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 more than 35 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 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, 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 be factors that set 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 expectation of the stage having a long working life with little need for maintenance.

Birmingham Hippodrome
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. Hong Kong based Harlequin Asia 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: 188.92m²
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 PVC which conforms to marine 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 may be 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.
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 255m² of the total 500m² 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 for access to the opera chandelier.

Emerald Princess and Grand Princess

The main stage refurbishment project was carried out in conjunction with Stage Technologies.

The existing floorcovering was removed and any defects in the plywood sub-floor were repaired. A latex screed with flexible smoothing compound sand was used to give a suitable finish to install Harlequin vinyl. Harlequin Cascade was laid with welded seams and silicone applied to its perimeters, then PVC nosings were installed to the steps each side of the stage into the audience area.

Superstar Pisces and Aquarius

Harlequin ripped out the existing stage to the understructure and replaced the plywood on the stage using two layers of Dricon treated 18mm timber onto Isorubber fixed with tech screws through the plywood and Isorubber.

The plywood joins were filled and sanded to a suitable finish to install a Harlequin vinyl top surface. Harlequin Cascade was then installed lengthways across the stage with welded seams and silicone sealant to the perimeter abutting walls.

The wooden plinth at the front of the stage was 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 sprung floor panel system with good area elasticity, originally designed for both permanent or portable installation due to a patented 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 rounded tongue and groove, which is secured in place using our latch and lock mechanism.

Harlequin Liberty is a relatively "springy" floor, 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, and with no hard spots at the joints.

**Specification guide**

| Permanent or portable: | Both |
| Dimensions: | Full size panel 2m x 1m. Half size panel 1m x 1m |
| Weight: | 12.5kg/m² |
| Installed thickness: | 37mm (before inclusion of chosen finish) |
| Maximum designed distributed load: | 650kg/m² |
| Tested maximum point load (BS EN 1195): | 1,126kg |

Harlequin Liberty portable panels for Staatstheater, Nürnberg
Het Muziektheater, Amsterdam

An ingenious solution was developed for Het Muziektheater in Amsterdam – their full-size ballet stage floor from Harlequin is flown vertically above the stage whenever the opera performs. The Harlequin Liberty sprung panels already in use at the Het Muziektheater were popular with the dancers, so the solution was to build them into a new mobile wagon that could be hung vertically in the fly tower, but without the need to remove the panels when not in use.

Seeing an aluminium system used by a visiting touring company prompted the design. Harlequin worked with the stage engineering company to develop a new type of mobile ballet wagon, which is 13.5m x 16.2m but just 180mm high including the dance surface.

The wagon comprises two main sections that subdivide to allow the floor to be raised or lowered from horizontal into the vertical storage position on a pair of 3-ton hoists without flexing. Sections are linked together with pin joints and a self-locking worm gear system.

The Liberty panels are installed onto the aluminium frame using unique linear driven bearing devices spaced at regular intervals which allow the floor to flex in the working position and secures the panels to the frame when in the flying position.

Esplanade Theatre, Singapore

Harlequin Liberty portable sprung panels have been custom-sized to fit into the existing ballet wagon, which is stored horizontally below the stage and moved into place on 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. Harlequin Cascade was supplied for use as a roll-out surface.

Additional reinforced Harlequin Liberty panels were supplied to be used as replacements in the ballet wagon, when required to withstand heavy scenery loadings.
Stages and studios with integral acoustic properties

Stage floors that are integral to acoustic design

Occasionally 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.

Harlequin Activity™ with 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 secretly 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)

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<th>Description</th>
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<td>Weight</td>
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<td>Maximum designed dynamic load</td>
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<td>Tested maximum point load (BS EN 1195)</td>
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Carnival Cruises land-based facility in Southampton. Photo ©Maria Slough
**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 floors recently installed 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.

**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 351m² 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 177m² 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.
Whether opting for a hardwearing permanent vinyl or a traditional ‘sacrificial’ painted wood surface, Harlequin can install what is required. In addition to custom constructed floors, Harlequin offer a selection of vinyl floors for loose-lay that are suitable for the needs of the theatre – floors that will stand up to the rigours of trucks, flats and tallescopes running over them and can be cut to fit around tormentors, trap doors and revolves.

Until the advent of purpose-made vinyl floors, pioneered by Harlequin in the 1970s, the choice was severely limited to a wooden floor or a linoleum surface. Harlequin has continued to be involved with extensive research into reducing performer injury, improving acoustic damping and offering a wide selection of finishes to blend with the venue’s architectural aesthetics.

Harlequin Reversible – the original vinyl stage floor – as its name hints has a different colour each side and can be used either way up - effectively two floors in one! Both surfaces are slip-resistant and suited to temporary stage flooring to protect a wooden floor beneath and also is suited to several different dance styles.

Harlequin Hi-Shine is another loose-lay option. It rolls out easily to provide a dramatic glossy, ‘wet look’ effect and is available in a number of colours. Despite the very shiny appearance the floor is not slippery.
Printed floors for stage and touring

Innovative techniques developed by Harlequin’s engineering team mean the usually plain vinyl stage floor surface can now echo or integrate with the entire set design. Production managers, set designers for theatrical productions and events are able to add a stunning array of images, or bespoke designs to the floor - even match a colour to meet aesthetic requirements or match scenery backdrops.

Using advanced wide format computer controlled printing techniques, the chosen design is digitized for printing on rolls of specially formatted Harlequin vinyl flooring. The use of vegetable based inks and UV accelerators result in rapid drying and application without affecting the fire rating of the vinyl. Extensive testing and experimentation during the development of the technique ensure the surface characteristics are maintained while ensuring adequate adhesion of the inks to withstand scuffing.

This custom printing capability is now offered as an option for purchasers of Harlequin floors and is currently available on a choice of four vinyl floors in the Harlequin range.

- Harlequin Cascade - a multi-purpose vinyl floor suitable for both loose-lay or permanent installation
- Harlequin Reversible - a lightweight double-sided stage floor, which is especially suitable for dance and touring shows
- Harlequin Studio - a particularly hard-wearing loose-lay or permanent vinyl floor designed to offer some impact protection to performers against underlying hard sub-floors
- Harlequin Showfloor - ideally suited to temporary events where a short life floor is appropriate

The maximum roll size for print is 2m wide and 30m in length.

Bolshoi Theatre, Moscow

After a six-year restoration project, Moscow’s iconic Bolshoi Theatre re-opened with a glittering gala for which the Harlequin dance floor was itself an integral part of the set design. With printing techniques developed by Harlequin’s engineering team, the usually plain vinyl dance surface was custom printed with an intricate pattern designed by the Italian Designer Ezio Frigerio for the Bolshoi Ballet’s Sleeping Beauty.

"God’s Property" by Arinze Kene. Produced by Talawa Theatre Co at the Soho Theatre designed by Ellen Cairns. The picture shows Kingsley ben-Adir & Ash Hunter.
The world dances on Harlequin floors®