

Sound Mitigation in Multifamily Housing

Wisconsin Housing Preservation Corp.

President's Work Group on Environmental Justice

October 18, 2021 | By Zoom

whpc
Wisconsin Housing Preservation Corp.

Outline

- WHPC's Work
- Site and Noise Contours
- Conceptual Plan
- Sound Mitigation
- Questions

WHPC Mission

*To preserve, provide,
and protect affordable
housing for the low- and
moderate-income
citizens in the state of
Wisconsin*

\$515M

net assets

8,400+

apartments

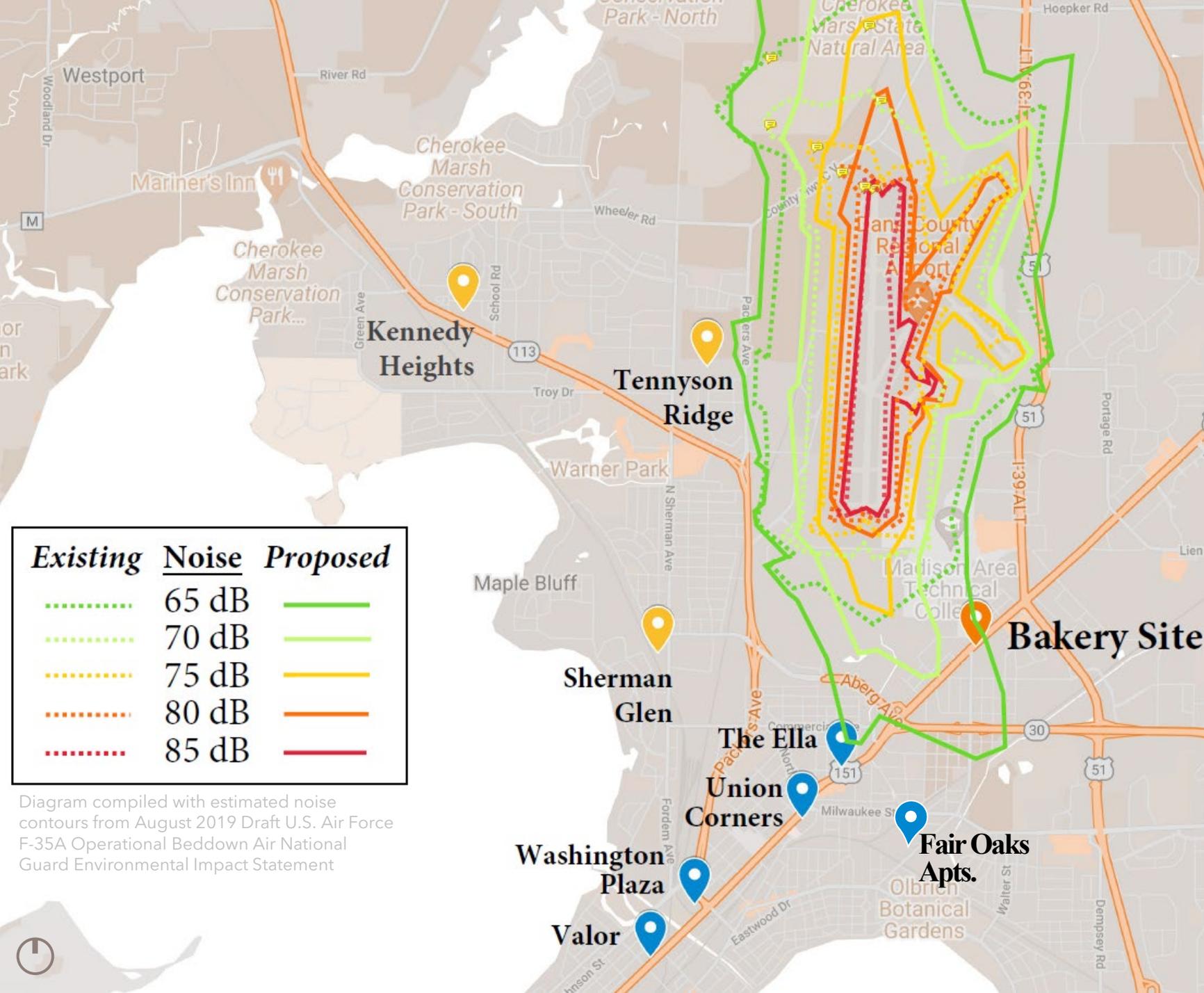


Prairie Haus,
New Glarus



Kestrel Apts.,
Middleton





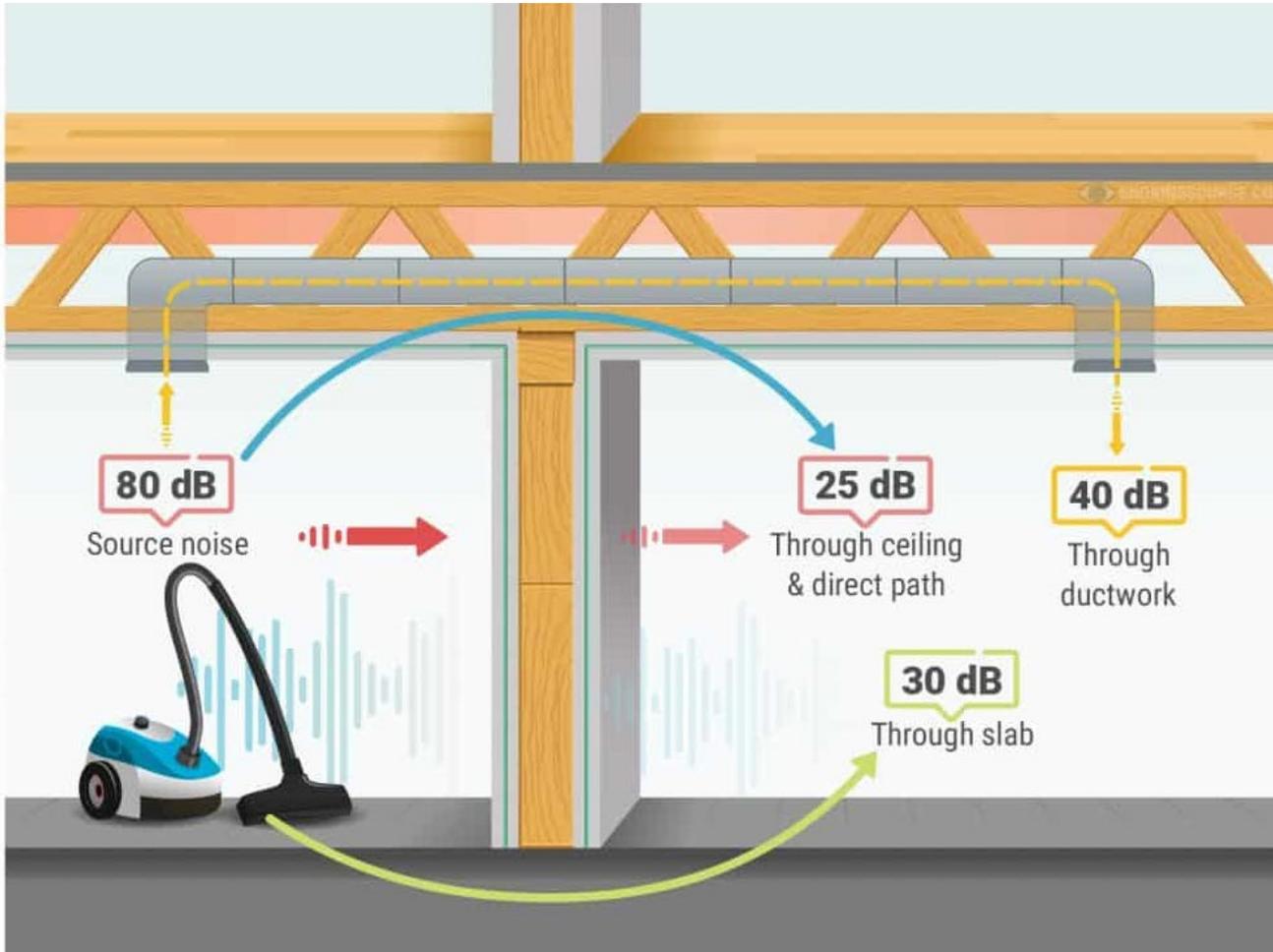
Site Location

Within the 65 dB noise contour

Initial Conceptual Plan

- Around 225-275 apartments
- Residential housing affordable to people at 50% County Median Income (CMI) to 70% CMI
- Three buildings
- Green space
- Connections to future bus rapid transit (BRT) stop
- Sound mitigation techniques





