Farrat
Engineering Excellence

Acoustic isolation of: CINEMAS

Recent Projects:

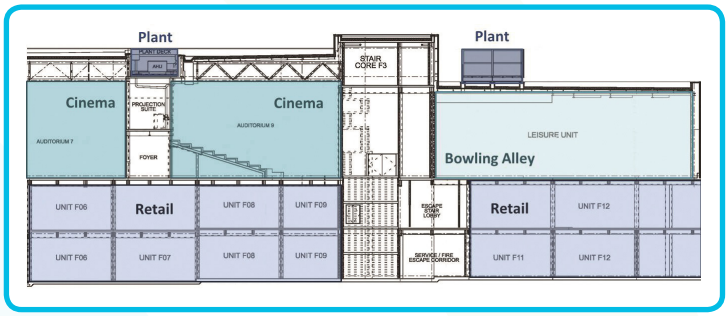
VUE	Trinity Square, Gateshead
Odeon	Old Livestock Market, Hereford
Cineworld	London Designer Outlet, Wembley
VUE	Glasgow Fort
VUE	The Rock, Bury
Odeon	Liverpool One
Cinemeerse	Paradiso Building, Hoofddoorp, Netherlands
VUE	Kennet Centre, Newbury
REEL	REEL Marina Mall, Dubai
VUE	Westfield, White City
VUE	Westfield, Stratford City

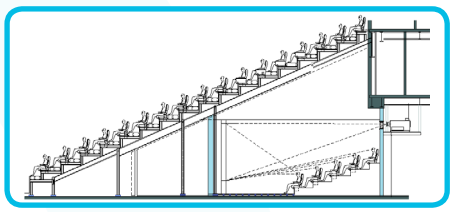
The Role of Cinema in the Leisure Environment

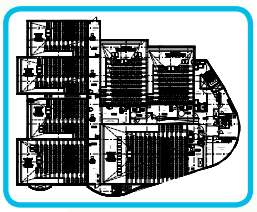
Cinemas play a significant role in modern leisure trends especially in the retail and restaurant mix where they act as the transition between shopping, dining and evening leisure. This trend has meant that cinemas are often situated on upper storeys or on the roof as people are funnelled through the shopping centre into the cinema.

Consequently cinema design has had to evolve to overcome significant acoustic and vibration disturbance challenges from:

- Retail units below
- Adjacent leisure activities such as bowling alleys
- Nearby plant and building service equipment
- Transport noise including that from aircraft
- Closely spaced auditoria







The result is that modern auditoria need to have sufficient sound and vibration isolation to ensure that the customers can enjoy the films as intended.

Most modern cinemas cannot rely on a thick concrete structural slab to provide sufficient isolation but instead look to a variety of box-in-box designs to decouple each auditorium from its surroundings.

Farrat can help in overcoming these challenges. From outline design all the way through to installation, we have multi-disciplined knowledge and capabilities in place to assist the entire design team. We can provide detail advice and specification assistance drawing on our wide port-folio of high performance products and solutions as well as a highly trained installation team, which enables us to deliver a fully guaranteed package.

Design Consideration:

Acoustics, Control of Noise and Vibration

Modern cinema design tends to demand a full box-in-box design for each auditorium to provide the highest level of acoustic isolation properties with the minimum risk of flanking transmission paths.

Box-in-box systems consist of an acoustic floating floor, isolated internal walls and ceiling resulting in a room that is completely decoupled from the surrounding building structure.

It is imperative that during construction, no solid 'bridges' exist between the floating floor, walls or ceiling as they will reduce the effectiveness of the system.

There are various ways to construct an effective box-in-box design and we have set out to explain the options available.

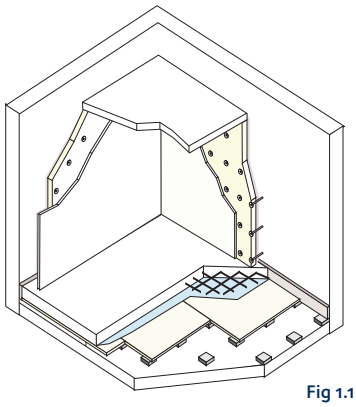


Fig 1.1

Solution 01 - Floors

Low Frequency Floating Floors

An acoustic floating floor is a secondary floor slab supported and decoupled from the structural slab with low natural frequency isolators. This design provides a very high level of vibration control as well as much higher sound insulation performance than a single, thick structural slab, whilst also providing space for thermal insulation and / or services.

