AECOM Imagine it. Delivered.

Cost model

New-build concert halls

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Contents

Cover image:
The Sage, Gateshead

Royal Festival Hall
London

Foreword

Concert halls enrich a city's cultural life and provide a stunning base for the world's best musicians. Often involving the premier league of architects, they are high-profile projects with budgets to match. Our cost model helps you get to grips with the costs and understand the underlying issues.

Venues such as the Philharmonie de Paris and the Elbphilharmonie in Hamburg are striking, but they're controversial too, with budget overruns and programme delays attracting bad press and causing headaches for their client organisations.

Avoiding these pitfalls requires a clear vision of what a scheme should achieve from the start. A robust business case and detailed feasibility study are essential for organisations as they embark on a new concert hall project. Procurement routes should acknowledge the inherent complexity of concert hall projects through an equitable division of risk between the client and contractor.

Funding can be hard to attract, and organisations may need to work with a bundle of funders to raise the required capital. There may also be pressure to make the concert hall multi-functional, which may impact both the design and, ultimately, the audience experience.

And, of course, the design is critical. Auditorium acoustics must be perfect. Front of house glamour must balance back of house efficiency. The building's quality must reflect its top-tier status.

AECOM's cost model examines the issues surrounding the design, procurement and delivery of new-build concert halls and offers some advice on how to achieve successful delivery.

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01

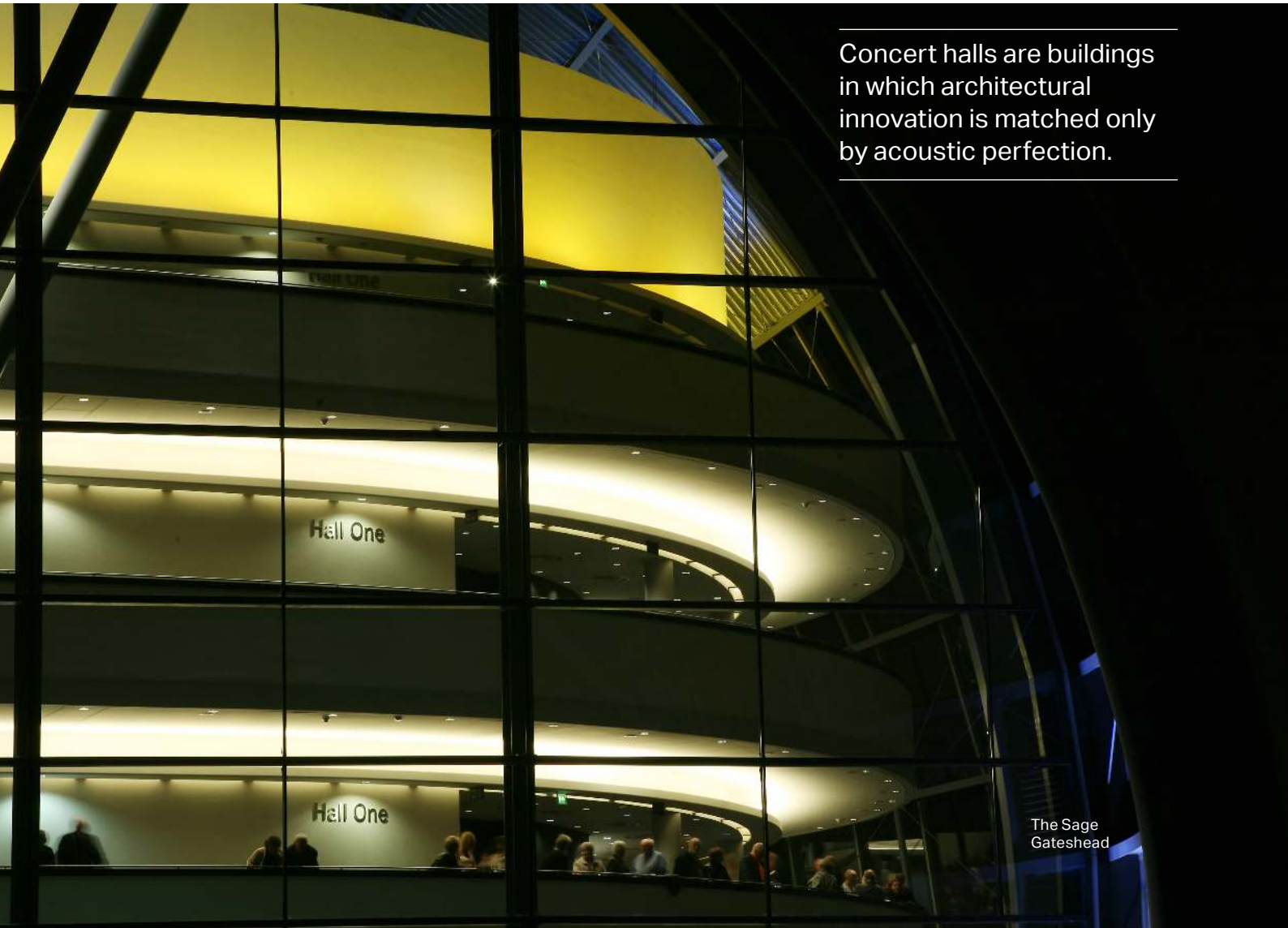
Introduction: cultural status symbol or expensive vanity project?

As much cultural status symbols as performance venues, concert halls are buildings in which architectural innovation is matched only by acoustic perfection. A modern concert hall makes a statement about its host city to the wider world — about civility, taste, sophistication and, ultimately, importance.

