



MARSHALL DAY
Acoustics 

COMPANY PROFILE
PERFORMING ARTS

WHO IS MARSHALL DAY ACOUSTICS?

Marshall Day Acoustics is one of the world's leading firms of acoustic consultants, providing the highest standard of architectural and environmental acoustic consulting to our clients.

For over 30 years, we have been providing innovative acoustic designs on major projects in over 15 countries and employ over 85 professional staff in offices in Australia, New Zealand, China, Hong Kong, and France.

As one of the largest acoustic engineering firms worldwide, we are able to provide our clients with the greatest range and depth of experience and expertise available.

Our strength in acoustic design comes from the diversity of our team members who have been drawn from engineering, architectural, musical and academic backgrounds, with one common focus; to provide innovative acoustic designs of the highest standard.

From concert halls to wind farms and everything in between, we have experts in every field of acoustics who have the specialist knowledge required to deliver quality project outcomes.



"I regard the acoustic designs of Marshall Day Acoustics to be amongst the finest and probably the most innovative in the world"

Dr Anders Gade, Associate Professor Technical University of Denmark

A COLLABORATIVE APPROACH

We have a collaborative approach to design and work as part of an integrated team with the client, architect and other consultants. We do not specify acoustic performance that “must” be achieved but instead we work with the project team to develop acoustic criteria and treatment that meets the desired project outcomes, whatever they may be. Recognising commercial realities and achieving an appropriate balance between quality and cost objectives is something we take very seriously.

SIR HAROLD MARSHALL KNZM

Sir Harold Marshall is an architect, engineer and physicist, internationally recognised for his contribution to concert hall design. He has over 45 years of experience in the acoustical design of auditoriums and concert halls.

Sir Harold is renowned as one of the world’s most creative and innovative concert hall designers. His ground-breaking studies into the importance of room cross-sections in concert halls in the late 1960s have had a profound effect upon modern day concert hall design.

In 1994, Sir Harold was elected a Fellow of the Royal Society of New Zealand. He also holds Fellowships in the Acoustical Society of America, the New Zealand Institute of Architects and the Royal Australian Institute of Architects. In 2009, he was made a Knight Companion of The New Zealand Order of Merit for services to acoustical science, KNZM.

Today, Sir Harold is Group Consultant of Marshall Day Acoustics, leading the conceptual design of concert halls and similar commissions, as required by any of the practice offices. This is a role for which his architectural and musical skills have uniquely equipped him to communicate with architects and their clients.

“Marshall Day Acoustics brought imagination and resourcefulness to the task... Their work has set a new standard.”

Donald L. Bates, Project Director,
Federation Square, Melbourne –
Lab Architecture Studio



TECHNICAL AND DESIGN CAPABILITIES

Marshall Day Acoustics is at the cutting edge of development in the acoustic industry. We are committed to being at the forefront of research and development in our field and have employed significant time, energy and resources into ongoing development of our in-house and commercially available tools across a range of sectors including concert halls, theatre design, building acoustics, environmental noise modelling, intelligent noise loggers, underwater acoustics and more.

We provide a unique combination of design skills, research knowledge and predictive techniques to ensure the client's requirements are achieved.

Our range of acoustic design tools including the facility to carry out computer modelling and also scale model testing on physical models as small as 1:50.

“MDA has developed a unique collaborative process involving 3-dimensional technologies to deliver proficient, yet original design accomplishments. The internationally recognised success in the acoustic designs of the Guangzhou Opera House is a reflection of this testament.”

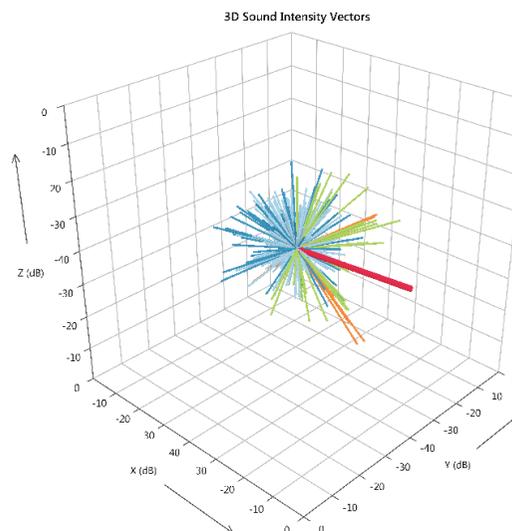
Woody K.T. Yao, Associate Director, Zaha Hadid Architects

This allows the accurate prediction of the objective acoustic properties and simulation of subjective qualities before they are constructed.

We are a world leader in the development of commercially available sound insulation predictive tools for consultants and engineers. Our proprietary software has sold more than 1,900 licences in 22 countries.

All of our offices are linked via a company intranet which indexes the collective experience of our consultants, providing access to solutions developed over many years of consulting projects.

We are committed to improving our delivery of quality and to enhancing our reputation as suppliers of quality acoustic consulting services in all of our markets.

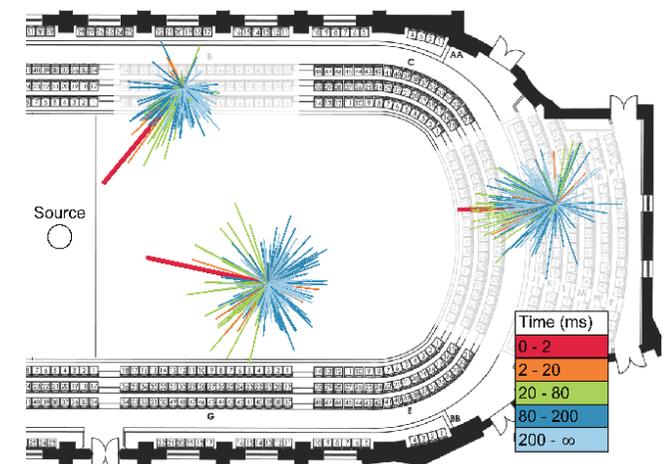


QUALITY ASSURANCE

Marshall Day Acoustics is certified in accordance with AS/NZS ISO 9001:2015.

The certifying body is SAI Global and the certificate number is QEC 23174.

Additional information about the system can be provided upon request.



CONSULTANCY SERVICES - WHAT WE DO

ARCHITECTURAL ACOUSTICS

Design or corrective work to make the acoustical environment effective and comfortable. Sound insulation, acoustic quality, speech privacy and the total acoustic design of projects such as music teaching facilities, offices, hotels, reception centres, broadcast facilities and apartments.

AUDITORIUM ACOUSTICS

Complete acoustic consultancy for all communication and performing arts spaces, including theatres, churches, conference rooms, multi-purpose halls and concert halls. Design techniques include state-of-the-art computer and scale modelling.

ELECTRO-ACOUSTIC SYSTEMS

Specialist consulting services for the design and commissioning of sound reinforcement and communication systems for performing arts applications, churches and convention facilities.

ENVIRONMENTAL NOISE AND VIBRATION

Assessment of noise and vibration impact of development proposals, including new roads, railways, air transportation developments and industrial projects. Site noise and vibration surveys, sound and vibration propagation predictions. Recommendations for the enforcement of environmental standards. Presentation of expert evidence for prosecutions or planning hearings. Assistance with development of noise and vibration control policy.

“Marshall Day Acoustics participated fully in the development of insightful, responsive and appropriate designs for the acoustic and vibration issues across the entire project”

Donald L. Bates, Project Director, Federation Square, Melbourne – Lab Architecture Studio Denmark

MECHANICAL SERVICES NOISE AND VIBRATION CONTROL

Design, specification, supervision and commissioning of noise and vibration control systems for mechanical plant. Control of all duct, pipe and structure-borne noise.

