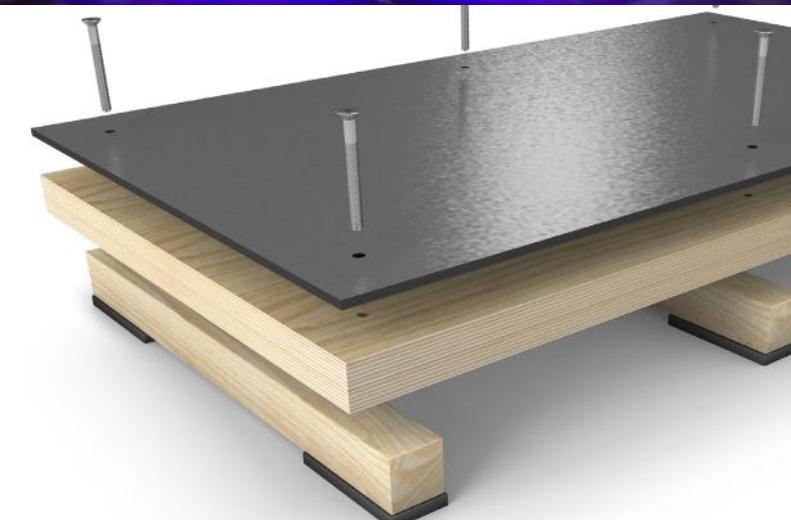
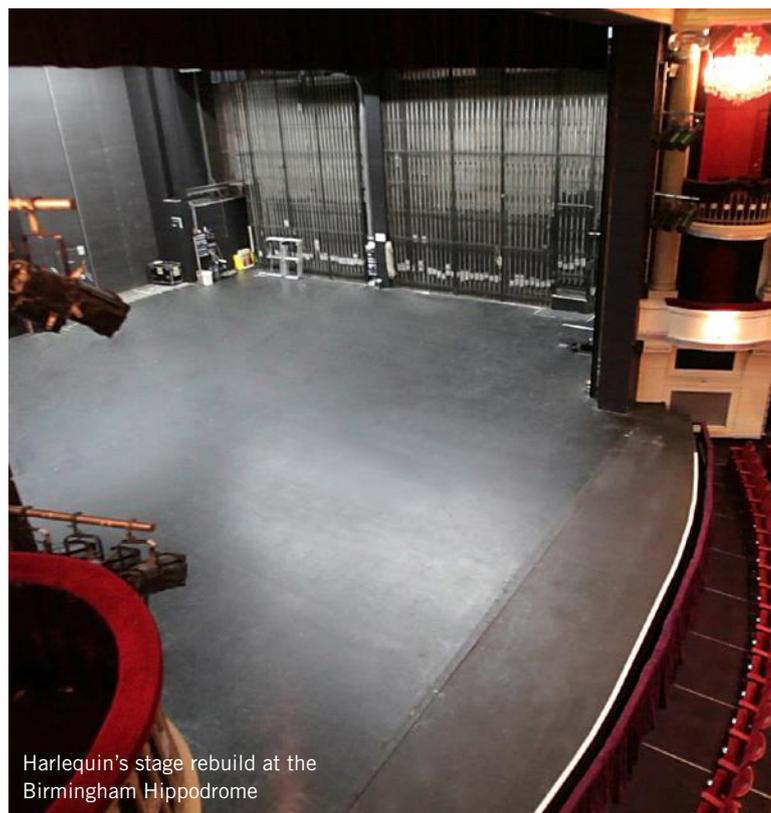


# Stage floor construction and technical solutions



# Building Stage Floors – refurbishment, rebuild and new construction

Backed by an engineering team and independent research, Harlequin Floors bring nearly 40 years' experience specialising in stages and floors for the performing arts. Harlequin works on major stage refurbishments from installing a new top surface to constructing a complete new stage.



Harlequin's stage rebuild at the Birmingham Hippodrome

Harlequin combines traditional floor construction skills using natural materials and advances in engineered floor products and engineered plastics components to meet the most demanding stage specifications. Whether working to designs by architects or a venue's in-house technical crew, Harlequin's skilled teams, vastly experienced in stage and floor construction, deliver the finished stage efficiently, on time and on budget.