Key Metrics in Sound Mitigation

- **Decibels (dB)**
 - Measure of how loud a noise is
 - Higher dB means *more* noise
- **Sound Transmission Class (STC) rating**
 - Measure of how well a building material or assembly attenuates airborne sound
 - Higher STC means *less* noise

Source: "Sound Transmission Class (STC) Rating Explained", <https://tinyurl.com/rdb7me2w>

Centers for Disease Control and Prevention



Source: Centers for Disease Control and Prevention, "Too Loud For Too Long!," https://www.cdc.gov/nceh/hearing_loss/toolkit/too_loud.html

Sound Mitigation – What’s Possible?

Construction Component	Notes	Estimated Impact
Windows	Reduce proportion of window to wall size from 50% to 20%	3 dB reduction
	Single-pane 3/16-inch glass	25 dB STC
	Single-pane 1/2-inch glass	35 dB STC
	Two 3/16-inch panes	51 dB STC
Walls	Double thickness of partition	6 dB reduction
	6-inch airspace	5 dB reduction
Studs	24-inch spacing (compared to common 16-inch spacing)	2-5 dB increase STC
	Resilient layers like fiber board and glass fiber board, resilient clips, and semi-resilient attachments	2-5 dB increase STC
Doors	Common hollow-core wood doors	17 dB STC
Insulation	Acoustical/isolation blankets made from materials such as mineral or rock wool, fiberglass, hair felt or wood fibers	Up to 10 dB increase STC

Source: Housing and Urban Development, "Chapter 4: Noise Attenuation"

KBA Upgraded Case Study: Fair Oaks Apartments

144 S Fair Oaks Ave. - 1.4 miles from Site

Construction Component	Notes	Estimated Impact
Windows	3/16" IN - 1/8" OUT glazing	33 dB STC
Walls	5/8" Type X Gyp., Resilient Channel at 24" o.c., 6 Mil. Poly Vapor Retarder, 7/16" O.S.B. Sheathing, Building Wrap, 1" Rigid Insul. (R-5 Min)	2-5 dB reduction
Studs	Wood studs 16" o.c.	
Doors	Patio doors are 3/16" IN - 1/8" OUT glazing Alum. Entry Door	32 dB STC 27 min STC
Insulation	Exterior walls closest to Kipp Corp. had R21 acoustical spray foam insulation	Up to 10 dB increase STC

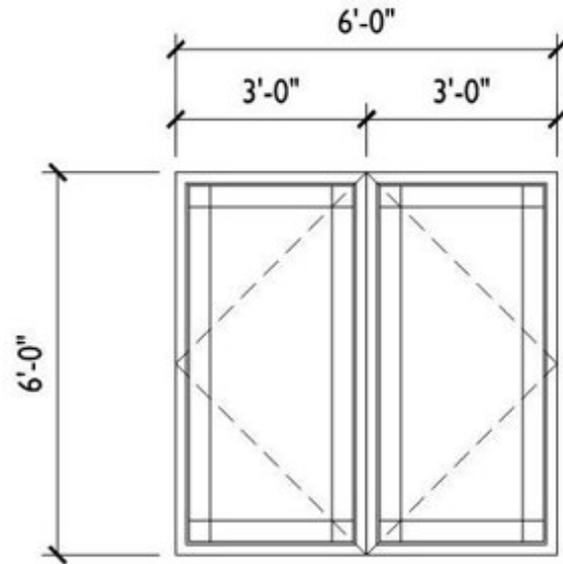


Source: Housing and Urban Development, "Chapter 4: Noise Attenuation"
Source: Indow Windows, "Soundproofing Windows: The Basics"

Glazing

- **Upgraded glazing in windows and patio doors**
 - Glass of different thicknesses are used to reduce sound transfer, depending on the desired acoustical performance rating and cost of the glazing.
- **Double-glazed windows**
 - For instance, in a double-glazed window, a $\frac{3}{16}$ " thick glass on the inside with a $\frac{1}{8}$ " thick glass on the outside of the window will reduce the sound transfer. Other options include $\frac{1}{4}$ " annealed glass or $\frac{1}{8}$ " laminated glass.