INDUSTRIAL NOISE CONTROL

Occupational noise surveys, noise abatement, factory planning, design of specialist silencers, screening and industrial enclosures.

Building vibration and structural dynamics estimation of vibration propagation factors in buildings and other structures.

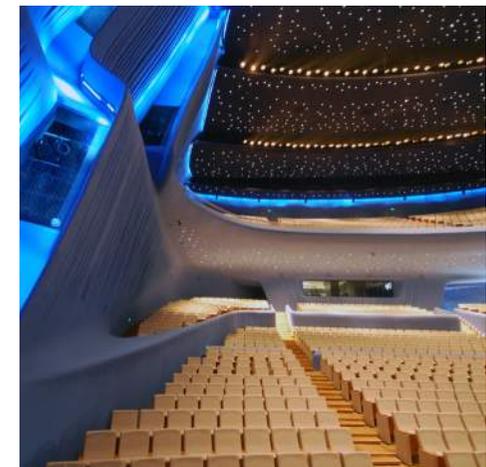
Estimation of re-radiated structure-borne noise, recommendations for vibration control measures, and empirical, theoretical and numerical modelling.

SOFTWARE DEVELOPMENT

Development of acoustics and vibration software, including software for the estimation of sound insulation properties, sound absorption coefficients and environmental noise propagation. Developer of INSUL, Zorba, dBSea and IRIS software, and agent for SoundPLAN.

COURSES AND SEMINARS

Provision of courses and seminars in the areas of building acoustics, mechanical services noise control, sound system



ROOM ACOUSTICS - PERFORMING ARTS

The ideal acoustic environment in performing arts auditoria is the one in which both performers and audience participate in a shared experience; where the artistic expression is conveyed with warmth and intimacy.

The most challenging and rewarding aspect of our role as acousticians is providing a balanced interface between architectural function and aesthetics whilst achieving the exacting acoustic requirements of symphony, recital, opera and theatre performance.

Since our foundation we have been at the forefront of innovative acoustic solutions for performance arts venues around the world. We pioneered the design concepts that result in envelopment and spatial impression for the audience, a concept which is now considered to be a property of the best concert halls around the world. Our ongoing research in room acoustics is borne out of our desire to provide a transcendent experience for performers and audience alike.

Use of the latest computer software and scale modelling techniques assist with the design process and provide auralisation of the room. This allows the project stakeholders to “hear” how the space will sound before a single brick has been laid.

“They provide a unique flexible and creative response to the unique project needs”

WoodyYao – Zaha Hadid Architects



FUNCTIONAL DESIGN BRIEF

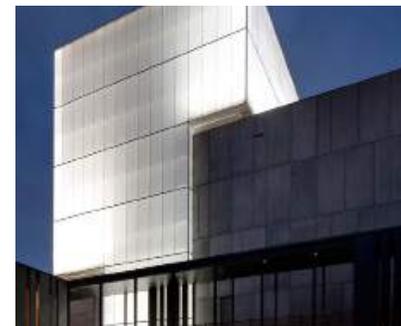
A critical phase in the design process is the development of the functional design brief.

Theatres, performance spaces and other cultural facilities are complex buildings with highly specialised requirements, and getting these well resolved early in the project is critical to smooth running and a successful outcome.

An informed functional design brief articulates the operational requirements for spaces without dictating architectural or aesthetic appearance, and sets a standard for the project where functionality and form are both satisfied.

Marshall Day Entertech specialise in preparing functional design briefs for new spaces, drawing on our expertise to create a definitive document that will guide and inform the architect, and others in the design team to achieve the best outcome for the client and end-users.

The brief typically addresses all areas of a proposed facility from audience access and way-finding, sight-lines, front-of-house facilities, to back-of-house requirements. It provides advice around room areas and minimum sizes for offices and dressing rooms, spatial relationships, furnishings and floor finishes, climate control requirements, keys and security, specialised power requirements, impact resistance of specific walls, loading dock requirements and any other critical requirements to be incorporated into the building's design.



“At last someone’s built a theatre and got it right.”

Denis Walter, performer, to his audience at The Drum Theatre, Dandenong

BUILDING ACOUSTICS

The design of industrial, commercial and residential buildings encompasses many fields of acoustics, which must be designed and co-ordinated to comply with a myriad of regulations and to accomplish the client's needs.

Factors such as controlling sound and vibration transmission between rooms, reverberation control within spaces, control of intrusive noise from external sources, HVAC and services noise and compliance with relevant boundary noise criteria may be necessary considerations.

Marshall Day Acoustics specialises in all aspects of acoustic prediction, development, assessment and mitigation advice. Since 1981 we have become the largest acoustic consultancy firm in Australasia, with project experience around the globe.

“We have no hesitation in recommending Marshall Day Acoustics for their services in both acoustic and vibration consulting”

David Waldren,
GROCON Constructors Pty Ltd

Our building acoustics services include:

- Acoustic design and assessment for healthcare facilities, stadia, apartments, concert halls, theatres, offices, art galleries, museums, libraries, recording studios, swimming pools, education facilities, mechanical plants airport terminals, factories, mixed-use developments, churches and many other building types
- Expert monitoring and measurement of noise and vibration
- Acoustic assessment of building elements (e.g. Building Code Compliance testing, Reverberation Time, etc.)
- Detailed acoustic analysis using proprietary modelling software such as IRIS, dBSea, Insul, Odeon, EASE and Zorba)
- Assessment and specification of noise control measures

- Research and assistance with preparation for of policy government and private sector
- Acoustically designed office fitouts, including speech privacy system design for open plan offices
- Presentation of evidence as Expert Witness



PROJECT EXPERIENCE - AUDITORIA

SHANXI THEATRE, CHINA

Client: Xi'an Qu Jiang Great Tang All Day Mall Cult

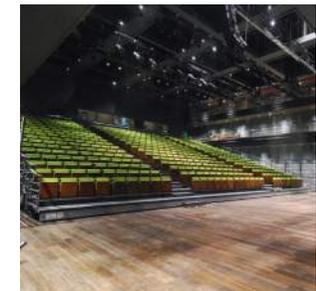
On 29th October, 2017 the drama of Puccini's Tosca resounded in the new Shanxi Grand Theatre. Situated across the road from the Xi'an Concert Hall, with acoustics also by the Marshall Day design team, the Theatre merges modern interiors with external references to the splendours of the Tang Dynasty.

Marshall Day designed the room acoustics of the performance spaces in addition to the sound insulation and mechanical services noise control for the project, working in close collaboration with the Beijing based architects.

The Grand Theatre seats an audience of 2,040 in two balcony levels and a split-level stalls area. Each seat feels intimately connected to the stage with a sound that provides an exceptional blend of fullness, envelopment and clarity. This quality is the result of early reflections from the wall and ceiling whose gently curved surfaces direct sound throughout the auditorium. The profiled walls were designed using algorithms to predict the diffusion of each surface then constructed using custom designed compressed bamboo panels.

A large open orchestra pit seats the musicians so that they all can clearly hear the ambience in the main auditorium. This provides excellent conditions for a balanced orchestral sound, and maintains the acoustic freshness that gives voice to the enormous range of textures required to support great Opera.

The multipurpose Small Theatre has retractable seating for an audience of 480. It provides a flexible performance venue for a wide range of events from music recitals to black box theatre. The striking side wall diffusion panels determine the acoustic ambience of the room and provide the acoustic intimacy for this space.