Stage floors are integral to performance spaces and today venue owners and theatre planners are demanding more than a safe and versatile performance surface. Integration with stage engineering, aesthetically sympathetic to the architecture, even contributing to the acoustic environment of the space can all be factors that demand high specification standards.

Stages not only need to be load-bearing for performers, scenery, props and trucks, but to be hardwearing, throughout fit-ups, get-outs and rigging – show after show. The floor surface should provide a safe working environment not just for performers but for the technical teams too. Then there is an obvious expectation of the stage having a long working life with little need for maintenance.

## Birmingham Hippodrome

After 30 years and more than a thousand performances, Birmingham Hippodrome's main stage was in need of replacement, and being the UK's busiest theatre outside of London, a world-class stage floor was needed.

### Rebuilding the stage

Harlequin removed the existing plywood stage and rebuilt the understructure fitting new dip traps and a double layer of 25mm premium ply. The stage was finished with Harlequin Standfast vinyl, hot-welded at the joins to produce a seamless, continuous surface suitable for a mixed programme of drama, opera and ballet.

- 630sq.m of black Harlequin Standfast vinyl flooring was installed
- The heavy-duty vinyl was designed to be used either as a finished surface or to support a portable sprung floor.

## United Nations International School of Hanoi

A specially constructed Harlequin semi-sprung batten floor system, with a Harlequin Standfast performance surface was installed at the United Nations International School of Hanoi in Vietnam.

The stage floor specification called for a robust solution that could take the wear and tear of school productions, stage props, trucks and scenery construction and yet offer a cushioned floor and non-slip surface for dance. Harlequin's Hong Kong based office took responsibility for the supply and installation of a specially constructed Harlequin semi-sprung batten floor system, with a Harlequin Standfast performance surface. A combination that provides durability as well as slip-resistance for performers.

Dave Porter, Director of Operations at the United Nations International School of Hanoi explained: "Harlequin provided us not only with a durable Harlequin Standfast floor but also a professional stage sub-floor build-up, customised to suit our school's needs. Our stage floor is being put to the test daily by our students and can withstand the harsh climate conditions here in Vietnam."

Harlequin Standfast is an extremely hard-wearing performance floor intended for permanent installation, suitable for heavy-duty use and ideal for stages, percussive dance, multi-purpose use and ballet.

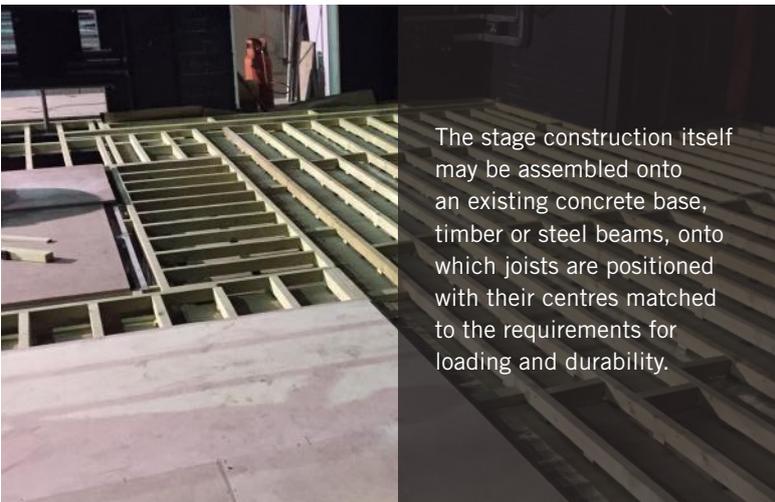
### Floor dimensions

10.38m x 18.20m Total area: 188.92sq.m



## Stage construction

Whilst each stage is different and may require its own solution, Harlequin uses established methods of construction and expertly selected materials.



The stage construction itself may be assembled onto an existing concrete base, timber or steel beams, onto which joists are positioned with their centres matched to the requirements for loading and durability.

Onto this is fixed a layer of durable 36mm or 44mm exterior grade birch plywood topped with the surface selected to fit the needs of the venue.



