

The Care and Preservation of
Horse-Drawn Vehicles
by Ellen Seidell Conservation Intern

INTRODUCTION

Historical horse-drawn vehicles can be maintained for years of use and enjoyment provided that some basic care and attention is given to its preservation. A variety of carriages are stored and displayed at the Henry Ford Museum, with most dating from the 19th and 20th Centuries. The conservation staff at The Henry Ford have compiled the information in this fact sheet to help individuals care for their objects and collections. The first step in the care of collections is to understand and minimize or eliminate conditions that can cause damage. The second step is to follow basic guidelines for care, handling and cleaning.

Please Note: This fact sheet will present a brief overview of the care of horse-drawn vehicles, focusing on proper maintenance and storage as the best method of preservation. It must be recognized that carriages are complex objects composed of numerous materials such as iron, wood, leather, textile, glass, paint, and varnishes – all of which experience deterioration differently. Depending on their physical state and level of degradation, certain components of carriages may require specialist intervention. Please contact a conservator if you require assistance with the conservation of the previously listed materials. To locate a conservator in your area, contact The Henry Ford or search the American Institute of Conservations database at:

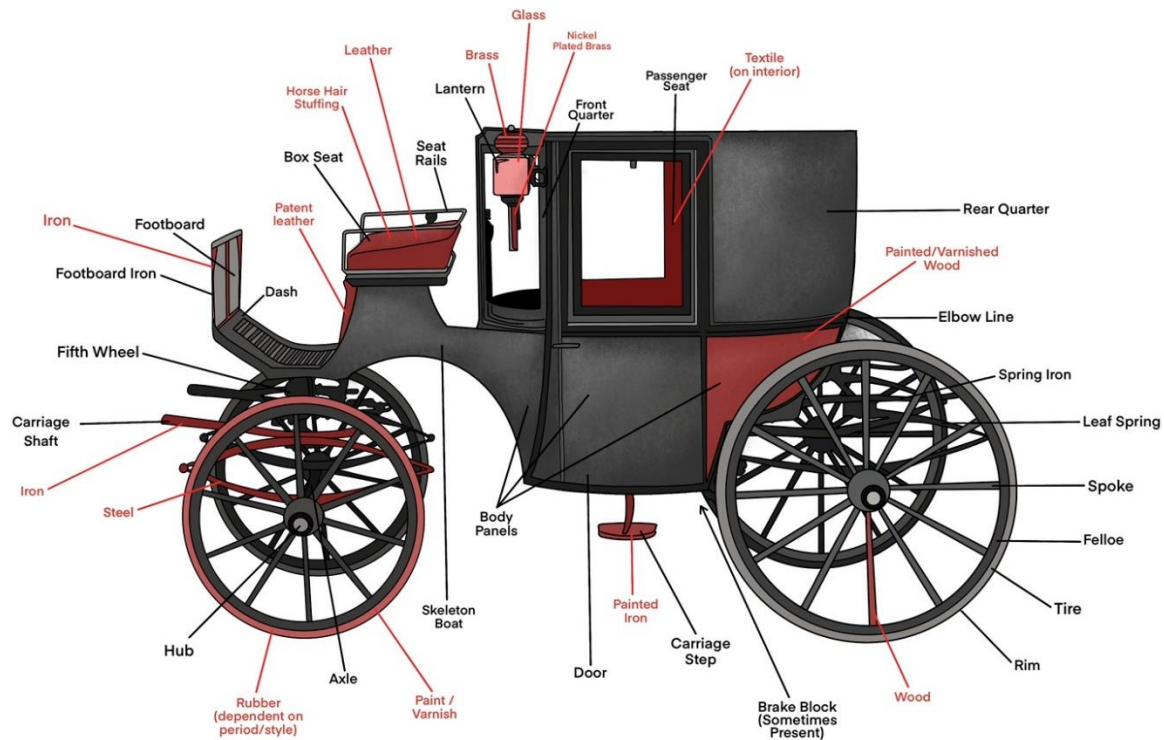
<https://www.culturalheritage.org/about-conservation/find-a-conservator>

ANATOMY OF HORSE-DRAWN VEHICLES AND TERMINOLOGY

In order to best preserve a horse-drawn vehicle in storage or on display, one must first be familiar with the general anatomy of the object. Often composed of hundreds of pieces and a breadth of materials, if not adequately analyzed, carriages can pose potential challenges for storage and preservation maintenance.

Below, you will find a diagram which shows components and structural elements that are present on a multitude of carriage types. The materials that make up many of these components are labeled to better display the complexity of these items. Please note that depending on their function, certain horse-drawn vehicles may have different parts and features that may not be included in this diagram.





