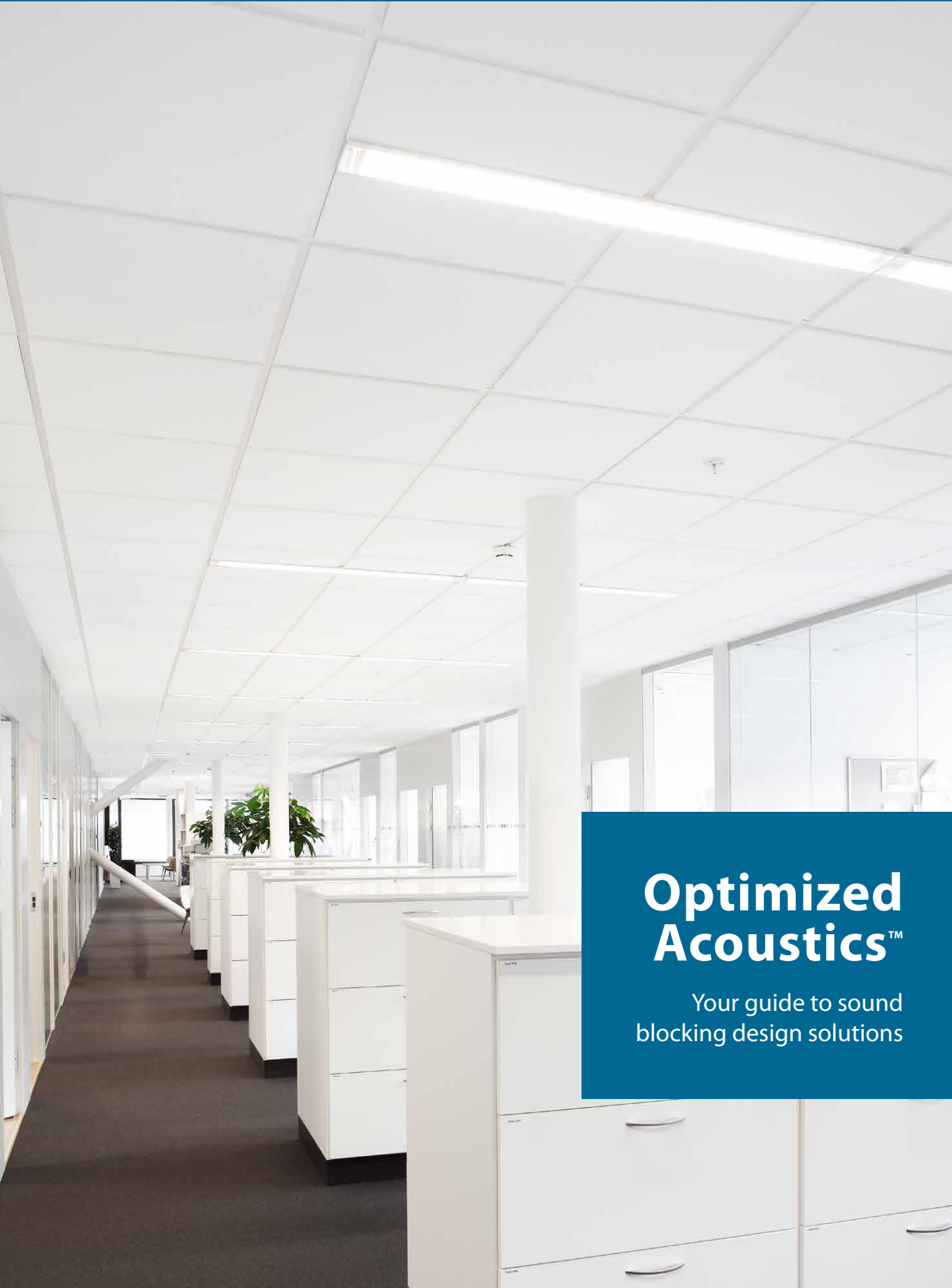




# Optimized Acoustics™

Your guide to sound  
blocking design solutions

# LISTENING TO DESIGN TRENDS

Everywhere you look, new, modern spaces are coming to life and while these open-concept spaces promote communication and collaboration, they also increase one main challenge – noise.

Now more than ever, an optimal acoustic experience is as important as the look, feel and function of a space. And it starts by choosing the right ceiling material to optimize the sound absorption for your space and where necessary, the right sound blocking strategy for privacy.



## HOW TO USE THIS DESIGN GUIDE

ROCKFON has assembled this guide to help you find the right sound blocking solution for your next design project. From helping you identify the level of sound blocking you need, to which building materials will give you the best results, this guide has the answers.

|                                                                 |                                               |         |
|-----------------------------------------------------------------|-----------------------------------------------|---------|
| <b>STEP 1</b><br>Determine the level of sound blocking you need | Sound Transmission Class (STC) Selection Tool | Page 3  |
|                                                                 | Examples of Common Spaces                     | Page 4  |
| <b>STEP 2</b><br>Select your design approach                    | Good Blocking (STC 40) Options                | Page 5  |
|                                                                 | Better Blocking (STC 45) Options              | Page 6  |
|                                                                 | Best Blocking (STC 50) Options                | Page 7  |
| <b>STEP 3</b><br>Consider other options you may prefer          | Alternative Wall Assemblies                   | Page 8  |
|                                                                 | Alternative Plenum Barriers                   | Page 9  |
|                                                                 | Ceiling Grid Details                          | Page 10 |

A FOCUS ON ABSORPTION FOR HIGHER PERFORMANCE

With greater awareness of the impact noise has on our daily lives, it's not surprising that building standards and guidelines are evolving with more stringent acoustic requirements. To meet many of these higher performance criteria, it's important to consider how every structure, surface, fixture, material and even gap plays a role in the way noise is experienced. For the best results, this means focusing on the true strength of ceiling panels – noise absorption.