## Surface finishes include:



**“Sacrificial” painted hardboard** – chosen when the stage surface is likely to receive nails or screws. The hardboard is tacked down in sheets and may be readily and economically levered up and replaced.



**Harlequin Standfast** – a hard wearing, easy-to-clean vinyl surface which is glued down and with the edges welded to provide a seamless surface.



**Harlequin Rocksure** – a solid, warp resistant polymer composite formulation for extreme wear, which is bolted to the floor in sections and can be unscrewed for access or to replace heavily worn areas.



For customers requiring the most traditional craftsmanship, Harlequin also constructs floors made from prime quality, specially selected and long-lasting Oregon Pine.



## Stage refurbishment

When an existing stage floor requires refurbishment, Harlequin offers a range of services including:

- sanding and repainting existing wooden floors
- replacement of a ‘sacrificial’ hardboard top layer
- rebuilding, repair or reconfiguration of stage



## Revolve at Les Rotondes Theater in Luxembourg

When creating the Rotondes in Luxembourg's Bonnevoie district, it was specified that the stage should have a sprung floor and this included integrating a revolve.

The importance of a sprung floor across the whole stage was recognised as essential for the benefits it brought in minimising stress injuries for the performers. Harlequin's knowledge and expertise in developing floors for dance are informed by the results of bio-medical research, which has demonstrated reductions in injury to dancers and was an important requirement of the specification.

This was the first time that a Harlequin Liberty® sprung floor had been shaped for a revolve with all edges individually cut and fitted by craftsmen on site.

## Frank Collymore Hall, Barbados

The Frank Collymore Hall, located in the heart of Bridgetown, is described as a 'state of the art theatre' and with seating for up to 491 people, is also one of the largest theatrical venues in Barbados. The venue is used for music recitals, dance, dramatic presentations and conferences.

Harlequin was invited to provide a solution for a major stage refurbishment. Harlequin opted for a variation of their WoodSpring floor and a traditional construction technique for replacing the 185sq.m stage, but incorporating modern methods and materials. Owing to the high levels of humidity in Barbados, it was essential that the wood was treated to prevent warping and distortion during transport and installation.

The 'basket weave' method of construction observes a traditional approach by using a triple layer of battens. These are interwoven at right angles to each other to create a sprung floor that works through the natural flexing and recovery of the select woods and is enhanced with the addition of shock-absorbent elastomer blocks.



# Stage floors for challenging environments



## Marine environments – stages for cruise ships

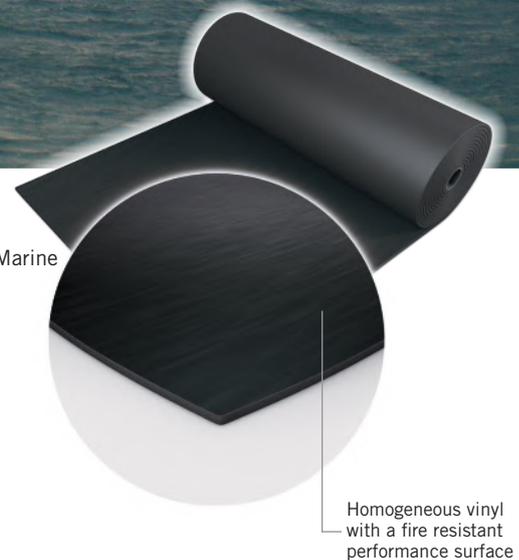
The popularity of cruise vacations has led to the commissioning of larger and more lavish ships including extensive entertainment facilities and well-equipped theatres. The marine environment and demands particular to ocean-going stages are challenges met by Harlequin’s experienced engineering and installation teams.

The range of specialist permanent flooring used on cruise liners includes Harlequin Marine, a hard-wearing, homogeneous vinyl which conforms to International Maritime Organization (IMO) standards and fire ratings. It is suitable for fitting within confined spaces on marine vessels and/or scenery docks on cruise ships. It is fire-resistant, with a slightly marbled surface to resist scuffing. It can be laid on any hard, smooth sub-floor and is an excellent choice as the vinyl performance surface when used in conjunction with a Harlequin sprung floor.

