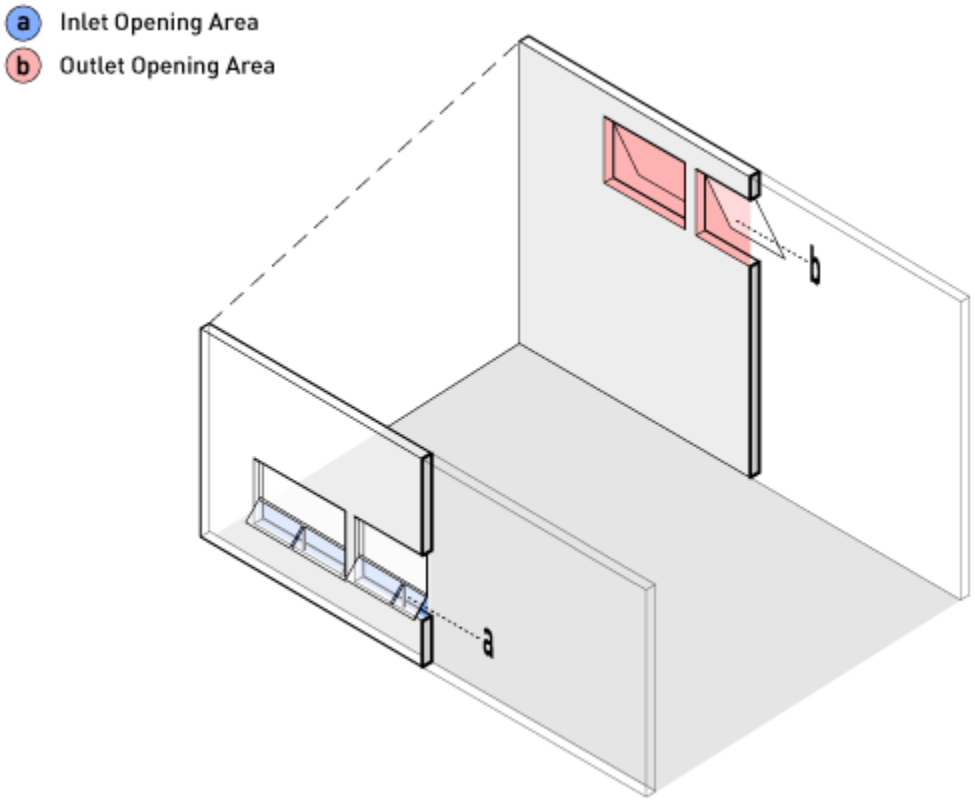
Stack Ventilation in a Space

By Architecture 2030

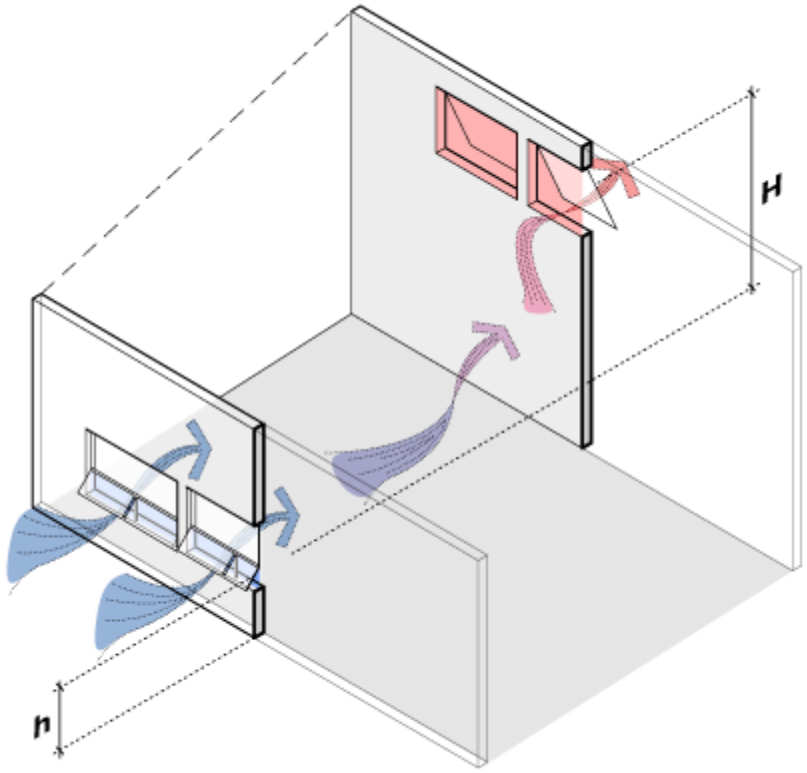
Stack ventilation can be incorporated in a building or space with a high ceiling when there is a significant difference in height between operable windows or vents located in the space. The larger the distance between openings, the greater the volume of air displaced.