To learn more about optimizing sound absorption with acoustic ceilings, please visit **OptimizedAcoustics.com**.

UNDERSTANDING THE REALITY OF BLOCKING

As you navigate the ceiling panel solutions available, you'll notice products in the market that attempt to absorb and block noise. There is a misconception that ceilings alone can block sound between rooms. The reality is, modular acoustic ceilings by themselves do not have enough mass to block sound. Additionally, ceiling systems will always have substantial noise leaks – created by installing light fixtures, air devices and other elements – making them even less effective at blocking sound. Research shows that

these noise leaks can cut the perceived sound blocking provided by the ceiling system 50% overall and 75% in the higher speech frequencies.<sup>1</sup> That is why you will not see design solutions that rely on ceilings alone to block sound in this guide.

By attempting to address both blocking and absorbing, those dual-purpose panels actually compromise both. Designers mistakenly sacrifice noise absorption (NRC – Noise Reduction Coefficient) for blocking (CAC – Ceiling Attenuation Class), and the blocking is simply not good enough. Instead, look to your ceiling panels to meet the high absorption requirements you need and to your walls for blocking, when it's needed. The CAC approach is no longer compliant with most acoustic standards, guidelines and rating systems.

OPTIMIZED ACOUSTICS™ FOR EFFECTIVE SOUND DESIGN

The idea is simple. Select a ceiling system to optimize absorption and where needed, use walls or plenum barriers to effectively block sound between rooms. This approach results in designs that comply with the standards and achieve the best sound experience at the best price.

WHAT LEVEL OF BLOCKING DOES YOUR SPACE NEED?

Sound Transmission Class (STC) measures a wall's ability to block noise from transferring between adjacent rooms. Most acoustic standards, guidelines and rating systems require an STC rating of 40, 45 or 50. Values below 40 do not provide adequate sound blocking or speech privacy.

STC - Optimizing Good, Better, Best\*

|                      |        |                                   |               |               |
|----------------------|--------|-----------------------------------|---------------|---------------|
| Sensitivity to Noise | High   | BETTER STC 45                     | BEST STC 50+  | BEST STC 50+  |
|                      | Medium | GOOD STC 40                       | BETTER STC 45 | BEST STC 50+  |
|                      | Low    | GOOD STC 40                       | GOOD STC 40   | BETTER STC 45 |
|                      |        | Low                               | Medium        | High          |
|                      |        | Amount of noise in adjacent rooms |               |               |

\* The values in this table are based on the acoustic criteria sections of current standards, guidelines and building rating systems including ANSI/ASA S12.60-2010 (schools), WELL Building Standard 2016, GSA PBS-P100 2016 (office buildings), The FGI Guidelines 2014 (healthcare facilities), and LEED® v4 ID+C (sustainable buildings).

3

## EXAMPLES OF COMMON SPACES

### Retail

In open spaces such as restaurants, stores, airport concourses, etc., sound blocking between rooms is not required. The ceiling should be optimized for absorption. Blocking parameters, such as CAC and STC, are irrelevant.



### Office

When a standard office is next to another office, the sensitivity to noise is typically Low or Medium and the potential for noise is typically Low or Medium. A Good to Better sound blocking level of STC 40-45 is required by the acoustics' standards and guidelines. Executive offices and conference rooms have a High sensitivity to noise, so the sound blocking level increases to High (STC 50). Blocking is not relevant in open offices.



### Healthcare

When a patient room is next to another patient room, the sensitivity to noise is Medium and the potential for noise is Medium. A Better sound blocking level of STC 45 is required by the acoustics' standards and guidelines. For exam and treatment rooms, the sensitivity to noise increases to High, so the required sound blocking level increases to STC 50.



### Education

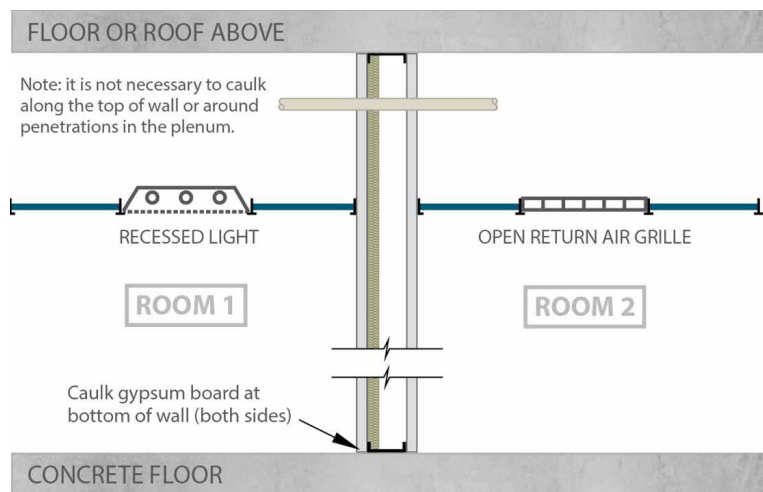
When a classroom is next to another classroom, the sensitivity to noise is High and the potential for noise is High. A Best sound blocking level of STC 50 is required by the acoustics' standards and guidelines.