## Working in the historic building environment

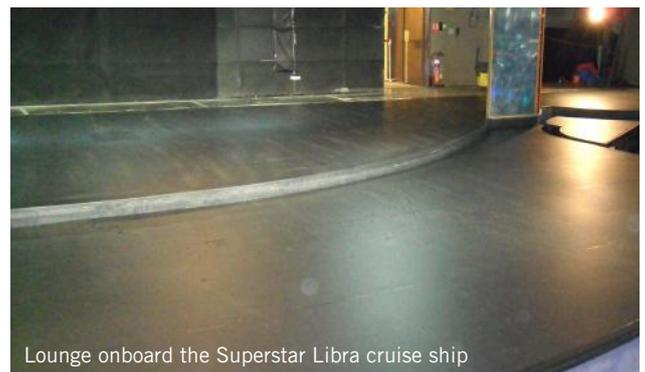
Many theatres and opera houses are historic buildings in their own right, which are subject to preservation orders to conserve the integrity of the structure. Materials and working practices are tightly regulated and inspected to ensure the building remains true to the original design and concept of its architect. In other cases the original purpose of the building may have become obsolete and conversion into a performing arts space allows the structure to be retained and given a new lease of life.

Harlequin Floors has years of experience, working sensitively to restore, refurbish or create new stages in buildings that are listed, preserved or subject to conservation orders. This may mean working around structural features, accommodating awkward spaces, complying with fire risk requirements and the selection of suitable materials.

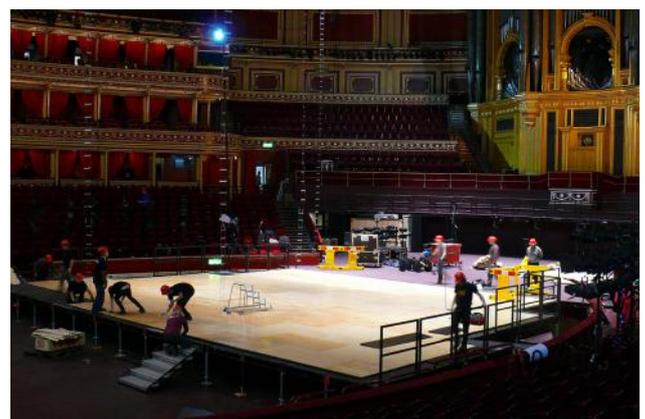


Harlequin Marine

Homogeneous vinyl with a fire resistant performance surface



Lounge onboard the Superstar Libra cruise ship



Harlequin Liberty® floor installation at the Royal Albert Hall. Panels had to be cut on-site to accommodate the iconic elliptical curve of the stage.

## Grand Théâtre De Bordeaux



A Harlequin Activity sprung floor with a Harlequin Studio surface was installed in a semi-circular shape in the Salle des Peintres, covering 255sq.m of the total 500sq.m space.

The room was converted into a dance studio with the perimeter of the room designed as a warming-up area, since the height under the original beams was not sufficient for dance practice. The Salle des Peintres is situated immediately above the main opera room and Harlequin Activity was preferred for its acoustic properties. Floor traps were fitted in order to allow access to the opera chandelier.



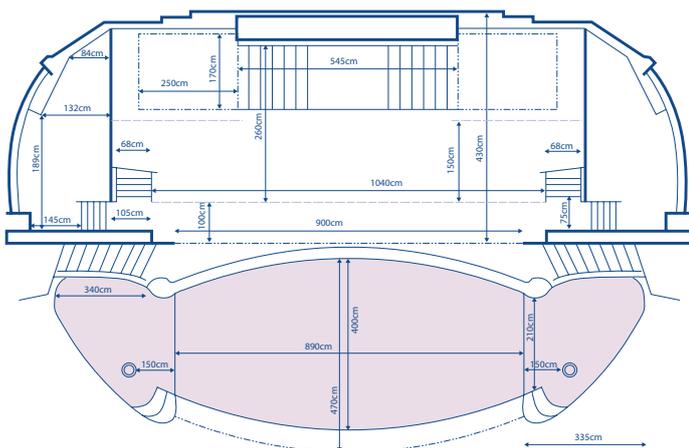
## Emerald Princess and Grand Princess

The main stage refurbishment projects were carried out in conjunction with Stage Technologies Group.