PHILHARMONIE DE PARIS

Client: Jean Nouvel

World renowned French Architect Jean Nouvel's design for the long awaited Philharmonie de Paris is as innovative as it is beautiful. Constructed within the 50 hectare cultural park at La Villette in north-east Paris, the €390 million, 20,000 square metre complex features a concert hall, two medium sized rehearsal rooms, practice rooms, a library, foyer and café.

At its heart is the 2,400 seat concert hall which will be home to the Orchestre de Paris, and is designed to host a wide range of performances from the symphonic through to those requiring sound reinforcement.

The hall's ingenious design enables a large audience capacity while retaining a highly intimate atmosphere by wrapping the audience around the stage. Combining elements from two of the most popular styles of auditoriums – the classic 'shoebox' and the arena-like 'vineyard' – the resulting design is unconventional and acoustically advanced.

Suspended balconies that appear to float within the larger volume of the auditorium allow the sound to circulate completely around the audience, enabling late reverberation while providing a superior symphonic experience of being enveloped by sound.

Philharmonie de Paris' extensive acoustic requirements filled a 40 page design brief and included complex requirements such as 'high clarity with ample reverberation', two conventionally incompatible elements in auditory theory. Through computer-based acoustic modelling and auralisation, the innovative concept developed by Ateliers Jean Nouvel and Marshall Day Acoustics meets these design objectives and sets new standards in symphonic auditoriums.

'I'm very happy to report that this is a big success acoustically.'

Paavo Jarvi, Orchestre de Paris
Music Director, Philharmonie de Paris



GUANGZHOU OPERA HOUSE

Architect: Zaha Hadid

Budget: US \$120 m

Resembling two enormous pebbles washed onto the banks of the Pearl River, Guangzhou Opera House is the realisation of London-based Architect Zaha Hadid's startling vision. The 70,000 square metre cultural centre is the largest performing arts centre in South China and at a cost of more than US \$120 m, has taken over 5 years to be constructed.

The Opera complex houses spacious entrance lobbies, a Grand Theatre, a 400 seat multi-function hall suited to musical and theatrical performances, rehearsal rooms and associated backstage facilities.

Located within the main building, the 1,800 seat Grand Theatre features an asymmetrical auditorium lined with moulded panels made of glass-fibre reinforced gypsum. Marshall Day Acoustics worked closely with the architect to deliver finely balanced room acoustics which involved a computer model acoustic study, as well as supervision of the construction and testing of a 1:20 scale model of the auditorium to verify the computer model predictions. The internal design of the rehearsal rooms was developed with the architect to incorporate acoustic treatments into clean, flowing and distinctive interiors.

Proprietary software developed by Marshall Day Acoustics was utilised to resolve acoustic issues caused by vibration transfer from an adjacent railway line, as well as to review the design of the building's mechanical services.



'I must say that the acoustic is fantastic...the balance felt just right'

Richard Margison in an interview with Opera Now after the opening night of Turandot at the Guangzhou Opera House.



XI'AN CONCERT HALL: GREAT TANG ALL DAY MALL CULTURAL SQUARE

Architect: DDB International LTD. Shanghai

Budget: \$100 million

Completion Date: 2009

Xi'an, the capital city of Shaanxi Province, has been one of China's most important capital cities for 13 dynasties. With a history going back more than 3,100 years, Xi'an is now reasserting its position as an educational, industrial and cultural centre.

Xi'an Concert Hall is the performance focus of a large modern Tang-style development, the Great Tang All Day Mall Cultural Square, close to the medieval city walls. The traditional design of the concert hall's exterior conceals a modern auditorium designed to offer symphony orchestras a world-class performance venue.

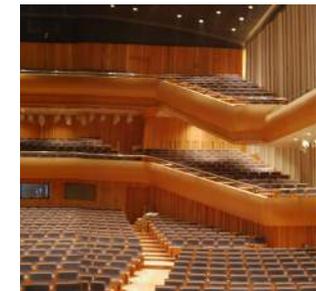
With seating for 1,250 patrons, the classic shoe-box style concert hall creates an intimate experience for orchestral concerts and chamber music recitals, and features a 4-manual, 60-stop pipe organ made by German master organ-builder, Orgelbau Klais.

Marshall Day Acoustics undertook acoustic computer modelling utilising Odeon analysis software in order to predict the absorption and scattering properties of the room. The resulting interior design for the auditorium developed by Marshall Day Acoustics cleverly integrates acoustical function within the hall's architectural form.

A high degree of diffusive surfaces and reflective elements positioned around the stage platform ensure superior clarity and ensemble conditions, resulting in excellent sound quality throughout the auditorium.

Marshall Day Acoustics also undertook an acoustic design review of smaller performance spaces within the facility.

The interior design for the auditorium cleverly integrates acoustical function within the hall's architectural form



BEIJING TELEVISION THEATRE

Architect: Nikken Sekki Ltd Japan
Budget: ¥ \$800 m

Located in the heart of the Beijing central business district, Beijing Television Center is a sophisticated television broadcast headquarters. As part of a redevelopment prior to the 2008 Beijing Olympic games, the broadcast center's facilities were expanded to include a 1,400 seat theatre designed by Nikken Sekkei Architects of Japan, in conjunction with the Department of Radio, Film and TV Design (DRFT) and Beijing Television.

The theatre is a conventional show theatre incorporating audience seating on two levels and a cruciform back-of-house area equipped with a revolving stage. While operating principally as a theatre for live performance broadcasts, the acoustic brief required versatility to enable use of the venue for occasional symphonic concerts and recitals.

Marshall Day Acoustics provided acoustic design solutions and addressed difficult architectural features within the venue, notably the acoustic characteristics introduced due to the cruciform back-of-house volume being significantly greater than the auditorium. The inclusion of an orchestral shell and VIP seating added to the complexity of the acoustic design for shows, live theatre and concert performances.

The theatre can operate in two modes with variable acoustics, which combined with optimum placement of lateral reflectors, provides a high quality acoustic environment for a range of performance styles.

Beijing Television Center Theatre is one of the first theatres to be designed with western architects and acoustic designers and represents a leap in Chinese interior design with its glass enclosed outer shell providing a stunning entrance to the television headquarters.



The acoustic brief required versatility to enable use of the venue for occasional symphonic concerts and recitals



STATE THEATRE CENTRE WESTERN AUSTRALIA

Architect: Kerry Hill Architects
Budget: AUD \$100 m

Hailed as ‘an iconic landmark for the city’ of Perth, the State Theatre Centre in Northbridge is the distinctive new home to resident companies Perth Theatre Company and Black Swan State Theatre Company.

The facility comprises The Heath Ledger Theatre, a 575 seat proscenium arch theatre, with sprung timber floor, orchestra pit lift, and fly tower complete with 58-axis power flying system. The inviting gold-toned Tasmanian Blackwood-clad auditorium seats 405 patrons in the stalls, and 170 patrons in the circle, with excellent sightlines to stage throughout.

Studio Underground, a 234 seat flexible black-box studio theatre with flat floor and retractable seating, hosts music, theatre and dance performances of a more intimate nature. In addition to spacious foyers, bars and rehearsal rooms, an outdoor area dubbed The Courtyard has been created as a multipurpose open-air performance space.

Marshall Day Entertech worked with the architect and end users to plan all aspects of the performance spaces and designed a comprehensive technical equipment specification that would adequately equip the venues for a broad range of performance styles. Marshall Day Acoustics was responsible for the acoustic design, devising sound insulation solutions in all spaces, as well as ensuring high quality room acoustics in each venue.

