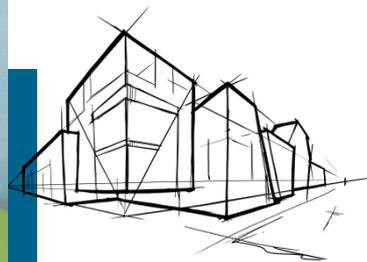




# CEILING SYSTEMS FOR HIGH- PERFORMING HEALTHCARE FACILITIES



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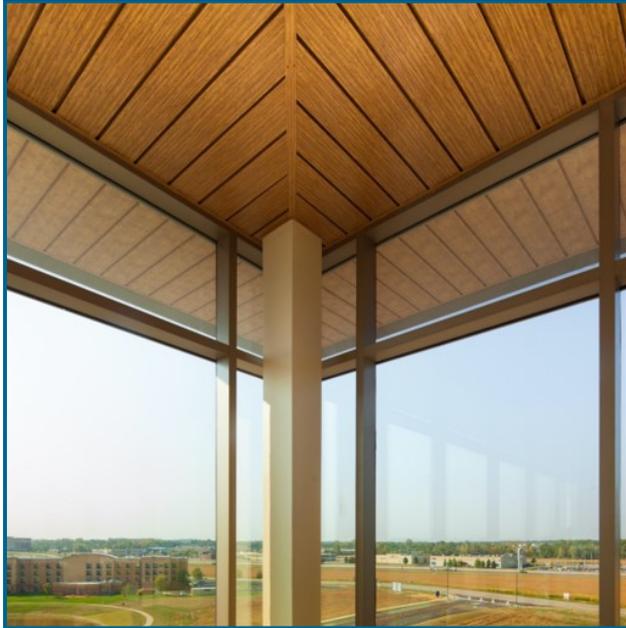
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## Course Overview

Few specifications could be as important as those for hospitals and healthcare facilities. The ceiling system plays an important part in the overall healthiness of the building, as well as the patients and staff. Attention should be given to ceiling systems with high sound absorption to cut down on noise that makes staff irritable and inhibits patient healing. The ceiling system can save energy on lighting and cooling. It can help prevent mold and infections with its cleanability. It can be made of recycled and recyclable materials. And a full palette of colors can help create a warm and inviting setting appealing to patients, staff, and visitors alike.

## Learning Objectives



**Upon completion  
of this course,  
the student will  
be able to:**

- Describe the importance of high NRC ceilings in a healthcare environment
- Identify how high-performing ceilings can impact infection control
- Define how ceiling specification increases natural daylighting
- Discuss how high-performing ceilings can affect operations and maintenance in a healthcare setting
- Define the connection between high-performing ceilings and a project's sustainability goals

# 1

## Introduction to High-Performing Healthcare Settings



# Introduction to High-Performing Healthcare Settings

## A new consciousness about healthcare settings

- Because of the global pandemic of 2020, the world became a different place
- Struggles of hospital staff and patients were illustrated
- Few built environments are so important to get right



# Introduction to High-Performing Healthcare Settings

## The importance of evidence-based design

- Evidence-Based Design (EBD) is the process of basing decisions about the built environment on credible research to achieve the best possible outcomes
- The Center for Health Design has developed many guiding principles for high-performing healthcare facilities
- Materials have an important influence on the appearance, feeling, and performance of a building and its interior spaces



## Introduction to High-Performing Healthcare Settings

**Done right, the ceiling system adds these qualities to the healing environment:**

- Enhances acoustic qualities and decreases unwanted noise
- Uses durable materials that hold up to infection control and cleaning measures
- Enhances natural lighting and provides proven natural light attributes
- Uses non-chemically treated materials to lessen the chemical load on patients trying to heal
- Uses non-organic materials that resist mold
- Adds to sustainability, a key aspect for any healthcare building's ceiling design

# 2

## Importance of High NRC Ceilings in a Healthcare Environment



# Importance of High NRC Ceilings in a Healthcare Environment

## Impact of acoustics on patients

- Highly sound-absorptive ceilings can impact healthcare by:
  - Increasing patient sleep and recovery
  - Increasing patient and staff safety
  - Improving patient privacy and dignity
  - Relieving caregiver stress and increasing job satisfaction



## Importance of High NRC Ceilings in a Healthcare Environment

### Positive points of quiet setting and patients getting more sleep

- More involved and compliant with their care
- Less pain medication
- Less fall risk
- Lower complications and readmissions
- There is a direct connection between sleep and cost/quality of care



