# Allies and Morrisons Office
# Acoustic Scheme Design

MACH ACOUSTICS

MACH PRODUCTS

MACH
ACOUSTICS

**Introduction**

MACH Acoustics have been requested to provide advice on acoustic treatments for the Reception space and atrium within Allies and Morrison's office. The acoustics of the office accommodation (2) is seen to be adequate. The main areas of concern are the Ground Floor multi use Reception space (1) and the transfer of noise through the atrium.

**MACH Acoustics Design Approach**

The dramatic, minimalistic, flat, hard architecture results in a building which does not lend itself to ceiling tiles or other conventional forms of room acoustic treatments. Importantly, the colour and material pallet in this building is limited to concrete (2), flat plaster (3), iron details and (4), glass coloured perforated aluminium. MACH Acoustics have therefore based our designs around these materials.

**Ground Floor Space**

The Ground Floor space is used as a reception space, informal meeting space, seating for lunch, CPD lectures, conferences, music and entertaining clients.

The measured reverberation time of this space is 1.5 seconds. A reverberation time of 1.5 seconds is not exceptionally high, reducing this time down to approximately 0.8 seconds will provide a quieter, more functional space. This target figure has therefore been adopted by MACH Acoustics.

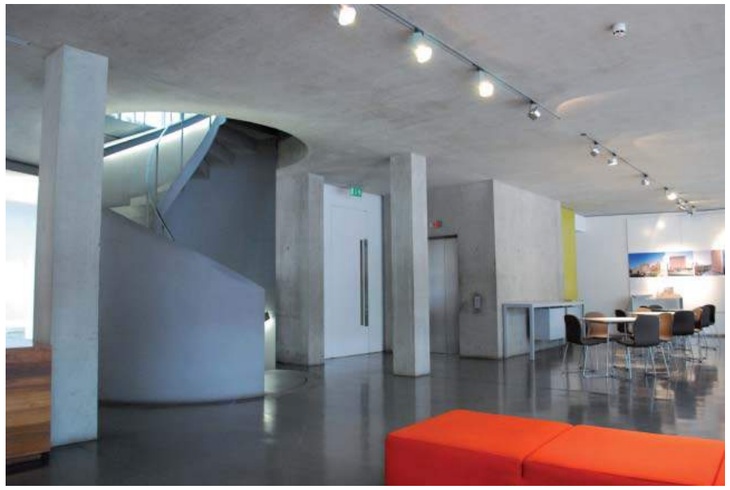
The measured reverberation time within the office accommodation was found to be 0.8 seconds.

**Atrium Acoustics**

Two key factors are being considered; the first is the transfer of noise from the Ground Floor reception to the office accommodation above. The second issue relates to the transfer of noise/speech between floors.

MACH Acoustics findings are that the transfer of sound between the office floors is due to sound being coherently reflected between the office floors. It is therefore likely that this issue could be resolved by placing diffusers in the atrium, i.e. irregular panels.

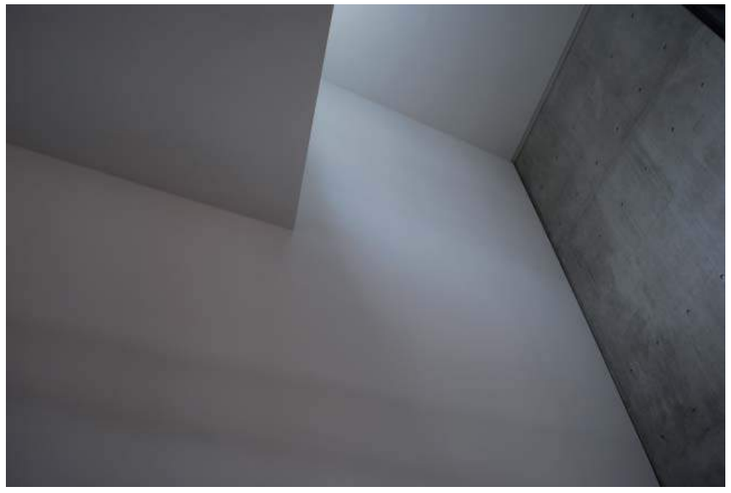
The transfer of noise from the Ground Floor reception to the office accommodation is likely to be improved by reducing the reverberation in the Reception space.



1

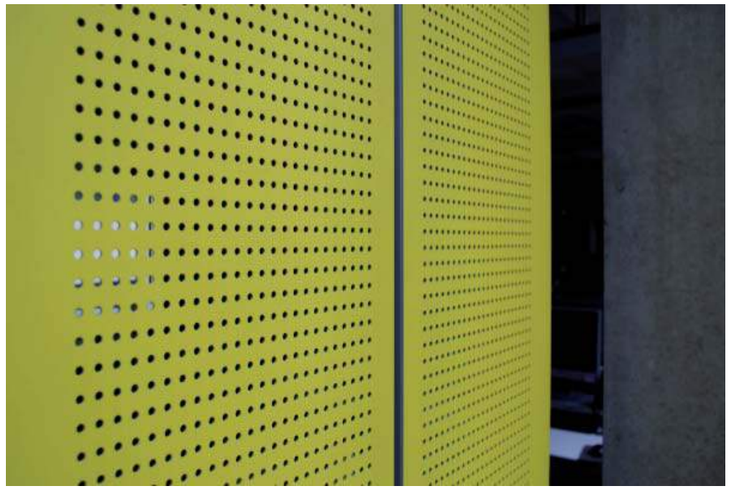
2

3



4

5



6

## Measurements and Assessments

A CATT Acoustics Ray Tracing model (2) built using a sketch up model (1), has been used to assess the effects of proposed solutions for the Reception space. This software works by sending out thousands of rays representing a given sound source. The advantage of this software is exceptional accuracy, due to the fact that the position of the acoustic treatments is considered by this type of modelling. This software can be used to determine the decay of sound, reverberation, the spread of noise through a building and the speech intelligibility across an audience.

## Measured Results

Four sets of tests where conducted during a Saturday when the office was empty. The main reason for undertaking testing was such to benchmark the performance of the existing building against MACH Acoustics models. The CATT model has been calibrated against the results of on site testing.

## Reverberation Test

Each row within the table below provides the average of 6 reverberation tests. Two sets of tests where taken within the Ground Floor entrance space, with the blinds up and down. The reverberation time of the office space is also provided.

| | 125Hz | 250Hz | 500Hz | 1KHz | 2KHz | 4KHz | Tmf |
|---|---|---|---|---|---|---|---|
| Reception space – blinds up | 1.1 | 1.3 | 1.6 | 1.6 | 1.5 | 1.3 | **1.6** |
| Reception space – blinds down | 1.1 | 1.3 | 1.4 | 1.4 | 1.2 | 1.2 | **1.3** |
| 2nd Floor office | 0.8 | 0.8 | 0.8 | 0.7 | 0.8 | 0.8 | **0.8** |

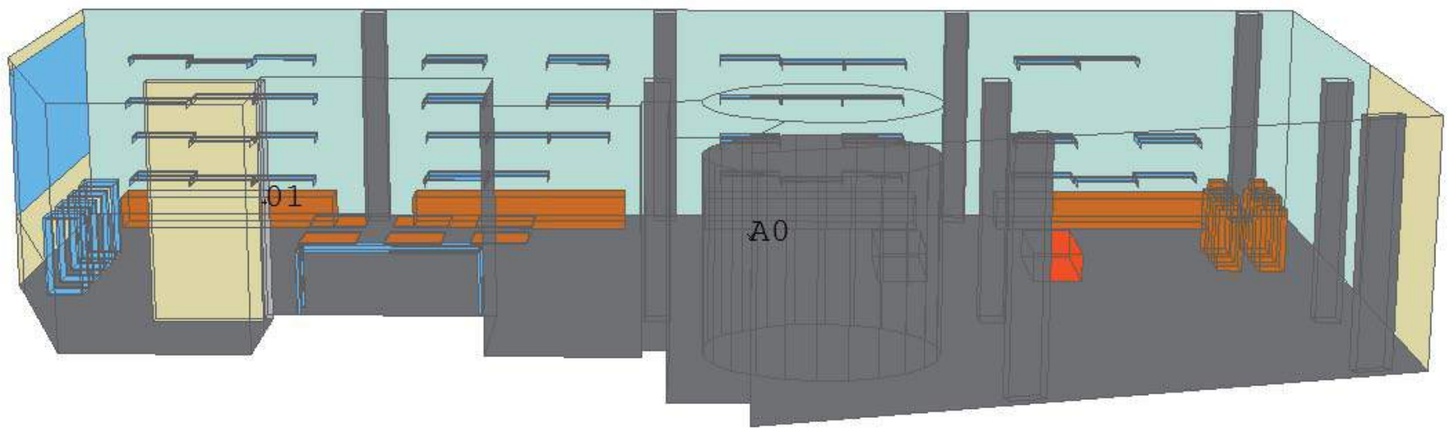
## Impulse Measurements

Such to assess the transfer of sound between the floors, impulse tests where undertaken. These tests where undertaken by measuring the response to a starter gun pistol. The concept behind these tests is to establish whether the transfer of sound between office floors is down to a few strong reflections or multiple delayed reflections (reverberation).

## Decay of Sound

For the purpose of calibrating MACH Acoustics models, the decay of sound has been measured between the Ground Floor and the office spaces above. In addition, several measurements have also been taken measuring the decay of sound along the length of the office accommodation. At this stage, this data has not been used.

1




2

MACH ACOUSTICS

## Reception Spaces - Required Levels of Room Acoustic Treatments

Such to assess the required levels of treatment and effects of proposed treatments, a CATT Acoustics Ray Tracing model has been used.

As per the introduction, MACH Acoustics design goal for this space is 0.8 seconds. The table below provides the required levels of room acoustic treatments for reverberations times between 1.5 seconds and 0.8 seconds.

| Reverberation time | 1.6s | 1.5s | 1.4s | 1.3s | 1.2s | 1.1s | 1.0s | 0.9s | 0.8s |
|---|---|---|---|---|---|---|---|---|---|
| Additional treatment | 0m² | 4m² | 8m² | 12m² | 17m² | 23m² | 31m² | 39m² | 51m² |

Note, the above levels of treatment are based upon the finishes achieving 1 Sabine per meter square of treatment. This is equivalent to 100% absorption

## Proposed Methods of Adding Acoustic Absorption

Such to reduce the level of reverberation within the Reception space, a range of design options have been reviewed. Two approaches are proposed; the first is based around adding absorption within numerous discreet locations (2,3,4,7,8,9). The second is to add adsorption in significant qualities (1, 5, 6).