Concert halls are also complex, high-risk and costly projects, often likely to hit the headlines for budget overruns and programme delays. To avoid these pitfalls, organisations need a firm statement of intent at the start of the project — that means being clear about the purpose, setting out a robust business case and undertaking a detailed feasibility study that will set a transparent path for future delivery.

Yet in these days of tight purse strings and cash-strapped city councils, even getting funds to start the process can be difficult. The UK hasn't built a major concert hall for more than a decade. The last one, the Sage, in Gateshead, opened in 2004, with the Bridgewater Hall in Manchester (1996) and the Symphony Hall in Birmingham (1991) prior to that.

In Europe, the signature architect-driven Philharmonie de Paris, designed by Jean Nouvel and the Elbphilharmonie in Hamburg by Herzog & de Meuron have created momentum, despite well-publicised delivery issues. Now attention is turning back to London, with the proposal for a New London Concert Hall to be built in the east of the city, on a site soon to be vacated by the Museum of London.



The Sage Gateshead

Concert halls are buildings in which architectural innovation is matched only by acoustic perfection.

Standards or standing?

Discussions about concert halls often revolve around the requirement to be of an international standard, balanced against the need to be "world-class". The former is usually a measure of acoustic quality — specifically, whether a concert hall has the sonic richness and fidelity demanded by a top-flight orchestra.

'World class', on the other hand, often refers to architectural impact and the building's standing in the city and wider world. Concert halls invariably have important symbolic and civic roles to play in the life of a city, and striking architecture is seen as a crucial ingredient.

This adds a layer of complexity over the purely functional requirement of the concert hall, manifesting itself in the form of challenging geometries and generous public areas — not to mention potentially adding 20% or more to the costs of a concert hall from the model included within this report.

Single- or multi-use?

Squeezes on revenue funding from central government mean that performing arts buildings are under pressure to be multi-functional. They need to stage rock concerts, show films or support corporate events as well as host world-leading orchestras.

Increasing adaptability can compromise a concert hall's core function. A particular issue is the requirement to change an auditorium floor from raked — sloped upwards and away from the stage — to flat. While this enables the space to be used for dining and other corporate events, it is less than ideal for an orchestral concert audience.

Techniques to adapt the acoustics of the space to suit amplified music and other events need to be introduced with great care as they risk increasing capital spend and potentially compromising the concert hall's effectiveness.

House of Music
Denmark

02
Early stages

For projects as complex as concert halls, it is important that client organisations clarify the function, benefits and design criteria of the project early on. Working through three key stages, before going out to tender, will help them achieve this.

- **Business case:** describes the benefits to the organisation and funder, based on projections of operations immediately after completion and when delivering a full artistic programme. Enables the organisation to review the implications of the preferred project option effectively.
- **Business plan:** outlines the objective, functional brief, funding and management strategy of the concert hall project, and contains a statement of design criteria. It describes how the new building will be used, and the mix of activities and outreach activities.
- **Feasibility study:** confirms demand for the artistic programme and verifies the overall benefit of the scheme. Identifies optimum technical and design solutions, and the organisational resources required for delivery. Confirms proposed sources of funding and ways of fundraising. Quantifies risk and assumptions.

The organisation should also consider the wider question of the organisation's capacity to undertake the project. It should assess the impact of managing the project on the day-to-day running of the company, the risks associated with a disruption to its existing artistic programme and the risk of donor fatigue during and after completion of the project.

Home Theatre, Manchester
Image courtesy of Paul Karalius

03
Design

Acoustics

For any high-profile concert hall, maximising the listener experience is a priority. The best natural acoustics as possible are essential, bringing the orchestra's performance to life and adding detail and clarity to solo passages.

The acoustician is fundamental to the design process, helping to refine the shape and layout of the hall and focusing on reverberation times and sound modelling to ensure audience enjoyment.

Within the auditorium, bespoke finishes may be used to model the sound. Wall panelling is often curved and will be solid to aid acoustic performance. Balcony fronts should be treated in a similar way and can incorporate house lighting.

In addition to the quality of the sound within the space, acoustics experts will also reduce sound break-in and break-out to and from the auditorium.

