MASONRY Institute of Michigan

Sound

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Sound Abatement and Noise Control

USING CONCRETE MASONRY

NATIONAL CONCRETE MASONRY ASSOCIATION
Sustainable Concrete Products for Structures and Hardscapes

MASONRY Institute of Michigan

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What is Sound?

Sound is a series of vibrations transmitted through an elastic medium. Sound is generated by vibrating objects which cause pressure fluctuations in the medium.

Sound is characterized by its frequency (pitch) and intensity (loudness).

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Sound Intensity

Examples of sound intensity:

- Hearing Threshold: 0 dB
- Whisper: 20 dB
- Normal Speech: 60 dB
- Vacuum Cleaner: 80 dB
- Loud Music: 110 dB
- Jet Engine: 140 dB

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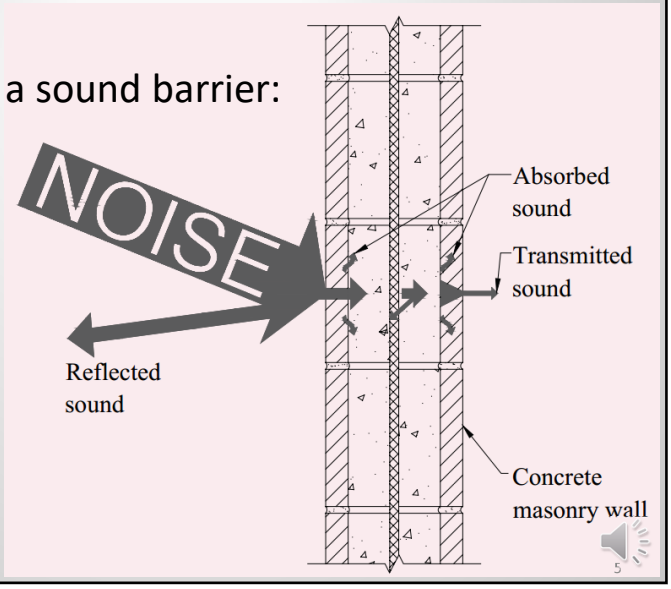
Sound Barriers

When struck, a sound barrier:

- Reflects
- Absorbs
- Transmits

the sound to varying degrees.



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Noise Reduction Coefficient

The measure of a sound barrier's ability to reflect versus absorb/transmit sound is captured in the noise reduction coefficient (NRC).

- NRC = 1.0: 100% of the sound is absorbed/transmitted; 0% reflected.
- NRC = 0.35: 35% of the sound is absorbed/transmitted; 65% reflected.

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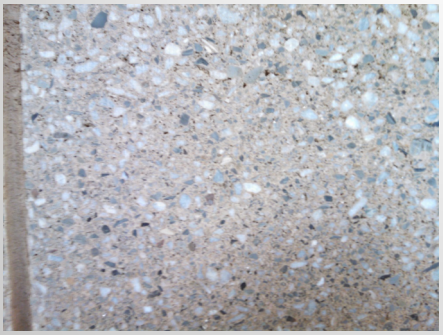
Noise Reduction Coefficient

The NRC changes with CMU surface texture.

Fine Texture



Medium Texture

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Noise Reduction Coefficient

The NRC changes with CMU surface texture.

Coarse Texture

Coarse Texture

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Noise Reduction Coefficient

The NRC changes with CMU surface texture.

Sealed Unit

Painted Unit

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Noise Reduction Coefficient

NRC Values for Concrete Masonry Assemblies
Without Coatings

	Surface texture:		
	Coarse	Medium	Fine
Lightweight concrete masonry	0.50	0.45	0.40
Normal weight concrete masonry	0.28	0.27	0.26

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Noise Reduction Coefficient

NRC Values for *Painted Lightweight CMU*

Paint, application	Coats	Surface texture: Coarse	Medium	Fine
Any, sprayed	1	0.45	0.41	0.36
	2	0.40	0.36	0.32
Oil, brushed	1	0.40	0.36	0.32
	2	0.23	0.21	0.18
Latex, brushed	1	0.35	0.32	0.28
	2	0.23	0.21	0.18
Cement, brushed	1	0.20	0.18	0.16
	2	0.05	0.05	0.04