The photo to the left provides a range of potential locations where acoustic treatment could be added to the Reception space. The table below provides the area, quantities, effectiveness of the treatment and the total Sabines provided by the different treatments proposed.

Note that to achieve the desired reverberation time of 0.8 seconds, a total of 51m2 of treatment is needed. The total Sabines from all the treatments above is 88m2.


1


2


3

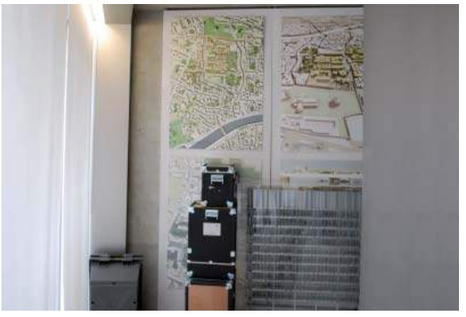

4


5


6


7


8


9

| | | Surface Area | Sides | Units | Total Area | Effectiveness of absorption | Sabines |
|---|---|---|---|---|---|---|---|
| 1 | End Wall | 11.6 | 1 | 1 | 11.6 | 95% | 11 |
| 2 | Shelves | 0.33 | 1 | 50 | 16.5 | 95% | 16 |
| 3 | Cupboards | 1.56 | 1 | 4 | 6.24 | 90% | 6 |
| 4 | Tables | 0.45 | 1 | 6 | 2.7 | 85% | 2 |
| 5 | Glass Wall | 29.2 | 1 | 1 | 29.2 | 65% | 19 |
| 6 | Ceiling Panels | 3 | 1 | 6 | 18 | 95% | 17 |
| 7 | Display Cabinets | 0.32 | 4 | 6 | 7.68 | 80% | 6 |
| 8 | Large Boxes | 0.5 | 2 | 4 | 4 | 90% | 4 |
| 9 | Hidden Wall | 8.6 | 1 | 1 | 8.6 | 85% | 7 |

Absorption provided by a range of finishes

**Transfer of Sound Through the Atrium**

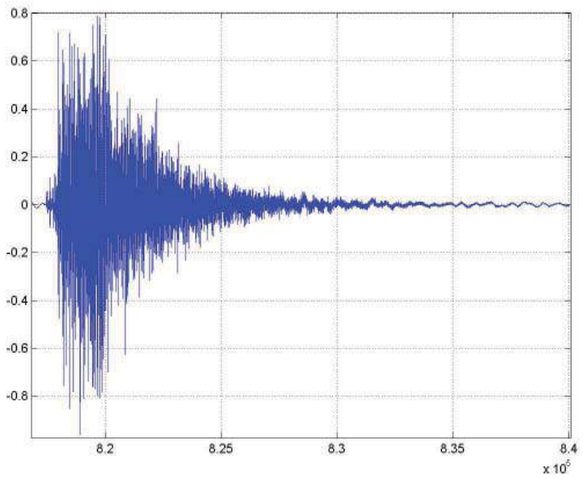
The transfer of sound between floors via the atrium (5) is seen to be higher than desirable. The atrium is a clean space, formed from flat, hard finishes, plaster and concrete. These flat surfaces offer the potential for strong coherent reflections between floors.

Adding acoustic treatments to this space is hard, due to the look and appearance of the space. Hanging treatments within this area are also not desirable since there are some important views across the atrium. MACH Acoustics proposal is therefore to apply hard, diffusive treatments to the walls within this space. The function of this treatment is to break up reflections and reduce the level of coherent reflections between floors.

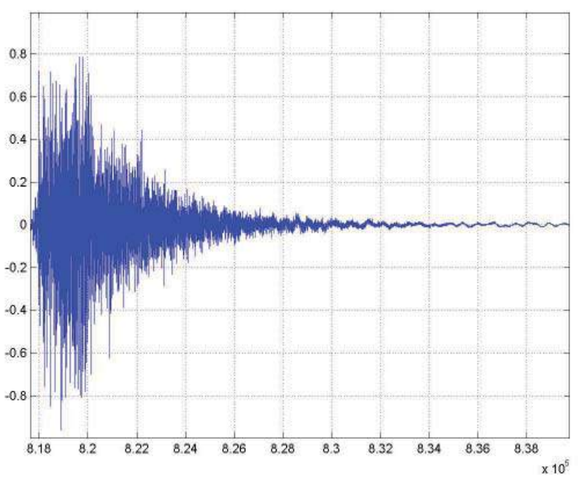
Such to assess the impact of these treatments, impulse measurements were taken. These tests look at the decay of sound from a loud, short bang, produced by a starter pistol. Graph (1) shows the measured decay of sound with the starter pistol located in the centre of the 2nd Floor office, the microphone was adjacent to the Atrium, 2nd Floor. Graph (2), the microphone was not moved, the starter pistol was located adjacent to the Atrium, 1st floor.

The results shown in graph 2 show stronger, clearer reflections that those in graph 1. This would suggest that the transfer of sound is down to reflections and can therefore be treated with diffusion rather than absorption. Diffusion can be added by adding hard, irregular shaped elements (3, 4)

At this stage, it is important to appreciate that there is a larger number of reflections than desirable, hence the location and level of diffusion required in this space, may be higher than aesthetically acceptable.




1




2

3

4

5

**Speech Intelligibility**

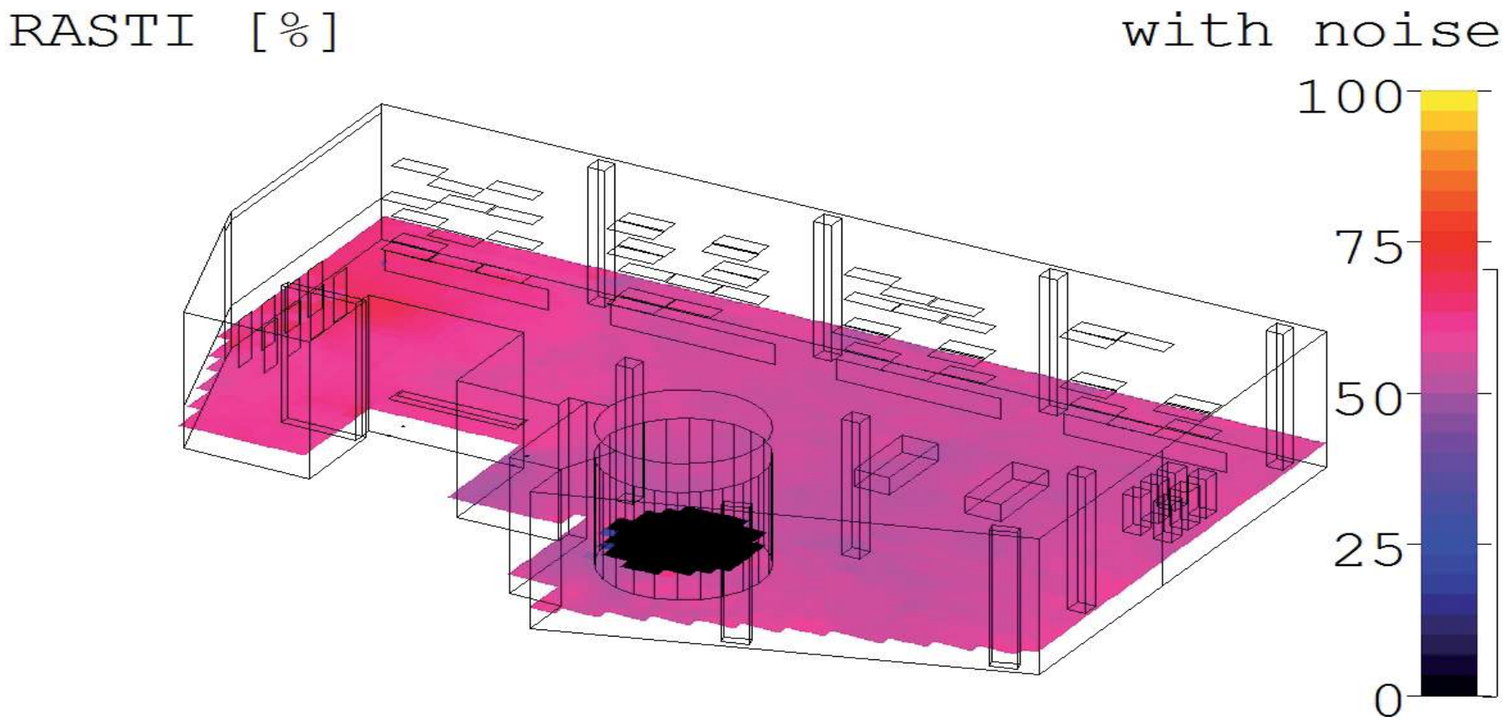
Improving speech intelligibility during lectures and CPDs within the Reception space, is seen to be an important requirement. A reverberation time of 1.5 seconds is likely to have a significantly detrimental effect on speech intelligibility. Reducing the reverberation time to 0.8 seconds will have a significant impact upon the clarity of speech.

At this stage, the proposed forms of room acoustic treatments have not been established and as such, it is difficult to accurately assess speech intelligibility levels. On the other hand, if the room acoustic treatments are selected to enhance speech intelligibility, they should be located in the zone used for the CPDs and ideally behind the audience. MACH Acoustics therefore propose to apply treatments to the ceiling, treatments to shelves, and potentially a retractable screen placed behind the audience.