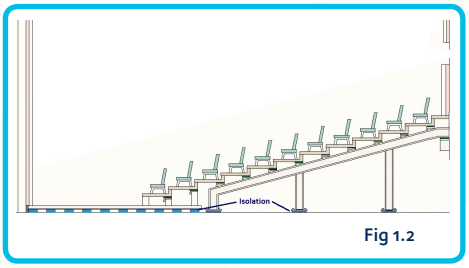


Fig 1.2

Typically the floating floor will span from the entrance doors to the circulation area in front of the seating structure, often with the first few seating rows placed directly onto the floor. In such cases the seating structure is supported independently on its own resilient mounts. This type of design allows for the area under the seating structure to be used for offices and bathrooms, etc.

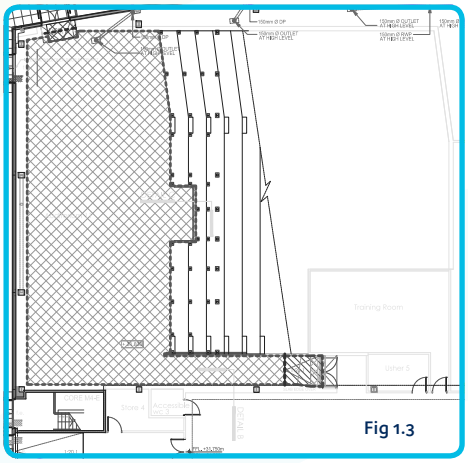


Fig 1.3

If the area under the seating structure is not anticipated to be used or where there may be significant risk of noise and vibration disturbance from below (for example if the room is to be at ground or basement level and direct vibration and reradiated noise from rail are in the vicinity) then the best solution may be to put a floating floor under the entire room footprint.

Fig 1.4

Why use Farrat?

Farrat offers a comprehensive range of floating floors with build-up heights as low as 80mm designed to adapt to all possible scenarios:

- Isomat-Concrete (Typical)
- Isomat-Dry
- Jack-up
- Pre-cast

Our range is backed up by accredited performance test data and a high degree of experienced service to support the design, manufacture and even installation of the floor system.

More information on floating floor design is available to download from: www.farrat.com/ffbrochure.pdf

Solution 02 - Walls

Acoustic Walls on the Floating Floor

This method is the generally accepted method of creating a box-in-box room. Acoustic walls are constructed from heavy duty studwork with acoustic plasterboard. In some very high performance cases, walls can also be block-work. In all cases, ties between leaves should be kept to a minimum.

The floating floor isolators located under the walls need to be carefully designed to minimise the deflection and stress in the floating floor under varying dead and live loads in the room. This can be achieved with larger isolators or shorter distances between isolators.