The existing floor coverings were removed and defects in the plywood sub-floors were repaired. A latex screed with flexible smoothing compound was used to give a suitable finish before the installation of the Harlequin vinyl surfaces. In both cases Harlequin Cascade was permanently laid, with seams welded and silicone sealant applied to its perimeters, before PVC nosings were installed to the steps each side of the stage into the audience area.



## Superstar Pisces and Aquarius



Harlequin removed the existing stages and replaced the plywood on both using two layers of Dricon® fire retardant treated 18mm timber onto Isorubber, fixed with tech screws through the plywood and Isorubber impact sound isolator.

The plywood joints were filled and sanded to a suitable finish before installing Harlequin vinyl top surfaces. Harlequin Cascade was then installed lengthways across both stages with seams welded and silicone sealant to the perimeter abutting walls.

The wooden plinths at the front of both stages were stripped of varnish, sanded and repaired then recoated with three coats of marine approved varnish.

# Sprung floors for dance and ballet wagons

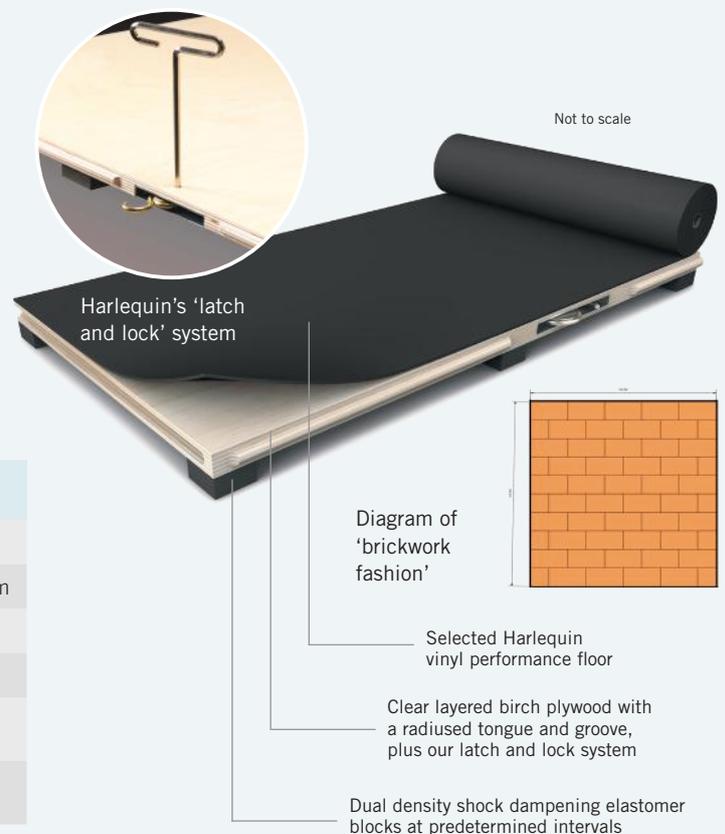
International venues with a large stage that is shared alternately between the resident ballet and opera companies are constantly presented with a problem: how to manage the regular transition of a stage floor designed for dance into a multi-purpose floor with scenery tracks and elevators required for opera productions.

A sprung floor designed for dance flexes under impact giving a softer feel and reduces the risk of injury to the performer. Harlequin Liberty is a modular sprung floor panel system with good area elasticity, designed for both permanent or portable installation due to its specialist interlocking feature. This flexibility means that the panels can be easily installed and removed by a theatre's own technical team or permanently installed onto a ballet wagon.

## Harlequin Liberty® permanent or portable sprung floor

Harlequin Liberty is a modular sprung floor panel system, designed for permanent or portable installation. Panels are laid in a brickwork fashion onto the sub-floor so that cross-joints do not coincide. The panels join together by a radiused tongue and groove, and are secured in place using our latch and lock mechanism.