Spatial Design



1. Locate the *outlet opening area* [b] as high as possible in the space to be ventilated. The outlet opening can be located vertically on a wall surface, or if located in the ceiling/roof, a turbine vent may be added to increase air exhaust rates. The *outlet opening area* is the total area all outlet openings, whether incorporating a single opening or number of openings.

2. Locate the *inlet opening area* [a] as close to the center of the space as possible. The *inlet opening area center-point height* [h] should result in a path that allows for appropriate ventilation of the occupants' upper body (i.e. head and torso). The *inlet opening area* is the total area all inlet openings, whether incorporating a single opening or number of openings. Shade the foreground adjacent to the side of the building with intake openings with features such as deciduous trees, vegetation, and trellises, to cool outdoor air before it enters the building.



3. The *ventilation stack height* [H] is measured from the center of the outlet opening [b] to the center of the inlet opening [a]. A clear path between inlet and outlet openings results in better stack ventilation performance.

4. To determine the inlet opening area [a] follow the steps in Determining the Inlet Opening Area, below. The outlet opening area should be the same size or slightly larger than the inlet opening area.

Determining the Inlet Opening Areas

Next, using a preliminary estimate of the *ventilation shaft height [H]*, trace a horizontal line moving toward the right side of the graph below until it intersects with the curve that best describe your building's classification. From the intersection of the horizontal line and the appropriate curve for your building's heat gain characteristics, move vertically toward the bottom of the graph to find the area of the inlet openings [a] as a percentage of the floor area to be ventilated. The inlet opening area is the total area of all inlet openings, whether incorporating a single opening or number of openings.