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Noise Reduction Coefficient

NRC Values for *Painted Normal Weight CMU*

Paint, application	Coats	Surface texture: Coarse	Medium	Fine
Any, sprayed	1	0.25	0.24	0.23
	2	0.22	0.22	0.21
Oil, brushed	1	0.22	0.22	0.21
	2	0.13	0.13	0.12
Latex, brushed	1	0.20	0.19	0.18
	2	0.13	0.13	0.12
Cement, brushed	1	0.11	0.11	0.10
	2	0.03	0.03	0.03

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Sound Transmission

In general, sound transmission is the amount of sound that is transferred through a sound barrier. For building design, there are three different sound transmission values to consider:

- Sound Transmission Loss (STL)
- Sound Transmission Class (STC)
- Outdoor-Indoor Transmission Class (OITC)

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Sound Transmission Loss (STL)

The STL is a measure of the reduction of the sound intensity (dB) from one side of a barrier to the other.

For example: if a 300 Hz, 80 dB sound on one side of a wall is reduced to 30 dB on the other side, the STL is 50 dB.

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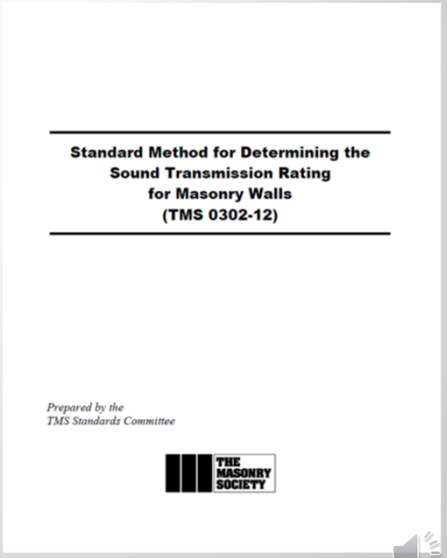
Calculated STC

TMS 302-12
Standard Method for Determining the Sound Transmission Rating for Masonry Walls



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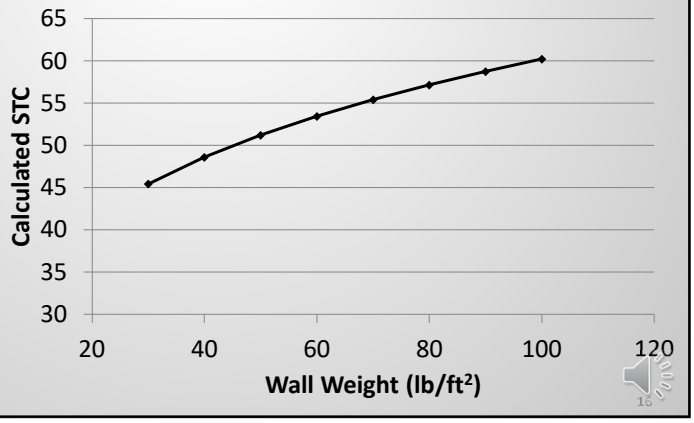
Calculated STC

For concrete masonry assemblies:

$STC = 20.5W^{0.234}$



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Calculated STC

NCMA TEK

National Concrete Masonry Association
an information series from the national authority on concrete masonry technology

CONCRETE MASONRY WALL WEIGHTS

TEK 14-13B
Structural (2008)

Table 4—8-in. (203-mm) Single Wythe Wall Weights

Units	Vertical grout spacing, in. (mm)	Mortar bedding	Wall weight, lb/ft² (kg/m²) for concrete densities, lb/ft³ (kg/m³) of: 85 (1,362)	95 (1,522)	105 (1,682)	115 (1,842)	125 (2,003)	135
Hollow	No grout	Face shell	25 (122)	28 (137)	31 (151)	33 (161)	36 (176)	3
Hollow	No grout	Full	26 (127)	28 (137)	31 (151)	34 (166)	37 (181)	3
Solid	No grout	Full	56 (274)	62 (303)	68 (332)	74 (362)	80 (391)	8
Hollow	8 (203)	Full	73 (357)	76 (371)	78 (381)	81 (396)	84 (411)	8
Hollow	16 (406)	Face shell	49 (239)	52 (254)	55 (269)	57 (279)	60 (293)	6
Hollow	24 (610)	Face shell	41 (200)	44 (215)	47 (230)	49 (239)	52 (254)	5
Hollow	32 (812)	Face shell	37 (181)	40 (195)	43 (210)	45 (220)	48 (235)	5

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Calculated STC

Calculation Example:

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Calculated STC

Calculation Example:

$STC = 20.5W^{0.234}$

$STC = (20.5)(55)^{0.234}$

$STC = (20.5)(2.55) = 52.4$ dB

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Calculated STC

Calculation Example:

$STC = 20.5W^{0.234}$

$W = (STC/20.5)^{4.274}$

$W = (63/20.5)^{4.274}$

$W = (3.07)^{4.274} = 121.3$ psf

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NEW NCMA SOUND CALCULATOR

NCMA Sound and Assembly Properties Calculator

This spreadsheet provides section properties for CMU walls that are either vertically or horizontally grouted.

