What is noise barrier tapering and why does MnDOT do it?

Noise barrier tapering is a process of gradually reducing the height of the noise barrier at the ends. It is usually done due to improve aesthetics of a noise barrier.

Figure 1: Tapering of a concrete noise wall located in Eagan, MN.

Federal Highway Administration (FHWA) states the following in regards to noise barrier ends:

“Abrupt endings on walls should be avoided; if at all possible, a return should be planned, which carries the line of the wall away from the eye of the viewer. This reduces the unpleasant, unfinished look which generates the impression that the wall might collapse at any moment. This may further be avoided by either a gradual tapering of the wall to a point near the ground or by stepping the wall in even increments until a point is reached where the wall is no longer visually dominant.”

Tapering noise barrier ends is considered for all MnDOT noise barrier designs. Tapers may vary due to topography, utility location, or other various reasons.

MnDOT concrete noise barrier taper design standard:

As per Precast Concrete Noise Wall Special Provisions (2411), "Wall end taper details. Steps must be uniform in increments within the range of a 1:4 to 1:6 ratio of panel length. Post spacing at end tapers may be decreased to accommodate the required step height ratios. The last wall panel shall be 10 to 12 feet in height."

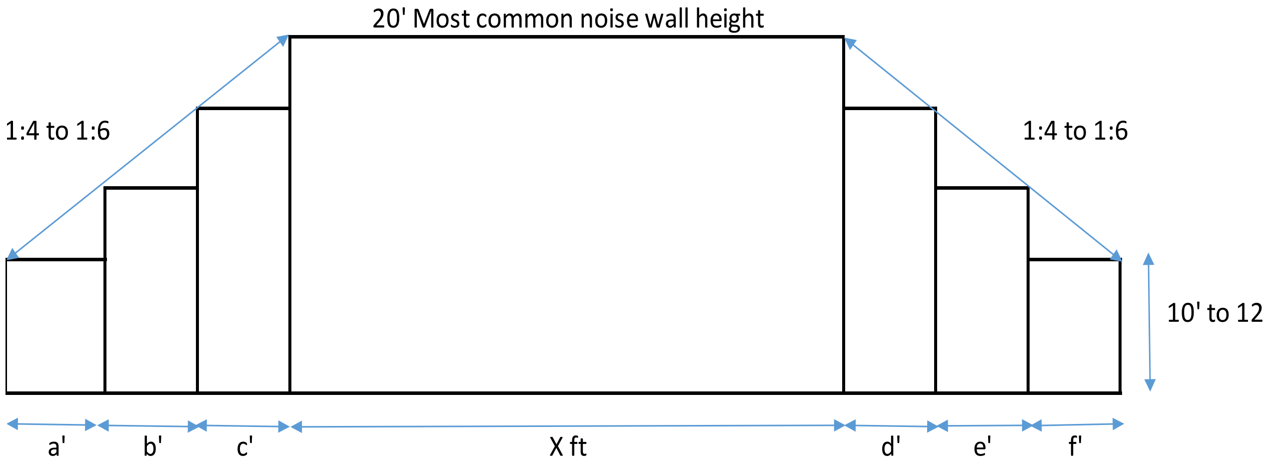

Figure 2: Example of a concrete noise barrier tapering per Special Provisions.

Noise model practitioners should model concrete noise barrier tapers so that the noise barrier tapers down to a height of 10 feet over a span of 60 feet. Concrete noise barrier panel widths and stepping heights are unlikely to be known at time of noise modeling because these details can vary by manufacturer.

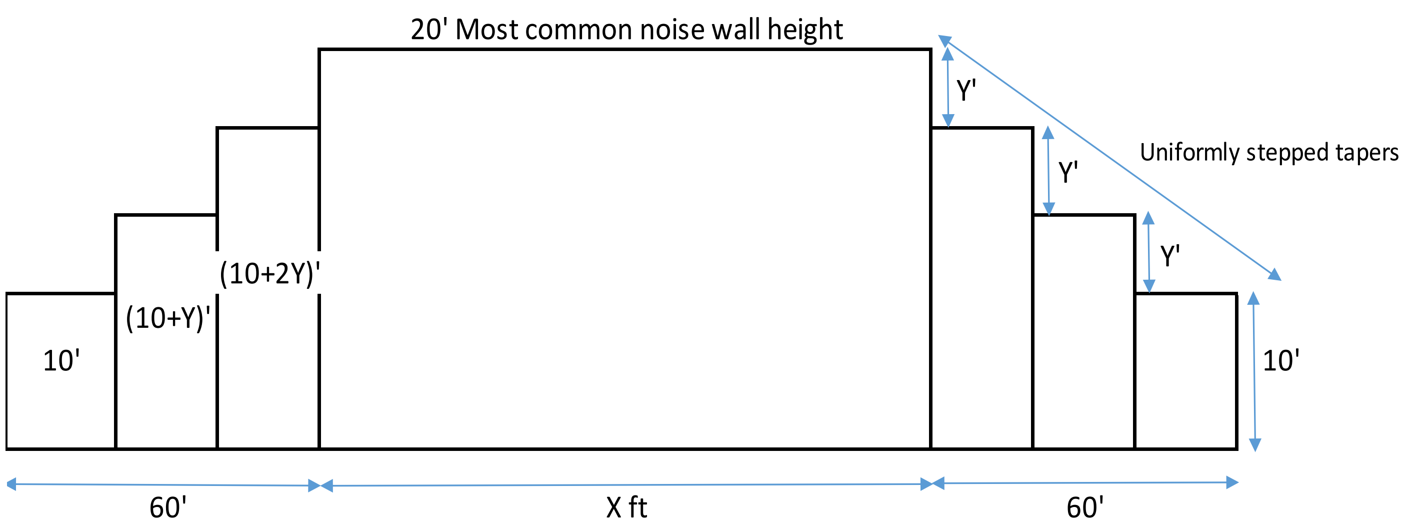

Figure 3: Example of a concrete noise barrier tapering for noise modeling purposes

