Arch 463   **ECS**   **Fall 2023**

LabX #3
"Creating and Using a Thermal Model"

For this laboratory exercise you will be expected to complete and document several assignments associated with:

> ♣ basic *SBEED* thermal modeling,
> ♦ parametric analysis,
> ♥ building redesign
> ♠ future climates.

Your Lab Exercise presentation will consist of six parts:
(1) Introduction—climate, site, building type, group members   **[0 pts]**
(2) Thermal zone analysis [Question A]   **[4 pts]**
(3) Parametric study for improved performance [Question B]   **[7 pts]**
(4) Building redesign [Question C]   **[4 pts]**
(5) Future climate consequences [Question D]   **[4 pts]**
(6) Conclusion   **[1 pt]**

[Up to 5 additional points may be awarded based on the quality and clarity of your presentation.]

Investigation questions:
(A) How well do each of your building's thermal zones perform?
(B) What changes in design can improve performance?
(C) What changes will you implement in your redesign?
(D) How successful will your design be in the future?

Use appropriate methods to investigate each of these questions.

You will present your Case Study in lab on **November 2** as a digital slide show, limited to 20 slides and 15 minutes. Points [2 pts] are deducted for exceeding these limits.

Annotate all your digital slides to make your presentation clear to all readers and the grader.

HINT: You can download *SBEED* and view tutorials at <http://www.aud.ucla.edu/energy-design-tools> or from <https://www.sbse.org/resources/sbeed>.

Suggested methods (use those appropriate to your Lab Project):

Question A—How well do each of your building's thermal zones perform?

(1) Use *SBEED* to model each of your building's thermal zones.

HINT You may model the whole building, then split it into zones *SBEED*'s Floor Planner page by designating Non Zone areas OR you may model each zone separately by designating the adjacent thermal zone(s) as Neighbor on the Floor Planner page.

(2) For each zone turn off both the furnace and the air conditioner on *SBEED*'s Heating and Cooling page to see how well your passive strategies work. Report the Indoor Air Temperature from *SBEED*'s 3D Results tab.

(3) For each zone report the Net Site Energy Use from the 3D Results tab.

(4) Critique the performance of each zone.

Question B—What changes in design can improve performance?

(1) Use *Climate Consultant* to make sure you have incorporated appropriate thermal strategies for your climate.

(2)For each zone use *SBEED* parametrically to determine the effect of design changes—one change at a time. Make a change to a scheme then copy it (Library tab) then make one more change, copy it, etc. *SBEED* allows for nine schemes (two that it creates and seven that you may create). .

(3) Add active systems (Solar PV Power and Solar Hot Water) to your design.

(4) Report your findings.

Question C—What changes will you implement in your redesign?

(1) Create your final thermal model in SB*EED* for each zone based on your findings from Question B.

(2) Turn on the furnace and the air conditioner on *SBEED*'s Heating and Cooling page if they are needed to attain comfort.

(3) Report the final performance of your building. How green is it?

Question D—How successful will your design be in the future?

(1) Future climate files are avaialble for 2020, 2050, and 2080. Use *Climate Consult* to compare the future climates to the current climate. Report and comment on the comparison.

(2) Use *SBEED* to model the performance of your thermal zones in 2080. Use the initial design page in the Basic tab to change the climate. Turn off the furnace and air-conditioner to model passive performance. *SBEED* will recalculate the building performance.

(3) Turn the furnace and air-conditioner back on to learn how much energy will be used in 2080. Has energy use for both systems increased?

(4) Report the design changes that you deem necessary to adapt to the future climate.

SBEED Hints

(1) You can use *SBEED*'s Non Zone function on the Floor Planner page to model each of your building's thermal zones. (2) Or you may simply make a separate model for each zone.
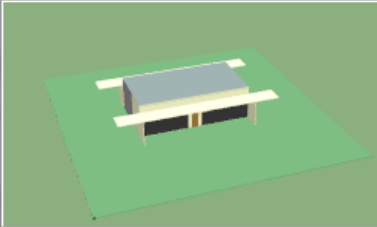
Floor Planner
Scheme 3 : As Is plus mass

Project : **Brillhart House**
Building Type: **SINGLE FAMILY RESIDENCE**
City Location: **Cleveland Hopkins Intl A**

Down   **Ground Floor**   Up

1. Gray area is Non Zone.

N

Fill in your Floor Plan:
Click or Drag to Fill or Erase areas.
Each grid square is 4 x 4 feet.
In your Initial Design Data you specified:
Total Area was 1,500 sq. ft.
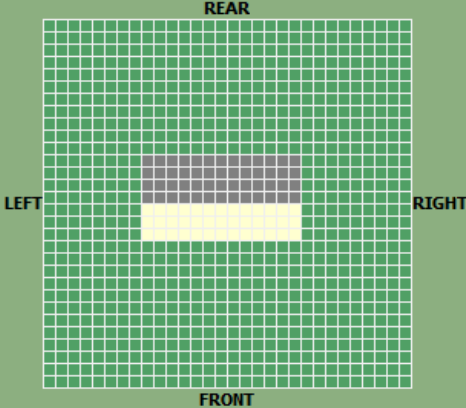Number of stories was 1.
In this Current Plan:
Total Floor Area is 636 sq. ft.
Number of stories is 1.
Area of this floor is 636.00 sq. ft.
Overall Width of this plan is: 52 feet.
Overall Depth of this plan is: 12 feet.
Coverage of overall Width x Depth is 102%.

Add Top Story   Remove Top Story

REAR

LEFT   RIGHT

FRONT

Erase | Building | Non Zone | Porch | Eaves | Garage | Paving | Trees | Neighbor

Recalculate   Back   Next

When you use the non-zone tool, you'll be prompted to assign loads properly...it's very important to do so.

Zone Tool   X

⚠ This allows you to create different Zones within one floorplan, with different HVAC systems, or different components, or differenc architectual definition in each Zone. You must preserve your Original Scheme, only make a copy of it for each new Zone. Click the "Non-Zone" and gray-out all the areas that are NOT part of the current Zone. The sum of the areas of all Zones must be equal to the area of the Original Scheme. Check the Window Design screen to be sure it only contains the windows assigned to this Zone. To avoid having double the internal loads, check the Appliance screen and cut back to only the loads assigned to this Zone. Check Thermal Mass to be sure it only contains mass elements assigned to this zone, and be sure the total number of occupants are divided correctly between Zones. Check also that the Water Heater, Solar PV Power and Solar Hot Water collectors are divided correctly between zones.

OK