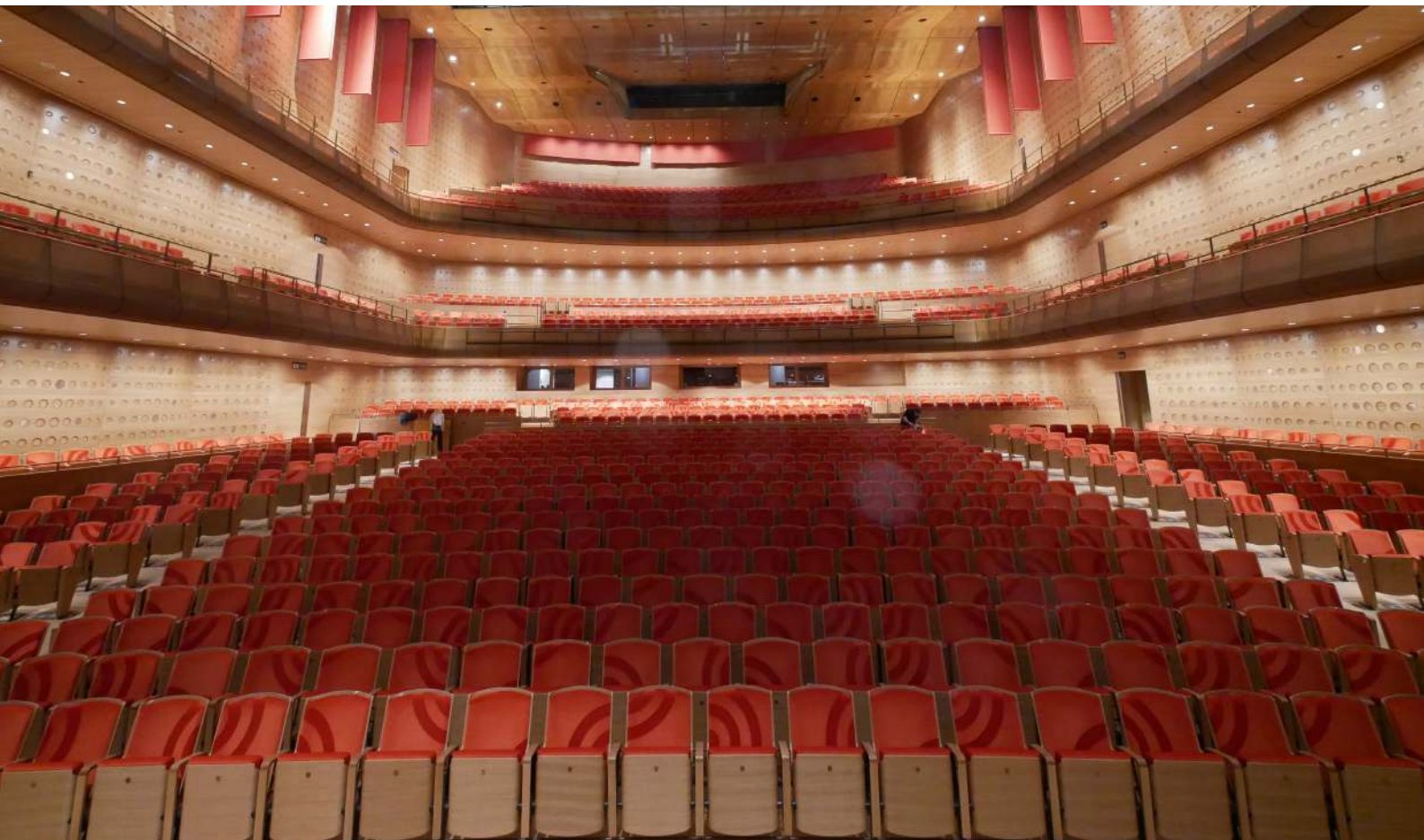
This is especially important in busy city centres, where traffic, other transport noise or vibration — from, for example, underground trains or air traffic — could affect performances.

Auditorium

A classically-designed auditorium is based around a 'shoebox' design with between 1,500 to 2,500 seats in total, split between a stalls level and balconies wrapping around the sides and back. It is usual for the auditorium to have a volume of between 12 m^3 to 15m^3 per seat.

Often the choir would sit behind the orchestra, who would sit on tiered orchestral risers. The facility to create an orchestra pit at the front of the orchestral platform is often provided for added flexibility.

Queen Elizabeth Hall
Antwerp, Belgium



Front of house

Front of house is the public face of a concert hall. These spaces are multi-functional, meeting a variety of demands throughout the day, drawing in the public and creating a sense of anticipation in advance of a performance.

Double-height volumes and high-quality finishes are often vital, reflecting the civic nature of the building and the intense wear and tear that these spaces will be subjected to.

Other considerations include:

- Circulation that avoids pinch-points and cross flows.
- Layout supporting efficient staffing.
- Segregation of public and private space.
- Ample food and beverage opportunities, both for daytime visitors and on performance nights, with positioning that maximises footfall.
- Opportunities to use front of house spaces for performances.

Back of house

Back of house is traditionally the poor relation to the auditorium and front of house spaces (although dressing rooms, particularly conductor and soloist rooms, are often high spec). Many projects have sought to provide high quality accommodation for technical and artistic staff, but have had to scale down plans in the face of limited funds — even though back of house space is relatively economical and not a good source of significant cost reduction.

Access needs to be well thought out. Appropriate disabled access to technical spaces is critical, as is well-planned entrance and exit for performers and other staff to ensure efficient turnover between shows.

Designers should take time to understand requirements for rehearsal rooms, including storage requirements.

The location of staff accommodation is also important. A successful concert hall relies on its performers and technical staff working together, and so accommodation design should strengthen the organisation's culture, identity and values.

Area breakdown — an example

This table shows a typical area breakdown for a 2,000-seat International Standard Concert Hall.

		m^2	m^2/seat	%
Auditorium including stage, stalls, balconies, orchestra pit, control rooms and sound lobbies.	2,000 seats, volume of auditorium 15m^3 per person	2,700		15.00
Public areas including foyer, fine dining restaurant, box office, WCs, bar/café including kitchen spaces, shop and support spaces.	Foyer at 1m^2 per person	3,450		19.17
Technical support including production offices, equipment and server rooms, workshop, stores and scene dock and technical attic.		2,650		14.72
Performer support including dressing rooms, green room, WCs and assembly areas.		1,200		6.67
Workspace including offices, meeting rooms, rehearsal space, education room and recording/broadcast.		2,000		11.11
Net Internal Area		**12,000**	**6.00**	**66.67**
Front and back of house circulation	25%	3,000		16.67
Risers/ducts/lift shafts	3%	360		2.00
Plantrooms	15%	1,800		10.00
Internal structure, partitions and voids	7%	840		4.66
Grossing		**6,000**	**3.00**	**33.33**
Gross Internal Area		**18,000**	**9.00**	**100.00**
Grossing Factor		1.5		

04
Procurement

Preferred procurement options must accommodate the complexity of concert hall projects through an equitable division of risk between the client and contractor — one that does not lead to risk pricing — while aligning to local market conditions. It pays to make this decision early in the project.