MATERIAL COMPOSITION OF CARRIAGES AND TYPES OF DAMAGE

Poor handling and inappropriate storage are the major causes of damage to horse-drawn vehicles that can lead to individual deterioration of select materials as well as more severe structural damage to the entirety of the object. Inappropriate storage refers to either storage that lacks proper environmental conditions (i.e., temperature, relative humidity, UV exposure), or storage that places unnecessary physical stress on the object. Incorrect handling can result in wear or breakage to the object, some of which may be irreparable.

Apart from assessing current and past storage conditions, it is important to note that some horse-drawn vehicles may have also been physically utilized for demonstrative purposes or original utilitarian use in the past. Thus, a portion of the object's degradation could be attributed to this previous function and must be a part of the historical significance of the object.

As stated, horse-drawn vehicles are inherently complex objects composed of a wide variety of materials. To best address the types of damage that can affect these objects, the following section incrementally addresses the various material components.

General Cleaning and Care Considerations

Before handling or cleaning any carriage it should be examined to identify any damaged areas. Damage should be documented in images and written form. Any previous condition reports if they exist should be referenced. This knowledge can aid in the detection of active deterioration and identify areas of active deterioration that require the assistance of a professional conservator.

WOOD

Wood is used to form portions of the carriage such as its body, axles, shafts, and wheels. Depending on the intended durability and flexibility of the object, a mixture of hardwoods (including hickory, oak, ash, elm, locust, beech, gum, cherry, and black walnut) and softwoods (whitewood, basswood, pine) could be present.

Environment

Inappropriate environments, in terms of light, temperature and relative humidity can lead to the damage of wooden carriage components. Elongated exposure to light can cause paint and varnishes to degrade, fade, darken or develop a cracked or “alligatored” appearance. In addition, wood is a porous material, when exposed to high levels of humidity it absorbs moisture which can cause swelling, warping and the formation of mold. Locations such as the felloes on the wheels are especially susceptible to this risk which can weaken the structure of the carriage. Contrarily, dry environments can also affect wood causing it to shrink and crack, leading to breakage and gaps within the joints.

The presence of insect pests can also damage wood. To prevent damage due from pests, carriages should be routinely examined to ensure no infestations are occurring. If evidence of infestation is found, if possible, the component should be placed in a plastic bag or the carriage should be otherwise wrapped and sealed in plastic and isolated until it can be examined by a professional conservator.

Cleaning and Handling

The following recommended cleaning procedures are only applicable to wood portions of carriages whose finishes are in good condition (no flaking) and for items with no lifting paint, varnishes, inlays, or gilding. Extensive cleaning of severely damaged finishes or highly porous wood should only be completed by a professional conservator.

If the wood on the carriage is in good condition with no flaking or lifting paint/varnishes, any dust may be removed using a vacuum with a small brush nozzle.

When wet cleaning is necessary, diluted detergents are recommended. When cleaning wood surfaces commercial cleaning products should be avoided because they often contain harsh cleaning agents, colorants or perfumes, instead mild cleaning agents such as Orvus or Triton X-100. These simple detergents should be diluted to approximately 1% in distilled water. Using soft cotton cloths, disposable cotton pads, or swabs, this solution can be used to lightly clean wooden surfaces. It is advised to first test clean a small section of the wood with the solution to ensure no negative reaction before fully cleaning. After cleaning, the surface should be wiped with distilled water to remove any residual detergent left on the surface.

METALS - IRON, NICKEL PLATED METALS, STEEL, BRASS

Iron and other metals are commonly found on carriages of all varieties. Iron and steel are frequently used to create the structural design of the body and undercarriage of a horse-drawn vehicle, with other metals like brass, and nickel-plated metals used for handles, lanterns, and other accessories.

Environment

Though metal can be a durable substance, exposure to temperature fluctuations, high humidity (above 70%), salts, and oils can cause unwanted, detrimental corrosion. Pitting from corrosion can structurally weaken metal, leading to fatigue and breakage. Active corrosion which is induced by high humidity and the presence of salts is of great concern, especially if it develops at the joints between metal components.

Painted metal is often protected if the surface of the paint is intact. If the paint surface is damaged, exposed metal will rapidly corrode in poor environmental conditions leading to further paint loss.