MnDOT wood noise barrier taper design standard:

With the wood plank barrier, the end tapers typically drop down to a 6 foot height over a span of 56 feet, with a typical post spacing of 8 feet.

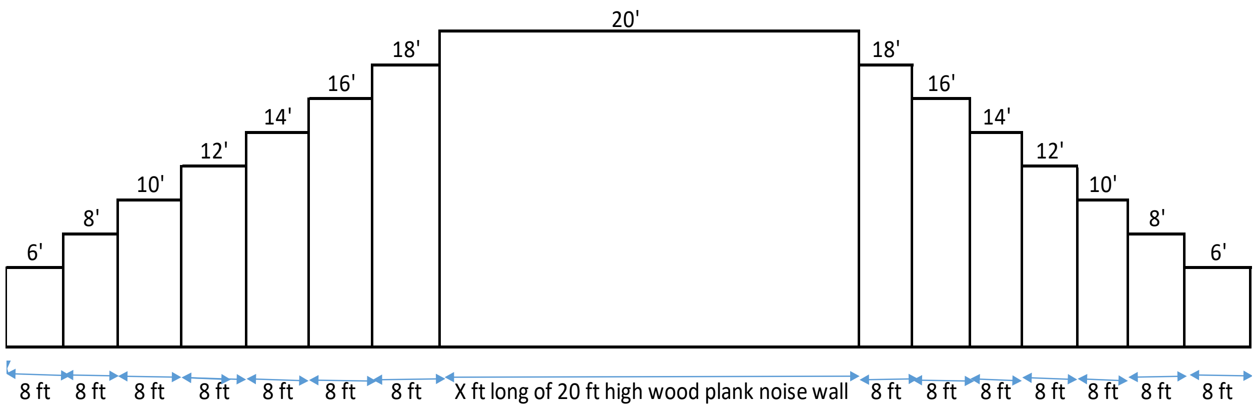

Figure 4: Example of a wood noise barrier tapering design for calculation.

Noise model practitioners should model wood noise barrier tapers so that the noise barrier tapers down to a height of 6 feet over a span of 56 feet. Panel widths and stepping details are more commonly known because MnDOT has a standard design for wood noise barriers. However, noise model practitioners do not need to model each individual step because this level of detail can overwhelm the Traffic Noise Model (TNM).

Noise Barrier Cost Calculations:

Noise barrier cost calculations within the Traffic Noise Report should document any tapering assumptions and calculations. The estimated noise barrier costs should reflect the reduction in area due to tapers.

An example table showing noise barrier cost analysis is provided below. Note that the table’s footnotes (#5) documents that the calculated area of the barrier includes subtracting area for tapers on both ends.

Table D-1: Modeled Wall 1 - 1,430 ft.
Noise Mitigation Cost Effectiveness Results

Receptor	Activity Category	No. of Units	Build 2040 LAeq dBA (no barrier)(1)	Build 2040 LAeq dBA (with noise barrier)(1)	LAeq dBA Reduction (2)	Number of Benefitted Receptors	Number of Receptors Meeting Design Goal Reduction (3)	Wall Height (ft)(4)	Wall Length (ft)	Barrier Area (sq ft) (5)	Total Cost of Barrier (6)	Cost / Benefitted Receptor (7)
'T1'	C	1	73.1	67.2	**5.9**	1	0					
'T2'	C	1	77.7	76.1	1.6	0	0					
'T3'	C	1	81.2	80.7	0.5	0	0					
'T4'	C	1	74.0	71.6	2.4	0	0	20	1,430	19,046	$1,344,216	$ 672,108
'T5'	C	1	72.2	65.2	**7.0**	1	1					
'2-1'	F	1	76.1	76.1	0.0	0	0					
'2-6'	E	1	72.2	72.1	0.1	0	0					
					Total	2	1					

(1) Underlined numbers represent any value approaching or exceeding the Federal Noise Abatement Criteria
(2) **Bold** Numbers represent benefitted Receptor (5 decibel reduction or greater)
(3) The design goal is to achieve at least 7 dBA noise reduction. For a wall to be considered reasonable, at least one receptor must meet this
(4) Wall height on bridge structure is 10 feet and 20 feet off structure.
(5) Area of the barrier includes tapers on both ends.
(6) The cost for the new barrier is $36/sq ft. The cost of the new barrier on the bridge is $134/sq ft.
(7) The maximum cost/benefitted receptor is $78,500 for a wall to be considered reasonable.

Figure 5: Example table for noise barrier cost analysis,