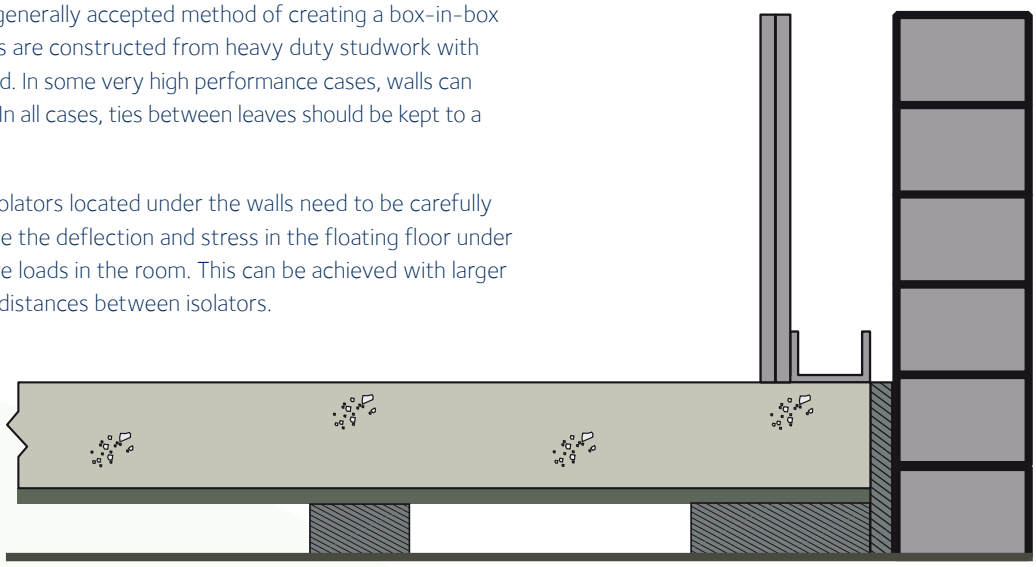


Fig 2.1

Acoustic Walls off the Floating Floor

In such cases acoustic walls are generally constructed from heavy duty studwork with dense plasterboard. The base channel is placed on a strip of 12.5mm thick Farrat FAVIM 100 and is then fixed at 600mm centres with resilient AWTH06 or AWTH08 acoustic top-hat washers with integrated bushes. The low frequency acoustic floating floor then butts up against the partition wall and is separated with Farrat FAVIM or IsoFoam strips which are bonded to the partition wall before the floor is constructed.

Such a method has been successfully used in a number of scenarios with very high levels of acoustic performance. It also has the advantage that the floating floors can be installed at the end of the build programme when the acoustic ceiling, overhead services, walls and seating structures have been erected. The acoustic floors can then be installed just before fit out works meaning no concern needs to be given to the potential for overloading floating floors or damaging their finishes, especially if they have been powerfloated.

Fig 2.2

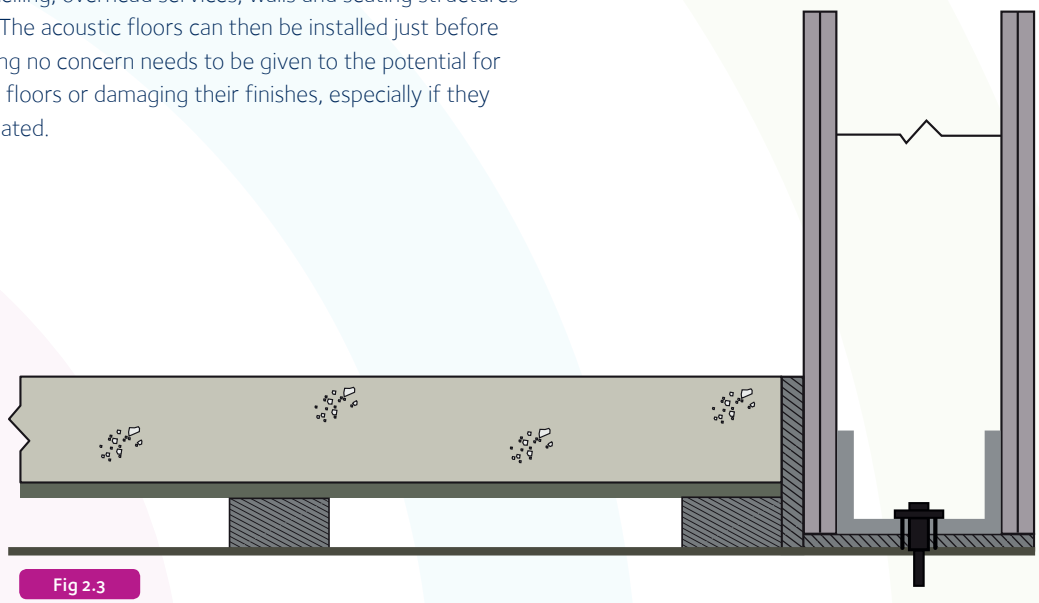


Fig 2.3

Solution 03 - Raked Seating

It is important to design and construct the seating structures to be totally independent of the floor slab, adjacent auditoria and structural steel.

Seating structures are typically constructed using a steel frame with either timber or pre-cast concrete tiers. In such cases each load bearing connection, such as column baseplate, is placed on a vibration isolation bearing pad and then bolted through using Farrat AWTH acoustic top-hat washers with integrated bushes.

Steel frames with timber tiers have very low static loads meaning it is difficult to achieve low natural frequencies at dead load. However, Farrat natural rubber bearing pads provide excellent performance results in these circumstances.

Fig 3.1

Horizontal Connections

To achieve tangible vibration isolation performance, isolation pads should be in compression. This is important at the back of auditoria where the raked beams meet the vertical structure.

In the configuration below (Fig 3.3), the acoustic pad can support all of the horizontal component of the load, but all of the vertical load will be supported by the bolts. Even if isolation bushes are incorporated, they will not provide sufficient isolation and may not withstand crushing from the bolt.