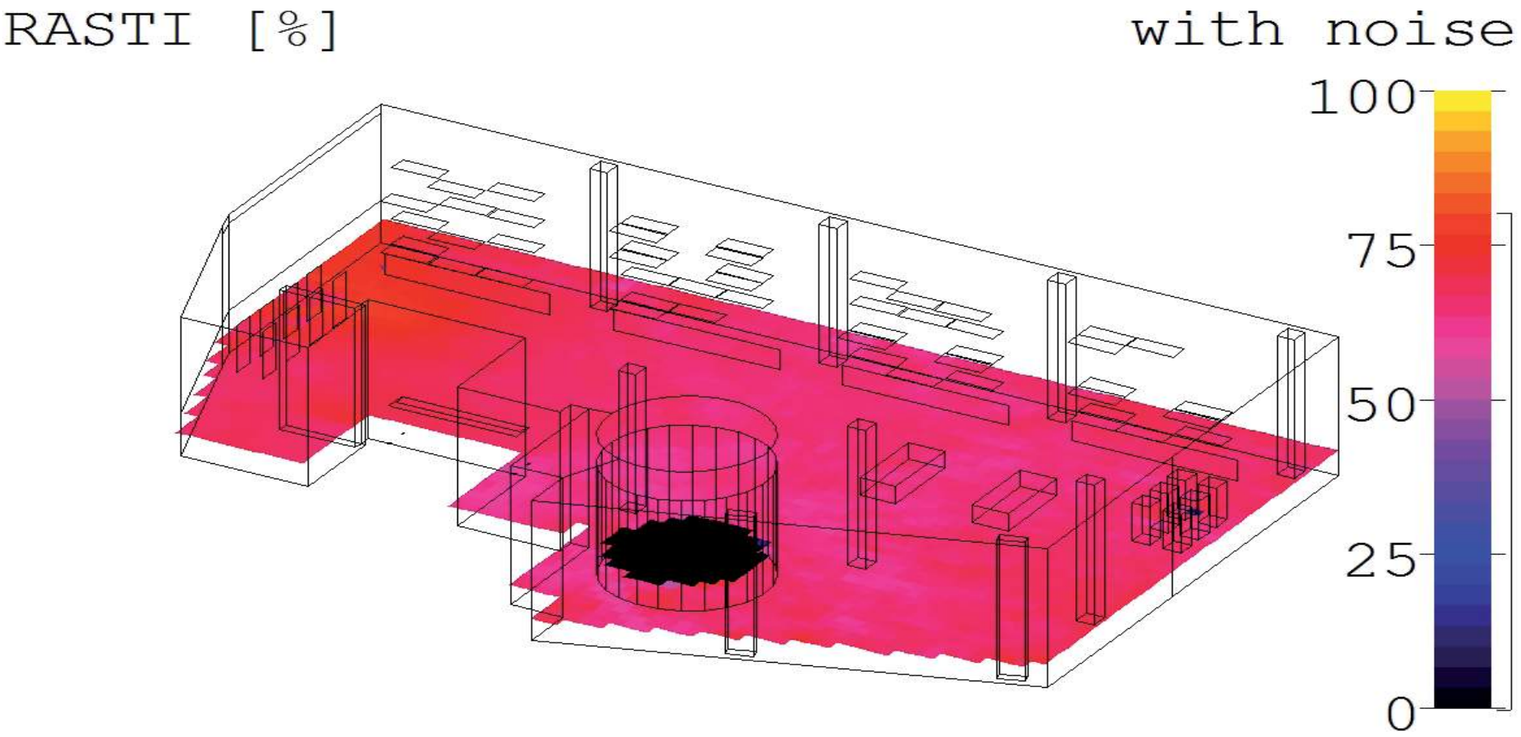
**Results of Speech Intelligibility Modelling**

Such to provide an understanding of the effects of treatments and to demonstrate the potential of this design tool, two models have been presented. The models show the speech intelligibility across the floor of the reception space. The presented model shows the RASTI level for a speaker located close to the end wall. Such to achieve good levels of speech intelligibility, RASTI levels should be maintained above 0.6 across the audience.

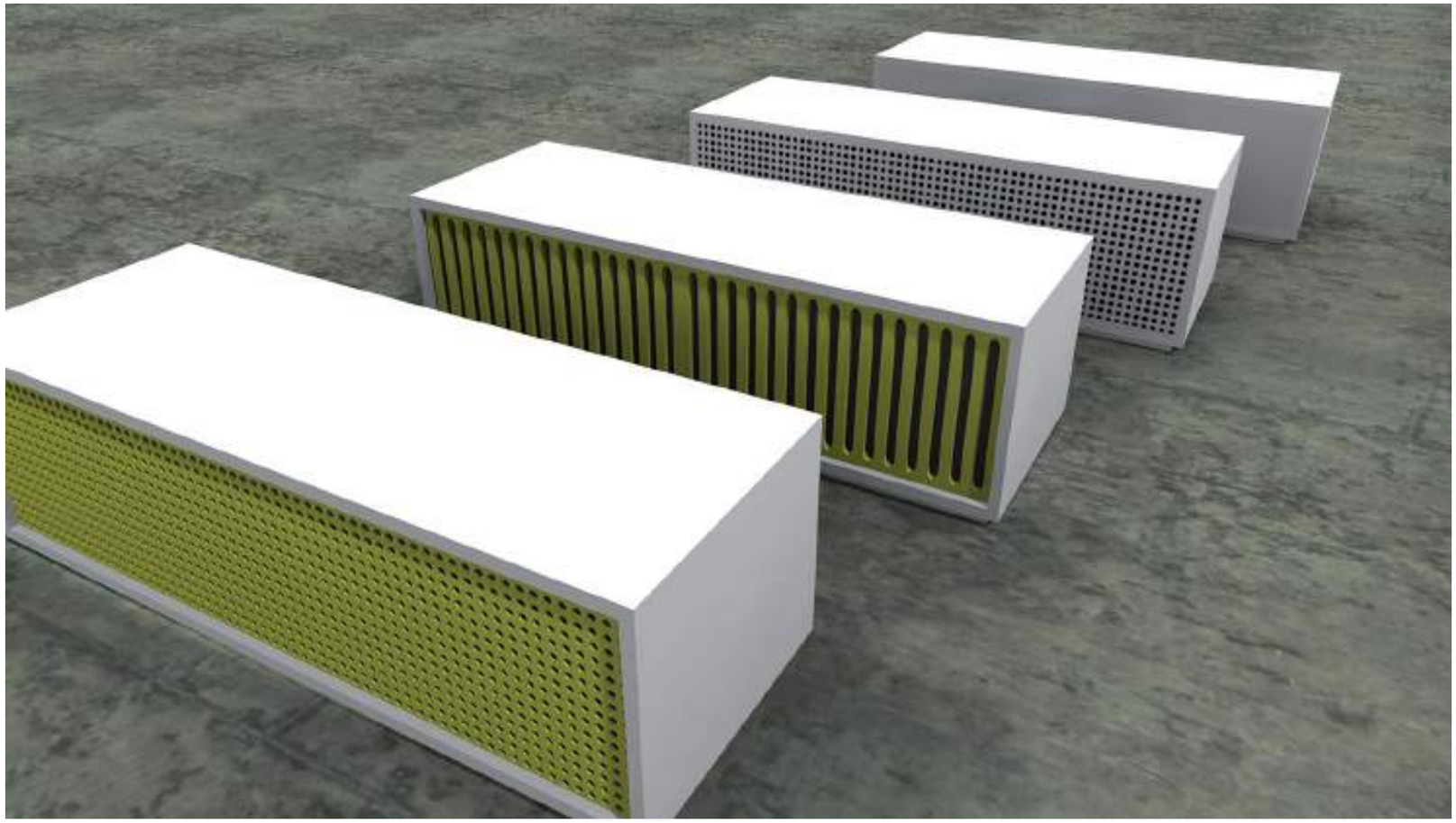
Modelling shows that current finishes compromise the levels of speech intelligibility (1), the inclusion of acoustic treatments has the potential to significantly increase speech intelligibility (2).