1. Orange cells are for user input
2. Grey cells with orange text are interim calculations with pertinent information.
3. Units must conform to a 2 faceshell configuration
4. Web locations must be defined by the user and must be within the confines of the specified unit dimensions.
   Web locations are measured from the leftmost edge of the unit to the leftmost edge of the web, when viewed from the top down (see **Figure 1** on the "Unit Configuration" page of this spreadsheet).
5. The sheet will automatically check if a unit is capable of partial grouting. If it is not possible, the subsequent results pages will not show the results for partial grouting and full mortar bedding.
6. Webs may be of differing heights, but certain restrictions will apply.
   a. Units with less-than-full-height webs can only be either fully grouted or hollow with faceshell mortar bedding.
   b. Any single web must be of a consistent height; units with "notched" webs (such as those that allow for insulation) cannot be calculated in this sheet.
7. Depending on user input, cells may appear or vanish based on what is needed. Leave no cells blank.
8. For a more detailed instruction, double-click the link below to be directed to a PDF (will open in Adobe Acrobat)
9. If you feel the need or desire to edit or alter the calculations in this sheet, the protection password is as follows:

bloxrox

SAAP Instructions Help File Ver 1.0

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Single Wythe Masonry

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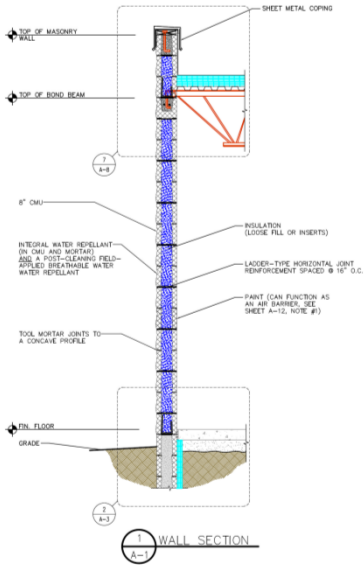

Weight

Given:

- **8” CMU**
- **Normal weight 125 pcf**
- **Partially Grouted**
  - **Vertical Bar @ 48” o.c.**

Answer:

- **Weight of wall = 44 psf**

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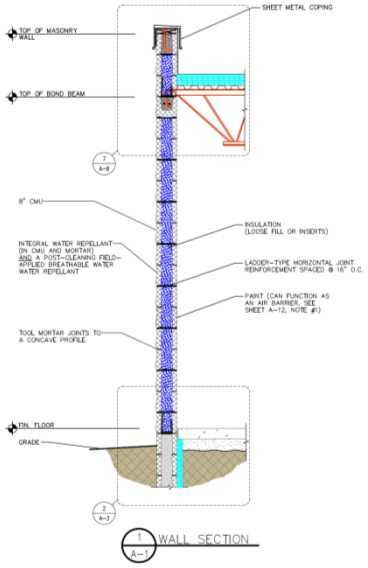
Single Wythe Masonry

MASONRY Institute of Michigan



Sound

Given:

- 8" CMU
- Normal weight 125 pcf
- Partially Grouted
  - Vertical Bar @ 48" o.c.
- Weight of wall = 44 psf

Answer:

- STC = 49.7
- OITC = 44.0

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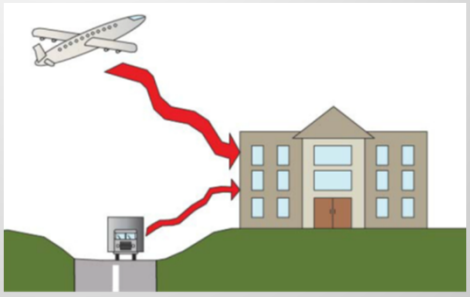
Outdoor-Indoor Transmission Class (OITC)

The OITC of an assembly is measured similarly to STC. The primary difference is the sound frequencies used for OITC assessment are weighted to capture typical exterior noise sources (i.e., traffic).