Acoustic isolation works much more effectively it the pad is situated under the vertical load (Fig 3.4) meaning the pad will be in its optimum working arrangement. Horizontal loads (which are generally a lot lower) can be restrained using the bolts, or separately mounted pads.

Fig 3.2

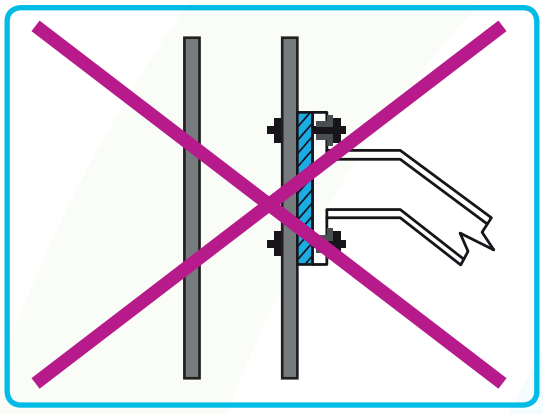


Fig 3.3

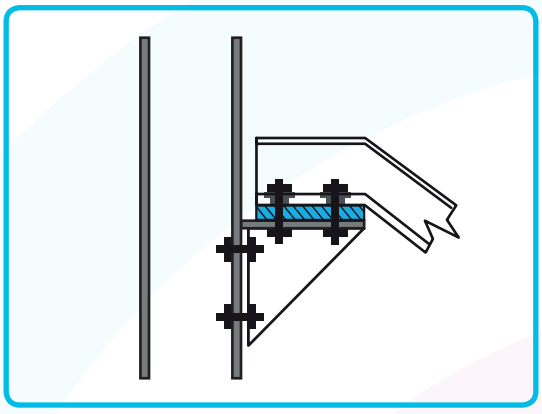


Fig 3.4

Raked Seating Structures Built off the Structural Slab


Fig 4.1

It should be noted that dead and live loads can vary significantly depending on the column location. Farrat has developed a very high service level for such scenarios, where we take the natural frequency requirements from the acoustic consultant and the individual column loads (dead and live, unfactored) from the structural engineer, then work with the steelwork fabricator to design each pad for each column and baseplate . Once finalised we supply the pads and washers pre-boxed per auditoria with each pad labelled to identify its exact installation location. We also provide a marked up drawing showing which pad should be placed in which location.

For steel frames and precast concrete tiers the isolation bearings can be placed either under all the steelwork connections or between the steelwork and precast concrete units. In both cases, because the ratio of static to live load is high, a low frequency can be achieved at both dead and live loads using Farrat plain or Isomat natural rubber pads.