Harlequin Liberty is a sprung floor that combines shock absorption with good area elasticity. The undersides of each panel are fully supported by dual density elastomer blocks spaced at regular intervals, giving uniform and consistent shock damping and providing the same "feel" and energy return to one or several dancers on the same panel, with no hard spots at the joints.



### Specification guide

<b>Permanent or portable:</b>	Both
<b>Dimensions:</b>	Full size panel 2m x 1m. Half size panel 1m x 1m
<b>Weight:</b>	12.5kg/m <sup>2</sup>
<b>Installed thickness:</b>	37mm (before inclusion of chosen finish)
<b>Maximum designed distributed load:</b>	650kg/sq.m
<b>Tested maximum point load (BS EN 1195):</b>	1,126kg



Harlequin Liberty portable panels for Staatstheater, Nürnberg

## Royal Opera House ballet wagon

When their ballet wagon was in need of a complete refurbishment, the Royal Opera House's technical team called on the expertise of Harlequin Floors' craftsmen.

Working under the direction of Harlequin's Senior Technical Director, the old ballet wagon was stripped back to its steel frame where the structure was inspected before rebuilding.

A layer of custom-sized Harlequin Liberty panels was permanently installed over a triple layer of sound insulating materials. The panels were custom-tuned to reflect the response of Harlequin Floors already installed in the Opera House's rehearsal studios.

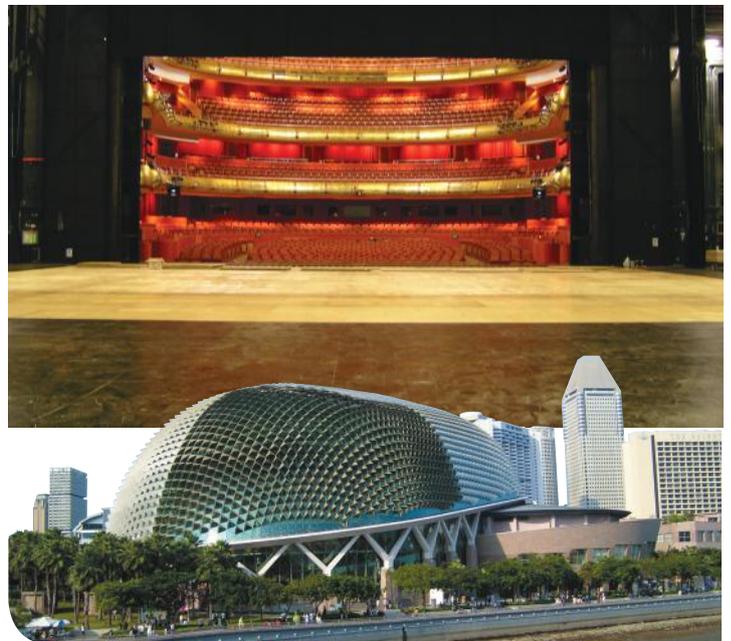


## Esplanade, Singapore

Esplanade – Theatres on the Bay is one of the busiest arts centres in the world. Harlequin Liberty® portable sprung floor panels were custom-sized to fit into the existing ballet wagon, which is stored horizontally below the stage and moved into place using a motorised track and elevator.

Six custom traps were manufactured on site and installed within the Harlequin Liberty panels on the wagon. Extra Harlequin Liberty panels were supplied for an infill area to extend the performance area downstage, with Harlequin Cascade being supplied for use as a roll-out performance surface.

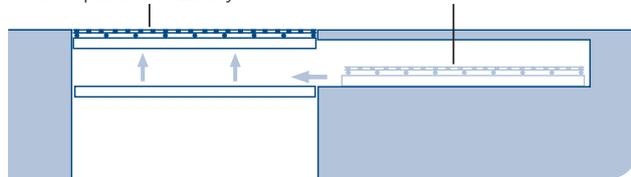
Additional reinforced Harlequin Liberty panels were supplied to be used as replacements in the ballet wagon, when required to withstand heavy scenery loadings.