Cleaning and Handling

When handling and cleaning metal objects, nitrile gloves must be worn to prevent the transfer of salt and oils from hands onto the surface of the metal. Metal surfaces may be lightly cleaned with distilled water or 1% Orvus or Triton X-100 in distilled water using a cotton cloth, cotton pads, or swabs to remove any dust or light residue present. Store-bought cleaning agents

should be avoided, as they can contain harmful chemicals that can damage the object. If paint is flaking or lifting from the surface of metal, it is best to avoid cleaning or touching the area altogether. This may require the assistance of a conservator to stabilize the paint.

TEXTILES AND UPOLSTERY MATERIALS

Textile and stuffing materials are commonly found on horse-drawn vehicles either in the form of seating or as means of lining the interior of the body. The materials used for textile coverings can range from cotton, wool, linen, hemp, canvas, carpet, and on occasion silk. Upholstery stuffing materials generally consist of horsehair, cotton waste, Spanish moss, waste hemp or jute, bass, or whalebone shavings.

Environment

As an organic substance, textiles and stuffing materials are highly susceptible to degradation when kept in poor storage conditions. Excessive exposure to both visible and Ultraviolet light can cause fading of textiles, thus, it is recommended to limit light contact as much as possible. Fluctuating or extreme temperature and humidity levels can also adversely affect textile fibers. While high temperatures and increased humidity can encourage detrimental mold growth, low temperatures and decreased humidity can embrittle fibers. More often, severe temperature and humidity fluctuations can provoke the expansion and contraction of fibers weakening the textiles and catalyzing deterioration.

Insect and rodent pests including clothes moths, carpet beetles, silverfish, firebrats, and mice can cause distinctive damage to textiles and stuffing materials.

- Clothes moths are attracted to materials such as wool and feathers. White cocoon webbing is often found adhered to textile surfaces of infested upholstery. Clothes moths are white in appearance and approximately 8cm in length.
- Carpet beetles feed on protein materials (wool, silk, horsehair) found in many textiles and stuffing materials. The presence of holes, carcasses, and a colored powder (an excrement called frass that is usually the same color as the textile) are an indication of an infestation.

- Firebrats and silverfish feed on the starchy materials within a fabric such as adhesives and fabric sizing. Silverfish (approximately 12mm in length) are scaly in appearance and can be found in dark, moist, and cool conditions. Conversely, firebrats are darker in color and thrive in dark, warm, and moist environments.

Cleaning and Handling

Contrary to working with metal, nitrile gloves *should not* be worn when handling or cleaning textiles. Gloves present a risk of causing damage to textiles because they inhibit the handler from feeling delicate surfaces of the object leading to additional damage. Thus, clean, bare hands are recommended for handling textile items.

Due to their fragility, it is advised that textiles only be cleaned using a vacuum to prevent unnecessary damage to the object.

If mold is present on the textile, the surface should be carefully vacuumed to remove any loose powder using a soft brush or micro-attachment. In these situations, appropriate respiratory personal protective equipment (PPE) should be worn when both handling and cleaning the object. An N-95, N-99, N-100, half or full-face respirator will effectively protect from the inhalation of mold spores.

LEATHER

Various types of leather can often be seen on horse-drawn vehicles both on the interior and exterior in the form of strips, upholstery, and enameled leather. Ranging in size, strips of leather can act as straps, loops, braces, and structural supports on the carriage. Additionally, leather upholstery is commonly used for the driver's seat compartment and sometimes seating or paneling in the interior. Due to its durability, the utilization of enameled leather or patent leather (leather with a hard varnish applied to its surface) can include storm curtains, hoods, mud guards, and interior panels.

Environment

When subject to poor storage conditions and inappropriate handling, leather can be easily damaged. The methods of preserving historic leather differ greatly from those used on regularly used leather. In some cases, upkeep such as oiling and conditioning can accelerate leather deterioration rather than extend its lifespan.

Light has the potential to adversely affect the state of a leather object. Both visible and Ultraviolet light can dry and weaken the material with excessive exposure. Extreme or fluctuating humidity and temperature levels can have harmful effects on leather. High temperatures (above 70 °F) combined with low humidity can dry leather, causing it to become brittle and fatigued. Extreme temperature combined with high humidity can also encourage mold growth and insect infestation within the leather, leading to breakage and rot. Mold appears as white, grey, or black spots or as a powdery substance. Similar to textiles, leather is also susceptible to pests such as carpet beetles, clothes moths, and hide beetles. If you see indications of an infestation (as discussed in TEXTILES section) please consult a professional conservator on the matter.

Leather suspension straps, used to support the body of the carriage, can be especially at risk of fatigue or breakage due to the continued weight on them for years. For those that have broken or are at risk of breaking, it is advised that padded wooden blocks be installed between the undercarriage and the body of carriage on the front and back in order to remove stress from the straps while still providing necessary support to the rest of the object.