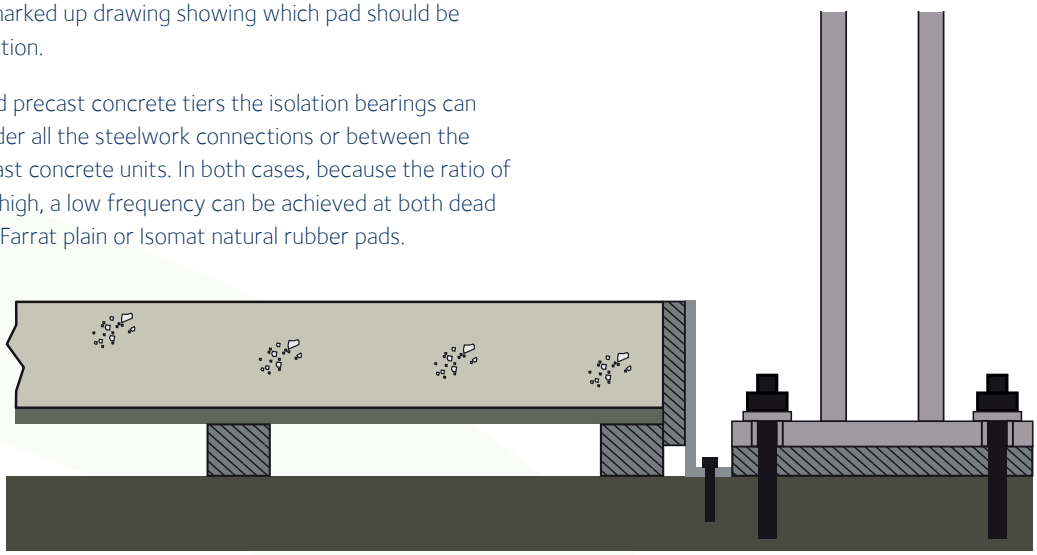


Fig 4.2

Raked Seating Structures Built off the Floating Floor

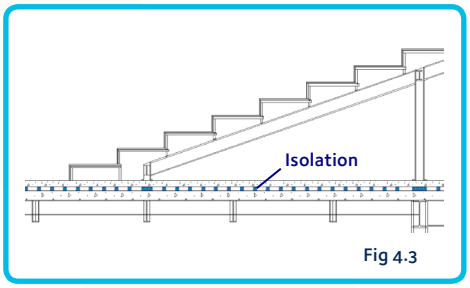


Fig 4.3

In some cases the raked seating structure needs to be built directly off the floating floor. In such cases the isolators under the floor need to be carefully designed and placed to directly support the column / fixing point loads above. The floating element should include a concrete slab to provide sufficient strength to support the point loads from the seating structure as well as the variable loads.

Farrat can assist with the entire design process working with the architect, acoustic consultant, structural engineer and the contractor to ensure the correct solution is designed for the individual application. To enable us to do this, we would need to know the intended area as well as the unfactored dead and live loads and the required natural frequencies. Once we have that information we can provide a full installation service, or marked up drawings showing where each isolator should be placed.

We supply the bearings packaged as kits for each auditorium, with each isolator location marked to ensure a quick, easy and accurate site installation.

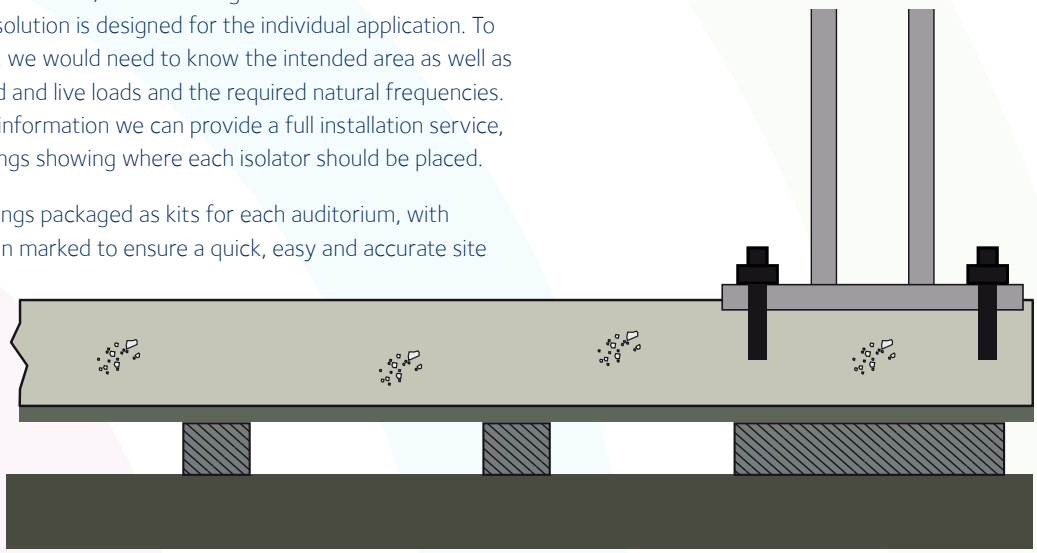


Fig 4.4

Timber Frame Raked Seating Structures

It is important to design and construct the seating structures to be totally independent of the floor and adjacent auditoria.

For smaller auditoria or refurbishments where access is constrained, a timber frame seating structure may be the only option. Effective isolation of timber frames has its challenges since;

- It is very lightweight
- The live loads are very high relative to the static (dead) loads
- It may require full area support

These challenges mean that a high performance isolator is required that can provide excellent vibration isolation performance at dead loads, whilst still being able to withstand the peak loads when the seating structure is full.

25mm thick Farrat Verlimber strips with our HD-AWS pre-compressed washers have proved to be an ideal solution as it has the capacity to deflect by up to 50% as part of a normal loading cycle.

