishandling and exposure to harsh travelling conditions can occur, therefore safety features in a case's design are important.

E.g. Need cautions, addresses, case dimensions, net and

gross weights in pounds and kilos. These will guide handling e.g. a 100kg box needs two to three handlers and any larger box needs a forklift.

Label the work and the box with unpacking/repacking instructions.

A case may be painted for aesthetic value and to give added environmental protection. The paint can be water resistant and colours yellow, orange, pale blue, grey or white are common. A large case needs battens for forklift handling.

## **Tray Packing For Flat Objects** —————●

Each object fits into a unique position and each on a tray with shock absorbers at the corners of the handling frame. About 5 to 6 frames per crate.

Shock can be a problem, so to compensate add absorbent material where the tray meets the crate.

## **Vertical Sliding Panels Or Trays** —————●

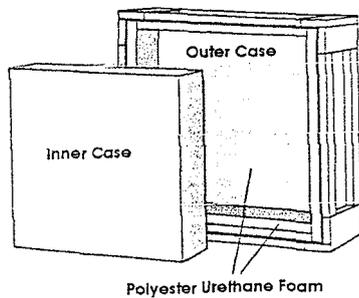
Slots or tracks allow vertical storage of panels. This system requires frames to be smooth to accommodate sliding and handling. Cases can be heavy and durable, or of lighter weight construction materials and fewer panels inside. Solid panels are stronger than perforated ones.

## **Canvas Works** —————●

A weak canvas fabric work may need to be consolidated with a second one i.e. lining with beeswax or a similar adhesive. This gives greater stability when faced with RH changes.

## **Padded Trays For Rolled Objects** —————●

The tray should be padded and compartmented to give protection. Each rolled object should be supported by a cardboard or other tube. These tubes should be chemically safe for the object. Each object to be protected by a clear, plastic sleeve, and numbered. Label materials 'save for repacking'.



- 1) Place down one large white cotton sheet (no starch or size) and place on top an acid-free tissue layer.
- 2) Then textile face down on top.
- 3) If the work is too large to be stored flat, gently roll the work around a large padded and chemically free cylinder, then pack in a box with soft material to keep the roll free from the box walls.
- 4) Store in a crate that is lined with waterproof building paper, to keep it moisture free.

Tapestries should be rolled over large cylinders, with acid free paper between layers to prevent friction, and held in place by ribbons attached to the crate or wrapped around the outside of the roll. The crate should be lined.

Materials and pieces used inside the case should be carefully numbered and labelled to facilitate repacking.

On the outside of crates there should be codes and numbers for crates and objects', in separate colours. Arrows for the best direction the crate should be packed in and another coloured arrow for an alternative packing orientation.

Smooth transitions will occur through notifying the people concerned about the works and crates, where in the gallery the works are to be unpacked and packed, the inclusion and use of condition reports and packing instructions.

### **Packing For Long Distance Transport —•**

This is a much more complicated problem entailing the maintenance of the object inside the packing material without crushing it or allowing it room to move. A rolled object is comparatively simple, as long as the rolling is carried out with meticulous care so that there is no slack which could be crushed by strapping.

Small, flat textiles can be carried between two stiff pieces of board, firmly joined together to ensure that the object cannot slip down if the boards are carried vertically.

Large textiles which have to be folded should be surrounded by a rigid box and wedged into position with a copious amount of tissue paper, each sheet made into a round ball. Alternatively an easier way is to use sheets or rolls of polyester wadding tucked round the objects, using sheets of tissue or muslin to prevent catching.

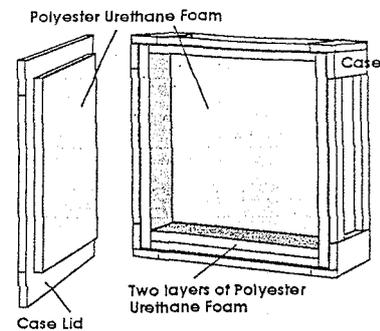
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**These extracts have been transcribed from the conference pre-prints " Art in Transit". This conference was organised by the National Gallery of Art, Washington, USA.**

## **Notes On Unpacking From The Robert McDougall Art Gallery**

- *Do not hurry.*
- *If packaging doubtful, photo is good for insurance/claims.*
- *Follow label instructions to unpack.*
- *Prepare area carefully: clean, adequate space.*
- *Cut or undo fasteners, then fold back. Do not rip.*
- *Only unwrap a painting flat, not on edge.*
- *Photograph a damaged artwork. Check glass and if broken minimise movement to reduce chance of glass slivers moving across surface of work.*
- *Keep packing material for reuse and label them.*
- *Don't damage packing crate. Take photos to record correct packing arrangement, for repacking.*

Conservation Department  
Robert McDougall Art Gallery



### Temperature Protection

A packing case can encounter very cold and warm temperatures, where the air temperature inside may differ substantially from the outside temperature. The air temperature inside an object's case will, over time, be affected by the air outside the case.