Designed by award-winning Kerry Hill Architects, the design delivers an impressive building that not only provides functional and inspiring venues for performers and their audiences, but has also become a defining architectural attraction for Perth.

The State Theatre Centre was awarded The Jeffrey Howlett Award for Public Architecture; The Julius Elischer Award for Interior Architecture; and a commendation in the Monduluce Lighting Award category at the Australian Institute of Architects’ 2011 WA Architecture Awards.

The multi-award winning venue has become a defining architectural attraction for Perth



CROSS-DISTRICT COMMUNITY CULTURAL CENTRE, KWUN TONG, HONG KONG

Architect: Rocco Design Architects Ltd

Client: Hong Kong Architectural Services Department

The project is a cultural and performance complex building with a CFA of 48,600 m² to serve as a hub for theatrical, dance performance & community events across 5 different city districts, namely Kwun Tong, Wong Tai Sin, Kowloon City, Sai Kung and future Kai Tak area.

The project includes two well equipped main stages for the 1,200 seat and 600 seat theatres that are surrounded by rehearsal rooms and studios. The front of house will include all the facilities required to make the CDCCC building a community hub.

The main theatre is a proscenium theatre with main stage and associated side and rear stages to allow the following event types: Chinese opera, Gamelan and Chinese orchestra, Amplified drama, Musical theatre, contemporary acoustic and amplified music, conferences, school and college events and education events. A very wide range of events that calls for careful acoustic considerations. An orchestra shell is provided to enclose the fly tower for orchestral performances.

The smaller theatre has an audience capacity of approximately 600 seats and a thrust stage configuration. It will be used for the following event types: Drama, Contemporary dance, Chinese Opera, Dance, Musical Theatre and Contemporary music. Our brief includes the specialist room acoustic design from concept to commissioning and handover.



Full acoustic design of 1,200 seat theatre and 600 seat thrust stage theatre to serve as a cultural hub community events across 5 different city districts



FEDERATION SQUARE, MELBOURNE

Architect: LAB Bates Smart

Budget: AUD \$450 m

Completion Date: 2004

Federation Square is a bold collection of architecturally arresting and individual buildings located at the primary entry to Melbourne's central business district, overlooking the picturesque Yarra River. A combination of civic space and cultural precinct, Federation Square is home to the SBS studios, Australian Centre of the Moving Image, the Ian Potter Centre of National Gallery of Victoria shops, cafés and restaurants.

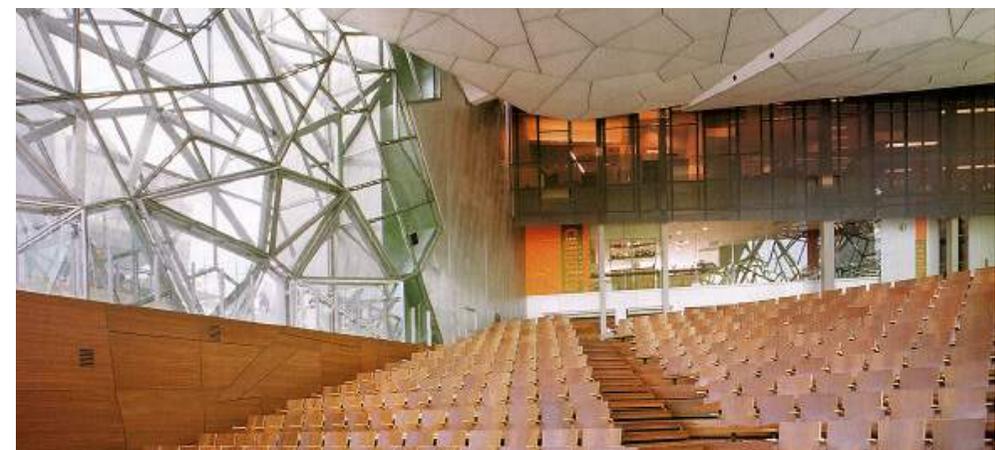
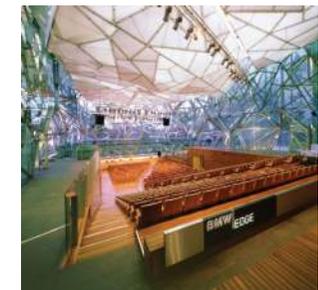
During construction of Federation Square, Marshall Day Acoustics was presented with the challenge of turning the southern atrium built of glass, steel and zinc into a performance space suitable for classical music, small to medium-scale theatre, comedy and cabaret performances, corporate launches, lectures and live broadcasts.

Working in close consultation with the architects, Marshall Day Acoustics used acoustic modelling techniques to shape and angle the glass walls to provide sound reflection sequences that would create a suitable space for classical music, and would complement the installed sound reinforcement system for other uses. Using auralisation techniques in a three-dimensional computer model, Marshall Day Acoustics was able to demonstrate the effect of design changes to the architect, client and potential users.

The resulting venue, BMW Edge, is a versatile and dramatic performance space with inspiring views of the Yarra River from every seat through walls made entirely of glass. The room's natural sound is warm and intimate and is ideally suited to the performance of all forms of chamber and orchestral music.

"BMW Edge is a venue that combines architectural splendour with fine acoustics"

Jeffrey Crellin Artistic Director of the Australia Pro Arte"



HAMER HALL, MELBOURNE

Architect: ARM Architects

Budget: AUD \$136 m

Following a competitive tendering process Marshall Day Acoustics was appointed in partnership with Kirkegaard Associates to the renovation of Melbourne's Hamer Hall. Opening in 1981 and originally designed as a venue for symphonic performance, the venue's busy schedule now covers a wide range of performance types, requiring adaptable acoustic conditions and short change over times. At the the same time, it remains the performance home of the Melbourne Symphony Orchestra and is the venue of choice for touring ensembles including the Australian Chamber Orchestra. The renovation included improving access for visitors to the building and circulation within it, with new foyer spaces, restaurants and bars. Improvement to the acoustic conditions included reviewing sound insulation throughout the building, reduction of the auditorium's mechanical service noise levels, and installation of a new sound system and audience seats.

For musicians, the conditions on stage have been dramatically improved, with new stage surround walls and a new over stage reflector. The stage has been more effectively coupled to the auditorium with the removal of parts of the side balcony arms and rebuilt wall surfaces close to the stage. The stalls have been narrowed to increase envelopment in the lower audience areas. The sound quality in the circle seats is richer and is more even. The sound in the balcony is warmer with greater clarity particularly in the bass registers.

"New Hamer Hall restores clarity and vitality to the symphonic sound. New acoustic reveals colours that astonish"

Eamonn Kelly - The Australian

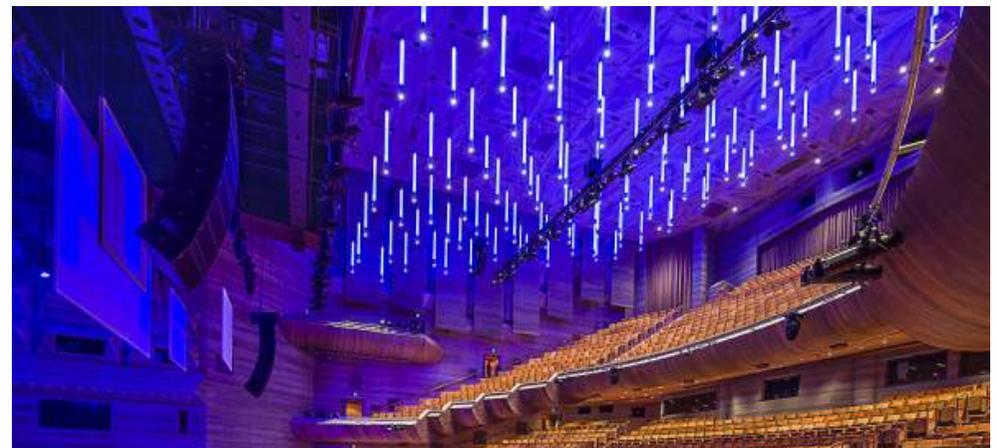
"From the very first moment that we introduced musicians back on to that stage all of us had very big smiles on our faces."