Cleaning and Handling

Leather like upholstery does not require the use of gloves during handling. Leather that is pliable and free from surface cracks can be cleaned with a damp rag or cottons swabs and distilled water. Cleaning should be light and minimal, so as not to damage the leather. If the object is brittle or weak, cleaning should consist of dusting with a soft brush or a soft brush attachment on a low suction vacuum. Handling fragile leather during cleaning should be avoided as much as possible. If any pieces of leather have broken off from the object, place them into a plastic bag and keep with the object.

If mold is present on the leather, the surface should be carefully vacuumed to remove any loose powder. In these situations, appropriate PPE should be worn as with textiles (see above).

GLASS

Though minimal in comparison to the amount of other materials on a carriage, glass is often present in the form of windows or lanterns.

Environment

Breakage is the major risk to glass. Glass can be an unforgiving material, and even with reassembly, these repairs are often visible and obtrusive. Pollutants and improper annealing during glass production can cause glass to become cloudy in appearance. In these situations, high humidity should be avoided. If glass degradation is severe the glass may need to be replaced.

Cleaning and Handling

Glass may be cleaned with distilled water or ethanol and water using a microfiber cloth.

GENERAL STORAGE AND DISPLAY OF HORSE-DRAWN VEHICLES

In many museums, storage is often not ideal and can sometimes pose as a danger to its collections. Through critically assessing storage conditions, one can more effectively mitigate and actively protect collection items from these hazards.

Temperature and Relative Humidity

To avoid damage to horse-drawn vehicles, it is recommended to keep a year-round temperature of 68-75°F for both storage and display. Some variation between winter and summer is acceptable as long as changes in relative humidity are gradual and do not exceed 5% per day. For summer, preferred relative humidity is between 55-65% while in the winter, it may safely drop to 30-45%. Routine monitoring of storage environments can also aid in the detection of inappropriate environmental conditions

Visible and Ultraviolet Light

When possible exposure to visible, and ultraviolet light should be minimized. Generally, lights should remain off in storage facilities when staff are not working. Since light damage is cumulative and irreversible light levels in exhibitions should be set at approximately 100 lux or lower.

Pests

To prevent possible insect infestation, it is best to keep the contents of the carriage contained. All doors and windows should remain closed on the vehicle. If window tabs are severed or the glass is partial or not present at all, corrugated plastic can be cut to fit the open panel and act as a barrier in its place. If door latches are broken or are missing, cotton twill tape can be used to secure the door shut. In the event there are still gaps between the door/window and body of the carriage,

ethafoam may be cut and placed accordingly to fill any voids.

Sticky traps may be installed on or within the carriage as a means of monitoring pests. This method is only effective when good housekeeping and routine checks are established. Traps should be checked and replaced accordingly on a scheduled basis and a log of any insects or rodents caught should be kept on record. In the event of an infestation occurring, please contact a professional conservator to address the situation.

Leaks and Flooding

Water damage from leaks or flooding can severely damage horse-drawn vehicles. If a collection's storage location has a history of leaks from pipes or an aging roof, it is best to cover any at risk carriages with a layer of waterproof tarp or plastic. Ceiling mounted leak catchers can also be purchased from New Pig <https://www.newpig.com/leak-diverters/c/5036?show=All> . This barrier will ensure the carriages are not physically damaged by water while the leak is being repaired.

For buildings that experience ground flooding, it is advisable to place any horse-drawn vehicles on blocks or elevated surfaces to prevent damage to the wheels and undercarriage of the object. As described in the section titled 'Wood', the felloes and spokes of a carriage are highly susceptible to mold when exposed to moisture. If flooding is an unavoidable risk within the storage facility, keeping items directly off the ground can actively prevent them from structural degradation.

Additional Suggestions

- To best prevent the potential formation of mold, adequate ventilation should be maintained within the storage building.
- Tyvek fabric can be utilized to protect loose cushions (Both in the interior of the carriage and the driver's seat) and other miscellaneous carriage items from light, liquid, collecting dust, and infestation. Objects can be wrapped in the fabric and edges can be secured with Tyvek tape to adequately contain the item.
- When labelling a carriage and objects within it, it is best to use indirect labeling such as tags that can be attached by thread rather than adhesives. When used, adhesives can leave residues on the surfaces of objects, some of which are difficult to fully remove.