KBA Standard Window



GLAZING: 3/32 IN - 3/32 OUT

SIZE (W X H): (2) 3060

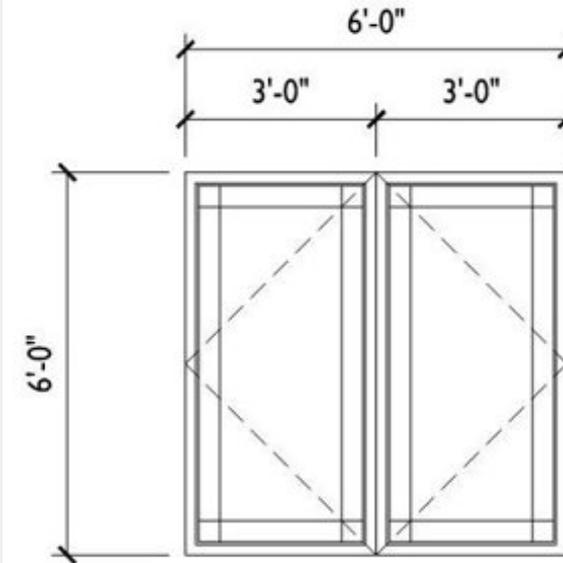
DAYLIGHT (SF): 26.51

VENTILATION (SF): 27.24

NOTES:

STC: 25

KBA Upgraded Window



SIZE (WxH): 2 (3060)

DAYLIGHT (SF): 26.51

VENTILATION (SF): 27.24

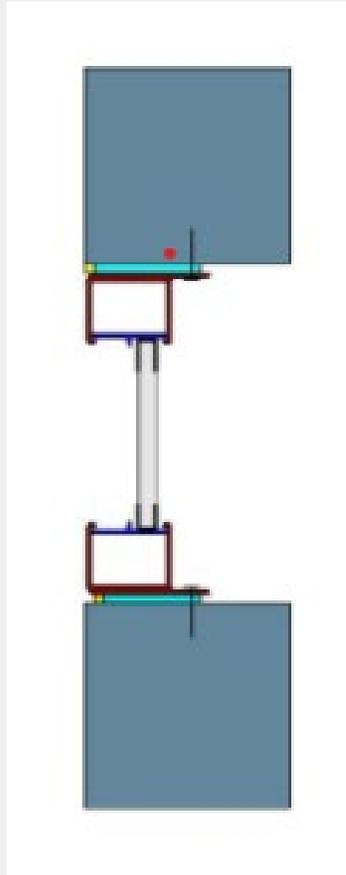
NOTES:

- CASEMENT
 - a. GLAZING: 3/16" IN - 1/8" OUT
 - b. STC RATING: 33
 - c. OITC RATING: 28

STC: 33

Added... Increase pane thickness from 3/32" IN - 3/32" OUT to 3/16" IN - 1/8" OUT

Upgraded Window System Option (Soundproofing Frame)



Legend

- Wall (existing window not shown)
- Soundproof Window Frame
- Foam/Gasket Material
- Window Track
- Caulking Joint
- Glass Panel (tightly seals and is movable/removable)
- Attaching Screw

Window Glass	Normal STC Range	Typical Value
Single pane glass	26-28	27
Dual pane glass	26-32	26
Soundproof Window over a single pane window	48-54	48
Soundproof Window over a dual pane window	48-54	48