1

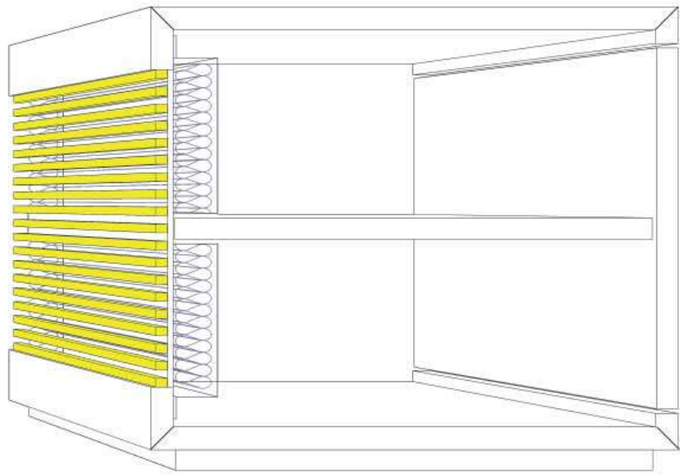



2



1

2



3

MACH ACOUSTICS

MACH PRODUCTS

# Cupboard

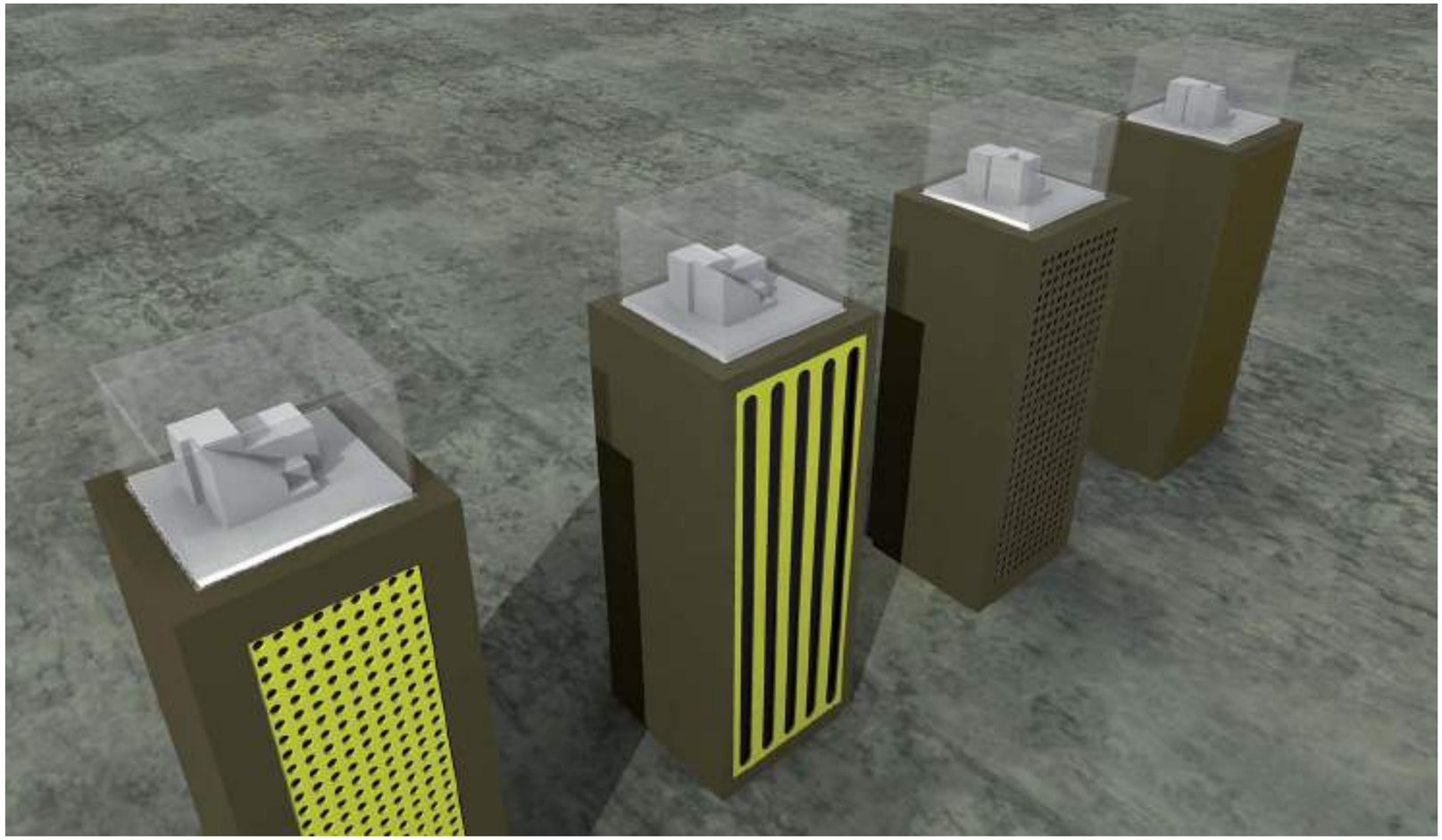
| Sabines per meter squared of treatment |
|---|
| 0.9 Sabines |
| **Area per cupboard** |
| 1.56 $m^2$ |
| **Units** |
| 4 |
| **Total Sabines provided by 4 cupboards** |
| 6 Sabines |

Cupboards run along the length of the reception space. The backs of these cupboards could be perforated or covered with an acoustically transparent finish. Acoustic absorption is then added within the cupboards as shown in the 3D section.

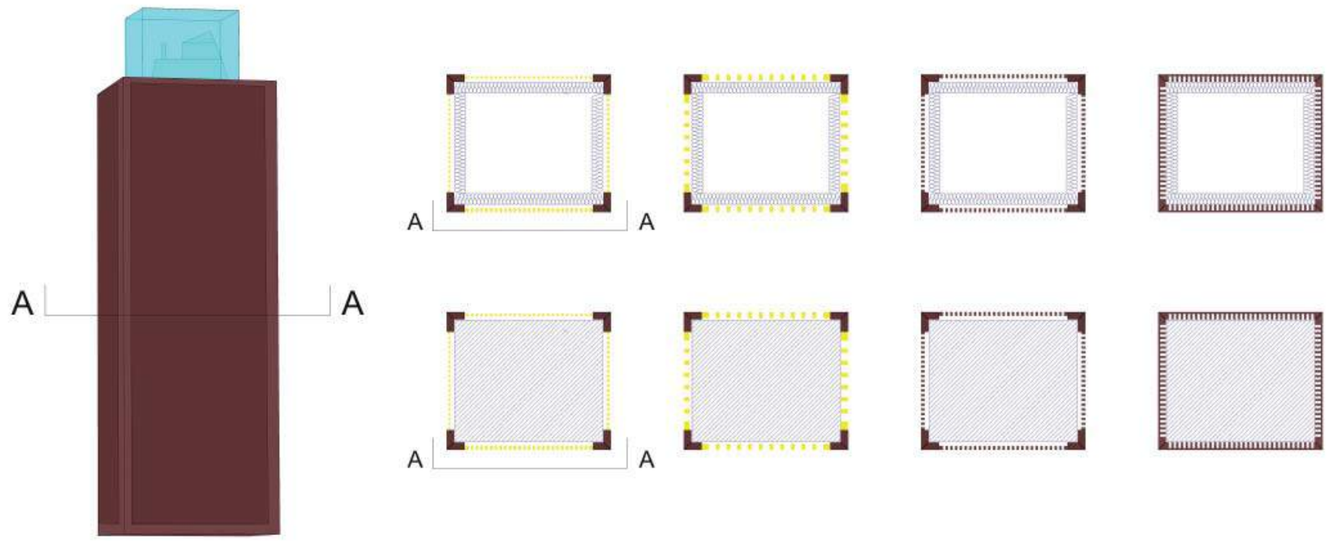
1 Visual of the acoustically backed cupboards
Front - Perforated metal element added to the backs of cupboards
Front middle - Wooden slats added to the rear of cupboards
Back middle - Perforations added directly to the rear of the cupboards
Rear - A perforated sheet covered with a thin, acoustically transparent film or cloth, applied to the rear of the cupboards.
2 Photo of cupboards within the Reception space
3 Section through acoustic cupboards, this illustration shows the acoustically transparent finish applied to the rear of the cupboard. Mineral wool or acoustic foam is then applied to the rear, inside panel of the cupboard.

| | | |
|---|---|---|
| Title: See top of page | | |
| Project: Allies and Morrison Reception Space | | |
| Client: Allies and Morrison | | |
| | Rev: 1 | Scale: Not To Scale |

MACH Acoustics, Trelawney House, Surrey Street, BS2 8PS
Phone 0117 944 1388



1




2

MACH ACOUSTICS

MACH PRODUCTS

# Display Cabinets

| Sabines per meter squared of treatment |
|---|
| 0.9 Sabines |
| **Area per side of display cabinet** |
| 0.32 $m^2$ |
| **Total number of sides** |
| 24 |
| **Total Sabines provided by 6 display cabinets** |
| 6 Sabines |

As in the case of cupboards, the base of the display cabinets could be made to provide acoustic absorption in the Reception space.

1 Visual of the acoustic display cabinets
Front - Perforated metal element added to the side of the display cabinets
Middle front - Wooden slats added to the sides of the display cabinets
Middle Rear - Perforations added directly to the side of display cabinets
Rear - A perforated sheet covered with a thin acoustically transparent film or cloth applied to the side of the display cabinets

2 Section through display cabinets, the acoustic absorption can either be provided by lining the inside of the cabinets with mineral wool or foam. This build up is shown in the top row of the illustration. The second design option is to place a block of foam in each cabinet.

| | | |
|---|---|---|
| Title: See top of page | | |
| Project: Allies and Morrison Reception Space | | |
| Client: Allies and Morrison | | |
| | Rev: 1 | Scale: Not To Scale |

MACH Acoustics, Trelawney House, Surrey Street, BS2 8PS
Phone 0117 944 1388

1

2

3

4

MACH ACOUSTICS

MACH PRODUCTS

# Ceiling Panels
# Option 1

| Sabines per meter squared of treatment |
|---|
| 0.95 Sabines |
| **Area per Panel** |
| 3 $m^2$ (2.5m by 1.2m) |
| **Number of panels** |
| 6 |
| **Total Sabines provided by 6 ceiling panels** |
| 17 Sabines |

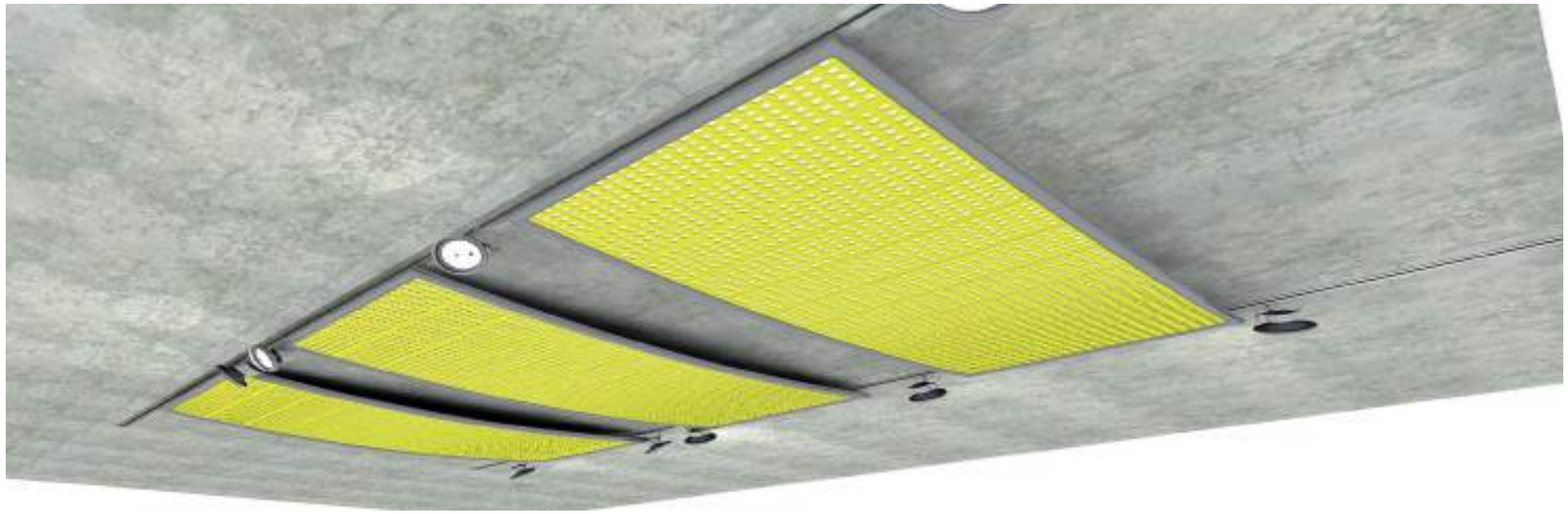
This design option presents suspended acoustic absorption finished with metal, plastic or cloth, fixed into the track lighting within the Reception space.