# Importance of High NRC Ceilings in a Healthcare Environment

## Room-to-room privacy

- Important that doctor and patient can talk in private environment
- Oral privacy complies with the oral privacy rules of the Health Insurance Portability and Accountability Act (HIPAA)
- Highly sound-absorptive ceilings should facilitate:
  - Speech intelligibility
  - Prevention of sound traveling into adjacent rooms



# Importance of High NRC Ceilings in a Healthcare Environment

## Wellness/stress reduction

- Study assessed impact of modifying room acoustics, switching between:
  - Highly sound absorptive ceiling panels
  - Low absorbing ceiling panels
- Study results found that in patients treated in conditions with sound absorbing ceiling tiles:
  - Patients had lower pulse amplitudes
  - Patients were more satisfied with care
  - The incidence of rehospitalization was lower



# Importance of High NRC Ceilings in a Healthcare Environment

## Impact of highly absorptive ceilings on alarm fatigue:

- Lower background noise levels
- Medical equipment alarms can be less loud
- Easier to recognize, identify, and locate alarm



# Importance of High NRC Ceilings in a Healthcare Environment

## Ability to focus and maintain accuracy

- Studies examined work performance of anesthesiologists and surgeons
- Compared quiet vs. noisy conditions
- Voices had to be raised by 25% to be heard in noisy rooms
- But speech discrimination was reduced by 23%
- Could increase errors by hospital staff



# Importance of High NRC Ceilings in a Healthcare Environment

## Less Pressure, Less Strain, More Patient Comfort

- Studies show that in spaces with high sound-absorbing ceiling panels:
  - Staff experience less pressure
  - Staff report less strain
  - Patients report more comfort
  - Patients heal better
- Studies showed in high sound-absorbing ceiling panels:
  - Staff experienced less pressure
  - Staff reported less strain



# 3

## Achieving High-Performing Acoustic Ceiling Design



# Achieving High-Performing Acoustic Ceiling Design

## Achieving optimized acoustics based on 3 practices

- Select a ceiling system to optimize acoustic absorption
- Where needed, use walls, floor slabs, or plenum barriers to effectively optimize sound insulation or blocking between rooms
- Ensure that the background sound level is within the desired range

## Standards, Guidelines and Building Rating Systems

- Facility Guidelines Institute (FGI) – Guidelines for the Design and Construction of Hospitals
- Leadership in Energy and Environmental Design (LEED)
- Green Globes Assessment Protocol for Commercial Buildings
- National Institutes of Health (NIH) – Design Requirements Manual

Accepted Standards for Healthcare Facilities*			
	Background Sound Requires mechanical system noise to be below a maximum permissible level	Absorption – NRC <sup>6</sup> Requires sound absorbing finishes, such as acoustic ceilings, to control reverberation and noise	Wall Insulation – STC <sup>7</sup> Requires full-height, STC-rated walls between rooms to prevent noise transfer
Facilities Guidelines Institute (FGI) – Guidelines for the Design and Construction of Hospitals (2018)	45 dBA for Patient Rooms ✓	✓	STC 45 for Patient Rooms ✓
Leadership in Energy and Environmental Design (LEED) <sup>19</sup>	35 - 45 dBA ✓	✓	STC 45 for Patient Rooms ✓
Green Globes Assessment Protocol for Commercial Buildings <sup>14</sup>	45 dBA Patient Rooms ✓	Ceiling NRC 0.90 Reverb 0.50 ✓	STC 50 for Healthcare ✓
National Institutes of Health (NIH) – Design Requirements Manual	NC <sup>8</sup> 40 - 45 for Laboratories ✓	Ceiling NRC 0.80 (min) in Laboratories ✓	STC 50 Between Areas NIC <sup>10</sup> 45 Within Areas ✓