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Outdoor-Indoor Transmission Class (OITC)

The OITC of concrete masonry is determined using one of the following options:

- ASTM E90 – Laboratory Measurement
- ASTM E1332 – Field Measurement
- TMS 302 – Calculation

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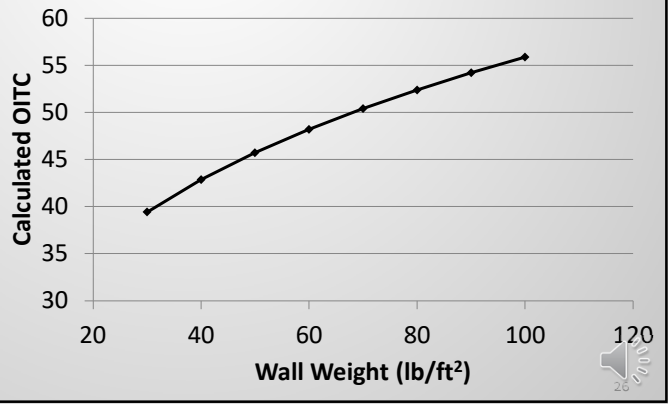
Calculated OITC

For concrete masonry assemblies:

$OITC = 14.7W^{0.290}$



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Calculated OITC

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Calculated OITC

Calculation Example:

$OITC = 14.7W^{0.290}$

$OITC = (14.7)(55)^{0.290}$

$OITC = (14.7)(3.20) = 47.0$ dB

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Calculated OITC

Calculation Example:

$OITC = 14.7W^{0.290}$

$W = (OITC/14.7)^{3.45}$

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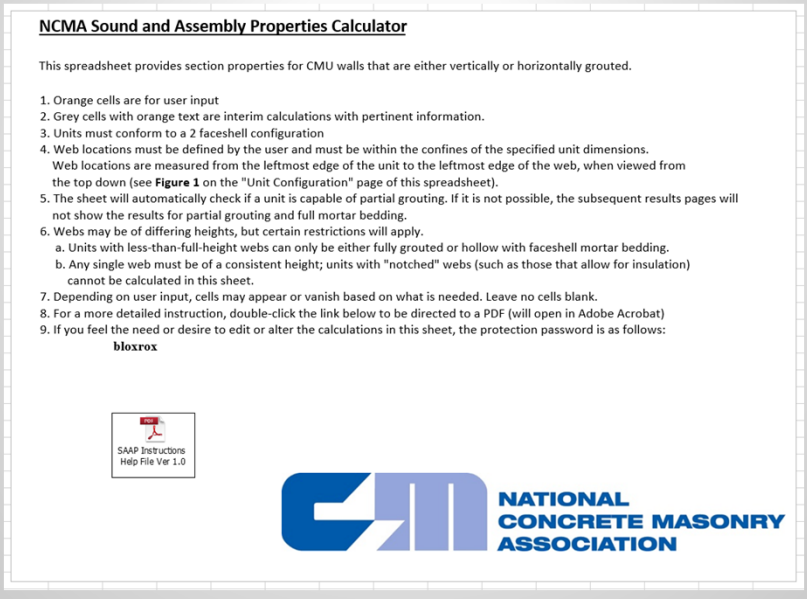
NEW NCMA SOUND CALCULATOR



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Calculated STC and OITC

As the weight of a concrete masonry assembly increases, so does the corresponding Sound Transmission Classification (STC) and Outdoor-Indoor Transmission Class (OITC).

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Effect of Finishes

- Drywall has little effect on STC when applied directly to CMU
- Significant increases in STC when drywall and sound insulation are used. Three factors govern amount of improvement:
  - Method of support
    - Independent studs are best
  - Depth of furring
  - Use of sound material in furring space

TMS 302-12 Commentary

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Effect of Finishes

Table 7.3.5 – Increase in STC Using the Furring Space Depth Indicated and a Single Layer of Drywall

Furring Space Condition	Sides	Furring Space, in.							
		0.5	0.8	1	1.5	2	2.5	3	3.5
No sound-absorbing material in the furring space	one	0.2	0.9	1.6	3.0	4.4	5.8	7.2	8.6
	both	-1.0	-0.1	0.8	2.6	4.4	6.2	8.0	9.8
Furring space filled with sound absorbing material*	one	3.4	4.1	4.9	6.4	7.9	9.4	10.9	12.4
	both	-1.8	1.0	3.8	9.4	15.0	20.6	26.2	31.8

*Fibrous materials, such as cellulose fiber, glass fiber or rock wool insulation, are good materials for absorbing sound; closed-cell materials, such as expanded polystyrene, are not, as they do not significantly absorb sound.