This design option offers a clean and interesting method of treating this space. A second advantage of this method is that no fixings are needed in the concrete ceiling. Additionally, it is possible to increase the level of treatment for CPD's and corporate events

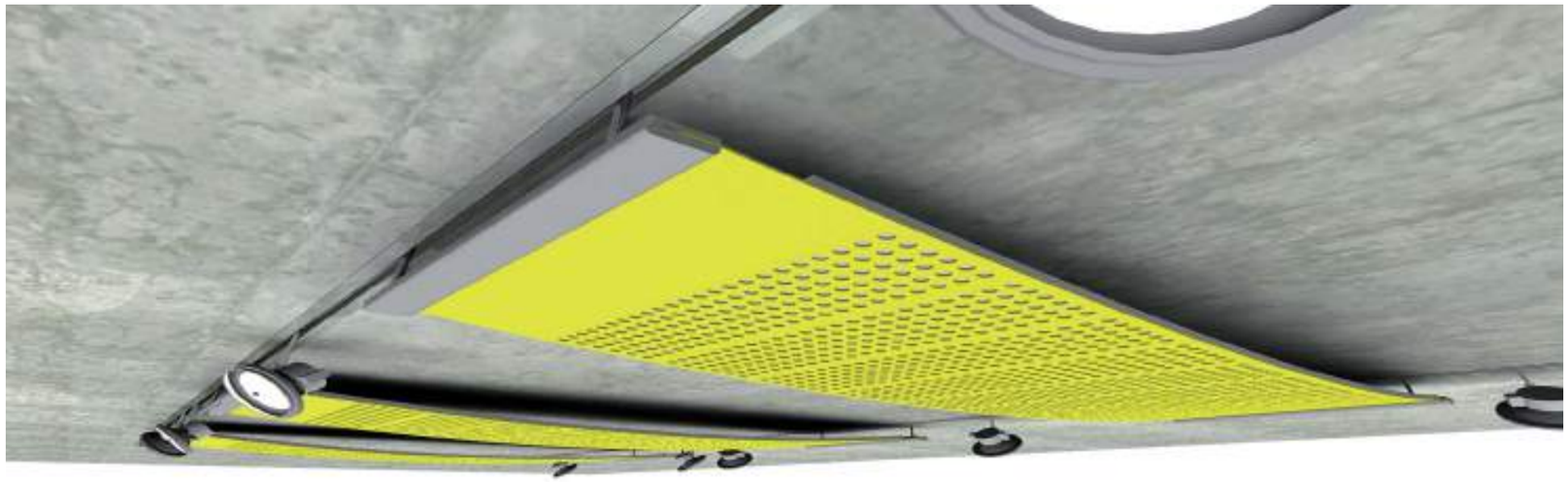
1 Ceiling of the reception space.
2 Design option for ceiling panel 1 - this illustration shows a cloth panel including acoustic absorption, supported by a metal frame.
3-4 Photos of the Scarlet Spa Hotel where acoustic absorption was added to the two shown spaces. (3) Acoustic panels placed in the centre of the space. (4) Cental canopy providing acoustic absorption

| | | |
|---|---|---|
| Title: See top of page | | |
| Project: Allies and Morrison Reception Space | | |
| Client: Allies and Morrison | | |
| | Rev: 1 | Scale: Not To Scale |

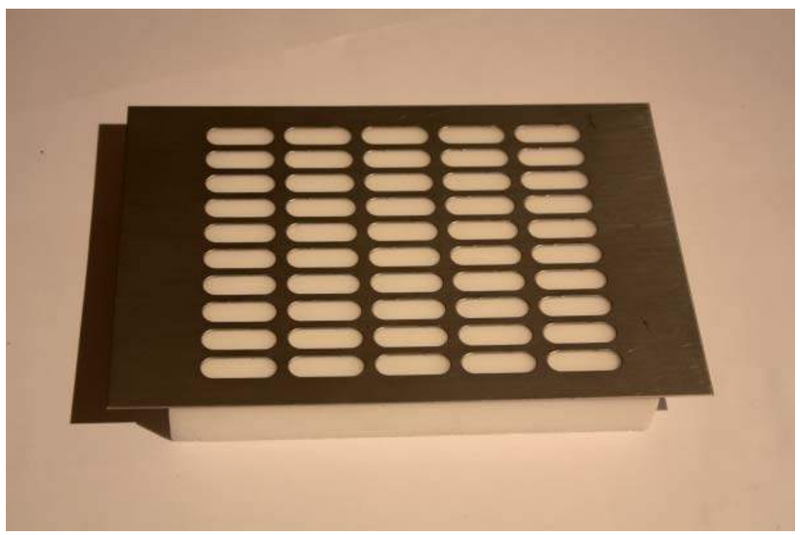
MACH Acoustics, Trelawney House, Surrey Street, BS2 8PS
Phone 0117 944 1388



1



2



3

4

MACH ACOUSTICS

MACH PRODUCTS

# Ceiling Panels

## Option 2

This second set of design options presents metal panels suspended between track lighting.

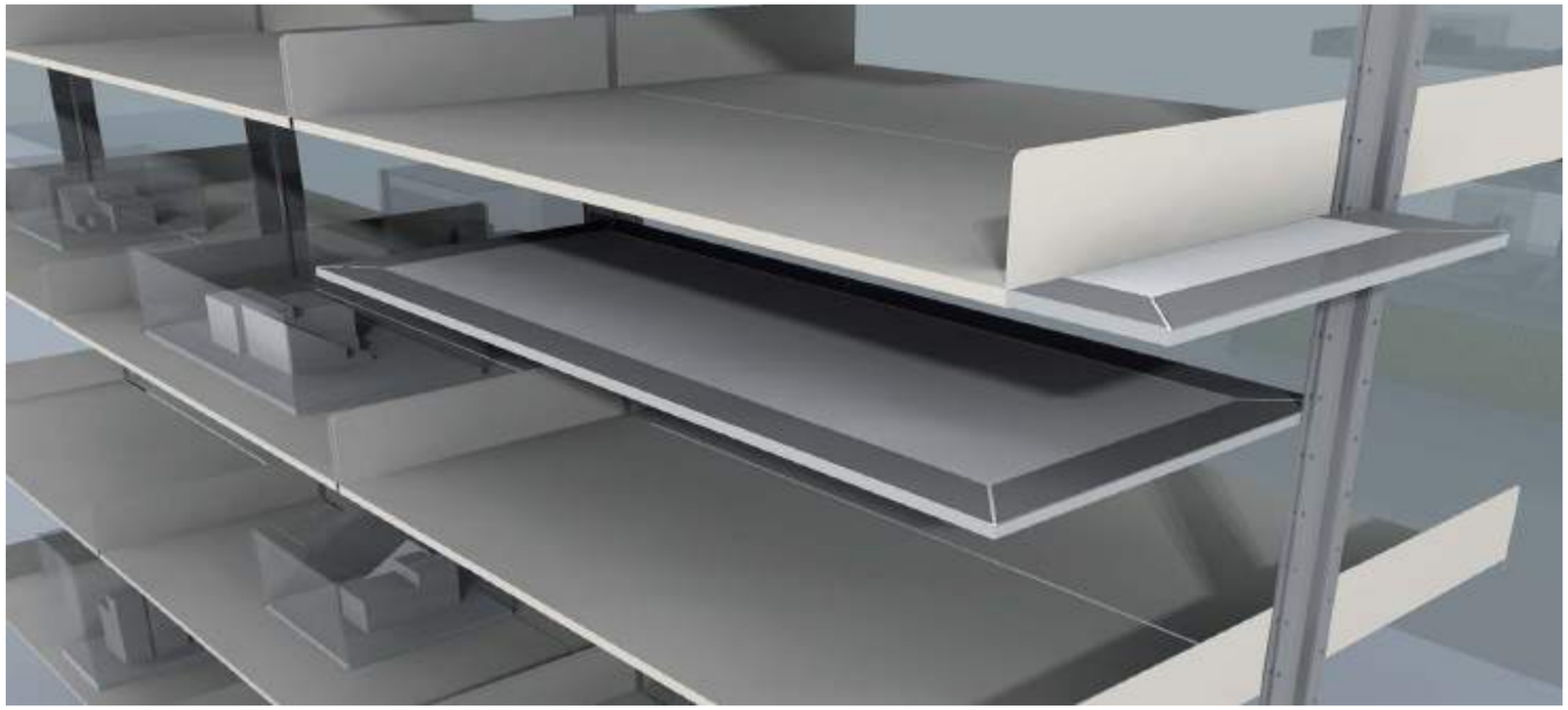
The illustration shows metal panels incorporated into a metal frame. The second example shows the thin metal frame backed with an acoustic foam.

The sample shown illustrates this make up. The photos of samples also show a design option based upon using a thick rubber mat.

