ARUP

The laboratory on your street

Structural advice for repurposing existing structures

Repurposing an existing structure to accommodate scientific research often requires the existing property to perform beyond the original design intent. Arup’s structural and vibration specialist engineers draw from a breadth of experience in the commercial and science sector to understand the challenges and performance requirements in order to maximise the capability of existing buildings.

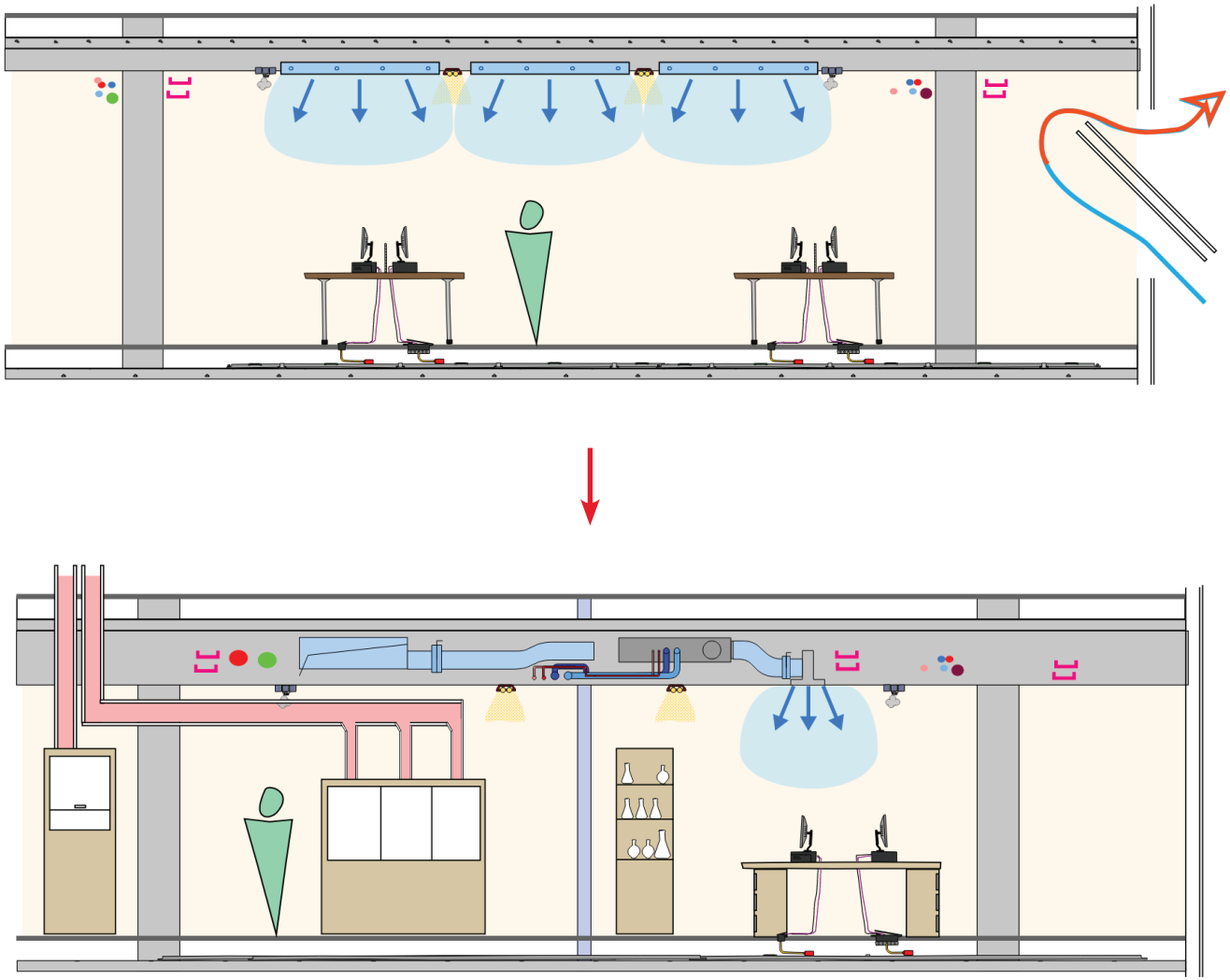
Integrated approach and holistic design

Many buildings may not appear to be adequate for science use, including applications such as microscopy or imaging.

Typically, it is possible to strengthen structures if heavier loads need to be carried locally. However, specialist measuring equipment and expertise are required to establish the vibration performance of an existing structure.

Arup teams can rapidly employ our expertise to any individual structure, to enable the design of cost-effective improvements to vibration performance.