Temperature regulation is best achieved by trying to keep the case out of harsh, hot or cold environments (in NZ, available carrier trucks do not have temperature controls) and by providing a case design and internal insulation which will slow and delay temperature change.

Quality case construction will minimise air leakage. Cube shaped cases have less surface area to be effected by temperature change, than large, slender cases. When the case is built its protection level can be checked with a thermometer, by moving the case from one room to another of different temperature.

### Relative Humidity

There are also damaging limits of RH levels. Too high an RH level can lead to loss of a material's strength (through moisture absorption/expansion) and mould growth. Too low can leave a material brittle from desiccation. Abrupt RH changes are worse especially if the change in moisture content causes chemical changes.

The packing case is required to be a protective system to minimise the likelihood of significant RH change, and any deterioration if the RH changes. Each object should be *assessed individually for its most suitable RH level, environment and protection*. Its past history is important. If an artwork had been in a hot, dry environment, it would not be wise to take it to a very humid climate.

Use wood, plywood, fibreboard, corrugated cardboard, and the case materials themselves act as 'cellulose dunnage' and their buffering action will maintain the RH environment well, up to a point. The case needs to be *stored under desired gallery conditions* for a time, and the objects to be packed need to be equilibrated to the desired RH and temperature levels (environment). Thus, if the temperature is stable, a packed, well sealed case's internal RH will remain fairly constant.

The materials of a case: paper, wood, foam: all act as humidity buffers to some degree, and will therefore restrict the effects of RH change on an object. This occurs because most cases, and their artworks, are made of moisture absorbent materials and there is only a small volume of air in the case. A humidity buffer is therefore unnecessary. However when the object is not hygroscopic and/or it is expected that the temperature and RH of the air outside the case will change harmfully the addition of a humidity buffer, such as silica gel, can be very useful.

Silica gel is a hard, inert, crystalline material, with a *high moisture capacity* of about 40% (of its own weight),

and so it can de-absorb/absorb a lot of water. It is also relatively insensitive to temperature.

Silica gel is used *most effectively if it is added to the case over as wide a surface as possible*. In a double case, place silica gel between the container walls and cover the inner container's walls with plastic. The gel must be conditioned to the desired RH, before it is introduced into the case. This must also be done before repacking. The gel can be dusty, and it may need a dense filtering material around it as a barrier.

Good RH control is additionally achieved by wrapping the artwork. In New Zealand different weights of flexible polyester (mylar) are available, the second best being polyethylene wrapping. The wrapping will leave a small layer of air around the painting, and within this the moisture absorbing materials will establish a Relative Humidity equilibrium.

### RH and Temperature Depend on Each Other

RH and temperature levels are linked together. If one changes, the other will change. The less air volume, in the case, will lead to a smaller RH change in relation to the temperature.

### Vibration And Shock

Shock and vibration are two factors which can also cause an object's condition to deteriorate in transit.

#### Shock

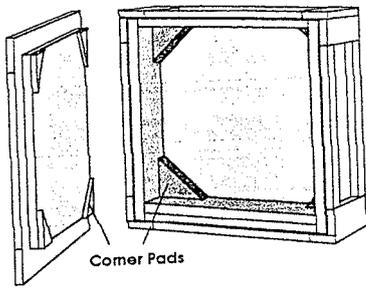
A shock can occur to a package if it is dropped, punctured, knocked, or falls over. Any shock cannot be predicted, but the packing case can be designed so that its size, weight and form will minimise the severity of a shock if an accident should occur.

#### Protection Against Shock

Consider how the object would be effectively moved by an impact. Look at the vulnerability of the object's materials and form also. Consider the probable drop heights which are likely, if the package is dropped, by the package's weight and the type of handling it is likely to receive.