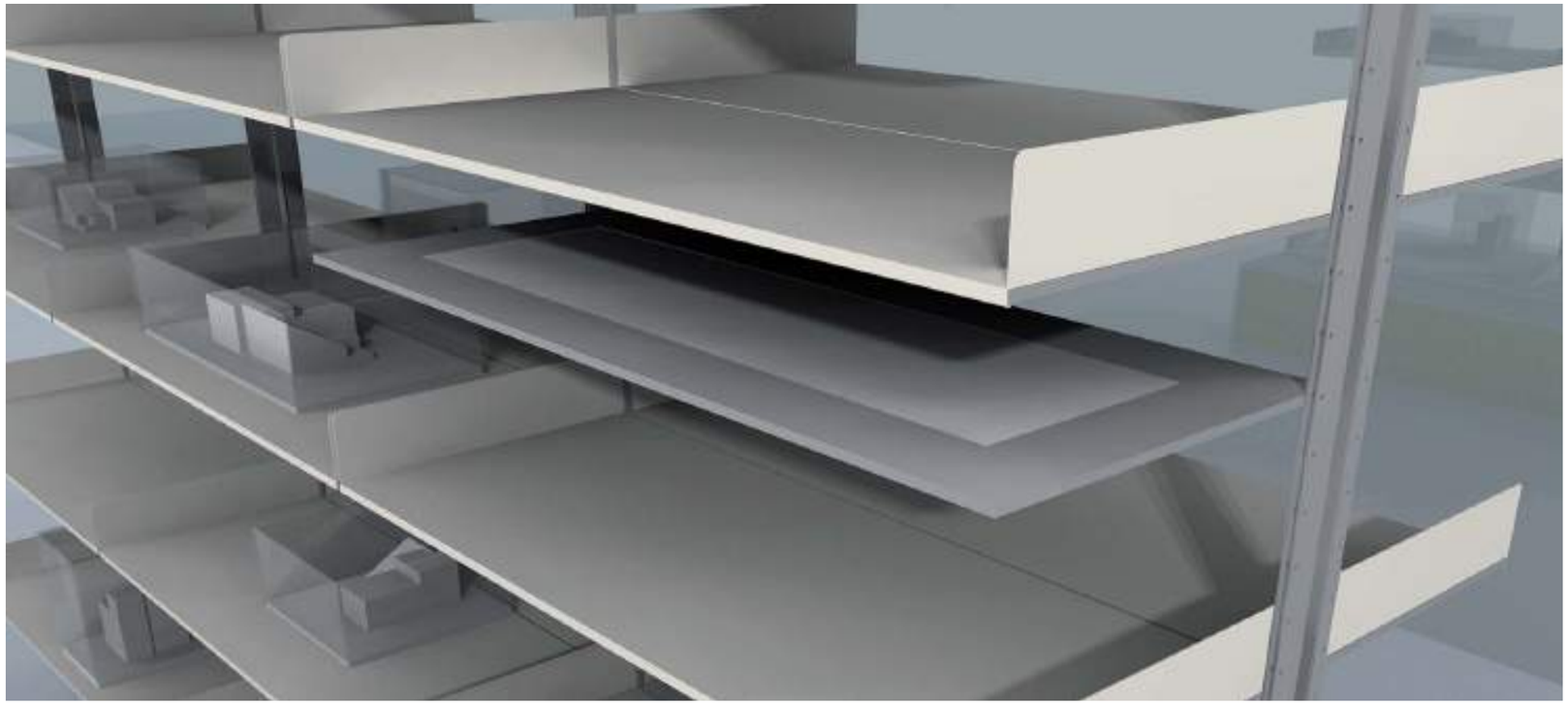
1 Design option for ceiling panel 2 - Thin perforated metal sheet held within a frame. Acoustic absorption provided by bagged mineral wool or acoustic foam.
2 Design option for ceiling panel 3 - Thin perforated metal sheet. Acoustic absorption provided by acoustic foam.
3 Sample of thin metal sheet placed over acoust ically absorbent foam.
4 Sample of a rubber sheet placed over acoust ically absorbent foam.

| | | |
|---|---|---|
| Title: See top of page | | |
| Project: Allies and Morrison Reception Space | | |
| Client: Allies and Morrison | | |
| | Rev: 1 | Scale: Not To Scale |

MACH Acoustics, Trelawney House, Surrey Street, BS2 8PS
Phone 0117 944 1388



1 - Drawing required to be up dated



2 - Drawing required to be up dated

MACH ACOUSTICS

MACH PRODUCTS

# Acoustic Shelves

| **Sabines per meter squared of treatment** |
|---|
| 0.95 Sabines |
| **Area per shelf** |
| .33 $m^2$ |
| **Number of shelves** |
| 50 |
| **Total Sabines provided by 50 shelves** |
| 16 Sabines |

The Reception space contains a large number of shelves supporting a range of architectural models. These shelves offer a discreet location to hide acoustic treatment.

The proposed method of adding absorption is to slide a perforated metal tray encapsulating foam or mineral wool, to the underside of the shelves.

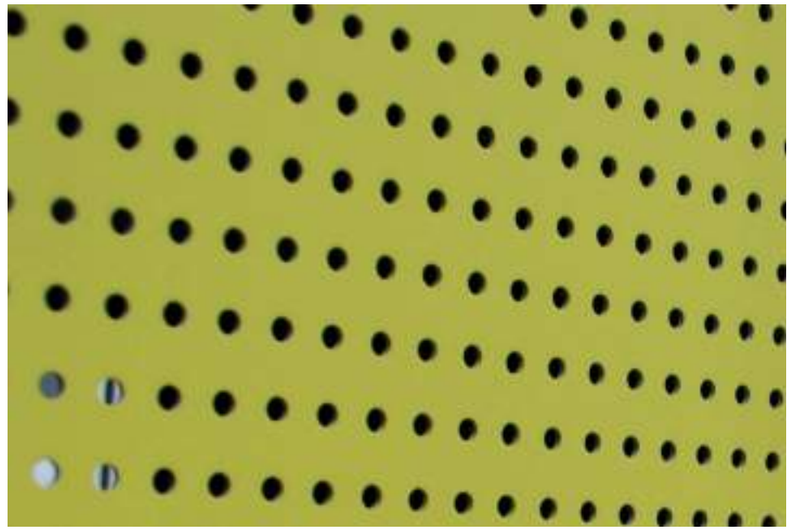
1 Acoustic panel being slid under the shelf within the Reception space.
2 Shelves containing acoustically absorbent panels

| | | |
|---|---|---|
| Title: See top of page | | |
| Project: Allies and Morrison Reception Space | | |
| Client: Allies and Morrison | | |
| | Rev: 1 | Scale: Not To Scale |

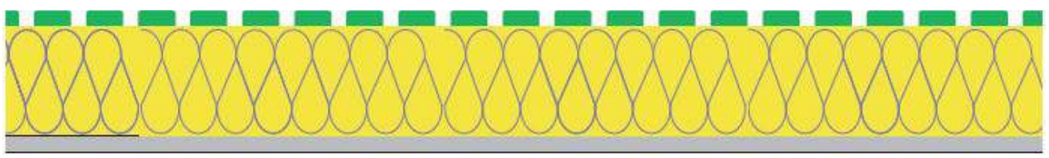
MACH Acoustics, Trelawney House, Surrey Street, BS2 8PS
Phone 0117 944 1388

1

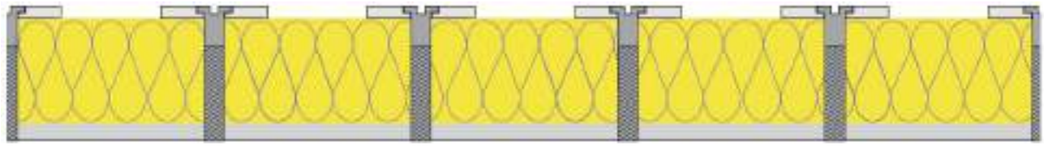
2



3



4



5

6

7

# End Wall

# Option 1

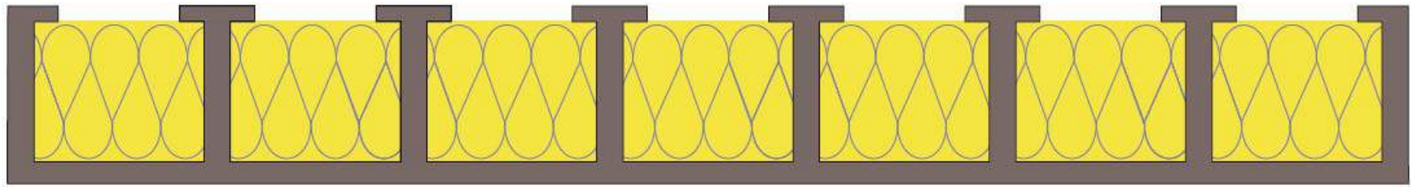
| Sabines per meter squared of treatment |
|---|
| 0.95 Sabines |
| **Area of treatment** |
| 11.6 $m^2$ |
| **Number of panels** |
| 1 |
| **Total Sabines provided end wall** |
| 11 Sabines |

The end wall of the Reception space offers a large area which could be treated with acoustic absorption.

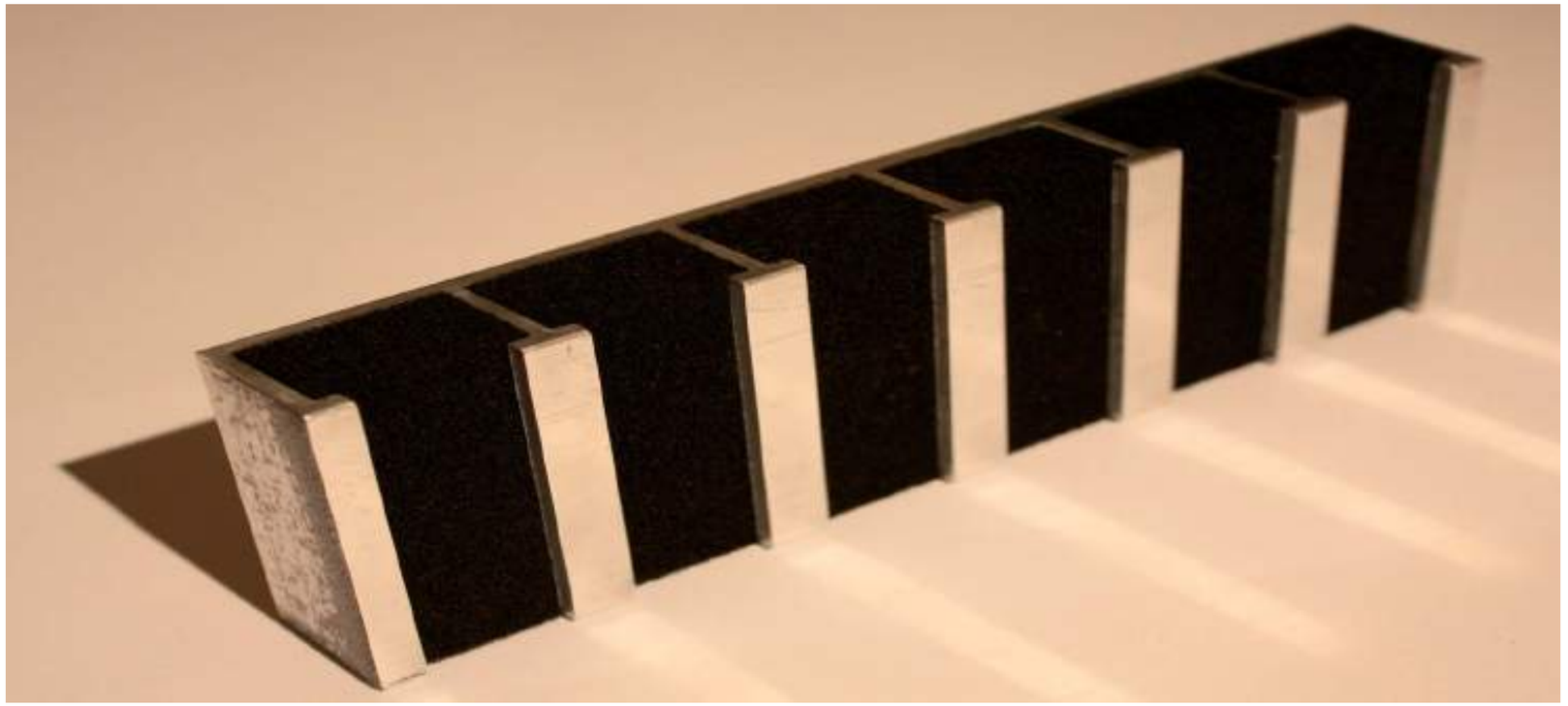
1 Photo of end wall within Reception space
2 Metal slats proposed as a design option for treating the end wall. Illustration 4 shows a section of this make up. The percentage of exposed acoustic absorption should not be less than 30%.
3 Option 2 for the end wall would be to use perforated metal. Illustration 5 shows a section of the proposed acoustic treatment.
4 Section through the proposed wall treatment using metal slats
5 Section through the proposed wall treatment based around perforated metal
6 Magnets - Note that these surfaces could still be used to present drawing and projects.
7 A small, magnetic, moveable white board could also be