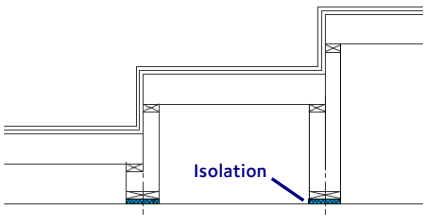


Fig 5.1

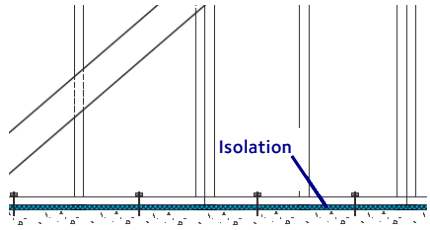


Fig 5.2

If the timber frame is to be bolted down to the structural floor then Farrat HD-AWS washers need to be used to be able to maintain tension in the fixing even when the Verlimber strip has deflected by 50%:

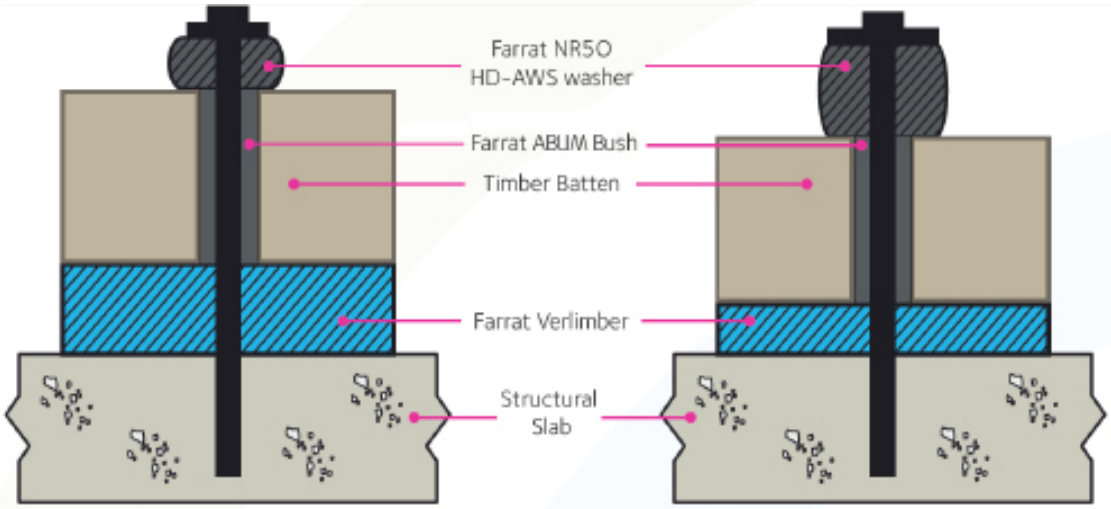


Fig 5.3

0% Live load

HD-AWS washer is at maximum compression, Verlimber isolation is at minimum compression.

Fig 5.4

100% Live load

Washer is at minimum compression (but not unloaded), Verlimber isolation is at maximum compression.

Installation

AcouStruct Ltd is Farrat's sister company. It is a specialist contracting company set up to act as a high quality installer of Farrat Acoustic Floating Floors and other structural vibration isolation systems.

The performance of acoustic and vibration isolation systems is fundamentally reliant on the minimisation of mechanical bridging and noise flanking, which is not always easy to achieve and can only be accomplished with high standards of workmanship. AcouStruct was established to provide a service to clients where such installations can be carried out quickly, economically and to a very high standard.

AcouStruct Ltd
Installation & Construction of Acoustic Isolation Systems

Why choose AcouStruct?

- Direct access to Farrat's 50 years experience in acoustic & vibration isolation system design and manufacture.
- A company core competence is to construct floating concrete slabs and other building elements that are guaranteed to be COMPLETELY, 100% separated/isolated/decoupled from the surrounding structure to minimise any potential for mechanical bridging and noise flanking.
- Flexibility in services offered due to a wide range of expertise and experience.
- Inclusion of construction of non-acoustic corridor floors etc. bordering the acoustic floors/elements, allowing main-package cost savings.

Case Studies

Farrat has developed and Acoustruct has delivered a long list of cinema projects for a high-profile client base. Where we develop particularly innovative solutions or face onerous site challenges, we produce case studies which are available printed on request, or as electronic downloads from our website: **www.farrat.com/case-studies**

Recent Case Studies:

The Rock
Bury
Operator: VUE
Main Contractor: Laing O'Rourke

Westfield 2
Stratford City
Operator: VUE
Main Contractor: Bridgford Interiors

Kennet Centre
Newbury
Operator: VUE
Main Contractor: John Sisk & Son

Farrat

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