Cross section of ballet wagon

Finished position of Liberty floor

Storage position

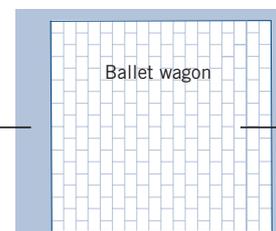


Plan view of Liberty panels

Edge trim

Ballet wagon

Liberty infill panels



# Stages and studios with integral acoustic properties

## Stage floors that are integral to acoustic design

Sometimes the choice of the appropriate stage floor construction can also contribute beneficially to the acoustic characteristics of the space. Sprung floor systems utilising a multi-layer sandwich construction provide suitable noise damping and acoustic separation from other areas of the building.

Theatre and acoustic consultants have the option of evaluating stage and studio flooring as an acoustic sympathetic component, whether the surface is finished in hardwood or vinyl. Harlequin Activity's well-established 'triple sandwich' permanent sprung floor construction is designed to provide absorption of performer loads and sound. These fully floating floors have no fixings to the sub-floor and can be laid on any reasonably smooth and flat surface without prior preparation.

Correctly reinforced, Harlequin Activity can withstand heavy loading including retractable seating and the top surface can be chosen from a wide range of vinyl or wood options.



Carnival Cruises land-based facility in Southampton. Photo ©Maria Slough

## Harlequin Activity™ with a hardwood surface

The construction is identical to Harlequin Activity with a vinyl surface, but the second layer of semi-flexible panels is replaced by a selected hardwood surface layer, normally an engineered board with a choice of hardwood wear layer. However, if desired, this can be substituted with a solid hardwood layer. This is installed with the use of a modified elastic one-component silane adhesive and invisibly secured through the tongues using lost-head nails. The hardwood surface may optionally be protected by impregnation with a multi-coat hardwearing polymer lacquer. The expansion gap around the perimeter of the room can be concealed by a scotia profile of matching hardwood to form a neat edging.



### Specification guide

(Typical construction using engineered board)

<b>Overall thickness:</b>	52mm
<b>Description of board:</b>	14mm thick 2-ply engineered hardwood
<b>Total thickness of hardwood wear layer:</b>	4mm
<b>Weight:</b>	16-22kg/sq.m depending on hardwood surface chosen
<b>Maximum designed dynamic load:</b>	750kg/sq.m
<b>Tested maximum point load (BS EN 1195):</b>	549kg

## Shakespeare's Globe, Sackler Studios

"It's not just a dance surface it's also an acoustics surface." said Andy Scorgie, Head of Facilities Management at Shakespeare's Globe in London, talking about the floor installation by Harlequin at their education and rehearsal centre.

The Globe's selection of a Harlequin Activity sprung floor with hardwood oak surface was chosen not just for its spring characteristics and aesthetics, but also for its acoustic properties. Located close to Shakespeare's Globe and reflecting the same architectural feel, thanks to the use of oak and curved walls, the Sackler Studios comprise a rehearsal room for the theatre company, four education workshop studios and a music room, as well as a café.



Harlequin Activity with hardwood surface  
Sackler Studios, Shakespeare's Globe,  
London

## Central Saint Martins College of Arts and Design

The King's Cross Campus in London includes four multi-purpose performance and seven rehearsal spaces. The combination of specialised products, customisation and innovation were employed to ensure individual floors matched the demands of performance styles including ballet and rock concerts.

### Blending aesthetics and customisation

The stylish KX Platform Theatre was complemented with a Harlequin Activity sprung floor finished in Weitzer Parkett oak to match the interior. To create an optional orchestra pit economically, Harlequin designed a 351sq.m floor based on Steeldeck® platforms that could be removed in sections as required.

- Harlequin Cascade vinyl floors, one black and one white, were chosen for the multi-purpose monochrome workshop spaces
- The studio theatre space has 177sq.m Harlequin Activity sprung floor finished in engineered maple
- Harlequin Activity fully-floating floors were also installed in seven additional rehearsal spaces and finished with engineered maple or Harlequin Standfast.





**HARLEQUIN**  
www.harlequinfloors.com

British Harlequin plc  
Festival House, Chapman Way  
Tunbridge Wells, Kent TN2 3EF

Tel: +44 (0)1892 514888  
Fax: +44 (0)1892 514222  
Freephone: 0800 28 99 32

www.harlequinfloors.com  
enquiries@harlequinfloors.com

LONDON  
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