# GOOD BLOCKING - STC 40

A sound blocking level of STC 40 can provide privacy between rooms if the speech level is no louder than general conversation. Once speech levels rise, phrases and sentences can be understood in adjacent rooms and will likely disrupt people. Acoustics standards, guidelines and building rating systems occasionally permit an STC rating as low as 40. However, most require blocking levels of STC 45 or higher<sup>2</sup>. An STC 40 level of blocking should be considered a minimum as privacy cannot be achieved at levels below STC 40.

## FULL HEIGHT WALLS



### CEILING SYSTEM

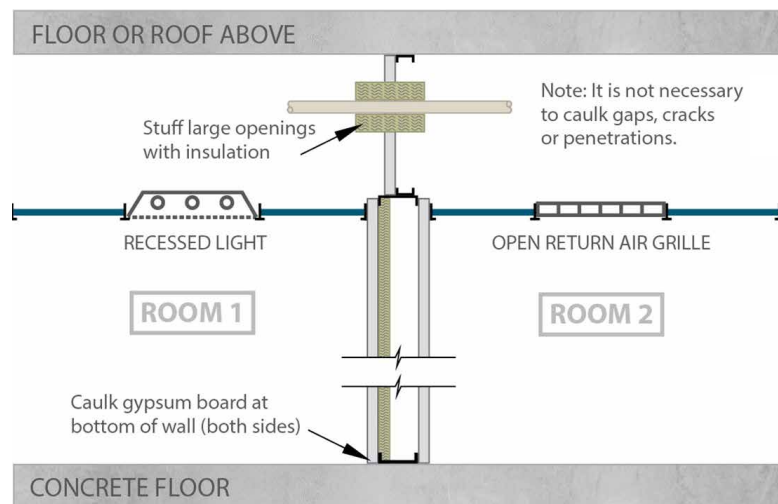
- Chicago Metallic tee-bar suspension grid
- ROCKFON stone wool ceiling panels – optimized for sound absorption
- Noise control measures for noise flanking paths through lights, grilles, diffusers – not required

### WALL ASSEMBLY

- 1/2" gypsum board (type X) – 1 layer each side
- 3-5/8" steel studs (25 gauge) spaced 16" on center
- 1-1/2" thick ROXUL AFB® Semi-Rigid Batt Insulation
- STC 40 (lab test<sup>3</sup> #TL-93-343)

## PLENUM BARRIERS (Preferred)

Research conducted by ROCKFON and NGC Testing Services<sup>4</sup> shows that a lightweight plenum barrier positioned vertically above the wall, blocking the plenum, can provide an STC/CAC 40 level of blocking when combined with a stone wool ceiling system. This design approach can decrease the cost of the ceiling, allow for greater aesthetic flexibility and prevent the need to control noise leaks through the ceiling system. The plenum barrier can be installed quickly and easily, and does not need to extend around the entire perimeters of both rooms<sup>5</sup>.



### PLENUM BARRIER

- 5/8" gypsum board (type X) – 1 layer
- Quick install<sup>6</sup> (no tape or caulk)

### CEILING SYSTEM

- Chicago Metallic tee-bar suspension grid
- ROCKFON stone wool ceiling panels – optimized for sound absorption
- Noise control measures for noise flanking paths through lights, grilles, diffusers – not required
- CAC 41 (with plenum barrier)
- Lab test #NGC0615037

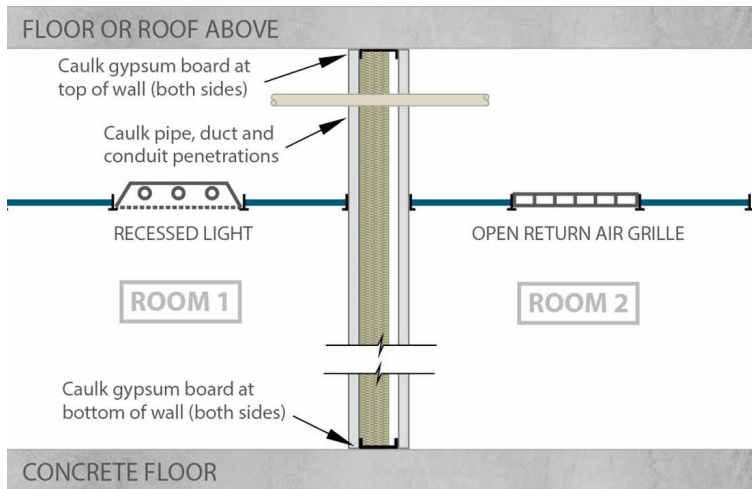
### WALL ASSEMBLY

- 1/2" gypsum board (type X) – 1 layer each side
- 3-5/8" steel studs (25 gauge) spaced 16" on center
- 1-1/2" thick ROXUL AFB® Semi-Rigid Batt Insulation
- STC 40 (lab test<sup>3</sup> #TL-93-343)

# BETTER BLOCKING – STC 45

A sound blocking level of STC 45 means that a listener in a quiet room would hear raised speech in adjacent rooms, but would not be able to understand the conversation. The transmitted noise would not typically be disruptive. Acoustic standards, guidelines and building ratings systems most frequently require an STC 45 level of blocking between rooms. Examples include patient rooms<sup>7</sup>, enclosed offices<sup>8</sup> and corridors along classrooms<sup>9</sup>.

