

ROOM ENERGY MODELING - PART 2

OKLAHOMA CITY, OKLAHOMA

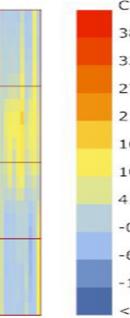
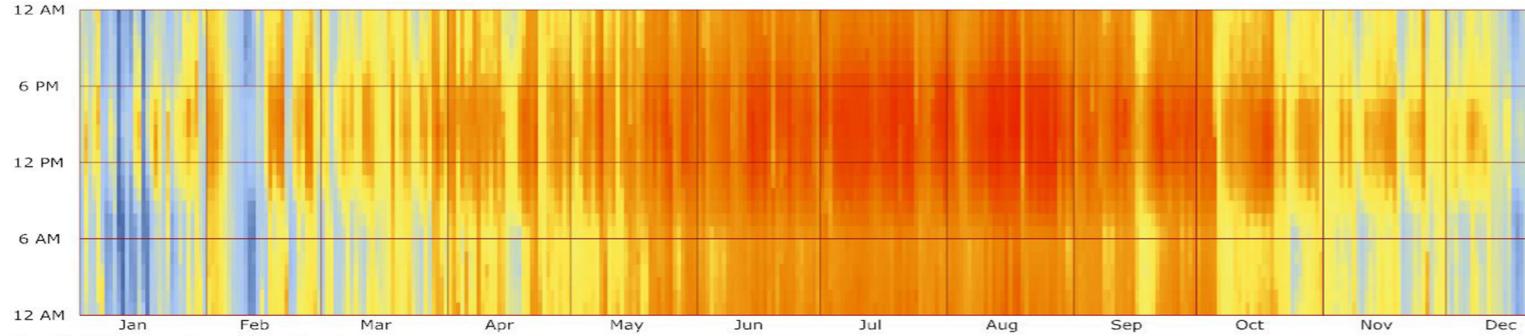