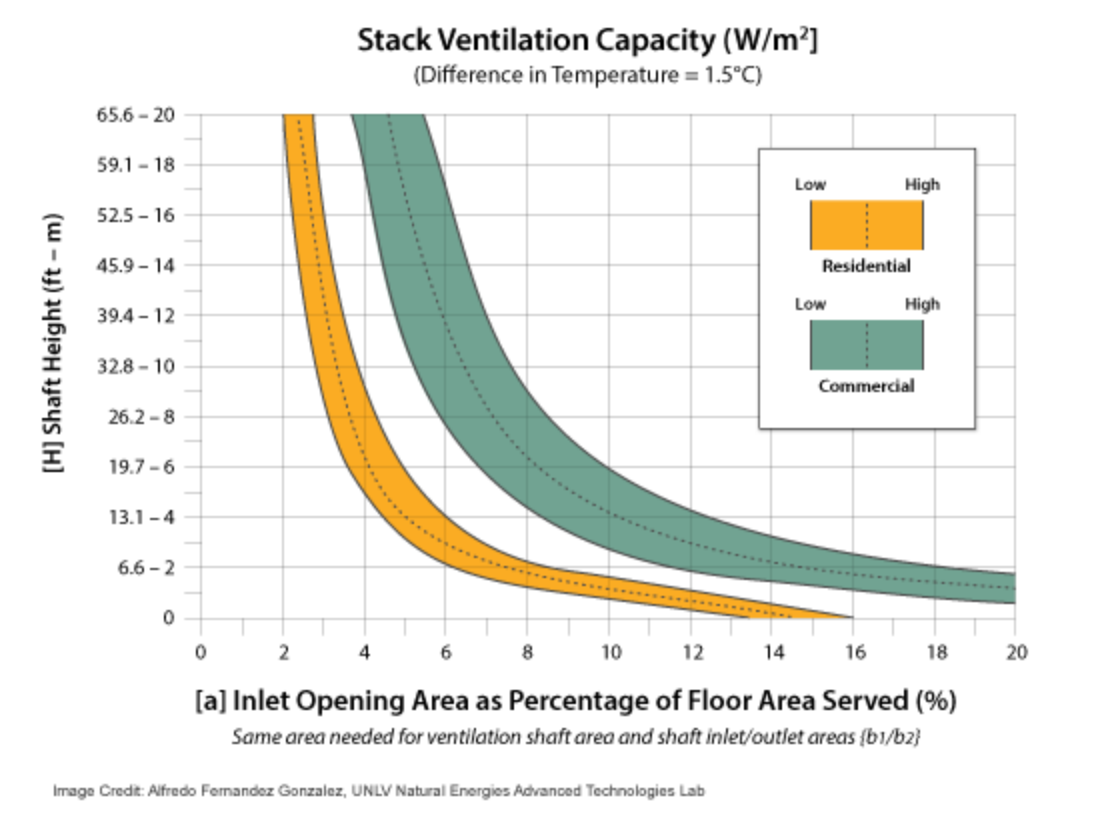


Image Credit: Alfredo Fernandez Gonzalez, UNLV Natural Energies Advanced Technologies Lab

For example, a commercial building with a “Low” Building Classification, and an estimated ventilation stack height of 20 ft (6.1 m), the total area of the inlet opening would equal 6.8% of the total naturally ventilated floor area:

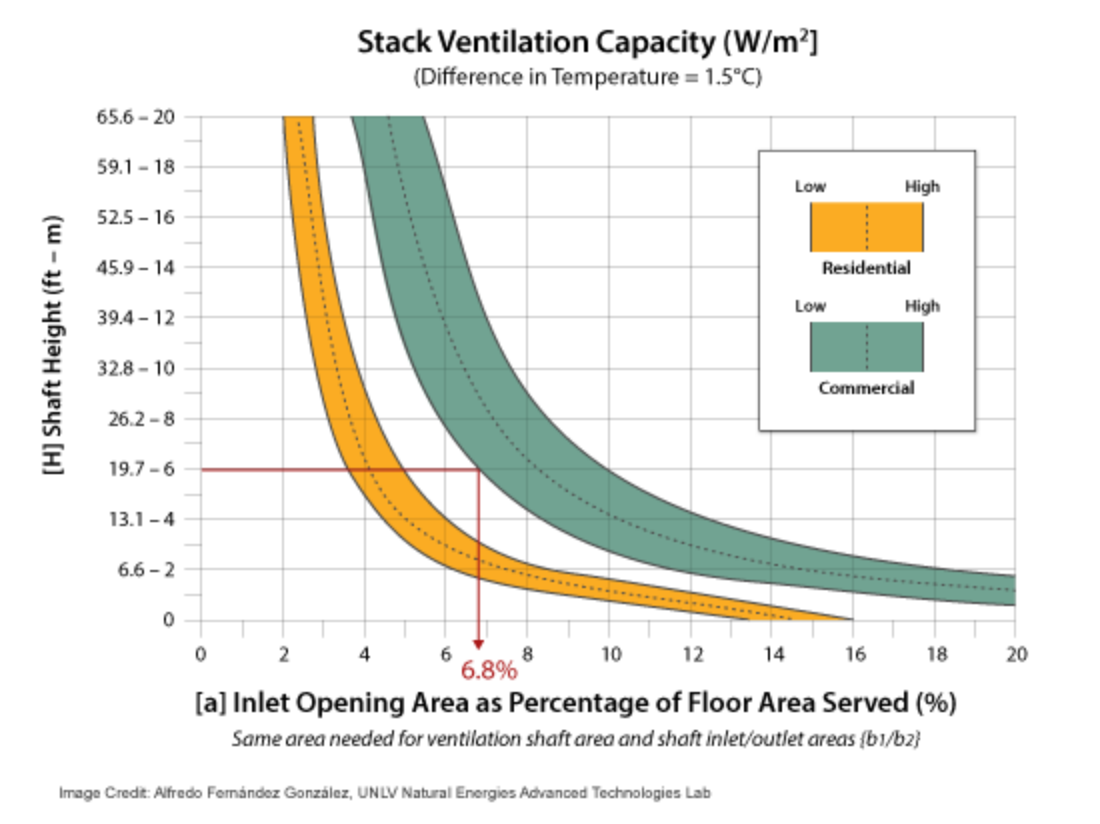


Image Credit: Alfredo Fernández González, UNLV Natural Energies Advanced Technologies Lab