## FULL HEIGHT WALLS



### CEILING SYSTEM

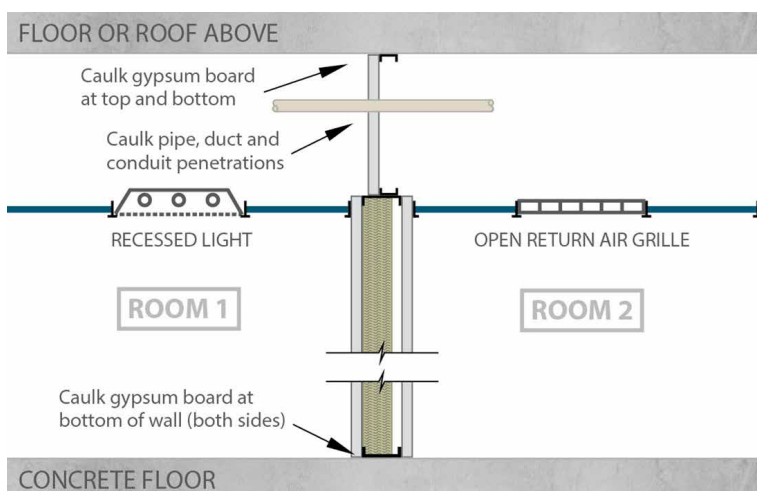
- Chicago Metallic tee-bar suspension grid
- ROCKFON stone wool ceiling panels – optimized for sound absorption
- Noise control measures for noise flanking paths through lights, grilles, diffusers – not required

### WALL ASSEMBLY

- 5/8" gypsum board (type X) – 1 layer each side
- 3-5/8" steel studs (25 gauge) spaced 16" on center
- 3" thick ROXUL AFB® Semi-Rigid Batt Insulation
- STC 45 (lab test<sup>3</sup> #TL-93-335)

## PLENUM BARRIERS (preferred)

Research conducted by ROCKFON and NGC Testing Services<sup>4</sup> shows that a lightweight plenum barrier positioned vertically above the wall, blocking the plenum can provide an STC/CAC 45 level of blocking when combined with a stone wool ceiling system. This design approach can decrease the cost of the ceiling, allow for greater aesthetic flexibility and prevent the need to control noise leaks through the ceiling system. The plenum barrier should be installed with care ensuring no large openings while taping or caulking small openings, gaps and cracks.



### PLENUM BARRIER

- 5/8" gypsum board (type X) – 1 layer
- Sealed install<sup>10</sup> (caulk & tape)

### CEILING SYSTEM

- Chicago Metallic tee-bar suspension grid
- ROCKFON stone wool ceiling panels – optimized for sound absorption
- Noise control measures for noise flanking paths through lights, grilles, diffusers – not required
- CAC 46 (with plenum barrier)
- Lab test #NGC6015025\_R1

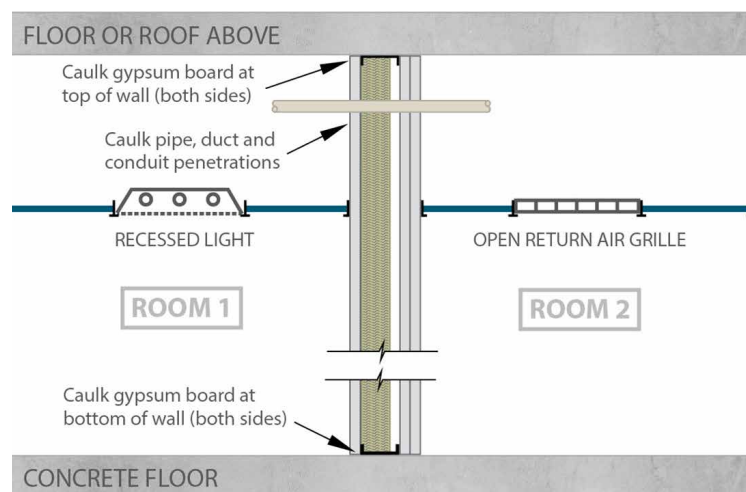
### WALL ASSEMBLY

- 5/8" gypsum board (type X) – 1 layer each side
- 3-5/8" steel studs (25 gauge) spaced 16" on center
- 3" thick ROXUL AFB® Semi-Rigid Batt Insulation
- STC 45 (lab test<sup>3</sup> #TL-93-335)

# BEST BLOCKING – STC 50

A sound blocking level of STC 50 means that a listener in a quiet room would need to exert effort to hear raised speech levels in adjacent rooms, and the speech would not be understandable or disruptive. Acoustic standards, guidelines and building rating systems require an STC 50 rating between rooms such as classrooms<sup>9</sup>, conference rooms<sup>8,11</sup>, executive offices<sup>8</sup>, patient exam rooms, treatment rooms and consultation rooms<sup>7</sup>.