It should be clear who is managing the design coordination. The Contractor's Design Portion Supplement (CDPS) must be carefully managed to align with perceived client risk transfer and capability of market. A detailed net cost plan should be agreed by all the design team members.

Programme is another important early milestone. It should be thorough and robust, outlining the discovery, design and procurement stages. Specialist trades should also be engaged early, wherever commercially possible.

A risk mitigation strategy should describe programme risk, define the mitigations and drive the actions across the programme.

European procurement regulations (OJEU)

Most European concert halls receive at least some public money and, as a result, are required to follow European procurement (OJEU) regulations.

OJEU applies to projects that exceed a value threshold of £209,000 for services (such as consultant commissions) and £5,225,000 for construction works. Both relate to the aggregate value of the design commission or construction contract.

Clients cannot circumvent the regulations by tendering individual consultant commissions or construction packages separately.

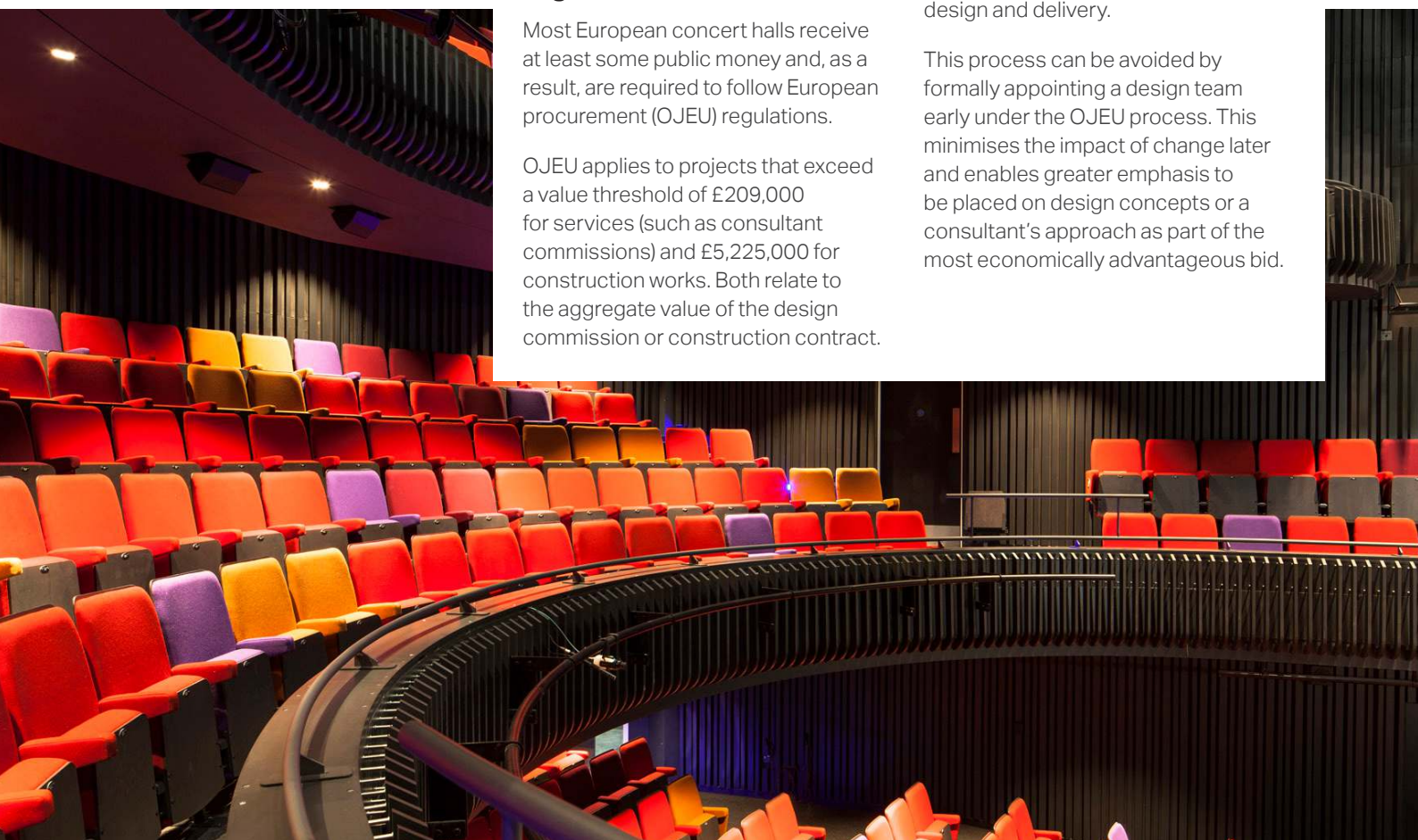
Concert hall projects following OJEU regulations must invite prequalification or tender submissions publically from consultants and contractors, assess submissions against published selection criteria, and allow at minimum timescales for preselection and tender procedures.

Decision-making may be subject to challenge from unsuccessful bidders, so following these procedures is important. The Freedom of Information Act 2005 means that being able to demonstrate due process and rational decision making is critical.

The real impact of OJEU on concert hall projects can be felt after feasibility, when the client is often required to reselect the design team if they have not followed the OJEU process from the beginning and the project requires an element of public funding. This can result in personnel changes at a critical stage, breaking the relationship between brief, initial design, detailed design and delivery.

This process can be avoided by formally appointing a design team early under the OJEU process. This minimises the impact of change later and enables greater emphasis to be placed on design concepts or a consultant's approach as part of the most economically advantageous bid.