Professional Conservation Treatments

Some carriages may need more extensive attention than the preservation measures mentioned above. If any of the following issues are encountered, please seek the help of a professional conservator:

- If mold is located on carriage (either on wood, metal, textile, or leather)
- Any indication of an active insect or rodent infestation (can be seen in wood, leather, or textile)
- Severe metal corrosion that threatens the structural integrity of the carriage
- More extensive treatments such as choosing to separate the coach body from the undercarriage to aid in accessibility of the cleaning, repair, or replacement of structural portions on the carriage.
- If the carriage is need of a wheel alignment in order for it to move safely and properly

BIBLIOGRAPHY

American Conservation Consortium, Horse-Drawn Vehicle Conservation. 2008. American Conservation Consortium Ltd. New Hampshire.

Calnan, Christopher, et al. Conservation of Automobile and Carriage Leathers. *Conservation News*, vol. 43, Nov. 1990.

Carriage Restoration: Repairs to Wheels from the British Army Manual of Horsemanship, Equitation and Animal Transport - 1937. *The Carriage Journal*, vol. 17, no. 1, 1979, pp. 45–46.

Logan, Judith and Grant, Terra. Caring for Ceramic and Glass Objects. 2018, December 14. Canadian Conservation Institute.

Ferrel, Merri. Amazing Grace: The Conservation of the Omnibus 'Grace Darling.' *Driving Digest Magazine*, 1991, pp. 11–14.

Ferrel, Merri. Dual Use of Conservation & Restoration Methods for Carriages: Review of the Museums' Chariotee. *Driving Digest Magazine*, 1991, pp. 12–15.

Ferrel, Merri. Conservation Treatment of a Grand Duc: A Case Study in Practice and Methodology. *The Carriage Journal*, vol. 33, no. 2, 1993, pp. 65–67.

Hunt, Valerie. Guidelines for the Care of Furniture and Wooden Artifacts. Shelburne, Vermont, 1990.

Hunt, Valerie. Conservation of Painted Surfaces on Antique Sleighs. *Driving Digest Magazine*. Shelburne, Vermont, 1994, pp. 52–56.

Hunt, Valerie. Tips on the Care and Preservation of Horse-Drawn Vehicles. Shelburne, Vermont, Nov. 1996.

I.D. Ware, Carriage Materials. *The Coach-Makers' Illustrated Hand-Book: Containing Complete Instructions in All the Different Branches of Carriage Building: Adapted to the Wants of Every Person Directly or Indirectly Connected with the Manufacture of Carriages: Written and Revised by Practical Men of Acknowledged Ability and Long Experience in Their Several Departments*. I. D. Ware, 1872.

Latham, Sidney. The Restoration of Carriages by an Old Hand. *The Carriage Journal*, vol. 1, no. 1, June 1963, pp. 18–21.

Mold Advisor. [Personal Protection When Removing Mold](#). 2014, April 29.

Moore, Charles J. Treatment of an Early 20th Century Road Coach: Alfred Gwynne Vanderbilt's Venture. *Driving Digest Magazine*, May 1992, pp. 17–22.

Museums and Galleries of New South Wales. [Preservation of Historic Leather, including Saddlery](#). 2019, January 16. New South Wales.

Notes on Coach Trimming: Part 1. Trimmer's Materials and Tools. *The Carriage Journal*, vol. 18, no. 2, 1980, pp. 79–83.

Ravenel, Nancie. 1991 Summer Work Project: Conservation of Horse-Drawn Vehicles. Shelburne Museum, 1991. Shelburne, Vermont.

Richardson, M. T. Practical Carriage Building. M.T. Richardson Co., 1892.

Varnish Making. *The Carriage Journal*, vol. 34, no. 2, 1996, pp. 71–73.

Victoria & Albert Museum Ceramics and Glass Conservation Studio. [Caring for your Glass](#) Victoria and Albert Museum, 2013, July 18. Retrieved from:

Warren, Sue. Conservation of a Mclaughlin Piano Box Buggy. *Driving Digest Magazine*, 1994, pp. 52–56.

To Find a Conservator:

The American Institute for Conservation

<https://www.culturalheritage.org/about-conservation/find-a-conservator>

SOURCES



General Tools and Supplies

Woodcraft

<http://www.woodcraft.com/>

210 Wood County Industrial Park

PO Box 1686

Parkersburg, WV 26102-1686

1-800-225-1153

Highland Woodworking

<https://www.highlandwoodworking.com/>

Orvus and Triton 100-X

Conservation Materials International

<http://www.conservationresources.com/>

Humidity Indicators

University Products

<https://www.universityproducts.com>

517 Main Street

PO Box 101

Holyoke, MA

1-800-762-1165