## FULL HEIGHT WALLS (preferred)



### CEILING SYSTEM

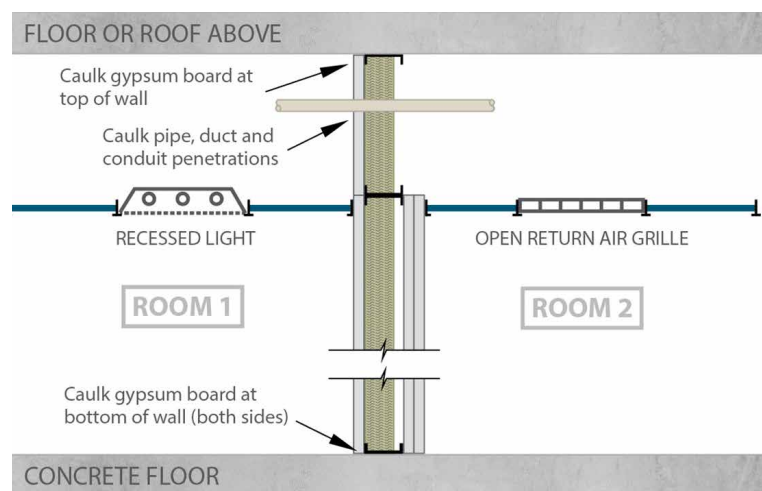
- Chicago Metallic tee-bar suspension grid
- ROCKFON stone wool ceiling panels – optimized for sound absorption
- Noise control measures for noise flanking paths through lights, grilles, diffusers – not required

### WALL ASSEMBLY

- 5/8" gypsum board (type X) – 1 layer one side, 2 layers other side
- 3-5/8" steel studs (25 gauge) spaced 16" on center
- 3" thick ROXUL AFB® Semi-Rigid Batt Insulation
- STC 50 (lab test<sup>3</sup> # TL-93-333)

## PLENUM BARRIERS

Research conducted by ROCKFON and NGC Testing Services<sup>4</sup> shows that a lightweight plenum barrier positioned vertically above the wall, blocking the plenum, can provide an STC/CAC 50 level of blocking when combined with a stone wool ceiling system. This design approach can decrease the cost of the ceiling, allow for greater aesthetic flexibility and prevent the need to control noise leaks through the ceiling system. The plenum barrier should be installed with care ensuring no large openings while taping or caulking small openings, gaps and cracks.



### PLENUM BARRIER

- 5/8" gypsum board (type X) – 1 layer
- Sealed install<sup>10</sup> (caulk & tape)
- 3-1/2" thick ROXUL AFB® Semi-Rigid Batt Insulation

### CEILING SYSTEM

- Chicago Metallic tee-bar suspension grid
- ROCKFON stone wool ceiling panels – optimized for sound absorption
- Noise control measures for noise flanking paths through lights, grilles, diffusers – not required
- System CAC 50 (with plenum barrier)
- Lab test #NGC6015023\_R1

### WALL ASSEMBLY

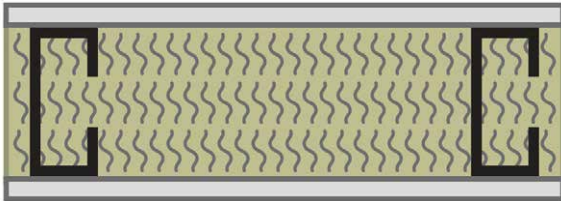
- 5/8" gypsum board (type X) – 1 layer one side, 2 layers other side
- 3-5/8" steel studs (25 gauge) spaced 16" on center
- 3" thick ROXUL AFB® Semi-Rigid Batt Insulation
- STC 50 (lab test<sup>3</sup> #TL-93-333)

# ALTERNATIVE WALL ASSEMBLIES

## STC 40

### WALL ASSEMBLY

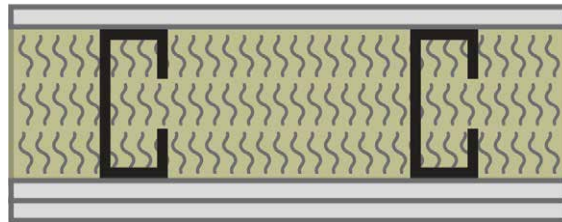
- 1/2" gypsum board (type X) – 1 layer each side
- 2-1/2" steel studs (25 gauge) spaced 24" on center
- 2-1/2" thick ROXUL AFB® Semi-Rigid Batt Insulation
- STC 43 (lab test<sup>3</sup> # TL-93-047)



## STC 40

### WALL ASSEMBLY

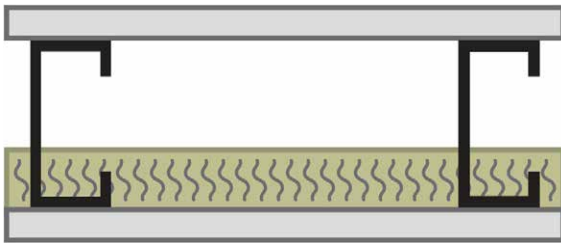
- 1/2" gypsum board (type X) – 1 layer one side, 2 layers other side
- 2-1/2" steel studs (25 gauge) spaced 16" on center
- 2-1/2" thick ROXUL AFB® Semi-Rigid Batt Insulation
- STC 42 (lab test<sup>3</sup> TL-93-065)



## STC 45

### WALL ASSEMBLY

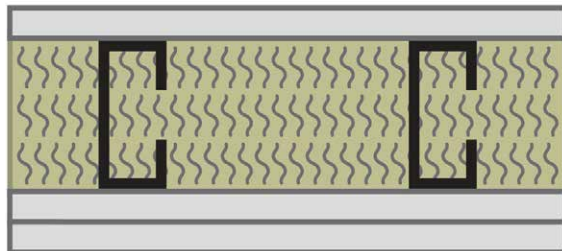
- 5/8" type X, gypsum board – 1 layer each side
- 3-5/8" steel studs (25 gauge) spaced 24" on center
- 1-1/2" thick ROXUL AFB® Semi-Rigid Batt Insulation
- STC 45 (lab test<sup>3</sup> #TL-92-396)