| | | |
|---|---|---|
| Title: See top of page | | |
| Project: Allies and Morrison Reception Space | | |
| Client: Allies and Morrison | | |
| | Rev: 1 | Scale: Not To Scale |

MACH Acoustics, Trelawney House, Surrey Street, BS2 8PS
Phone 0117 944 1388



1



2

3

4

MACH ACOUSTICS

MACH PRODUCTS

# End Wall Option 2

Three options have been reviewed:

a) Metal slats over an acoustically absorbent finish
b) Perforated metal – this is felt to be somewhat over used
c) MACH Acoustics preferred option would be to add a slated structure with a finish equal to that of the ballustrades and other elements.

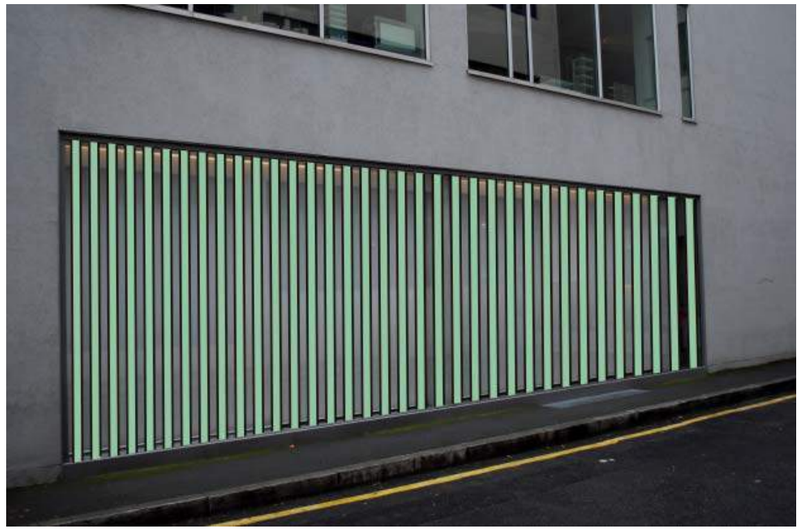
On this page, Option C is presented. A section of the wall treatment make up is shown, followed by a sample of the treatments, in this case made from aluminium. The two remaining photos are of the proposed finish for this wall treatment i.e. a heavy iron look

1 Section of proposed treatment Option C
2 Photo of sample formed from aluminium including black acoustic foam between slats.
3 Proposed finish for this treatment - photo taken to the under side of the ballustrades , showing large screw heads.
4 Photo of the top side to the ballustrades

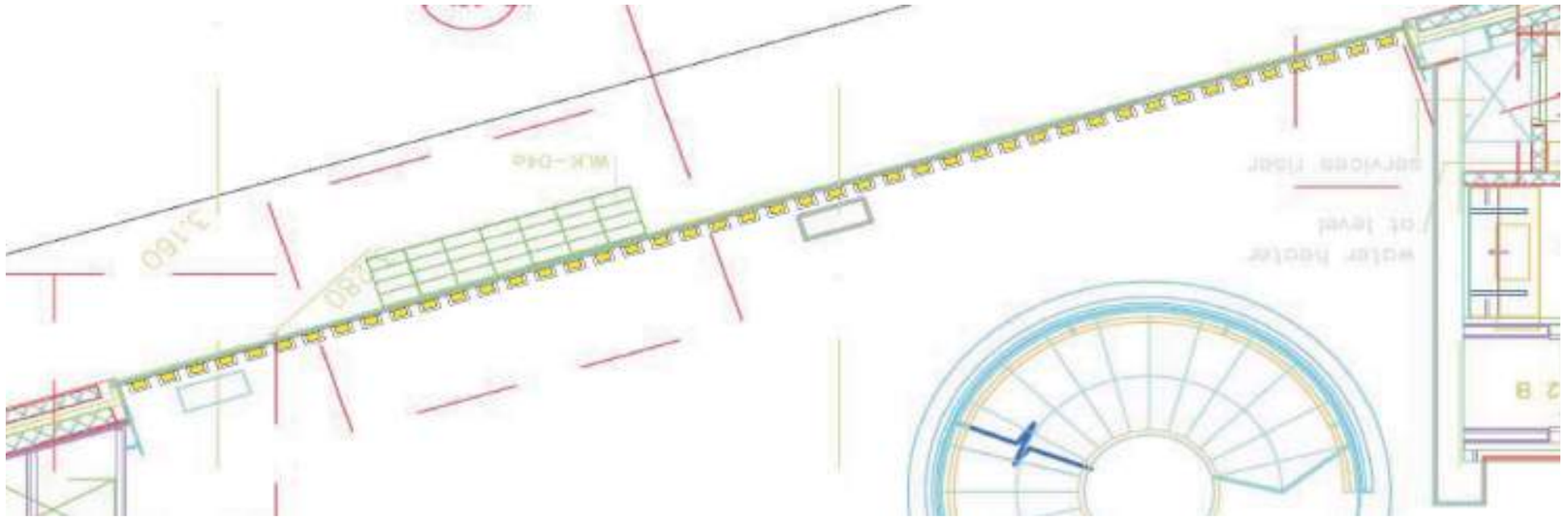
| | | |
|---|---|---|
| Title: See top of page | | |
| Project: Allies and Morrison Reception Space | | |
| Client: Allies and Morrison | | |
| | Rev: 1 | Scale: Not To Scale |

MACH Acoustics, Trelawney House, Surrey Street, BS2 8PS
Phone 0117 944 1388

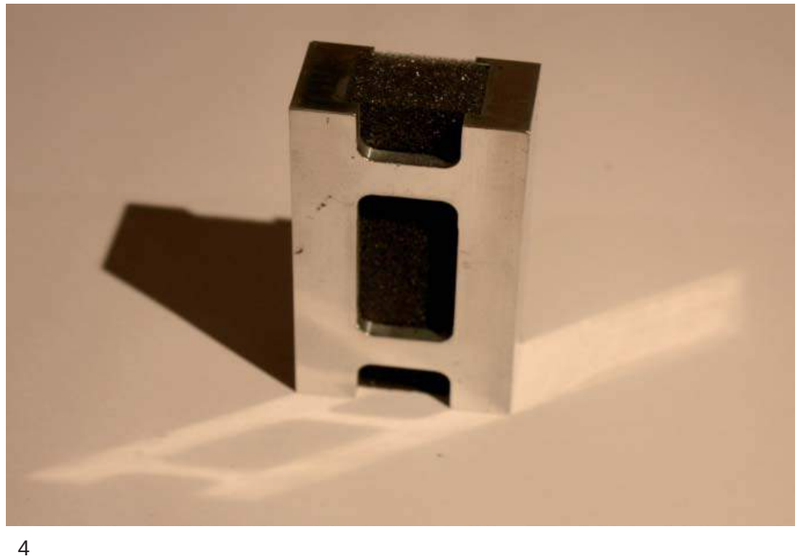
1



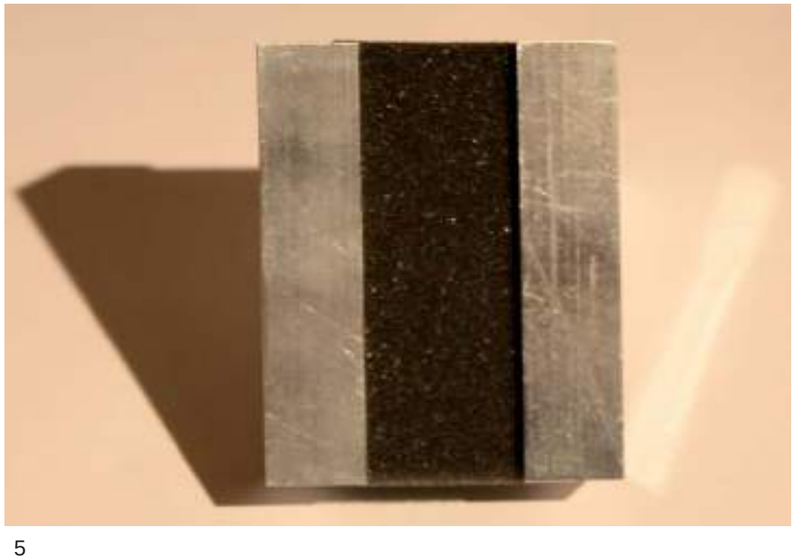
2



3



4



5

MACH ACOUSTICS

MACH PRODUCTS

# Glazed Wall Proposal

| **Sabines per meter squared of treatment** |
|---|
| 0.65 Sabines |
| **Area of glazing** |
| 29.2 $m^2$ |
| **Number of panels** |
| 1 |
| **Total Sabines provided end wall** |
| 19 Sabines |

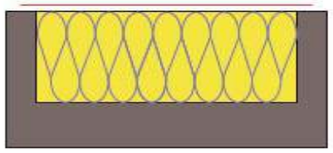
An interesting option is to incorporate acoustic slats in front of the window, placed behind the Reception space. The acoustic absorption is not required to face the Reception space. There is therefore the potential to provide an interesting visual effect.