Judith Isherwood - Chief Executive - Arts Centre Melbourne



"In the Hamer Hall you can actually sing piano, proper piano, and it will resound through the whole Hall. It's amazing."

Bass-baritone Daniel Sumegi



CONCOURSE, SYDNEY

Architect: Francis-Jones Morehen Thorpe
Budget: AUD \$115 m

The Concourse represents one of the most comprehensive cultural infrastructure projects undertaken by an Australian local government authority. The \$115 m civic facility located in Sydney's North Shore features a performing arts centre, outdoor amphitheatre, library, shops, cafés and restaurants, all set within a large open space development. Willoughby City Council's aspiration for the performing arts centre is to create a home for world-class performances and local school productions alike.

Appointed as acoustic consultant to the project, Marshall Day Acoustics provided innovative solutions for auditorium acoustics and building noise control for the various venues within the performing arts centre and the greater development.

The Concourse's 1,000 seat concert hall is of the traditional high-ceilinged European design, creating an intimate atmosphere for patrons while being ideally suited to a wide range of musical and performance styles. The two-tiered 500 seat proscenium arch theatre is equipped with a fly-tower and orchestra pit making it a highly versatile venue.

Marshall Day Acoustics designed and delivered excellent acoustic environments in both the concert hall and theatre for a diverse array of uses, ranging from orchestras to school rock bands, dramatic performances to lectures. Environmental noise issues were addressed through the isolation of mechanical plant noise and the insulation of the auditoriums against external traffic noise.

Acoustic solutions were also provided for a multipurpose studio space as well as a banqueting hall, exhibition space, rehearsal space, greenrooms and meeting rooms.

"It has the most beautiful sound and there is a roundness and richness to it, resulting in a great warmth and gentleness... It is of a quality that any artist would be pleased to perform there."
Yvonne Kenny, London based Opera Singer

*Winner of the NSW
Architecture Award for
Public Architecture 2012*

*"It has the most
beautiful sound and
there is a roundness and
richness to it"*



JIANGSU GRAND THEATRE

Architect: ECADI

The Jiangsu Grand Theatre project in Nanjing, a capital city of Jiangsu province in eastern China, is one of the largest on-going cultural developments today.

The Jiangsu Grand Theatre has been more than a decade in the minds of the provincial government of Jiangsu. The project is one of the largest performing arts projects in China with a budget of RMB 2 billion on a site of 200,000 square meters.

It includes a large 2,300 seat opera house, a 1,500 seat concert hall and a 1,000 seat drama theatre.

A fourth building houses conference facilities. Marshall Day has started design work in collaboration with architect ECADI and theatre planner Kunkel.

Our brief includes room acoustic design of course, but also sound insulation and noise & vibration control.

ECADI has been appointed as Interior Designer for the Concert Hall and Opera House. Golden Mantis is in charge of the interior design for the Drama Theatre. Works with both has commenced.

This project is one of the largest performing arts projects in China. We are providing full acoustic design services for the opera house, concert hall and drama theatre



ZENGCHENG GRAND THEATRE

Architect: Architecture Design & Research Institute South China University of Technology

The Zengcheng Grand Theatre project, located one hour North-East of Guangzhou, is one of the new generation of performing arts centres in Mainland China. Designed in a second tier city, the performing art centre is built at human scale.

The project includes a 1,500 seat grand theatre and a 600 seat multipurpose and flexible theatre. Additional rehearsal rooms and other facilities will allow the large visiting orchestras and theatre companies to feel at home comfortably. They will also provide a very strong support for the local art community.

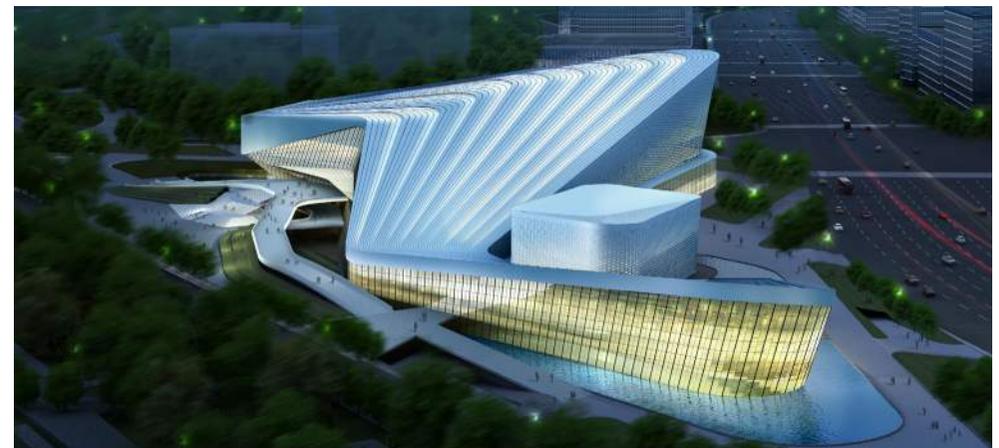
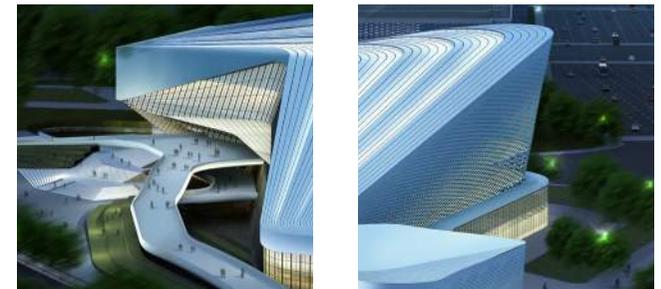
Located on the waterfront, the project aims at demonstrating that one does not need to live in the big centres to enjoy world class acoustics and smart planning.

Our brief includes:

- Room acoustic design of course
- Sound insulation
- Noise & vibration control
- Theatre planning review

A fast paced project, the schematic design phase is due for completion in 2013.

*Full acoustic design of
1,500 seat grand theatre
and 600 seat blackbox
theatre*



TIANJIN CBD II O-SHOW THEATRES

Architect: ECADI Shanghai and P&T Hong Kong

The Tianjin project, located at the heart of the new CBD metropolitan district of Tianjin is developed by Goldin Property Holdings Ltd.

The project includes a 1,600 seat concert hall and a 500 seat multipurpose and flexible theatre in the basement. Designed as a touring venue, the concert hall will provide excellence in acoustics for the most prestigious touring orchestras and support the art delivery to the tens of thousands new residents.

Designed within a very tight gross floor area limit, the concert hall appears as a sky-hooked shell within the entry foyer. Nevertheless, the Concert Hall stage will provide full flexibility of a semi-circular riser system, yet able to provide a flat stage floor when required.

With complex outside broadcast facility, the new Tianjin Concert Hall will soon become one of the highlights of the new development.