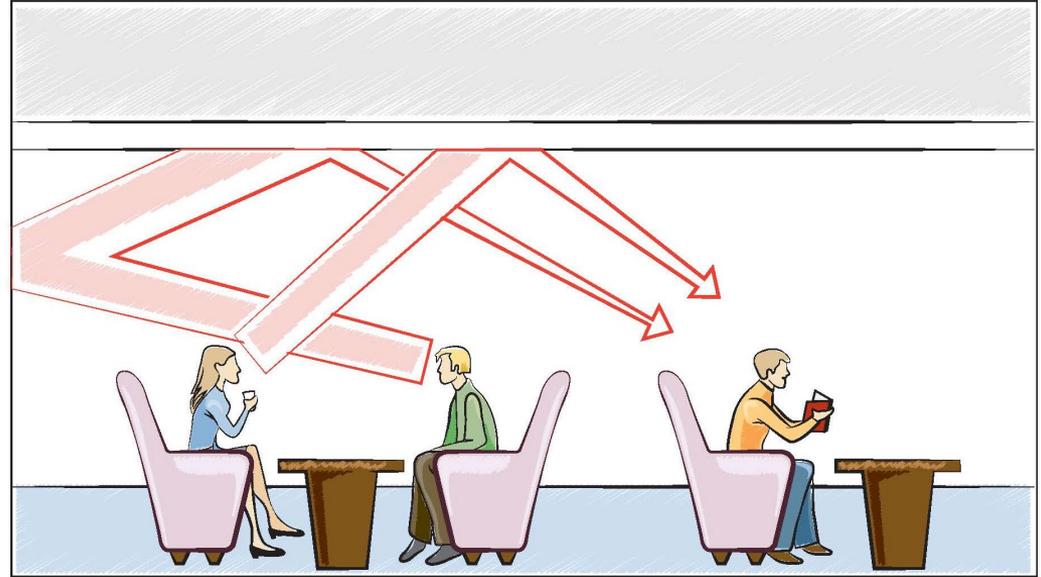


# Achieving High-Performing Acoustic Ceiling Design

## What is acoustic absorption?

**Snippet:** “Acoustic absorption occurs when an architectural surface—such as a suspended ceiling, wall-mounted panels or carpet—converts energy in sound waves into insignificant heat energy by means of friction inside the pores of the material.”

**Snippet:** “The more sound energy that is absorbed by the surface, the less that is reflected back into the room as noise, reverberation, echo or flutter.”



# Achieving High-Performing Acoustic Ceiling Design

## Why is acoustic absorption important?

- When ceilings with a high Noise Reduction Coefficient (NRC) replace ceilings with less acoustic absorption, people perform much better
- **Center for Health Design – The Business Case for Building Better Hospitals with Evidence Based Design (2008) “Installing high-performing sound-absorbing ceiling tiles (NRC 0.90 or higher) is a priority design recommendation based on the strength of the evidence available and their impact on safety, quality and cost.”**
- More specifically, this means reduced patient and staff stress, reduced patient sleep deprivation, and increased patient satisfaction.

Good 0.70+

Better 0.80+

Best 0.90+

Ceilings  
become  
absorptive at  
around 0.80

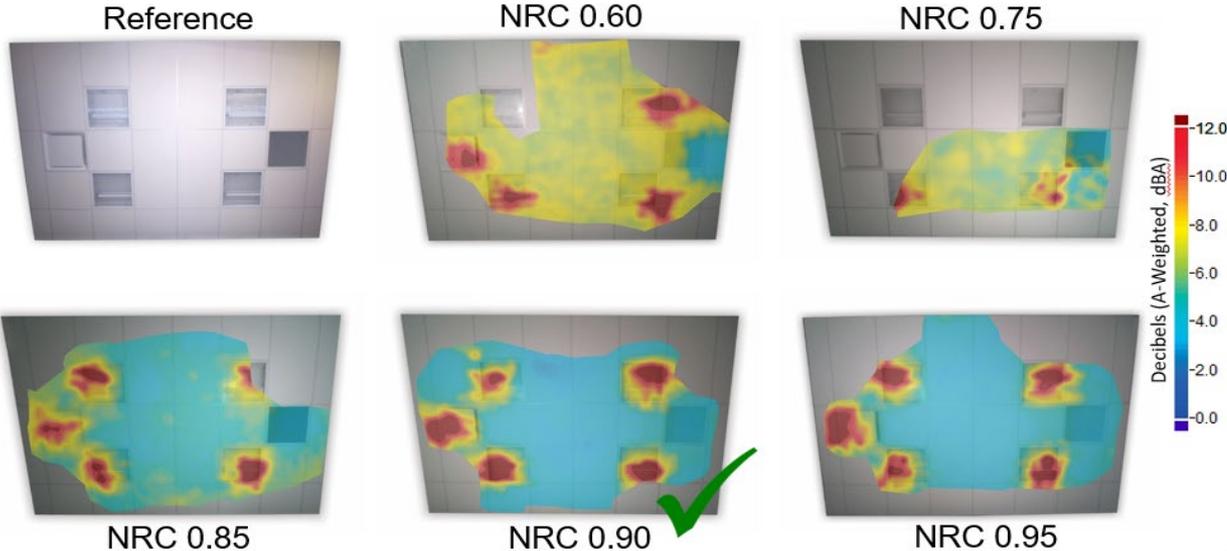
Ceilings below  
0.80 reflect  
too much noise

# Achieving High-Performing Acoustic Ceiling Design

## Absorption color mapping

- Images show examples of color maps of sound being either reflected off a low NRC ceiling or being absorbed by a high NRC ceiling

When does a ceiling become absorptive?