Home Theatre, Manchester
Image courtesy of Paul Karalius



05
Construction

Construction of concert halls is complex, with the design teams integrating often quite intricate geometries with the need to create clear spans internally and all within an acoustically isolated environment.

The auditorium may need to be isolated from the surrounding structure by 'floating' it on springs. This is known as 'box-in-box' construction, which needs careful co-ordination with the surrounding structure and adds additional volume to the building.

Technical attics are often provided above the auditorium which serve to further isolate the auditorium from the external envelope of the building as well as providing maintenance access and a services distribution void.

High occupancies in the auditorium, combined with the demanding acoustic requirement lead to huge volumes of air being moved around the building to condition the main auditorium. Air conditioning is often distributed within the auditorium via a floor plenum, situated under the seats.

To achieve the required level of acoustic separation, it is essential to have significant levels of supervision to ensure that the highest levels of workmanship are achieved.

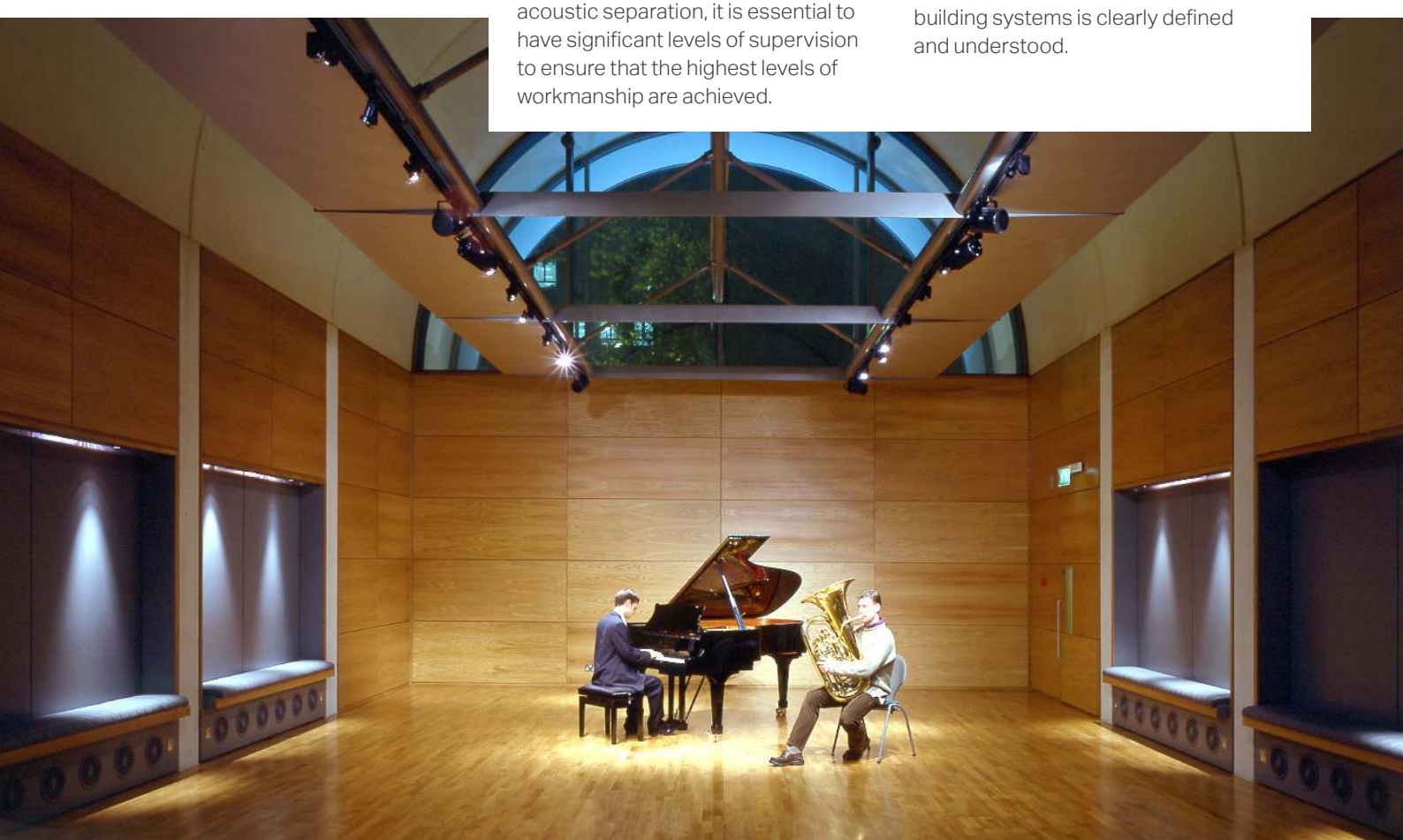
Mechanical and electrical services installation will require rigorous commissioning. We would recommend the inclusion of a separate commissioning consultant as a key member of the team.

Technical fit-out

The technical fit out to the auditorium and rehearsal spaces is often an area of major expenditure. The budget is typically split into:

- Stage engineering: orchestra pit lift, adjustable acoustic reflectors over the orchestra platform, lighting bridges, equipment bars and variable acoustics systems in audience areas.
- Sound and communications: including AV installation.
- Specialist lighting.

It is not uncommon to spend up to 10% of the works packages on the specialist equipment. This could increase to over 15% if you increase the flexibility of the hall, for example by introducing flat floor mechanisms to the auditorium. It is also vital to ensure that the interface between the technical fit-out and base building systems is clearly defined and understood.