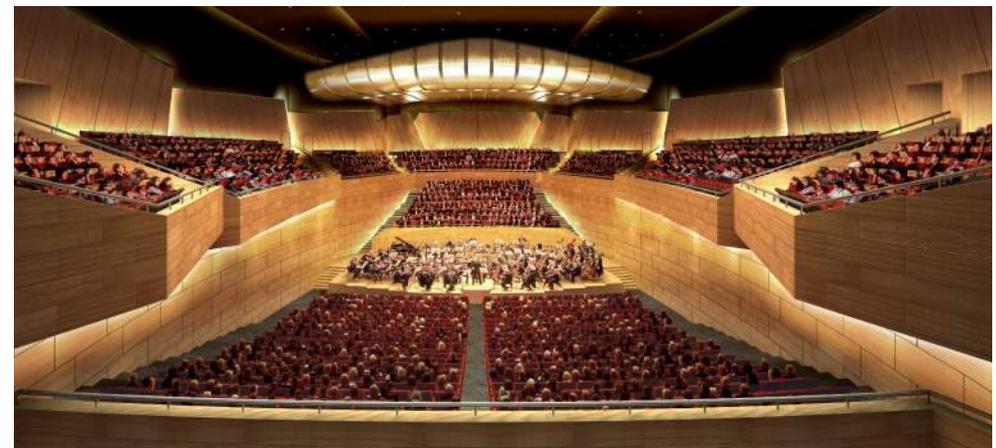
Our brief includes:

- Room acoustic design of course
- Sound insulation
- Noise & vibration control
- Theatre planning
- Theatre design

We are proud to partner with dUCKS Sceno for the theatre planning and design.



Full acoustic and theatre design of 1,600 seat concert hall and 500 seat flexible multipurpose theatre



CHANGSHA MEIXIHU INTERNATIONAL CULTURAL CENTRE

Architect: Zaha Hadid Architects

The Changsha project is a very large cultural centre including the Grand Auditorium, arts galleries, museum, libraries and educational facilities.

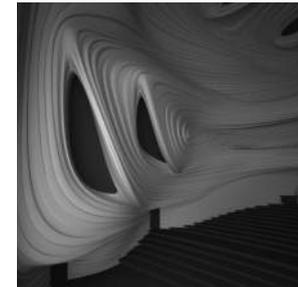
Designed by Zaha Hadid Architects, the project includes a complex design for the Grand Auditorium that required state-of-the-art parametric modelling for both acoustics and architecture.

Combining our resources in both discipline, a parametric approach has been developed on Rhino, Grasshopper and Maya to develop the complex geometry for the auditorium while optimising the acoustics, in particular the Clarity.

Although the seating plan is symmetrical, the geometry of the room envelope is not. Each portion, area and section of the room has been designed to merge the architectural and acoustic concepts. The input and requirements from the theatre consultant were also integrated into the design algorithm to ensure real-estate on the side walls and ceiling could be dedicated to lighting while not required for acoustics.

This is a prime example where collaborative design was successfully conducted without conflicts into a well coordinated design.

Complex acoustic design for the 1800-seat Grand Auditorium that required state-of-the-art parametric modelling for both acoustics and architecture



ZHUHAI OPERA HOUSE

Budget: AUD \$35 m
Completion Date: 2017

Following an international design competition attracting 33 entries, the Zhuhai Opera House is being built on an island at Xiangzhou Bay in the South China Sea. Close to Macau and Hong Kong the area is one of China's premier tourist destinations and is known as the Chinese Riviera. The performance venues are housed within pairs of large shells to create a visual identity which is visible from afar.

The Opera House is fully equipped with staging and technical infrastructure to support performances of Opera, Musical Theatre, Ballet and Symphony Orchestra. The Small Theatre is suited to performances of spoken theatre and chamber music performances.

Marshall Day Acoustics is working with the Beijing based architects and German based Theatre Consultants to create a Performing Arts Centre that will attract performers of both traditional Chinese dramas and Western traditions. The Centre will be the largest performance venue in the region and is planned to show 100 performances in the Opera House and 80 performances a year in the Small Theatre.

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RECITAL HALL, QASR AL ALAM GUEST COMPLEX, MUSCAT

Architect: Project Office, Diwan of Royal Court

One of Muscat's most notable landmarks is the waterfront palace of the Sultan of Oman, Sultan Qaboos Bin Said Al Said. A recent major building project resulted in the construction of a guest complex and private recital hall for the royal court, close to the Qasr Al Alam Royal Palace. After undergoing a competitive tender process, Marshall Day Acoustics was selected from a shortlist of leading international acoustic experts, as the successful acoustic consultant for the recital hall. The brief was to create a room with excellent acoustics for a range of performances including organ recital, western orchestra, eastern orchestra, choir, theatre and poetry recitals. The existing royal auditorium at Bait al Barakah was used as a benchmark due to its comparable size and function, and the acoustical conditions were measured to assist in the design of the new space. The intimate recital hall has the capacity to seat up to 80 of the Sultan's personal guests in an innovative, highly flexible salon-style auditorium featuring a stunning interior design based on the ornate architecture of the region.

In designing a variable acoustic environment, Marshall Day Acoustics established the functional requirements of the space, and how they differ from western musical performance. An unusual acoustical challenge was that in some instances the orchestra is larger than the audience. Acoustic treatments added to the hall have ensured its suitability for a wide range of performances, and in referencing the geometric fret-work patterns prevalent in local architecture as the facing for the acoustic panels, the aesthetic of the space is upheld.

The design process involved a highly compatible interaction between architect, client, acoustical consultant, engineers and theatre consultant to deliver a highly successful recital hall that meets its acoustical objectives.

"(MDA has) a unique ability to establish the client's needs in a highly creative and innovative manner.... the process was a very rewarding experience, of great benefit to the project."

- Hamood Al-Mahrooqi, Project Director, Sultanate of Oman



HONG KONG CULTURAL CENTRE

Architect: Architects Office, Public Works Department, Hong Kong
Budget: US \$150 m

Situated in a commanding waterfront location on the tip of the Kowloon Peninsular, Hong Kong Cultural Centre houses three distinct performance spaces: a 2,000 seat concert hall, a 1,700 seat Grand Theatre and a 500 seat studio theatre. The Hong Kong Cultural Centre opened in 1989.

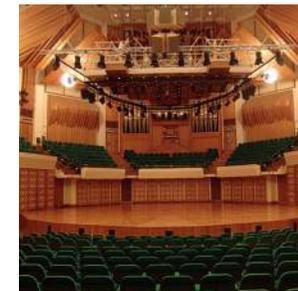
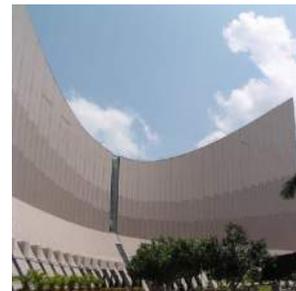
Given the specialised nature of each space, Marshall Day Acoustics had the opportunity to tailor the impulse responses in each room to best suit its specific function.

The two-tier oval-shaped Concert Hall is designed for the performance of music and features 360 degree seating, a 93-stop, 8,000-pipe Austrian organ, acoustic canopy and curtains.

The Concert Hall was modelled on the seminal Christchurch Town Hall, but with further refinements and significant improvements in design techniques. The acoustic design of the lyric style Grand Theatre enables the high early energy ratio needed for clarity with a full reverberation time to support the singers, while the Concert Hall is fitted with reflector arrays aimed at producing similar sequences in the main floor as in the balconies.

At the time, under a post-doctoral program, a hybrid modelling technique was being developed in the Acoustics Research Centre as an acoustic design tool. The resulting system is MIDAS, a user-friendly digital data acquisition suite of programs capable of obtaining the impulse response of halls or any enclosure, from small-scale acoustical models at 1:50, to full size auditoriums.