A color map showing sound reflecting off a mineral-fiber panel acoustic ceiling with an NRC rating of 0.60 (yellow).

A color map showing sound being absorbed by a stone wool panel acoustic ceiling with an NRC rating of 0.95 (blue).

## Achieving High-Performing Acoustic Ceiling Design

Acoustic expert speaks on ceiling panels

“In many ways, acoustics is money. There’s a close tie between acoustics and patient recovery and safety. Noise hinders deep restorative sleep. Sleep deprivation causes patient noncompliance with treatment plans and increased risk of injury due to falls. As a result, patient length of stay increases and readmission due to complications or recurrence increases.”

“The studies showing that high-performance, sound-absorptive, ceilings result in improved patient recovery all used ceilings with a Noise Reduction Coefficient of at least NRC 0.90. There are no studies showing that lower-performing ceiling panels produce the same positive outcomes.”

— Gary Madaras, PhD, Rockfon Acoustics Specialist, INCE, ASA, CAA, Associate AIA

# Achieving High-Performing Acoustic Ceiling Design

## HCAHPS Patient Satisfaction Survey

- One of the lowest-scoring questions on the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) satisfaction survey asks patients:  
**“How quiet was the area around your room at night?”**

## Financial Reimbursement from Medicare/Medicaid

- Medicare reimbursements are tied to patient satisfaction
- With low survey results, hospital and healthcare facilities could lose funds



## Case Study Kaiser Permanente: Taking a Healthy Approach to Ceilings

- Kaiser Permanente, Mission Bay Medical Offices San Francisco, California
- 9-story, 220,000-square-foot structure
- LEED® Gold certification
- Top priorities for ceiling specification:
  - Optimizing acoustics with sound-absorbing ceiling panels that deliver a high Noise Reduction Coefficient (NRC)
  - Contributing to the indoor environmental and air quality (IEQ/IAQ) with GREENGUARD® Gold certified products
  - Providing easy-to-clean materials that improve infection control



## Case Study Kaiser Permanente: Taking a Healthy Approach to Ceilings

### ■ Products specified include:

- Acoustic stone wool ceiling panels
- Torsion spring concealed metal ceiling panels
- Metallic panels with ceiling suspension system
- Coordinating trim
- Light reflecting panels for majority of common areas LR value of 0.85



# 4

## How High-Performing Ceilings Impact Indoor Air Quality



## How High-Performing Ceilings Impact Indoor Air Quality

### Ceiling tiles play a role in controlling mold

- Materials should not provide nourishment for potentially harmful microorganisms
- Surfaces should be easy to clean and disinfect without affecting their appearance or performance
- Ceiling panels also should be durable and demountable
- Stone wool ceiling products meet all of these criteria



# How High-Performing Ceilings Impact Indoor Air Quality

## Care and cleaning

- High-quality ceiling panels are manufactured for durability
- These panels can be vacuum-cleaned with a soft brush attachment
- Medical and hygienic ceiling panels can be cleaned with disinfectants
- Some high-performing ceiling panels can be steam cleaned for infection control
- The Centers for Disease Control (CDC) provides guidance on cleaning ceilings in health care facilities in a document titled: "Guidelines for Environmental Infection Control in Health-Care Facilities."



# How High-Performing Ceilings Impact Indoor Air Quality

## Clean materials, clean air

- Some products have biocides to enhance antimicrobial performance
- However, the overuse of antimicrobials can give rise to resistant bacteria
- Better to specify products without antimicrobial additives
- Perkins+Will white paper\* states that antimicrobial additives in building materials may have negative impacts

\* *Understanding Microbial Ingredients in Building Materials*, white paper by Perkins+Will in collaboration with Healthy Building Network



## How High-Performing Ceilings Impact Indoor Air Quality

### **Fewer pollutants in materials better for those with compromised immune systems**

- Some patients have compromised immune systems
- Susceptible to pollutants emitted from materials
- High levels of pollutants and contaminants can lead to:
  - Loss of concentration
  - Bad odors
  - Irritation for staff, caregivers and visitors alike
- For best indoor air quality, specify ceiling panels that are GREENGUARD® GOLD Certified

# 5

## How Ceiling System Specifications Impact Natural Daylighting



# How Ceiling System Specifications Impact Natural Daylighting

## Light is vital to human functioning

- Important for our psychological and physiological condition
- Acts as a stimulant to keep us alert and able to perform better cognitively
- Dodge Data & Analytics identified access to daylight as a key feature for healthier buildings
- LEED v4 rating system recognizes the power of natural light
- LEED compliance for Lighting Quality can be demonstrated with surface reflectance of ceilings