Unfortunately at this stage, this form of treatment is not seen to be the most effective form of treatment. MACH Acoustics are looking at methods of improving this form of treatment.

1 Illustrative visual of acoustic strips viewed from the Reception space out through the rear window.
2 Illustrative visual of acoustic strips from the out side of the building.
3 Plan showing the metal strips running along the length of the window.
4 Sample of proposed acoustic strips - the oval openings are required such to allow the sound to reach the acoustic foam.
5 Sample of proposed acoustic strips - alternative design to the oval openings

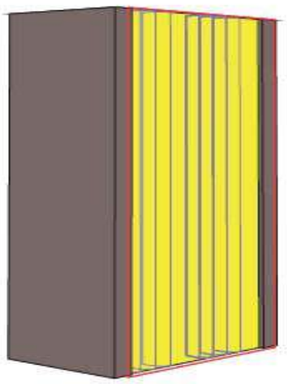
| | | |
|---|---|---|
| Title: See top of page | | |
| Project: Allies and Morrison Reception Space | | |
| Client: Allies and Morrison | | |
| | Rev: 1 | Scale: Not To Scale |

MACH Acoustics, Trelawney House, Surrey Street, BS2 8PS
Phone 0117 944 1388

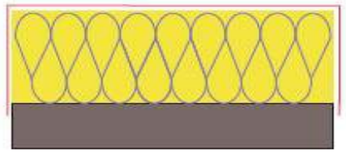


1

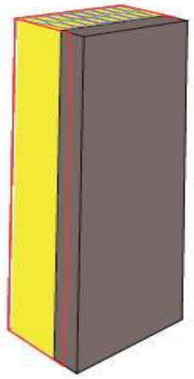
2



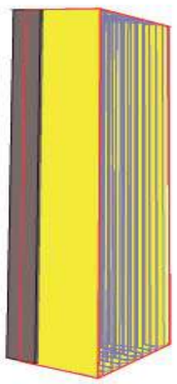
3



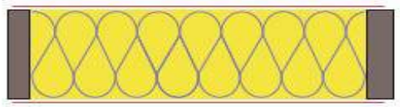
4



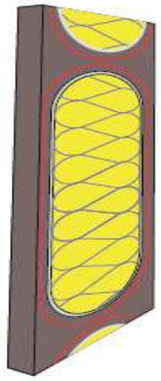
5



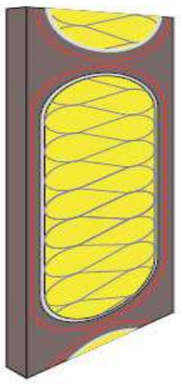
6



7



8



9

MACH ACOUSTICS

MACH PRODUCTS

# Glazed Wall Details

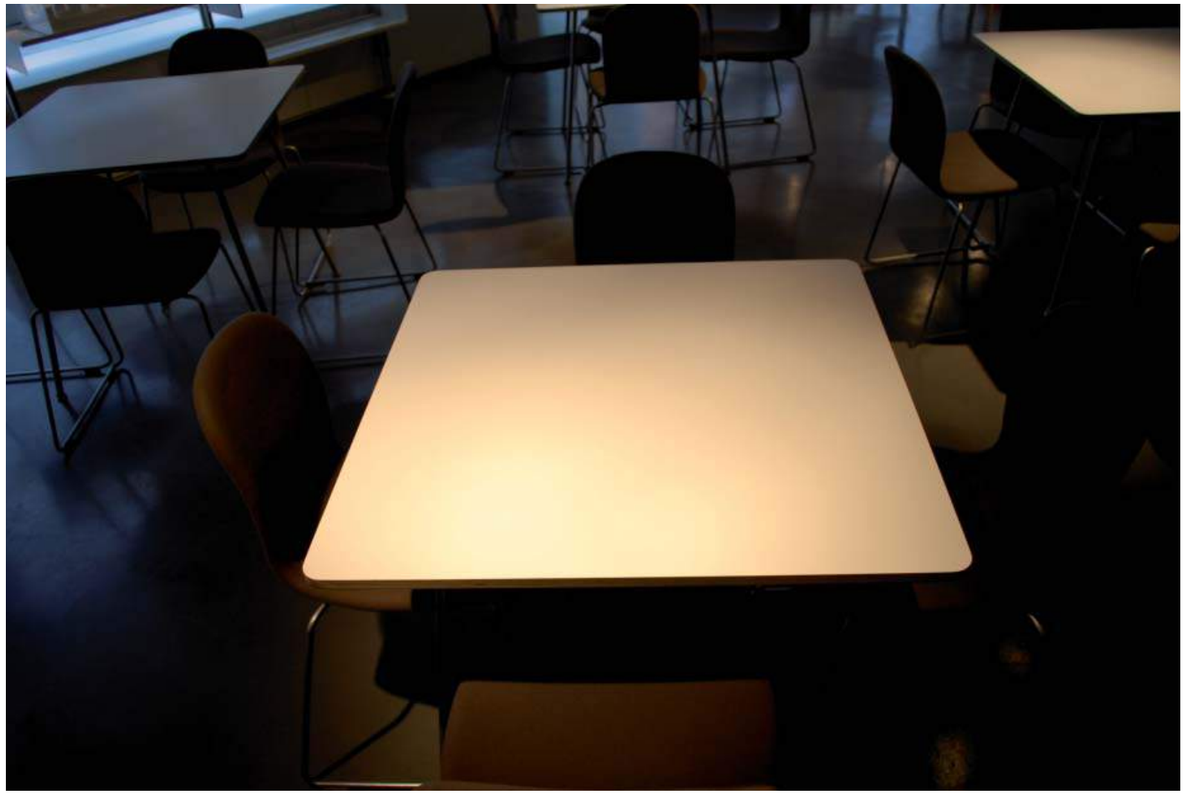
This page presents a range of details as to how the proposed acoustic slats could be formed. Three different design options are proposed.

a) The detail formed using a U shape channel. Acoustic foam is placed within the channel.
b) This second detail is formed by bonding a strip of acoustic foam to a metal strip.
c) The third detail is formed by incorporating the acoustic absorption into the frame of the metal strip

1 Option A - Acoustic absorption held within a U channel
2 Rear view of Option A
3 Front view of Option A
4 Option B - Acoustic absorption bonded to a simple metal strip.
5 Rear view of Option B
6 Front view of option B
1 Option C - Acoustic absorption placed within the metal strip
2 Rear view of Option C
3 Front view of Option C

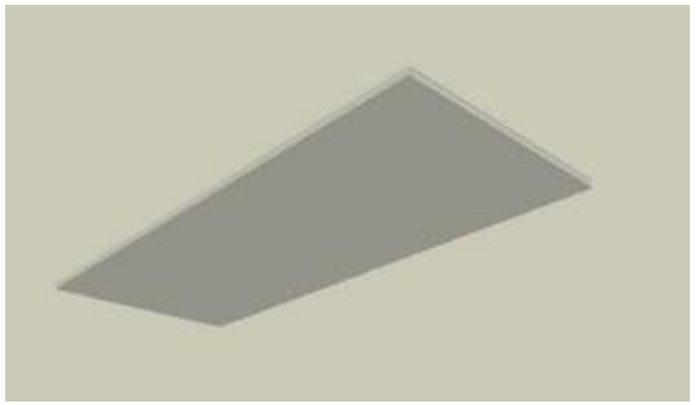
| | | |
|---|---|---|
| Title: See top of page | | |
| Project: Allies and Morrison Reception Space | | |
| Client: Allies and Morrison | | |
| | Rev: 1 | Scale: Not To Scale |

MACH Acoustics, Trelawney House, Surrey Street, BS2 8PS
Phone 0117 944 1388

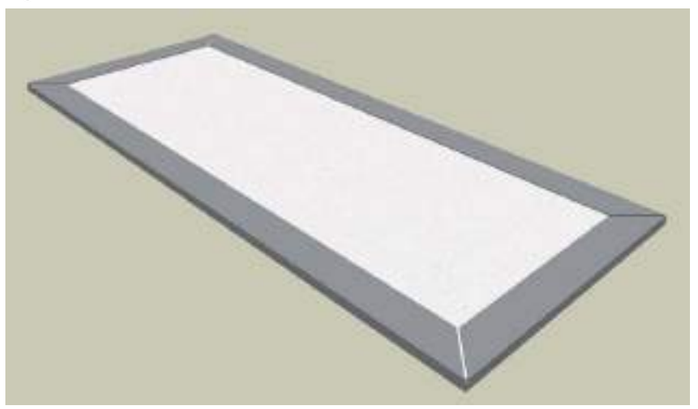


1

2



3



4

# Underside of Tables

| Sabines per meter squared of treatment |
|---|
| 0.85 Sabines |
| **Area under table** |
| 0.45 $m^2$ |
| **Number of tables** |
| 6 |
| **Total Sabines provided end wall** |
| 2 Sabines |

The underside of tables offers a discreet location in which to add acoustic absorption. The illustration shows how an absorbent panel is placed under the table. The panel is formed from foam or mineral wool, enclosed with perforated metal.

1 Top side of tables within Reception space
2 Underside of table shown the acoustic panel
3 Bottom exposed side of acoustic panel
4 Top hidden side of acoustic panel

| | | |
|---|---|---|
| Title: See top of page | | |
| Project: Allies and Morrison Reception Space | | |
| Client: Allies and Morrison | | |
| | Rev: 1 | Scale: Not To Scale |

MACH Acoustics, Trelawney House, Surrey Street, BS2 8PS
Phone 0117 944 1388