Marshall Day Acoustics used the MIDAS system during the design process and in the commissioning measurements undertaken on completion of Hong Kong Cultural Centre.



The Concert Hall was modelled on the seminal Christchurch Town Hall, but with further refinements and significant improvements in design techniques



CHENGDU NEW CENTURY CONTEMPORARY ART CENTRE

Architect: Zaha Hadid Architects

Client: Exhibition & Travel Group

Known as the land of abundance, Chengdu is the location for the construction of China's largest cultural building. Architect Zaha Hadid's extraordinary Chengdu Contemporary Art Centre, due for completion in 2014, boasts an aquarium, shopping centre, museum, conference centre, public areas and three auditoriums. Marshall Day Acoustics was selected as acoustician for the performing arts venues of this prestigious project based on their expertise and particular proficiency with Zaha Hadid's irregular shaped spaces.

The 2,004 seat Grand Main Auditorium features a flytower, orchestra pit and variable proscenium - up to 31 metres wide - suitable for large productions and screen projections. Variable acoustics are integrated into the architecture to accommodate amplified events from Chinese opera to conferences. The 876 seat Performance Hall is a smaller version of the main auditorium featuring similar internal architecture and variable acoustic elements, and is suited to drama, fine music, western opera and rock concerts.

The interior architecture of the Grand Main Auditorium and Performance Hall is a series of timber shells, reminiscent of a string instrument. These curved wooden panels cocoon the audience with intimacy, while concealing access doors and lighting positions. In designing the acoustics, Marshall Day Acoustics worked collaboratively with the architect to modify the orientation of the shells to reflect sound toward the audience, increasing clarity, and integrated the variable acoustic absorption behind an organic pattern of perforations. The 1,027 seat surround Music Hall, designed for small music recitals and orchestras of up to 70 musicians plus choir, features an articulated ceiling that supports the performers on stage and project sound to the audience and can be lowered for smaller ensembles. The two-directional curvatures have been seamlessly used to provide early lateral reflections to the audience while maintaining the organic nature of the interior architecture.

MDA modified the shells to reflect sound toward the audience, increasing clarity, and integrated the variable acoustic absorption behind an organic pattern of perforations



IWAKI AUDITORIUM

Architect: Peddle Thorp Architects

Budget: AUD \$5 m

Located within the Australian Broadcasting Corporation's Southbank Centre in Melbourne, Iwaki Auditorium is the rehearsal home of the world-renowned Melbourne Symphony Orchestra, in addition to serving as the favoured venue for chamber music broadcasts and recordings for ABC Radio in Victoria. The auditorium is named in honour of Hiroyuki Iwaki, Melbourne Symphony Orchestra's first Conductor Laureate.

In designing the acoustics of the space, Marshall Day Acoustics worked closely with Peddle Thorp Architects and undertook design workshops with members of the Melbourne Symphony Orchestra to determine the functional requirements for their rehearsal centre.

While the primary requirement was for a satisfactory orchestral rehearsal room, a variable acoustic environment was specified in order for the venue to be utilised for a wide range of performance styles, from chamber music to choral and jazz.

The 600 m² main acoustic space features an adjustable ceiling space frame with reflective panels to control overhead reflections. A calculated mix of wall mounted absorption and diffusive panels provide lateral reflections, which define the character of the sound.

Performance facilities include practice rooms, green rooms and an entry foyer, and capacity for 375 audience members is provided through fixed tiered seating for 200 people in a raised balcony, and capacity for an additional 175 seats at floor level.

Iwaki Auditorium has been used for the recording of many orchestral film and musical scores including Babe, The Dish, Moulin Rouge, the Australian cast recording of Beauty and the Beast, and the Opening and Closing ceremonies of the Sydney 2000 Olympic Games.



We undertook design workshops with members of the Melbourne Symphony Orchestra to determine the functional requirements for their rehearsal centre



SEGERSTROM HALL, ORANGE COUNTY USA

Architect: Caudill, Rowlett, Scott and Blurock

Budget: US \$120 m

Completion Date: 1986

Framed by a Grand Portal arch, and set behind a red granite and glass facade, Segerstrom Hall is an uncompromising 3,000 seat multipurpose auditorium. Part of the Segerstrom Centre for the Arts in Orange County, California, the opera house style hall is designed to suit orchestral, ballet, opera, drama and musical theatre performances.

In order to accommodate the large audience capacity while ensuring close proximity to the performers and excellent sightlines to the stage from every seat, the hall is designed in a broad fan-shape. Traditionally, broad fans are notoriously bad for the symphony because they lack adequate lateral reflected sound in a majority of seats.

Marshall Day Acoustics worked in a joint venture with acoustic consultants Hyde, Paoletti/Lewitz in designing the room acoustics for the hall under the direction of Sir Harold Marshall.

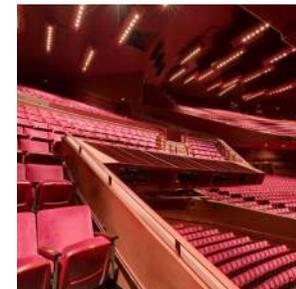
Sir Harold Marshall's innovation in addressing the broad fan shape of the auditorium was to divide the orchestra level seating obliquely to provide lateral reflecting surfaces within the space, with comparable surfaces for each of the three tiers of seating above. The result was a striking asymmetrical space entirely without precedent.

A 1:10 scale physical model of the auditorium was constructed at Marshall Day Acoustics' New Zealand offices and underwent rigorous testing at 25 seat locations to predict acoustic responses in each of the hall's performance modes including symphony, musical theatre, chamber music and opera.

Segerstrom Hall opened to critical acclaim in 1986.

"I regard the acoustic designs of Marshall Day Acoustics to be amongst the finest and probably the most innovative in the world."

Associate Professor
Dr Andres Gade



MICHAEL FOWLER CENTRE WELLINGTON, NEW ZEALAND

Architect: Warren & Mahoney, Christchurch

Budget: NZD \$80 m

Completion Date: 1983

The Michael Fowler Centre opened 1983 and was modelled on the Christchurch Town Hall. Located in Wellington, New Zealand's capital city, it was intended to replace an existing 100 year old rectangular Town Hall. In the event, the much loved old hall was also retained and provides an interesting contrast in acoustical style with the new hall.

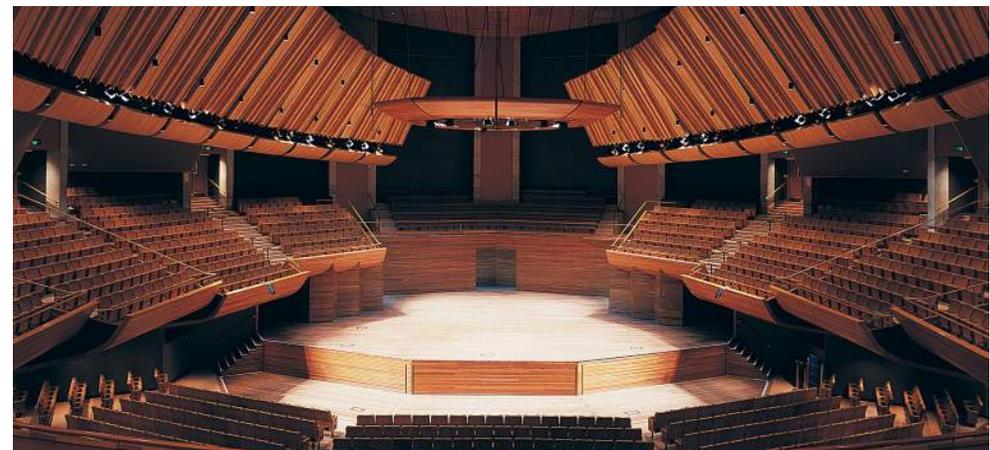
The Michael Fowler Centre was at the leading edge of acoustical knowledge when it was designed. It incorporates a number of world firsts in its details. Most striking is the first use of "Quadratic Residue Diffusers" on a large scale on the principal reflectors. Prof Marshall had worked on these with their inventor Prof Manfred Schroeder in Goettingen during a sabbatical in 1977. The room was modelled at 1:10 scale so that any audible effects of the QRDs could be studied. Another first application was the so-called Primitive-root Diffuser on the rear wall, designed to disperse a potential echo. After the Christchurch Town Hall success, intensive research on the effects of lateral reflections had revealed that image shift could occur with reflections either too early or too energetic and in the Michael Fowler Centre the reflector design was modified to avoid these effects. The result is a striking architectural /acoustical ensemble in which there are no arbitrary elements.