LEED  
v4

# How Ceiling System Specifications Impact Natural Daylighting

## What is light reflectance (LR)?

- LR indicates the percentage of light that ceilings reflect
- LR rating of 0.80 means 80% of light is reflected
- Ceiling panel light reflectance has profound impact on patients and staff
- Panels should have smooth or lightly textured surface



# How Ceiling System Specifications Impact Natural Daylighting

## Ceiling color selection creates healthy, inviting spaces

- With color specification, a designer can:
  - Establish harmony, warmth or comfort with earth tones
  - Make healthcare feel like hospitality
  - Communicate elegance using metal reflectance colors
  - Go for a faux-wood ceiling to create a home like setting.



# 6

## How Ceilings Specification Impacts Operations and Maintenance in Healthcare Facilities



# How Ceilings Specification Impacts Operations and Maintenance in Healthcare Facilities

## Challenges for hospital and healthcare facility specifications

- Materials need to be durable over longer periods to maintain visual continuity
- Endure regular cleaning and disinfecting
- Ceilings require access to services hidden behind



# How Ceilings Specification Impacts Operations and Maintenance in Healthcare Facilities

## Increasing energy efficiency

- Energy efficiency enhanced with high light reflectance ceiling
- Lower light loads and reduced cooling costs
- Reduced number of fixtures needed



# How Ceilings Specification Impacts Operations and Maintenance in Healthcare Facilities

## Reducing microbes, increasing mold control

- To deal with mold, reduce moisture
- To help prevent moisture problems, specify ceiling materials that will not absorb moisture
- Example: Stone wool and metal ceiling products are not organic, so they do not promote the growth of mold or bacteria

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# 7

## High-Performing Ceilings Enhance a Project's Sustainability Goals



# High-Performing Ceilings Enhance a Project's Sustainability Goals



## Indoor air quality

- Air pollution is “the invisible killer”
- OSHA says qualities of IAQ should include:
  - Comfortable temperature and humidity
  - Adequate supply of fresh outdoor air
  - Control of pollutants from inside and outside of building
- To support health, indoor air quality, and environmental quality, choose ceiling materials that are GREENGUARD GOLD certified for low emissions

# High-Performing Ceilings Enhance a Project's Sustainability Goals

## Recycled content

- Ceiling system can help support standards that call for recycled content
- Some metal suspension systems contain up to 90% recycled content
- Panels can also contain recycled materials
- Example: Stone wool ceiling panels can contain up to 43% recycled materials and are made from abundantly available basalt rock



# High-Performing Ceilings Enhance a Project's Sustainability Goals

## Acoustics

- Acoustic quality, already covered earlier in the course
- Acoustic quality is a major element in buildings that are healthy for occupants



# 8

## Putting it All Together - Solutions for Healthcare Spaces



## Putting it All Together—Solutions for Healthcare Spaces

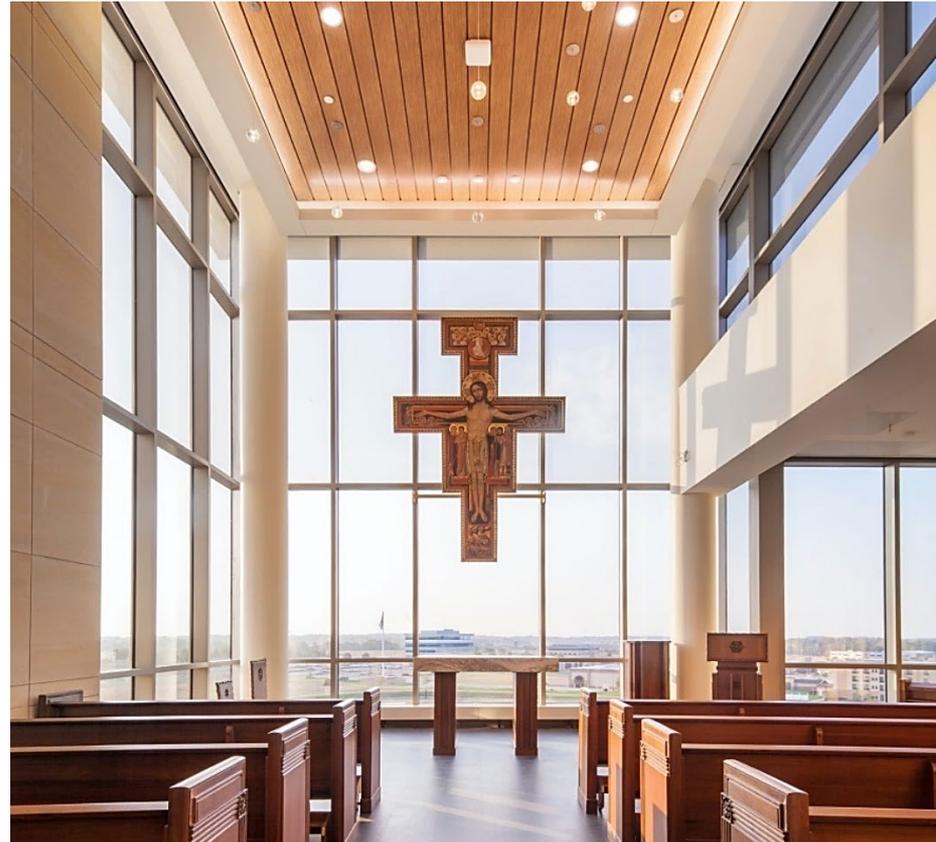
### Different areas have different performance needs