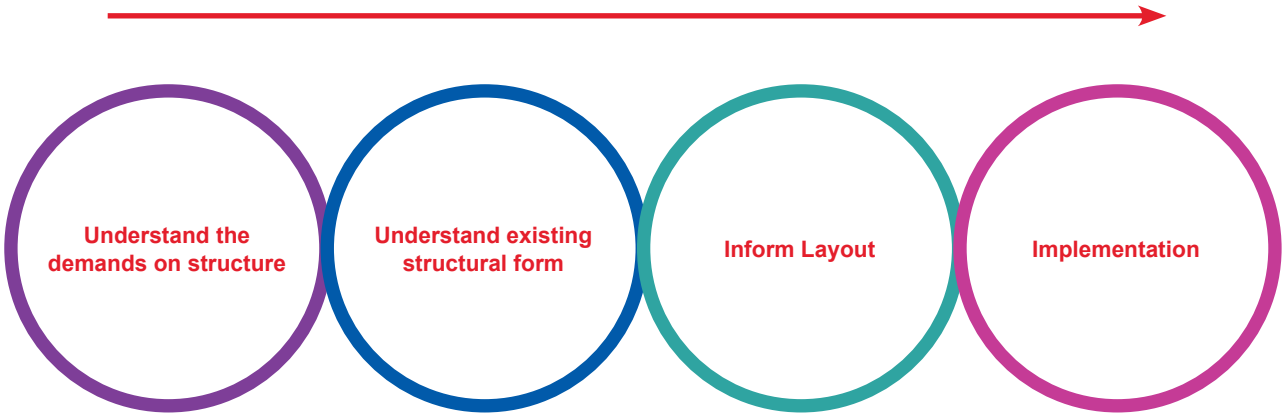
Our structural and vibration engineers work collaboratively to combine extensive structural knowledge with specialist skills in vibration modelling and assessment to design bespoke enhancement and mitigation measures, improving vibration performance where required.



Working with the pre-existing characteristics of each building, and in collaboration with the client and the design team, we aim to find cost effective and unobtrusive interventions to suit the required performance of each space.

Where end uses are yet to be established, for example, in more speculative developments, we can develop a suite of options to be fitted as and when detailed requirements are established.

This integrated structural and vibration design approach can extend the range of buildings that can be considered for repurposing for science.



Understand the demands on structure	Understand existing structural form	Inform Layout	Implementation
Loading	Vibration performance	Location of sensitive equipment	Strengthening
Vibration	Modelling	Vibration generating activities	Vibration mitigation and improvement measures
	In-situ measurement		

The vibration performance of a structure is affected by four key factors:

1. Mass
2. Stiffness
3. Damping
4. The source of the vibration input

While mass and stiffness are typically set by the existing structural form, the damping and vibration input can be influenced by the fit out and use of the space.

We believe there are often opportunities to provide enhanced vibration performance of existing building structures within the fit-out design.

If significant vibration performance improvement is required, targeted local measures can be utilised to achieve this in most circumstances.

Arup teams develop options that are flexible, are simple to install, can be installed only where required by either landlord or tenant. This can deliver significant performance upgrades to the building.