For architectural reasons the Michael Fowler Centre was to have a sloped main floor, unlike Christchurch Town Hall where the floor is level and this has implications for the design of balconies and reflector arrays. It also gave rise to the opportunity to obtain reverberant coupling behind the balconies to blocks of seats toward the rear.

Again the on-stage communication has been addressed by an over-stage reflector on hoists. This room was intended for multi-function use in its design and has demonstrated that full scale opera (*Die Meistersinger von Nürnberg*) and chamber music are equally at home there with the symphonic repertoire.



The Michael Fowler Centre was at the leading edge of acoustical knowledge when it was designed and it incorporates a number of world firsts in its details



CIVIC THEATRE RESTORATION, AUCKLAND

Architect: Jasmax/City Design
Client: Auckland City Properties
Budget: NZD \$34 m
Completion Date: 1999

This project included the major refurbishment, restoration and adaptive re-use of a late 1920's atmospheric theatre. The project required careful consideration of the heritage issues whilst optimising the acoustic environment through innovative designs.

A new fly tower, improved break-out rooms and bar areas, custom furniture and finishes, were all part of the three year undertaking of one of New Zealand's most sophisticated heritage projects.

Marshall Day Acoustics was engaged to provide recommendations on treatment necessary to achieve a suitable environment for amplified stage shows. In addition we provided advice on building services noise control and sound insulation performance. The project opened in 1999.

"A highly successful major restoration and alteration of one of Auckland's best landmarks... in keeping with one of Auckland's most loved public buildings."

Extract from 2000 NZIA Local Award citation



MELBOURNE RECITAL HALL, PEER REVIEW

Client: Arts Victoria
Budget: AUD \$100 m

Melbourne is a city blessed with superb cultural facilities across the arts. However, for some years the lack of a first class auditorium for chamber music and recitals has been a major concern. The Melbourne Recital Hall has now recently been built on the corner of Southbank Boulevard in the Arts precinct. It is sited next to a 500 seat theatre for the Melbourne Theatre Company (MTC). The Recital Hall attracts the finest of Australian and international artists and ensembles for the Melbourne International Chamber of Music Competition. The Recital Hall team is vital for creating an artistic environment which encourages the best music-making and a rich experience for audiences.

Melbourne's new Recital Hall is:

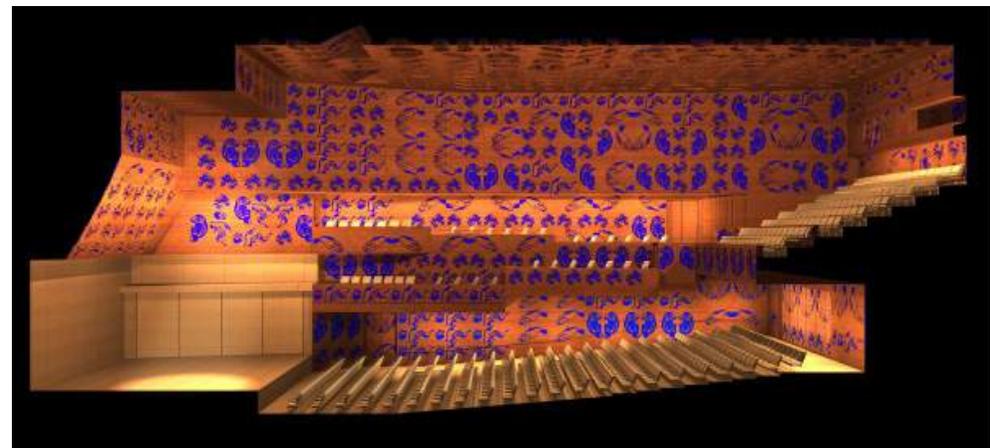
- ranked amongst the world's great recital halls for its uncompromising acoustic, architecture and artistic program
- revered and loved by musicians and audience
- respected for nurturing and promoting young musicians
- aligned with the highest music standards
- a living cultural space

The Recital Hall is a first class venue designed specifically for small ensemble performances. It has an excellent acoustic and incorporates new technology across a range of facilities and services for the benefit of emerging and established musicians. There is a 1,000 seat auditorium for performance, recording and rehearsal, a salon with flexible seating for up to 150 people for performance, recording and meetings and the 500 seat MTC theatre.

Marshall Day Acoustics' role was as peer review consultant, evaluating room acoustics, sound insulation and vibration control requirements for the project in conjunction with Arts Victoria and the project acoustic consultant.



The Recital Hall attracts the finest of Australian and international artists and ensembles for the Melbourne International Chamber of Music Competition



YIXING GRAND THEATRE, CHINA

Architect: ECADI
Completion: 2015

The Yixing Grand Theatre is part of a large new lakeside development incorporating a Library, Museum, and Youth Centre. The Grand Theatre building houses the 1,200 seat main auditorium, a 650 seat concert hall, backstage and rehearsal facilities, meeting rooms for a conference centre and several cinemas.

The main auditorium is suited to Western and Chinese Opera, Ballet and orchestral performances. Seating is in divided stalls areas on the ground floor and one balcony level.

The Concert Hall is designed for recitals, chamber ensembles and small orchestras. A single balcony wraps around the stage providing excellent communication between the musicians and audience.



XI'AN CONCERT HALL, CHINA

Completion: 2009

Xi'an, the capital city of Shaanxi Province, has been one of China's most important capital cities for 13 dynasties. With a history going back more than 3,100 years, Xi'an is now reasserting its position as an educational, industrial and cultural centre.

Xi'an Concert Hall is the performance focus of a large modern Tang-style development, the Great Tang All Day Mall Cultural Square, close to the medieval city walls. The traditional design elements of the concert hall's exterior conceals a modern auditorium designed to offer symphony orchestras a world-class performance venue.

The classic shoe-box style concert hall creates an intimate listening experience for orchestral concerts and chamber music recitals for 1,250 patrons, and features a 4-manual, 60-stop pipe organ made by German master organ-builder, Orgelbau Klais.

Marshall Day Acoustics was involved in all aspects of the room acoustic design, from concept through to commissioning. This included room acoustic analysis using 3D computer modelling and the Odeon software. Our principal challenge was to create a room suited to a large orchestra with the seating capacity for a relatively small audience. The resulting interior design for the auditorium integrates specially designed acoustic diffusion within the hall's architectural form to enhance the spatial impression of the room.

The design of surfaces around the stage platform ensures superior clarity and ensemble conditions for the musicians, and excellent sound quality throughout the auditorium.

Marshall Day Acoustics also undertook an acoustic design review of smaller performance spaces within the facility.





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