*These weights given are typical*

-small painting in hand carried case	:up to 9kg
-small painting case for cargo shipment	:up to 22kg
-large easel painting	:22-136kg
-large ptg + frame & shipping case	:363- 408kg
-sculpture	:over 450kg



The most effective protection against damage from a shock, is to use appropriate cushioning material in the packing case.

Select a quality cushioning material e.g. polyester foam of a type which can provide an appropriate level of protection (e.g. polyether urethane foam or polyester urethane foam). Polyurethane foams are appropriate because they provide good shock protection for paintings over a broad range of static loads and, as a good insulator, they also provide thermal protection.

In a double case, the artwork will be encased in an inner box. The cushioning should be placed between this and the outer box, so that the inside surfaces of the outer case are all covered with foam.

Ensure that the foam is adhered properly to the case, so that it will not bow out or come loose, and that glue or adhesives used are chemically stable and harmless to the art object.

#### Vibration Damage

Vibration damage may occur when the artwork's natural vibration frequency is similar to that of its carrier vehicle, and when the vehicle's vibration is continuous and of a high magnitude. Vibration in trucks is usually the most severe. Inside the carrier vehicle, the case should be well secured, so that it cannot bounce or shift about. Additional cushioning helps to lessen transmitted vibration in trains and trucks. This means using blankets, rubber pads etc.

#### Before Packing

Treat all interior wood and fibreboard with a fungicide. You must decide the duration of protection. If a solvent is used, let it evaporate before use. Cushioning materials should be hygienic.

Treated cases should carry signs warning of this, and borrowers informed about packing and repacking.

## The Packing Aim

*To design a protection system  
which minimises the stresses to the artwork,  
which are likely to occur in the transit*

#### Case Details And Design

The case requirements for unpacking and repacking should be simple, and repeatable. The case should be reusable. This is ensured by use of a good design and locks.

A case should be designed well in order to protect its cargo during its complete journey, and also so that it can be reused, it should house and support its object with insulation and cushioning foam. The case should maintain a sealed environment, and protect its contents from climatic forces; rain, snow, RH, temp, sun, and the effects of an impact or puncture.

The materials to be used for the case should be determined before construction. Plywood is a good, cost-effective material to use. It has a high strength for its weight, and provides some insulation and RH buffering action. It can also be used without special tools.

#### Cushioning Materials

Cushioning material can be foamed plastic, and rubber. Excelsior cushioning and cellulose wadding (cork, rubber and animal hair) have high damping shock absorption and high moisture absorption which is important for controlling relative humidity levels.

If using rubber or synthetic foam cushioning, the material should be of a firmness that after the object is placed on it, it does not fully compress (ideally no more than halfway). Over a long period of time in transit or in storage, some synthetic materials can release harmful chemicals such as acids. Any suspect material should be physically separated from the object. Additionally, absorbents can be used to trap any volatile chemicals which could be damaging.

#### Plywood

Do not use plywood thinner than 3/8" for a crate's walls and use 1/4" plywood for tray bottoms and inside compartments etc. The good side should always face outwards and plywood is a readily available material.

#### Constructing for Puncture Resistance

The thicker the case material (e.g. plywood), the more it will protect its cargo if a case is punctured, as it will lessen the depth of penetration.

#### Crate Weight

A case needs to be light enough to be lifted either by people via handles, or by mechanical means, which may require blocks or skids. This may be dictated by the