06
Cost influencers

Funding

Securing additional funding towards capital costs through grant aid is becoming increasingly difficult. Grant aid from the lottery is currently focused on supporting smaller revenue projects aimed at active community involvement, rather than on investment in physical assets.

Over the past decade, larger capital projects have received considerable support from lottery funds. Recent shifts in policy mean that support for these projects is now very much the exception. A successful outcome for a larger capital project is much harder to secure and the competitive nature of the bidding process means smaller projects seeking funding need to demonstrate that they meet local, regional and national strategic priorities to stand a good chance of success.

The Heritage Lottery Fund continues to support capital grants for heritage aspects of arts facilities, such as fabric restoration, but would expect this to be coupled with Arts Council funding. Many of the other sources of funding, including private trusts and foundations such as the Jerwood Foundation, are taking a similarly cautious approach.

Decision-making in the two-stage application process can take time. Two years is not uncommon, and this duration needs to be factored into allowances for inflation and other cost increases. With so many traditional funding sources on hold or being re-evaluated, organisations need to be creative in finding grant aid for capital projects.

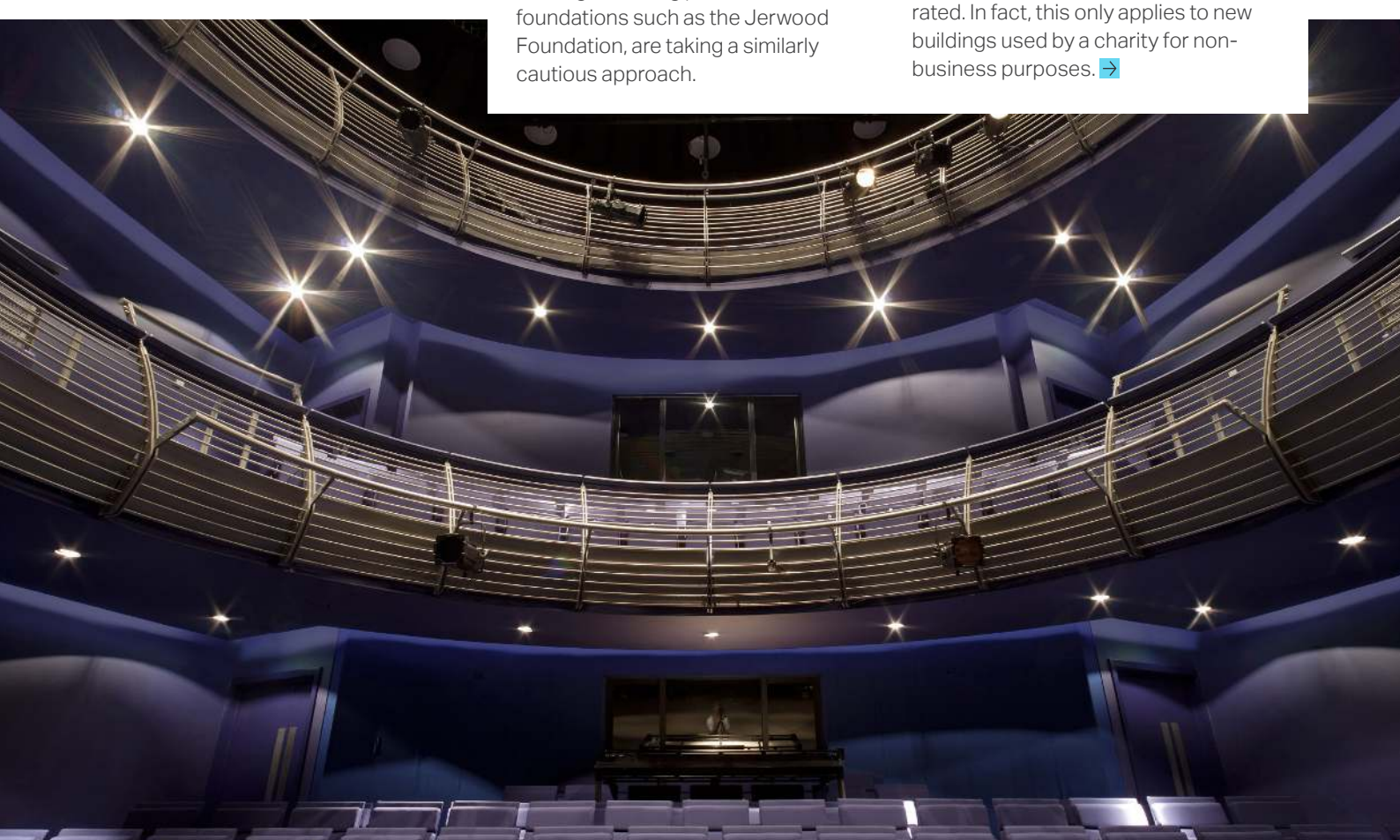
For this reason, many organisations are targeting private donors, with areas of the completed buildings often branded with donor names or organisations.

VAT

VAT can result in substantial unexpected additions to project costs if not considered at an early stage. Risk associated with VAT liabilities can be driven by the organisation, the operations of the project client or end-user and the uses of the building.

This is a complex area for which specialist advice needs to be obtained. When the theatre is run by a non-commercial organisation, there is a common misconception that the construction works may be zero-rated. In fact, this only applies to new buildings used by a charity for non-business purposes.

Royal Welsh College of Music and Drama
Image courtesy of Joe Clark



Where a charge is made for admission, catering or parking this will be deemed a business activity and VAT applies.

Once it is known the construction works are liable to VAT, the key issue becomes the amount of VAT which can be recovered. This depends on the extent to which the building is used for taxable business activities rather than exempt or non-business activities, such as outreach programmes.