## STC 45

### WALL ASSEMBLY

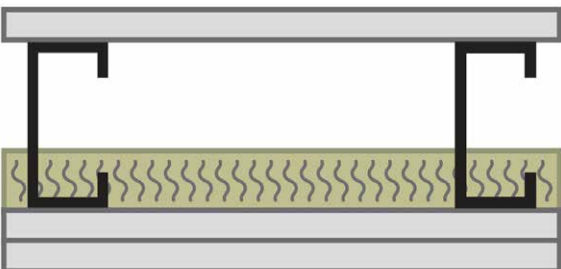
- 5/8" type X, gypsum board – 1 layer one side, 2 layers other side
- 2-1/2" steel studs (25 gauge) spaced 16" on center
- 2-1/2" thick ROXUL AFB® Semi-Rigid Batt Insulation
- STC 45 (lab test<sup>3</sup> #TL-93-062)



## STC 50

### WALL ASSEMBLY

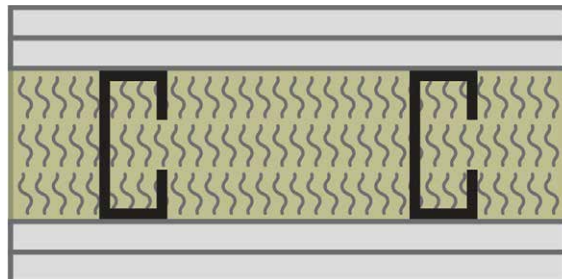
- 5/8" type X, gypsum board – 1 layer one side, 2 layers other side
- 3-5/8" steel studs (25 gauge) spaced 24" on center
- 1-1/2" thick ROXUL AFB® Semi-Rigid Batt Insulation
- STC 51 (lab test<sup>3</sup> #TL-92-397)



## STC 50

### WALL ASSEMBLY

- 5/8" type X, gypsum board – 2 layers each side
- 2-1/2" steel studs (25 gauge) spaced 16" on center
- 2-1/2" thick ROXUL AFB® Semi-Rigid Batt Insulation
- STC 52 (lab test<sup>3</sup> #TL-93-063)



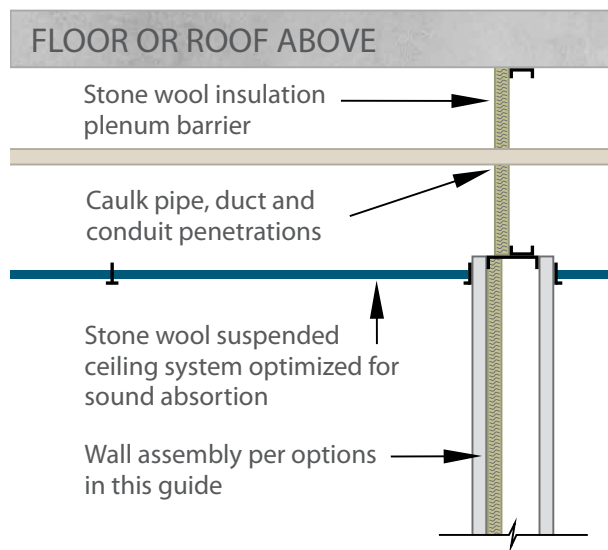
All wall assembly options are shown in plan view.

# ALTERNATIVE PLENUM BARRIERS

The plenum barriers in the Good, Better and Best sound blocking solutions in this guide are based upon gypsum board. Other materials, such as stone wool insulation, can also be used effectively as plenum barriers, giving designers and contractors multiple options.

## GOOD – STC 40

Use this option over walls with standard doors and over most glass wall systems.

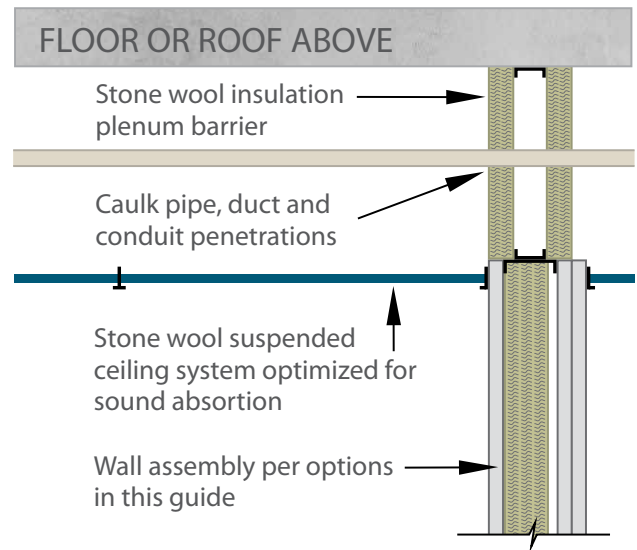


### PLENIUM BARRIER

- 1-1/2" thick ROXUL ROCKBOARD® 80 RFF
- Screw to 1-5/8" wide metal track at top and bottom
- Tape vertical seams with metal tape
- STC 40 (lab test #NGC6016016) with ceiling

## BETTER/BEST – STC 45-50

Use this option over substantial walls without doors and over comparable, high STC-rated glass wall systems.