JUAN D. GUARIN

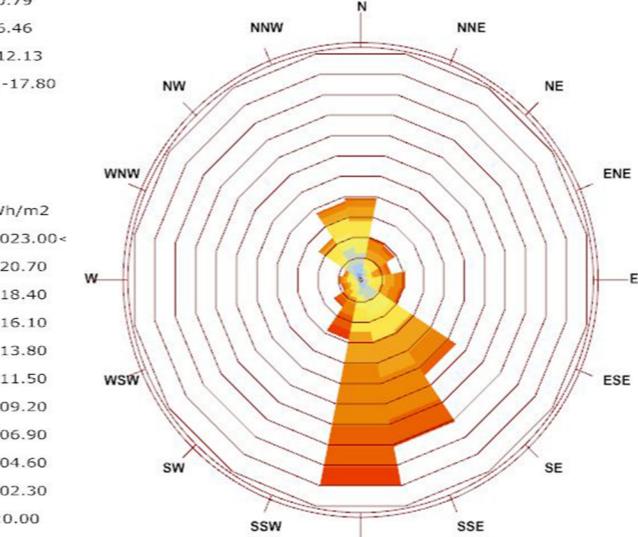
WEATHER ANALYSIS

OKLAHOMA CITY: WEATHER CONDITIONS

ANNUAL DRY BULB TEMPERATURE

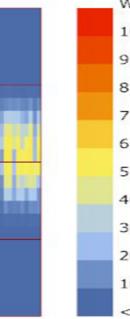
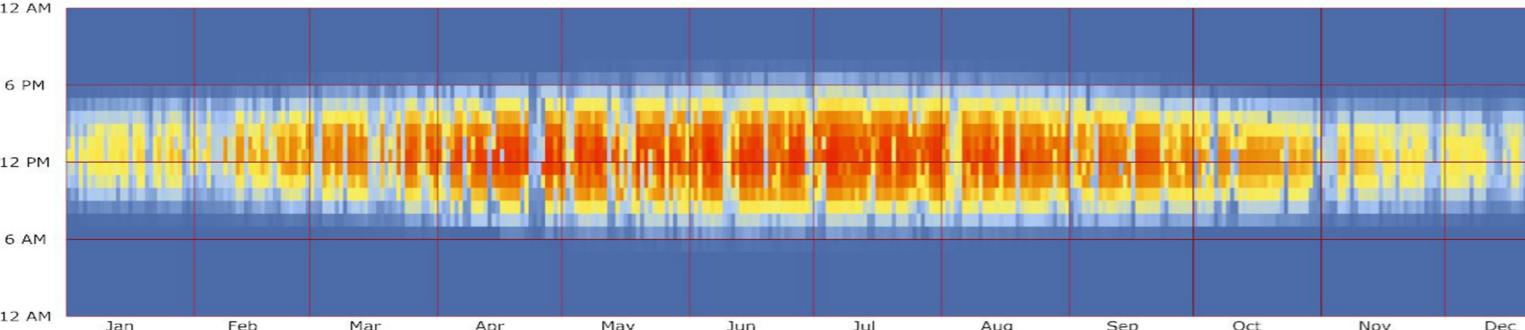


WIND ROSE TEMPERATURE

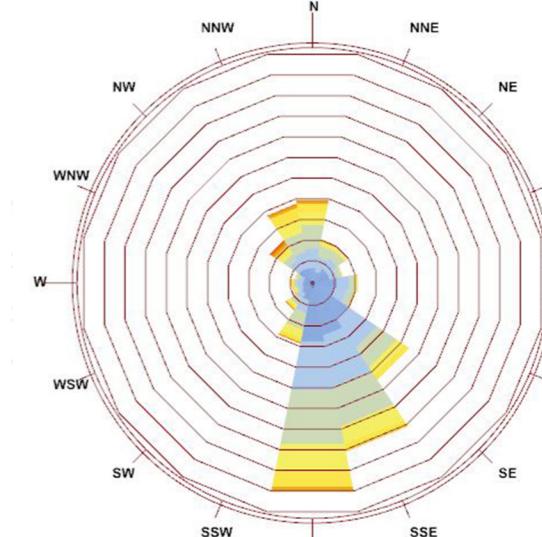


Wind-Rose
Oklahoma City Will Rogers Wor_OK_USA
1 JAN 1:00 - 31 DEC 24:00
Hourly Data: Dry Bulb Temperature (C)
Calm for 2.16% of the time = 189 hours.
Each closed polyline shows frequency of 1.9%. = 165 hours.

ANNUAL HORIZONTAL RADIATION

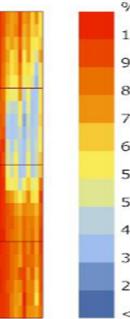
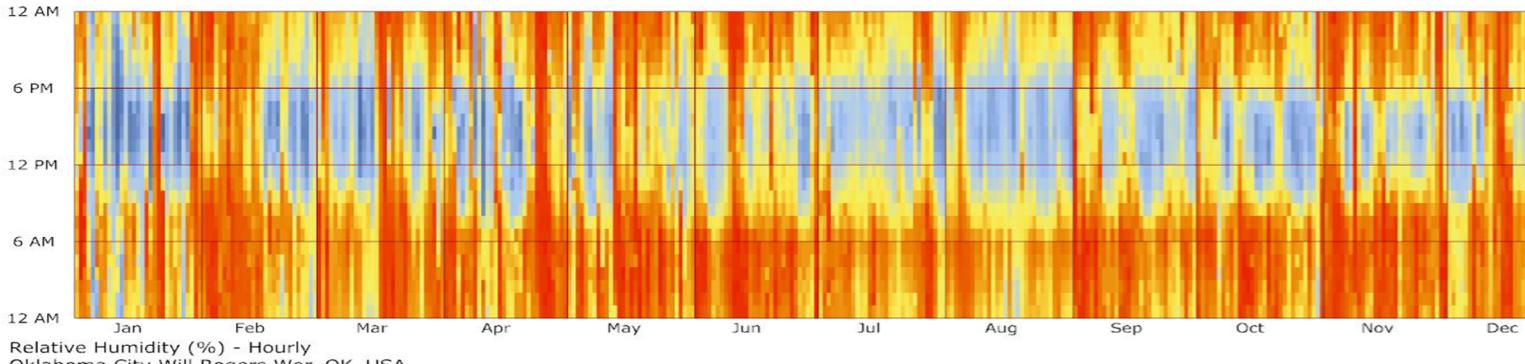


