

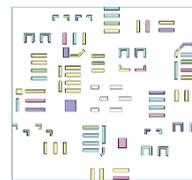
BIM Compatible CFD: Automation for Natural Ventilation

Complying with Green Mark guidelines

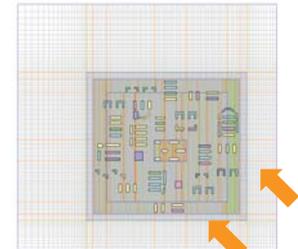
Green Mark Certification

When it comes to CFD analysis of natural ventilation that simulates the detailed behavior of natural flow, it faces much more technical challenges because simulating natural ventilation is as complicated as our nature which is full of uncertainty.

The Building and Construction Authority of Singapore helps in setting those complex conditions adjusted to the country's own circumstances. The organization provides a guideline within Green Mark Certification, a green building rating system of Singapore.



Initial domain boundary

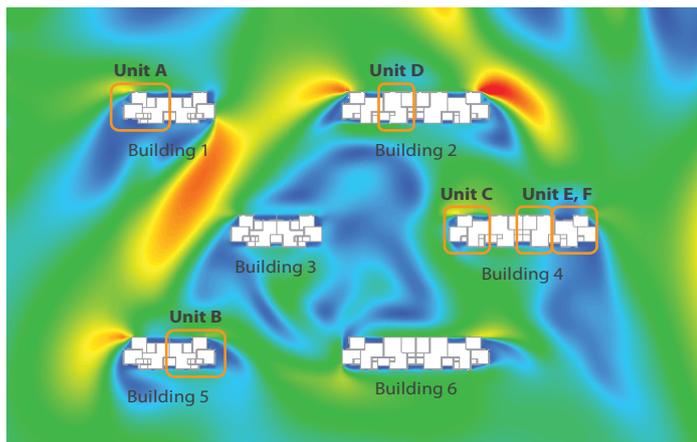


Adjusted domain size and automatic mesh generation

CFD meeting BIM

scSTREAM, the BIM compatible CFD software, is suitable for natural ventilation analysis. It makes many processes much simpler, and streamlines the geometry preparation process by importing a model directly from the BIM software.

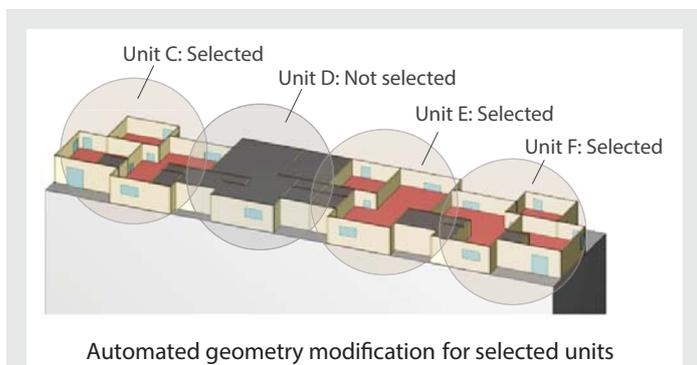
Automation of the CFD analysis lessens the burden even more. Once a user embeds the criteria into the code, the automated system will help define computational boundary settings, computational domain, mesh, geometry attributes and more.



Velocity contours around the development area

| Name | Area (m ²) | Velocity (m/s) |
|---------------------|------------------------|----------------|
| D1_livingroom_plane | 82.92 | 0.1827 |
| D1_bedroom_plane | 31.54 | 0.1498 |
| A1_bedroom2_plane | 28.12 | 0.3148 |
| A1_bedroom1_plane | 34.24 | 0.2188 |
| A1_livingroom_plane | 60.98 | 0.2496 |
| A1_bedroom3_plane | 12.50 | 0.2088 |
| C2_bedroom1_plane | 33.89 | 0.1641 |
| C2_bedroom2_plane | 25.77 | 0.2060 |
| C2_livingroom_plane | 62.39 | 0.1664 |
| E2_bedroom2_plane | 31.20 | 0.1283 |
| F2_livingroom_plane | 62.22 | 0.2513 |

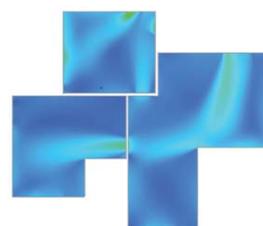
Automatic weighted velocity output sample



Automated geometry modification for selected units

An example is shown in the image above: Building 4 has four units and only three of them will be simulated. (The process of selecting units can be found the Green Mark Certification Appendix C.) Once the user moves those selected units into a separate folder, the automation system will modify the geometry and register the 1.2m planes for post-processor to show velocity on them.

Automation of post-processing



Unit C: Velocity

Once the velocity contour is obtained, the automation takes each plane out, shows velocity contour only on those planes, and finally calculates the area of each plane and yields the area-weighted average velocity. The area-weighted average velocity is then saved as a spreadsheet.

Automated reporting

One will need to gather the information of simulation as a submittal to apply for the certification. After several to numerous changes of settings, it is sometimes very difficult to track all the settings. The automated reporting thus helps summarize them by retrieving information from pre and post-processor and export them into a report.