- Specifying ceiling systems for healthcare facilities deserves serious attention
- Different areas in healthcare facilities have different performance needs
- Following are the Noise Reduction Coefficients needed

Good 0.70+

Better 0.80+

Best 0.90+



# Putting it All Together—Solutions for Healthcare Spaces

## Best Absorption (NRC 0.90 – 1.00)

- Patient care areas include:
  - Patient rooms and associated hallways and nurses' stations
  - Exam and treatment rooms
  - Diagnostics/imaging rooms
  - Clinics
  - Respite care rooms

Good 0.70+

Better 0.80+

Best 0.90+



## Putting it All Together—Solutions for Healthcare Spaces

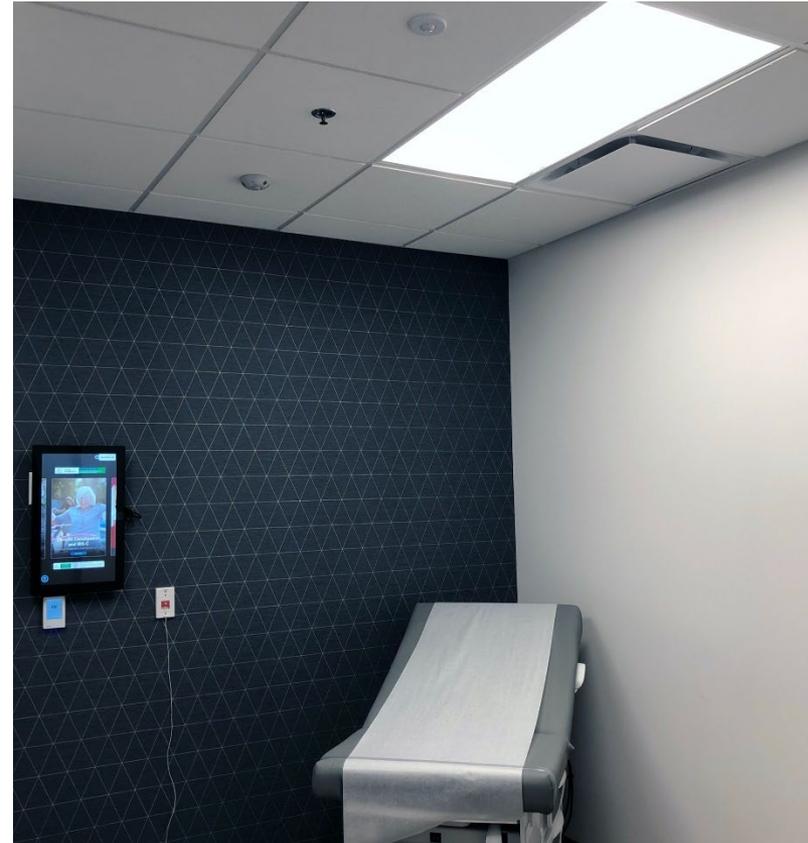
### Best Absorption (NRC 0.90 – 1.00)

- Ceiling recommendations for patient care areas
- Best Absorption—NRC 0.90 – 1.00
- Light Reflectance —LR no less than .83 or greater
- Color—Typically white, with some accent color
- Air Quality
  - Mold resistant
  - No added anti-microbials
  - Able to be cleaned