Organisations whose activities are not fully taxable may not be able to recover the full VAT payable on their project. Admission charges to 'a theatrical, musical, or choreographic performance' by certain types of organisations and companies that fall within the scope of the 'cultural exemption' are exempt.

Similarly, if no charges are made for activities such as education then this will be non-business activity. In either case, VAT recovery on the project costs is likely to be wholly or partially restricted, subject to the extent other taxable use is also made of the building.

Operating costs

Staff costs will equate to the largest on-cost moving forwards. Factors such as the number of entrances to the building, the location and opening hours of bars and restaurants, the changing market around ticketing and efficient back of house facilities will help to reduce staff costs as much as possible.

Energy usage will often increase as organisations move into more conditioned spaces. Design should consider the use of mixed mode/ natural ventilation for use in off-peak times to reduce energy costs.

Maintenance costs associated with new concert halls involve immediate and long-term commitments. Moving from an old building where a certain level of disrepair is acceptable to a pristine new building can involve a commitment to a substantial cleaning and preventative maintenance regime, in addition to longer term maintenance liabilities for replacement and renewal of plant and specialist equipment.

Wider project costs

As a rule of thumb, the construction costs of a concert hall represent around 50-60% of the total project value. The remaining 40-50% usually includes:

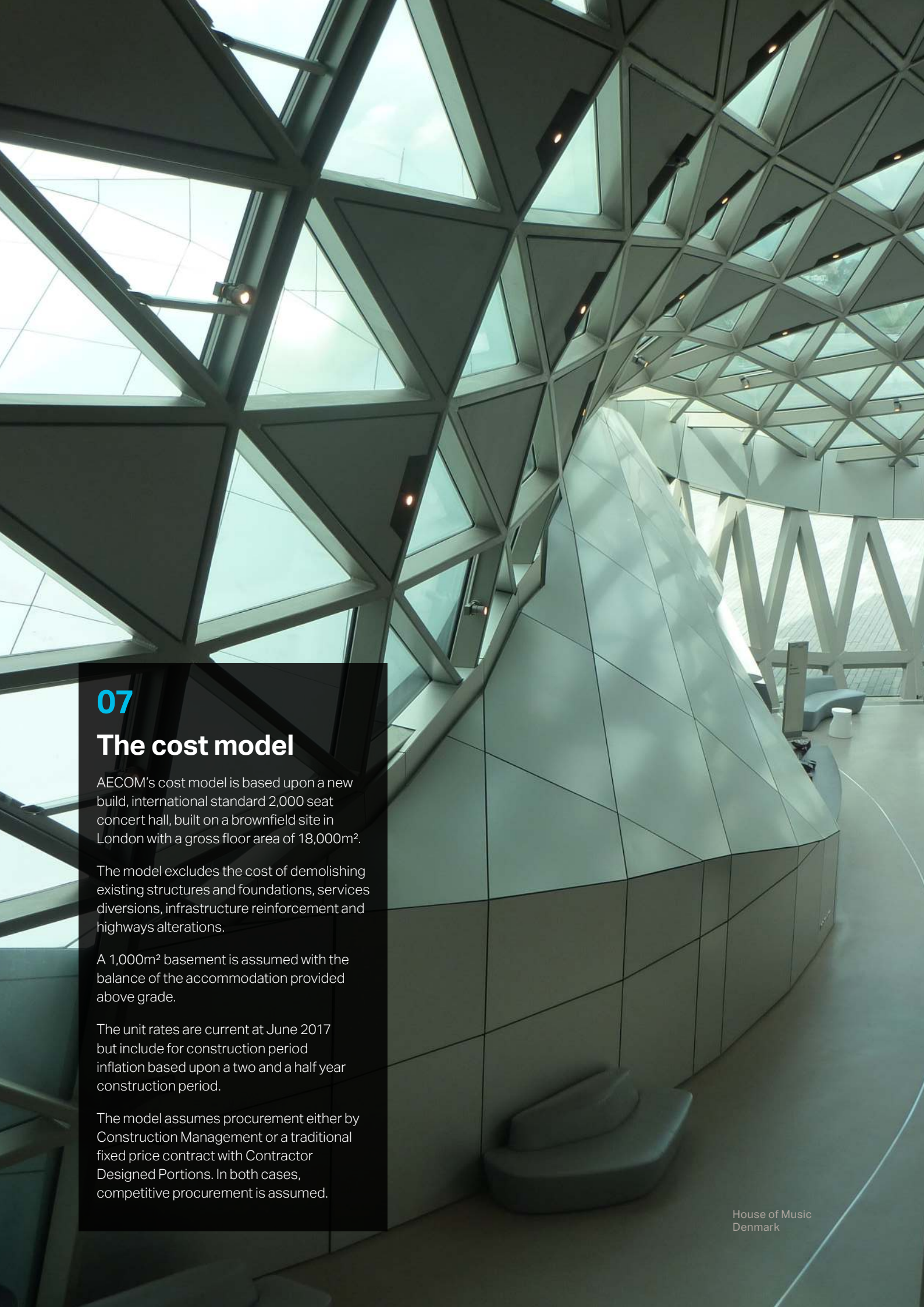
- Design team fees.
- Surveys and investigations.
- Inflation.
- Retail and catering fit out costs.
- Loose furniture, fittings and equipment (FF&E).
- Specific site-related costs (utility diversions, demolition costs, and the like).
- Internal client costs (business plan, brief writing, fundraising and internal project management).
- Public art works.
- Finance costs.
- Client contingency.

The only significant exclusions from the project budget would typically be non-recoverable VAT and site purchase costs.