STC: 48-54

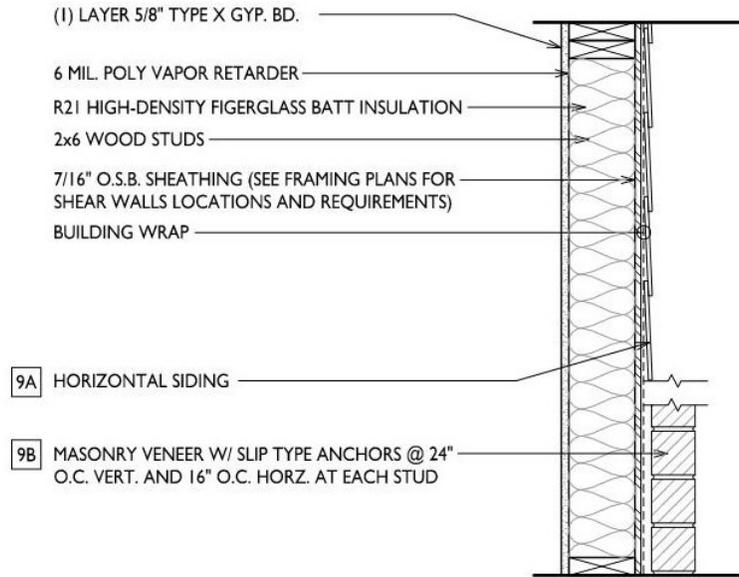


Source: iStock Getty Images, "Boss and Employee Communication Stock Illustration"
Source: Housing and Urban Development, "Chapter 4: Noise Attenuation"

Walls

- **Spray foam insulation in the exterior walls**
 - Typical exterior fiberglass batt wall insulation can leave gaps and voids when installed. Spray foam insulation reduces the gaps and voids, providing better acoustical separation.
- **Continuous exterior insulation**
 - This rigid insulation applied to the exterior of the building eliminates gaps and introduces another "layer" of material sound must pass through.
- **Resilient channels between interior drywall and exterior wall studs**
 - This channel acts to absorb sound vibration coming through the wall.
- **Dense exterior wall finishes**
 - Dense materials, such as masonry veneer, help absorb and deflect noise.

KBA Standard Exterior Wall



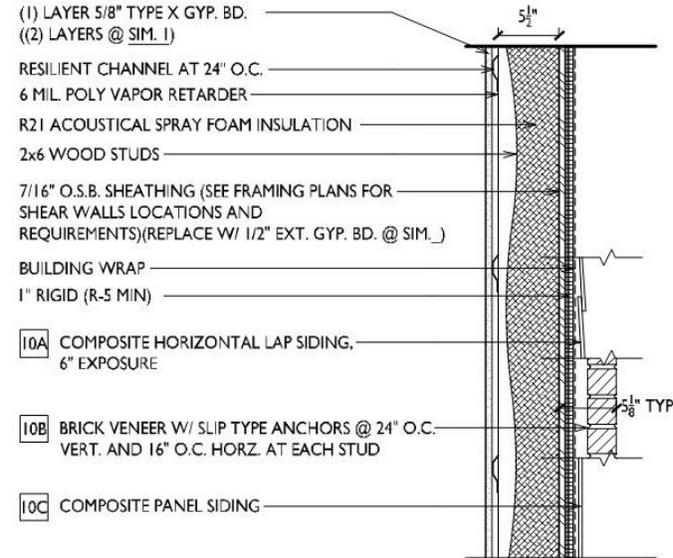
WALL TYPE: **9**
 1 HR EXTERIOR WOOD STUD WALL

N.T.S.

U.L. DESIGN NO. U356 - 1 HR

STC: 36

KBA Upgraded Exterior Wall



SOUTHERN WALL TYPE: **10**
 1 HR EXTERIOR WOOD STUD WALL

N.T.S.

U.L. DESIGN NO. U356 - 1 HR

STC: 46

Added...

- Resilient Channel
- R21 Acoustical Spray Foam Insul.
- 1" Continuous Rigid Insulation



Roofs

- **Continuous exterior insulation**
 - Like the wall system, rigid insulation applied to the exterior of the building eliminates gaps and introduces another "layer" of material sound must pass through.
- **Add another layer**
 - Adding a layer of fiberglass or another noise resistant material provides a higher density material to absorb sound and deflect noise.
- **Separate the ceiling from the roof**
 - The most expansive option, a suspended ceiling creates the most effective noise barrier by creating a complete separation from exterior vibrations.

18 dB total reduction

8 dB reduction:
Improved STC rating of windows and patio doors

10 dB reduction:
Improved STC rating of exterior wall

A 10 dB decrease in sound reduces perceived loudness by 50%, and it reduces sound intensity by 90% because of the nonlinear response of the human ear.

\$1M - \$1.25M

estimated cost in total

\$4K - \$5K

estimated cost per unit

An aerial photograph of a residential neighborhood, showing a mix of houses, streets, and green spaces. The image is semi-transparent, allowing the text and logo to be overlaid. A large, dark blue question mark is centered on the image, with a thin orange horizontal line underneath it.

Questions?