WIND ROSE SPEED



Wind-Rose
Oklahoma City Will Rogers Wor_OK_USA
1 JAN 1:00 - 31 DEC 24:00
Hourly Data: Wind Speed (m/s)
Calm for 2.16% of the time = 189 hours.
Each closed polyline shows frequency of 1.9%. = 165 hours.

ANNUAL RELATIVE HUMIDITY



WEATHER CONCLUSIONS

- THE OKLAHOMA CITY REGION IS A PLACE WITH A CONSIDERABLY HIGH RELATIVE HUMIDITY, SPECIALLY, DURING MORNING AND NIGHT HOURS. THIS CAN AFFECT THE TEMPERATURE PERCEPTION, MAKING THE COLD DAYS SEEM COLDER AND THE HOT DAYS SEEM HOTTER.

- EVENTHOUGH WINDS ARE MAINLY PREDOMINANT FROM THE NORTHERN AND SOUTHERN DIRECTION, THEY CAN REACH EXTREMELY HIGH SPEEDS OF UP TO 18 M/S. THIS CAN ALSO AFFECT THE TEMPERATURE PERCEPTION ESPECIALLY DURING WINTER AND SPRING, WHERE WINDS ARE THE FASTEST.

- “TORNADO SEASON” IN OKLAHOMA IS CONSIDERED TO GO FROM MARCH 15 TO JUNE 15, WHICH IS THE PERIOD OF TIME WITH THE HIGHEST WIND SPEEDS AND THE HIGHEST RELATIVE HUMIDITY IN THE YEAR.

- AFTER TAKING INTO CONSIDERATION THESE CONCLUSIONS AND ANALIZING ALL THE CHARTS ABOVE, MULTIPLE DESIGNS FOR THE ROOM IN OKLAHOMA CITY WHERE TESTED IN ORDER TO HAVE AS MUCH THERMAL COMFORT AS POSSIBLE THROUGHOUT THE YEAR.

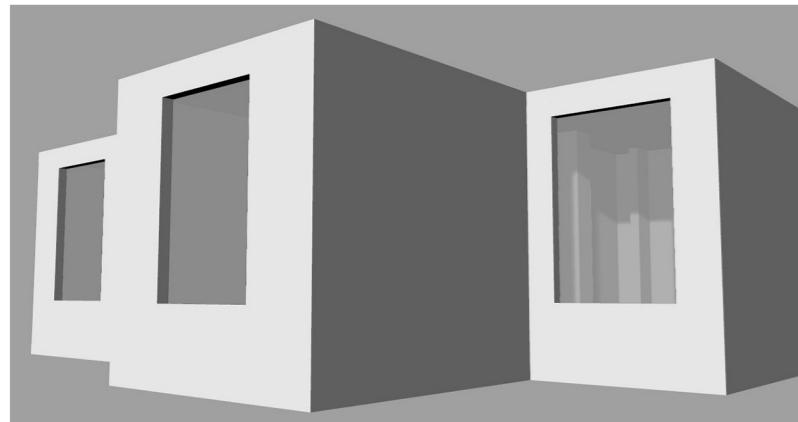
BASELINE: APARTMENT WITH ACTUAL CONDITIONS

WIND CONDITIONS:

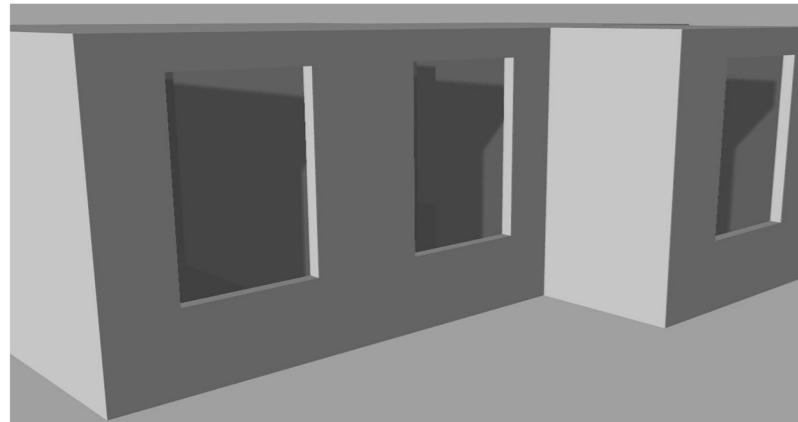
-MINIMUM INDOOR TEMPERATURE FOR NATURAL VENTILATION: 24°C
-MAXIMUM INDOOR TEMPERATURE FOR NATURAL VENTILATION: 27°C