Good 0.70+

Better 0.80+

Best 0.90+



# Putting it All Together—Solutions for Healthcare Spaces

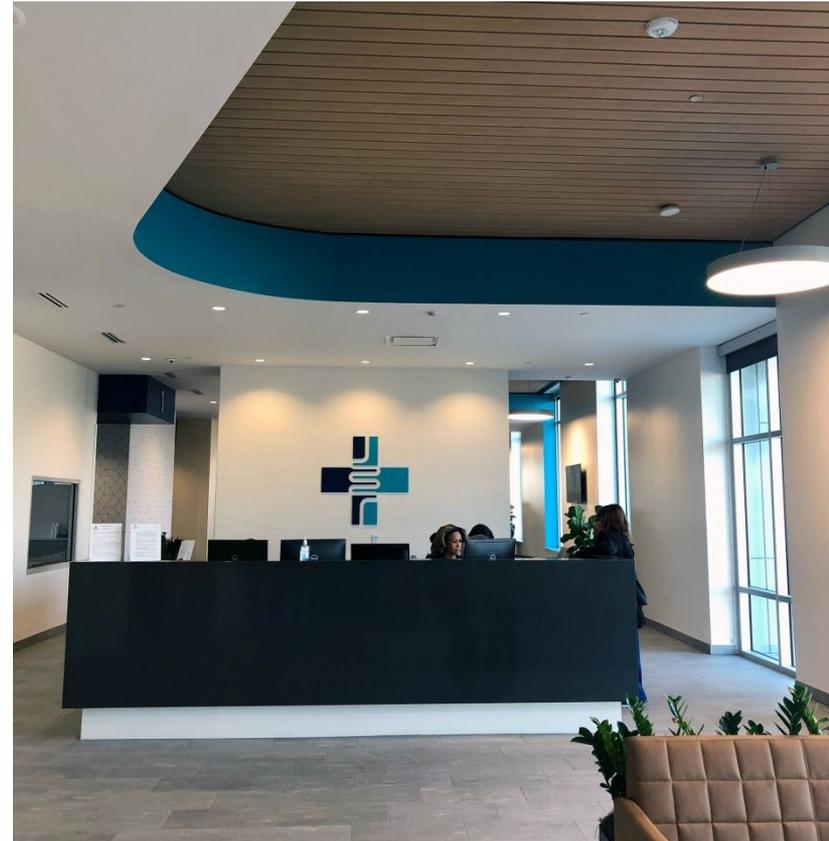
## Better Absorption (NRC 0.80 – 0.90)

- Public areas in a healthcare facility include:
  - Lobbies
  - Waiting rooms
  - Public (non-patient) corridors
  - Cafeterias

Good 0.70+

Better 0.80+

Best 0.90+



# Putting it All Together—Solutions for Healthcare Spaces

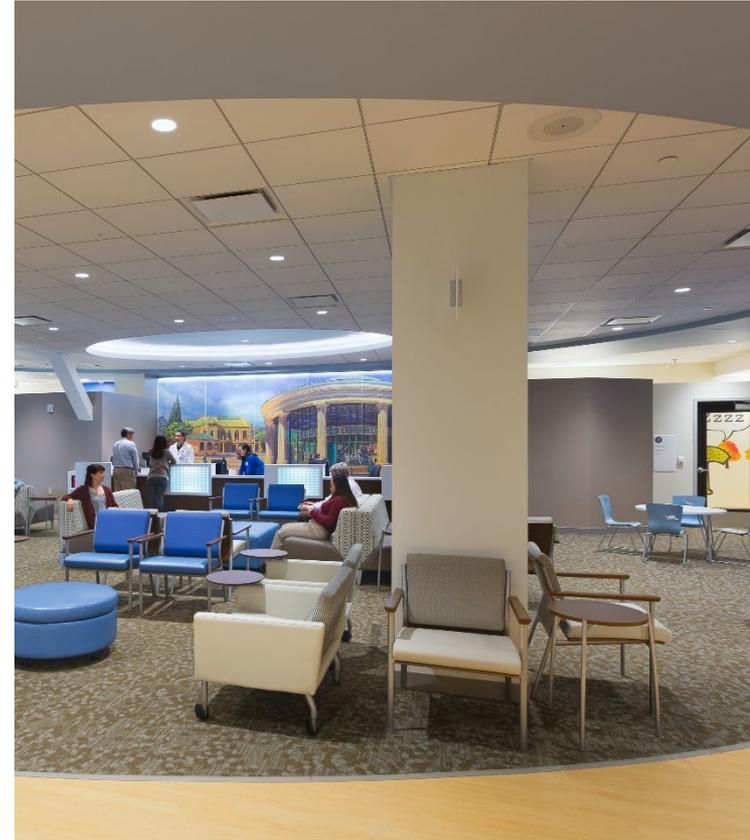
## Better Absorption (NRC 0.80 – 0.90)