**INERT PACKING MATERIALS AND EQUIPMENT**  
 PREPARED BY CANTERBURY MUSEUM CONSERVATION DEPARTMENT  
 FEBRUARY 1998

<u>INERT PACKING MATERIALS</u>	<u>SOURCES</u>	<u>DETAILS</u>
⇒ <b>Acid free corrugated card</b>	Conservation Supplies Ltd Jack Fry phone 04 568 2062 fax 04 568 8902	Double wall, 1200 x 2400mm \$58.10 /sheet Single wall, 1200 x 2400mm \$27.59 /sheet
	Carter Holt Harvey Wanda Cooper phone 03 353 5502	Double wall, 40"x 60" \$33.79 /sheet Single wall, 40"x 60" \$21.99 /sheet
⇒ <b>Archival manila</b>	Conservation Supplies	765 x 1020mm \$4.34/sheet
⇒ <b>Ethafoam</b>	Dunlop, Roger Martin phone 03 348 5009 fax 03 348 2741	220E Ethafoam, 2.7m x 0.6m \$64.94/plank, 30mm thick \$107.18/plank, 50mm thick \$107.18/plank, 70mm thick
		LD24 Plastazote, 1m x 1.5m \$7.65/sheet, 3mm thick \$12.99/sheet, 5mm thick \$20.82/sheet, 9mm thick
⇒ <b>Tyvek</b>	Fabir-cell phone 09 266 4924 fax 09 266 4929	1422 Tyvek \$4.50 /m
⇒ <b>Gummed linen tape</b>	S & M Supply Co. PO Box 4296 Kingston ACT 2604, Australia phone 00 61 6 280 6344 fax 00 61 6 280 4885	L533-1050 white, neutral pH 25mm x 45.7m roll 0Z\$26.60 /roll
⇒ <b>Acid free tissue</b> <i>Note: Do NOT use Buffered Tissue for protein-based materials (e.g. skin, wool, hair, silk, fur, feathers, horn, baleen, tortoiseshell, photographs)</i>	S & M Supply	<b>Buffered tissue</b> 508 x 762mm, #ARV 170 0Z\$793.65 /2500sheets
	Conservation Supplies	<b>Unbuffered tissue</b> 510 x 760mm, #TSU 03 (Barcham Green LZ tissue) \$325.50 /500 sheets
⇒ <b>Cotton twill tape</b>	Charles Parsons 1 Lancaster St., Christchurch phone 03 366 1669 fax 03 366 8180	12mm, 500m roll \$123.50 25mm, 200m roll \$84.10
⇒ <b>Mylar</b> (polyester/ polyethylene terephthalate)	Raeo NZ Margaret Broadbent phone 0800 800 791 fax 0800 800 235	#31300: 300mm x 50m \$36.68 /roll #31940: 940mm x 50m \$101.70 /roll

<u>INERT PACKING MATERIALS</u> (continued)	<u>SOURCES</u>	<u>DETAILS</u>
⇒ <b>Double sided tape</b> 3M #415	Conservation Supplies Ltd  Light Impressions 439 Monroe Ave, Rochester, NY 14607 USA fax 001 716 442 7318	33 metre rolls: 6mm wide, #TAP 03 \$20.76 12mm wide, #TAP 05 \$22.96  36 yard rolls: (*less \$ in bulk) ¼" wide, #05051, US\$6.35* ½" wide, #07148, US\$10.95* ¾" wide, #05863, US\$12.65*
⇒ <b>Zip-lock bags</b> (polyethylene)	Ace Packaging Supplies, Paul phone 03 365 6963 fax 03 365 6399	Various sizes ranging from: #7010: 62 x 75mm \$14.24/1000 to: #7170: 330x330mm \$115.54/1000
⇒ <b>Hot melt glue sticks</b>	Hardware shops	~\$35/box of 200
⇒ <b>Stainless steel staples</b> <i>Note: 16 staples required for average box &amp; lid</i>	SIFCO Distributors Industrial Products Division 8 Holt Place, Christchurch 03 358 8135	STCR 5019 - ¼" C stainless steel Requires stapler below ~ \$80/ box of 5,000
⇒ <b>Monel staples</b> <i>Note: 16 staples required for average box &amp; lid</i>	S & M Supply	#419-004M Fits standard staplers Aus\$76.50 /box of 5,000
⇒ <b>Archival adhesive</b> #924 Scotch Brand Transfer Tape	Carter Holt Harvey 03 379 3550	6mm \$4.11 12mm \$8.92 19mm \$11.90
⇒ <b>Cardboard tubes</b> <i>Note: not acid-free, cover with Mylar</i>	Shardlows, Mike 03 389 3014	305mm dia x 3m L \$51
⇒ <b>Calico</b> <i>Note: must be washed</i>	fabric shops	~\$3/metre
⇒ <b>Rigilene plastic boning</b> (polyester)	fabric shops	~\$1.85/metre
⇒ <b>Thread</b> (white, cotton or poly.)	fabric shops	
⇒ <b>Velcro</b> (non-adhesive backed)	fabric shops	~\$2/metre
⇒ <b>Dacron filler</b>	Ellis Fibre Processing Phone 03 476 4221 Fax 03 476 4745 (or fabric shop)	Code 7070, Supaloft-T 1525mm wide x 300gm 12m roll \$75/ roll, \$6 shipping