50-60%

The construction costs of a concert hall represent around 50-60% of the total project value.

Royal Welsh College of Music and Drama
Image courtesy of Joe Clark



07

The cost model

AECOM's cost model is based upon a new build, international standard 2,000 seat concert hall, built on a brownfield site in London with a gross floor area of 18,000m².

The model excludes the cost of demolishing existing structures and foundations, services diversions, infrastructure reinforcement and highways alterations.

A 1,000m² basement is assumed with the balance of the accommodation provided above grade.

The unit rates are current at June 2017 but include for construction period inflation based upon a two and a half year construction period.

The model assumes procurement either by Construction Management or a traditional fixed price contract with Contractor Designed Portions. In both cases, competitive procurement is assumed.

House of Music
Denmark

Demolitions

Substructure

Total (£)	£/m²	%
8,250,000	458.33	5.73

Piled foundations; RC ground bearing slab; lift pits and sumps. Partial basement 1,000m² assumed secant piled with RC lining walls and cavity drain.

Frame and upper floors

Total (£)	£/m²	%
13,220,000	734.44	9.18

Steel frame and composite upper floors; large span trusses over auditorium, rehearsal room and to create balconies in auditorium. "Box in box" construction to main auditorium and rehearsal room.

Roof

Total (£)	£/m²	%
2,910,000	161.67	2.02

Composite roof with inverted roof finish; extra over for 20% roof lights and 20% terraces including associated balustrading. Including roof mounted BMU; acoustic louvres to hide plant and smoke extract hatches.

Stairs

Total (£)	£/m²	%
1,940,000	107.78	1.35

Precast concrete escape stairs; feature foyer stairs; including balustrading and handrails.

External walls, windows and external doors

Total (£)	£/m²	%
13,680,000	760.00	9.50

Solid cladding (70%) and glazing (30%); entrance doors; terrace doors; plantroom and substation doors and fire escape doors; canopy over entrance.

Internal wall and partitions

Total (£)	£/m²	%
2,565,000	142.50	1.78

Blockwork and dry lined internal walls; balustrading to internal voids and balcony fronts.

Internal doors

Total (£)	£/m²	%
1,455,000	80.83	1.01

Internal doors, frames and ironmongery including glazed screens and doors; large format acoustic doors to auditorium.

Internal finishes

Total (£)	£/m²	%
9,225,000	512.50	6.41

Wall, floor and ceiling finishes throughout. Specialist panelling in auditorium and enhanced finishes in public foyer areas; provision for acoustic treatment.

Fixed furniture and equipment

Total (£)	£/m²	%
5,625,000	312.50	3.91

Includes main auditorium seating (2,000 nr @ £400), fixed fittings in box office, dressing rooms; cloakroom; workshops; front and back bars; servery counters; lockers and main information point.

Specialist installations

Total (£)	£/m²	%
8,740,000	485.56	6.07

Stage engineering incl orchestra pit lift, choir wagon, adjustable acoustic reflectors over the orchestra platform, lighting bridges, equipment bars and variable acoustics systems in audience areas; sound & communications incl AV installation; specialist lighting.

Mechanical services

Total (£)	£/m²	%
13,104,000	728.00	9.10

Sanitary ware: approximately, 600 nr @ £750
Rainwater installation
Soil, waste and vent installation
Hot and cold water services
HVAC
Toilet ventilation
Smoke extract over stage areas and in basement
Gas installations
Sprinklers to all areas excl. auditorium
Gas suppression to IT rooms - 400m²
BMS/control systems
Sub-contractor's preliminaries and testing and commissioning →

All figures round to the nearest £1,000

Electrical services

Total (£)	£/m²	%
10,941,000	607.83	7.60

Mains and sub-mains distribution
Standby generation - 1250KVA - including fuel supply and cabling
Small power installation
Power to mechanical services
Power to stage engineering
Lighting including cabling and controls
Emergency lighting
Earthing & bonding: including clean earth
Lightning protection
Fire detection and alarms
Public address system
Voice and data cabling only no active equipment
TV satellite system
Disabled toilet alarms
Disabled refuge system
Induction loops
Access control, CCTV and security detection
Communication systems containment
Sub-contractor's preliminaries, testing and commissioning

Lift installation

Total (£)	£/m²	%
1,940,000	107.78	1.35

Passenger and goods lifts including one number heavy duty scenery lift and disabled platform lifts.

BWIC

Total (£)	£/m²	%
1,265,000	70.28	0.88

Allowance for builder's work in connection with services.

Landscaping

Total (£)	£/m²	%
1,455,000	80.83	1.01

Allowance for landscaping to 5m perimeter strip around building.

Utilities connections

Total (£)	£/m²	%
485,000	26.94	0.34

Allowance for utilities connections including electric, gas, telecoms and drainage.

External drainage

Total (£)	£/m²	%
299,000	16.61	0.21

Allowance for below ground drainage.

Sub total

Total (£)	£/m²	%
97,099,000	5,394.39	67.43

Preliminaries (20%)

Total (£)	£/m²	%
19,420,000	1,078.89	13.49

Allowance for main contractors site staff and organisation costs associated with the works.

Main contractor's OH&P (7%)

Total (£)	£/m²	%
8,156,000	453.11	5.66

Design reserve (5%)

Total (£)	£/m²	%
6,234,000	346.33	4.33

Construction contingency (10%)

Total (£)	£/m²	%
13,091,000	727.28	9.09

Total concert hall cost model

Total (£)	£/m²	%
144,000,000	8,000.00	100.00

All figures round to the nearest £1,000

About AECOM
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