### PLENIUM BARRIER

- 1-1/2" thick ROXUL ROCKBOARD® 80 RFF
- 2 layers spaced 1-5/8" apart
- Screw to each side of 1-5/8" wide metal track at top and bottom
- Tape vertical seams with metal tape
- STC 52 (lab test #NGC6016017) with ceiling

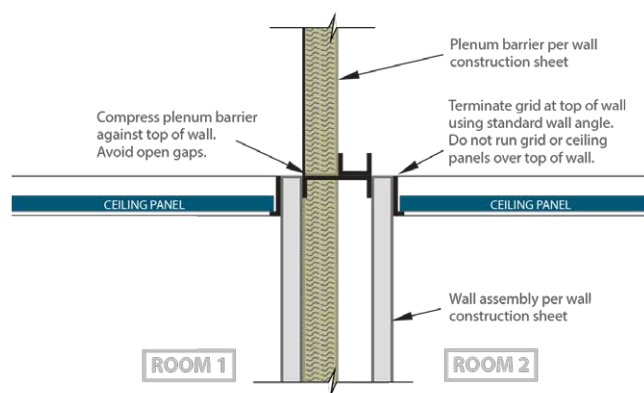


# CEILING GRID DETAILS

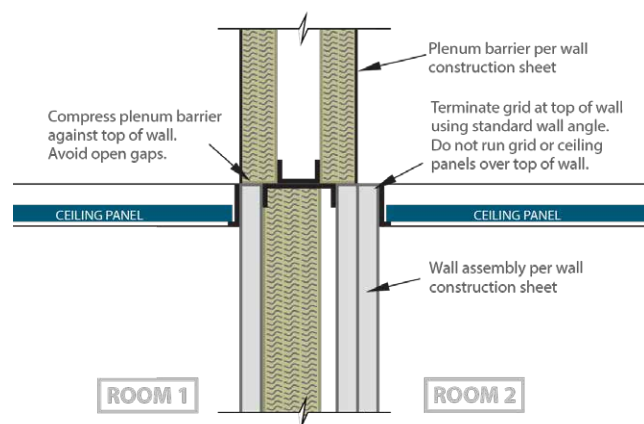
## WHEN THE WALLS INTERRUPT THE CEILING GRID

With some building designs, the interior demising walls between rooms interrupt the ceiling grid. The wall height may stop at the top of the ceiling grid (as shown below) or extend above it. The ceiling grid does not interface with the plenum barrier above the wall. This approach may require an angle or channel along the top of the wall to hold the bottom of the plenum barrier in position.

### SINGLE LAYER PLENUM BARRIER



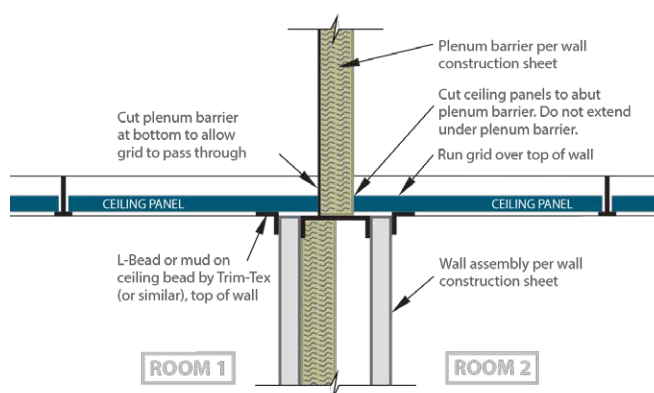
### DOUBLE LAYER PLENUM BARRIER



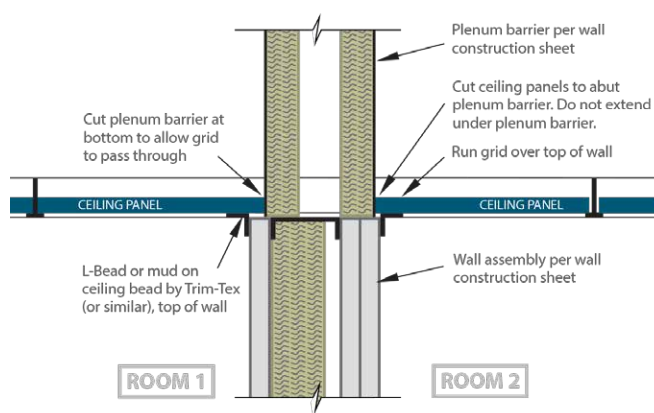
## WHEN THE CEILING GRID PASSES OVER THE WALLS

Running the ceiling grid continuously over the tops of interior demising walls is sometimes utilized so that future reconfiguration of the walls does not require replacement of the ceiling grid. This design approach requires the contractor to make a small cut at the bottom of the plenum barrier so the grid tee can pass through it.

### SINGLE LAYER PLENUM BARRIER



### DOUBLE LAYER PLENUM BARRIER



## ACOUSTIC PERFORMANCE

Laboratory tests per ASTM E 1414 and E 413 show that the two design approaches shown above provide equivalent inter-room sound isolation performance. For performance values, refer to the Good, Better, Best sound blocking scenarios in these design guidelines.

<sup>1</sup> Madaras, G. and Heuer, A. (2015) "Effects of Noise Flanking Paths on Ceiling Attenuation Class (CAC) Ratings of Ceiling Systems and Inter-Room Speech Privacy." Proceedings of Inter-Noise 2015, edited by Courtney Burroughs and George Maling, paper in 15\_083, San Francisco, CA, 9-12 August, 2015. Electronic publication.