- Ceiling recommendations for public areas
  - Better absorption—NRC 0.80 – 0.90
  - Reverberation—Counter with ceiling clouds or islands
  - Color
    - Wood looks, high end, more like hospitality venues
    - Color in ceilings to help with wayfinding
  - Indoor air quality
    - Panels with no added microbials
    - Materials naturally resistant to mold
    - Cleanable panels are necessary for cafeteria areas

Good 0.70+

Better 0.80+

Best 0.90+



# Putting it All Together—Solutions for Healthcare Spaces

## Good Absorption (NRC 0.70-0.80)

- Staff and non-patient areas
  - Doctors' offices
  - Employee break rooms
  - Employee restrooms
- Ceiling specification recommendations
  - Acoustics—Good absorption with an NRC 0.70-0.80)
  - Lighting —LR of .83 or higher, to eliminate strain on eyes
  - Indoor Air Quality
    - No added anti-microbials
    - Should be cleanable

Good 0.70+

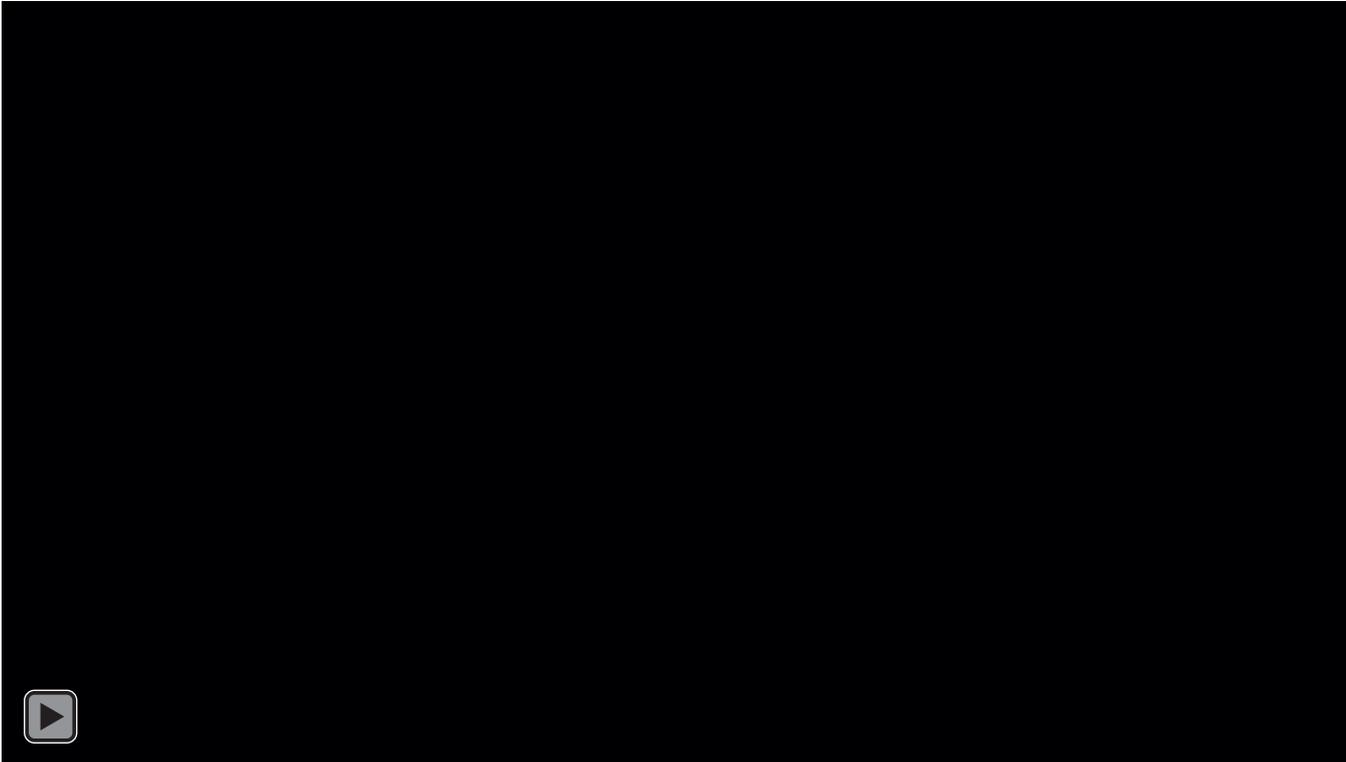
Better 0.80+

Best 0.90+



## Case Study Video: Premier Medical Plaza

- The renovation of a retail space into a highly functioning medical practice
- Illustrates the importance of the ceiling specification in a high performing space





# Conclusion

This concludes the continuing education unit on **Ceiling Systems for High-Performing Healthcare Facilities.**

Please take the quiz to receive your credits.

**Thank you for your interest in ROCKFON.**

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