Repurpose in practice

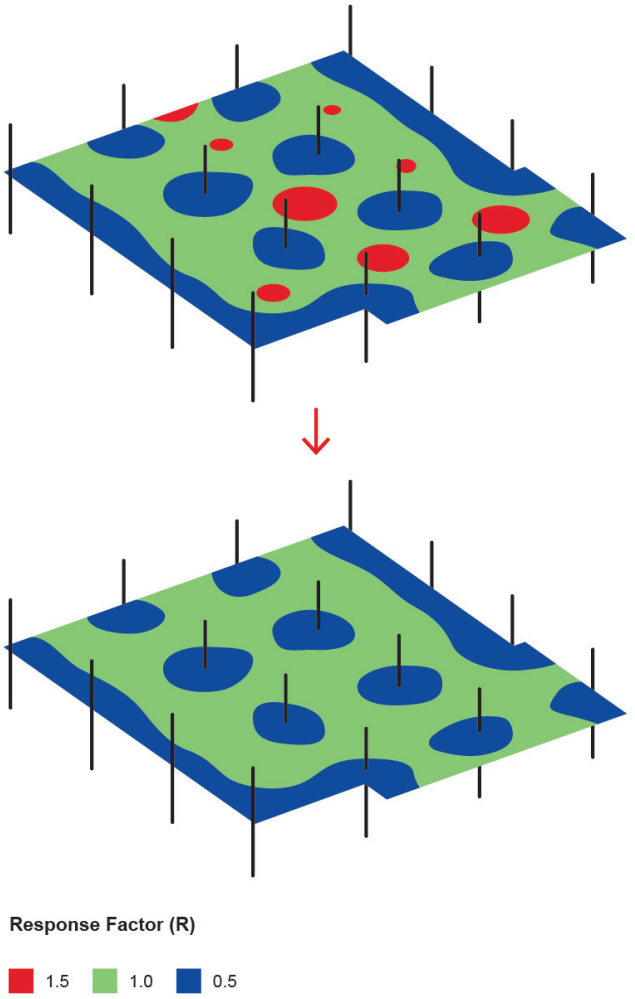
Concrete-framed headquarters building

Arup were instructed to review a concrete-framed building for re-purposing as a laboratory. The building was originally constructed by an owner-occupier as their headquarters office.

Through utilisation of the on-site archives, we were able to convert structural record information into a computer model of the floorplates to estimate the vibration performance. Although the floorplates performed well as expected due to their heavy mass and stiffness, the maximum response factor of R=1.5 was higher than the client target of R=1.0. Modelling results were validated through targeted on-site testing by the Arup team.

A refinement of the model showed the response factor target could be achieved through careful adjustments to the internal layouts to deliver an improved vibration response to meet the client brief.

Through detailed analysis and meticulous consideration of future layout planning, the client was able to position the building as a facility with laboratory-enabled floorplates, appealing to the growing market of potential tenants within the science sector.



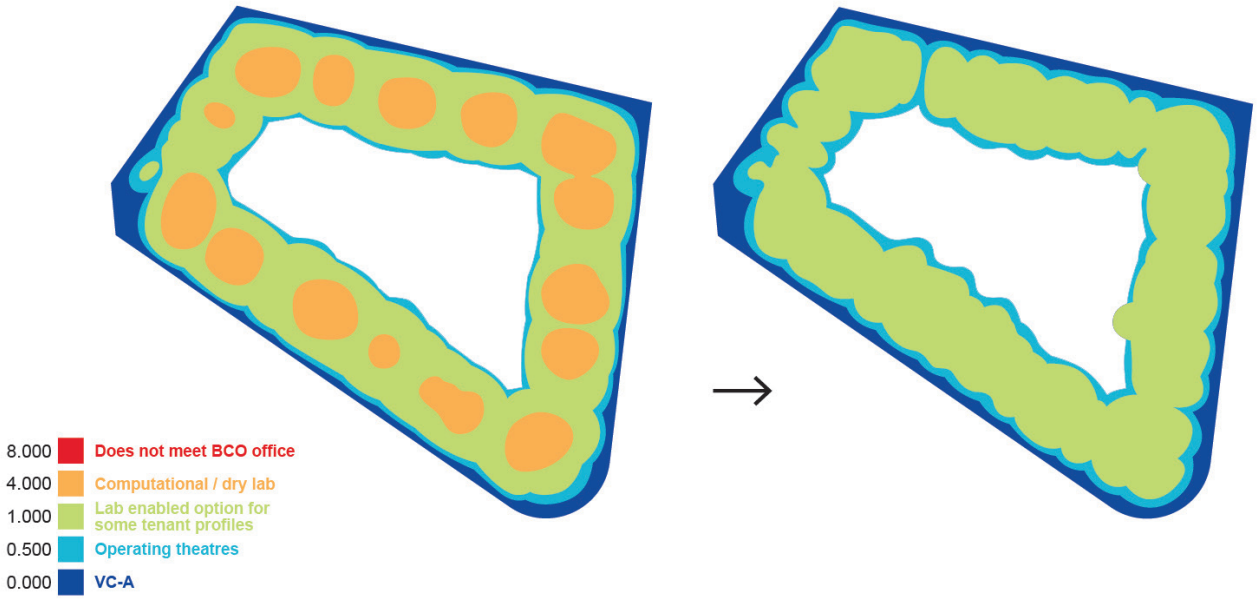
Steel-framed office building

Our Client was interested in letting a number of floors close to lease expiry within an existing office building to Life Sciences tenants and wished to minimise turnaround time and capital expenditure.

Long-span lightweight steel frames, which are common in modern offices, are traditionally seen as incompatible with laboratories due to their lightweight nature and higher vibration response.

However, working with the client and architect, the Arup design team developed a flexible, low-cost retrofit solution, compatible with a range of speculative lab layouts that is simple to install by either tenant or landlord.

The solution was shown by analysis models to significantly improve the vibration performance of floors, unlocking the ability to offer lab-enabled space to a range of life sciences tenants.



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