<sup>2</sup> For an overview of the sound blocking levels required by the various acoustics standards, guidelines and building rating systems refer to Madaras, G. "A Guide on the Four Categories for Acoustics Criteria in Building Standards and Guidelines." *Acoustical Interior Construction*, July-Sept 2016, pp. 27.

<sup>3</sup> The referenced laboratory test(s) are part of an extensive, multi-year, testing program conducted by the National Research Council Canada (NRCC) and published by the Institute for Research in Construction (IRC). For more details, including 1/3 octave band transmission loss data, refer to internal reports IRC-IR-693, October 1995 and IRC-IR-761, March 1998. The research program was partially funded by ROXUL, Inc. ROCKFON and ROXUL are subsidiaries of the ROCKWOOL Group.

<sup>4</sup> Madaras, G. and Heuer, A. (2016) "Optimizing Ceiling Systems and Lightweight Plenum Barriers to Achieve Ceiling Attenuation Class (CAC) Ratings of 40, 45 and 50." Proceedings of the New England NoiseCon-16: Revolution in Noise Control conference, Providence, RI, 13-14 June, 2016. Electronic publication by the Institute for Noise Control Engineering.

<sup>5</sup> Kruger, K. "The Effect of Various Parameters on the Sound Isolation between Offices with Suspended Ceilings." *Canadian Acoustics*, 16 (2), 1988, pp. 9-23.

<sup>6</sup> The 'quick install' method for the gypsum board plenum barriers uses rectangular cut pieces of gypsum board without cutouts for penetrating elements. Large holes in the plenum barrier around penetrating element are stuffed with stone wool, semi-rigid, batt insulation. Small holes, joints, screw heads, perimeter edges, etc. are NOT taped or caulked/sealed.

<sup>7</sup> 2014 edition of the Facility Guidelines Institute (FGI) *Guidelines for Design and Construction of Hospitals and Outpatient Facilities*. (fgiguide.org)

<sup>8</sup> U.S. Green Building Council (USGBC), Leadership in Energy and Environmental Design (LEED), version 4. (leed.usgbc.org)

<sup>9</sup> ANSI/ASA S12.60-2010/Part 1 American National Standard Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools, Part 1: Permanent Schools. (acousticalsociety.org)

<sup>10</sup> The 'sealed install' method for the gypsum board plenum barriers is similar to fire-rated wall construction in that it includes cutting the gypsum board to within 1/4" of elements penetrating the plenum barriers. The gaps around penetrating elements, as well as small holes, joints, screw heads, perimeter edges, etc. are all taped or caulked/sealed.

<sup>11</sup> International WELL Building Institute, The WELL Building Standard, v 1, February 2016. Access the standard at wellcertified.com.

To find out more about the **National Council of Acoustical Consultants** and their members, visit **NCAC.com**.

To find out more about the **Canadian Acoustical Association** and their members, visit **caa-aca.ca**.

ROCKFON, ROXUL and NGC Testing Services are collaborating on acoustics research and testing to optimize the use of high-performing, modular, acoustic ceilings and plenum barriers to comply with the performance levels mandated in the industry's standards and guidelines. NGC Testing Services is located in Buffalo, NY and is a fully-accredited fire, acoustical, and structural/physical testing facility (NVLAP Laboratory Code 200291-0).

For auditory demonstrations and tools to guide both sound absorption and sound blocking performance visit **OptimizedAcoustics.com**

# QUALITY & CUSTOMER SERVICE

## DEDICATED TO KEEPING YOUR PROJECTS RUNNING SMOOTHLY

At ROCKFON, we constantly seek new ways to satisfy existing customers and win new ones. This means challenging ourselves and our ideas to improve our products and service, and reduce costs.

### QUALITY WE STAND BEHIND

Produced with integrity and excellence, we're so confident in the quality and durability of our products, our stone wool panels come with a 30-year warranty.

### FLEXIBILITY TO MEET VARIOUS NEEDS

We understand that one size rarely fits all. That's why our solutions can be adapted to practically any space and our services tailored to your needs.

### AVAILABILITY YOU CAN COUNT ON

We strive to have a large selection of products available for fast delivery at all times.

### ON-TIME DELIVERY, EVERY TIME

In the building industry, time lost is money lost. So when we commit to a deadline, we meet it so that you can deliver your projects on time.

### EXPERT ADVICE AND EASY TO WORK WITH

We put our passion, heart, design and engineering into our products and your projects, so you can be sure to get the expert advice you need and a total commitment.

We believe our acoustic stone wool and metal solutions for ceilings and walls are a fast and simple way to create beautiful, comfortable and safe spaces.

Easy to install and durable, they protect people from noise and the spread of fire. They are our way of making a constructive contribution towards a sustainable future.

Create and Protect is what drives us. It means putting people first, sharing success and maintaining trust.

It's our rock-solid promise to you. At ROCKFON, Create and Protect is what we do and it's inspired by you.

January 2017

**ROCKFON**

4849 S. Austin Ave.

Chicago, IL 60638 USA

Toll free: 1-800-323-7164

Fax.: 1-800-222-3744

[cs@rockfon.com](mailto:cs@rockfon.com)

[www.rockfon.com](http://www.rockfon.com)

SNL# 150070