-MINIMUM OUTDOOR TEMPERATURE FOR NATURAL VENTILATION: 25°C
-MAXIMUM OUTDOOR TEMPERATURE FOR NATURAL VENTILATION: 30°C

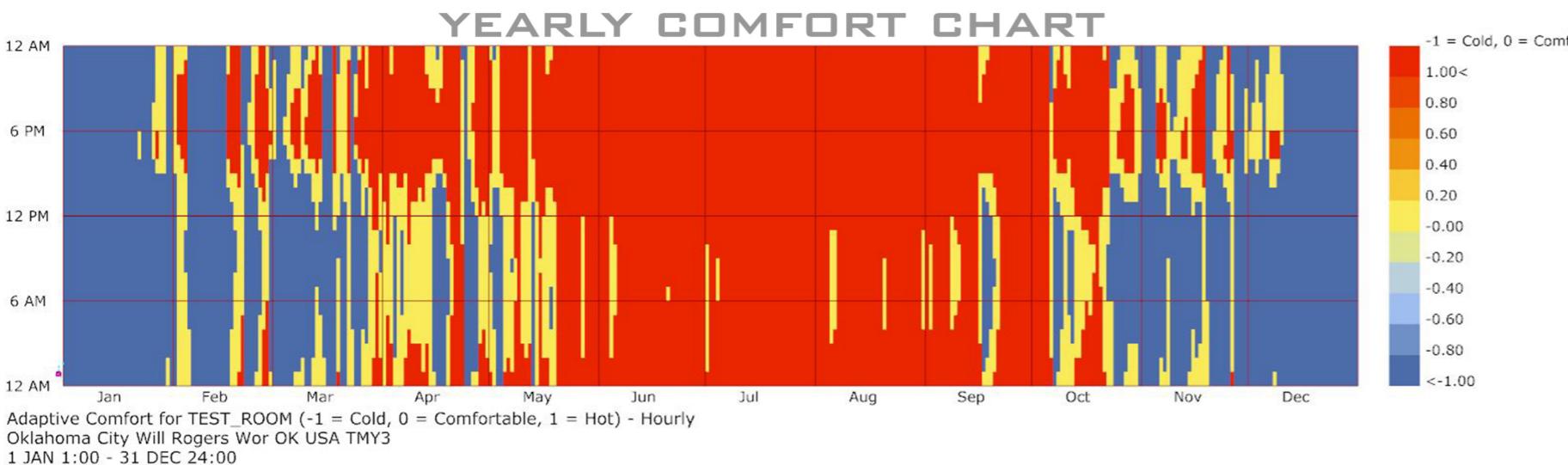
BASELINE: ACTUAL CONDITIONS



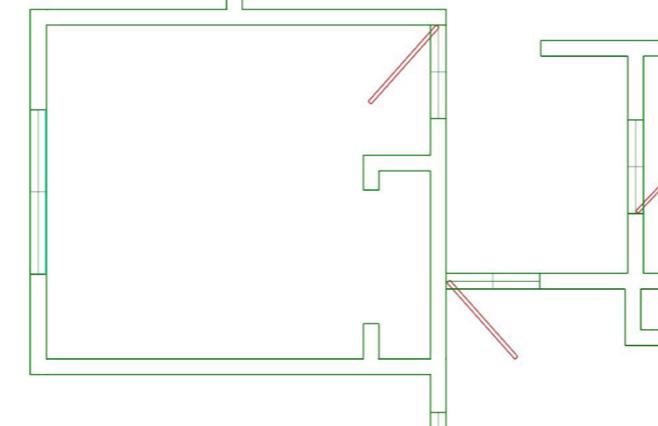
PERSPECTIVE 1



PERSPECTIVE 2

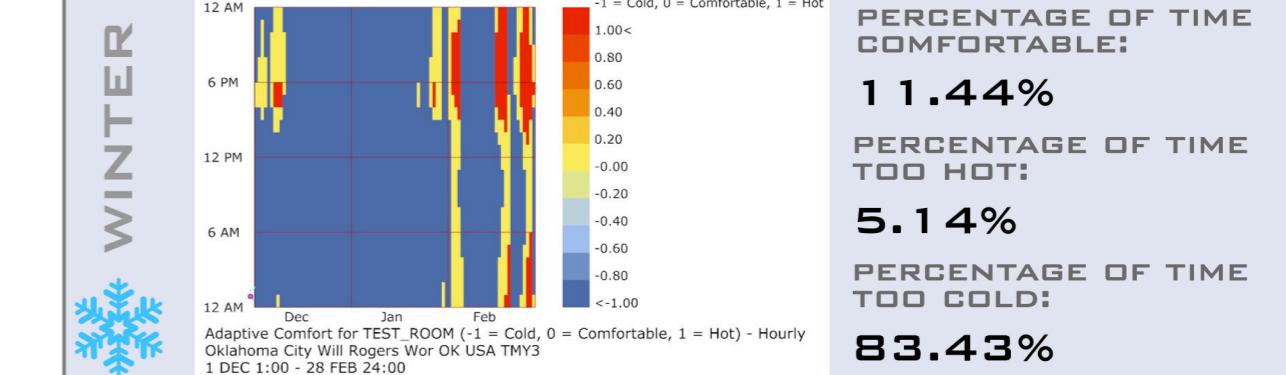


FLOOR PLAN



YEARLY COMFORT RESULTS

PERCENTAGE OF TIME COMFORTABLE	15.87%
PERCENTAGE OF TIME TOO HOT	48.68%
PERCENTAGE OF TIME TOO COLD	35.45%



PERCENTAGE OF TIME
COMFORTABLE:

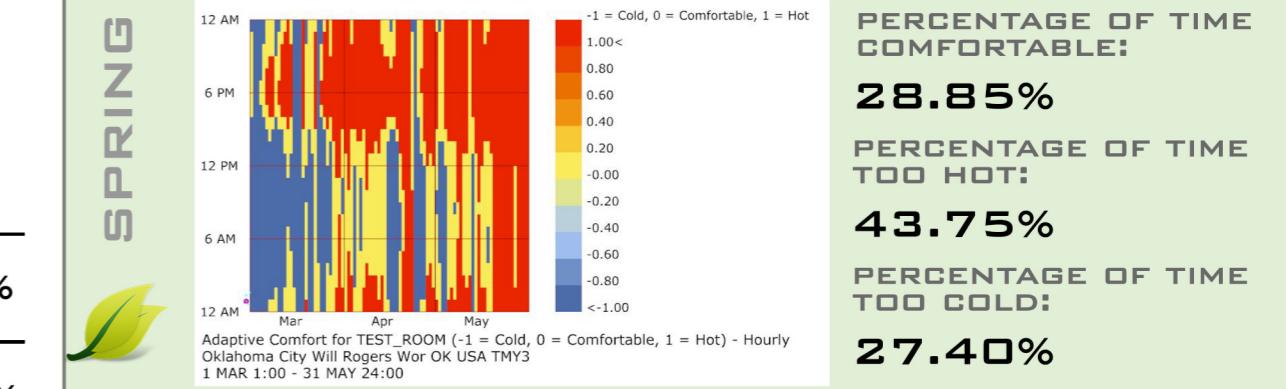
11.44%

PERCENTAGE OF TIME
TOO HOT:

5.14%

PERCENTAGE OF TIME
TOO COLD:

83.43%



PERCENTAGE OF TIME
COMFORTABLE:

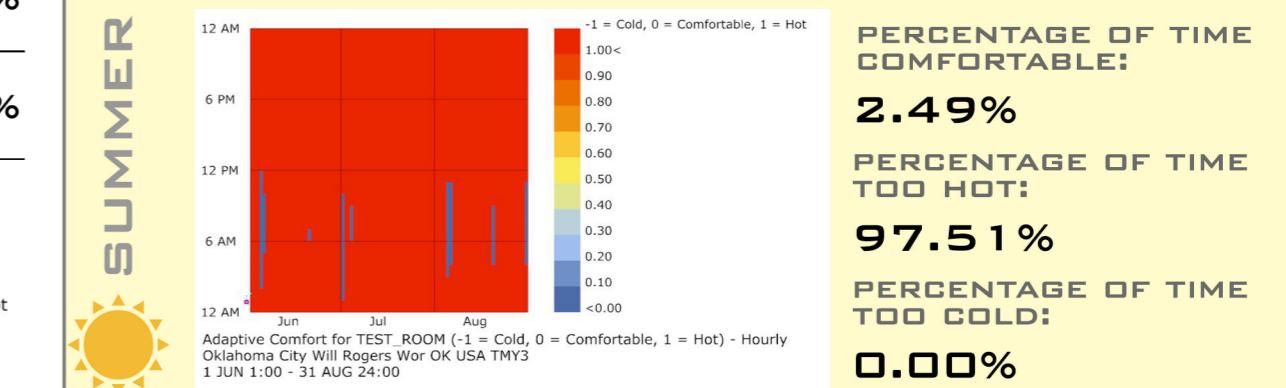
28.85%

PERCENTAGE OF TIME
TOO HOT:

43.75%

PERCENTAGE OF TIME
TOO COLD:

27.40%



PERCENTAGE OF TIME
COMFORTABLE:

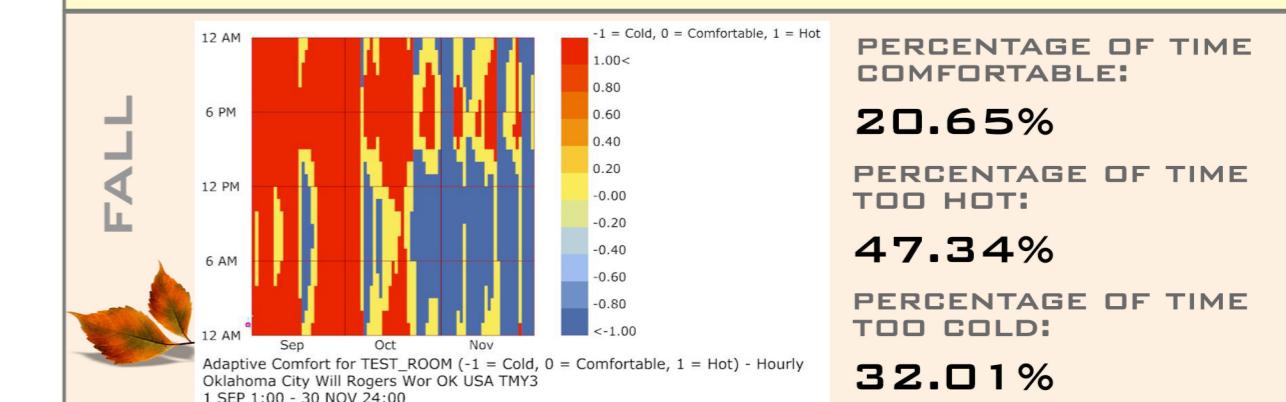
2.49%

PERCENTAGE OF TIME
TOO HOT:

97.51%

PERCENTAGE OF TIME
TOO COLD:

0.00%



PERCENTAGE OF TIME
COMFORTABLE:

20.65%

PERCENTAGE OF TIME
TOO HOT:

47.34%

PERCENTAGE OF TIME
TOO COLD:

32.01%

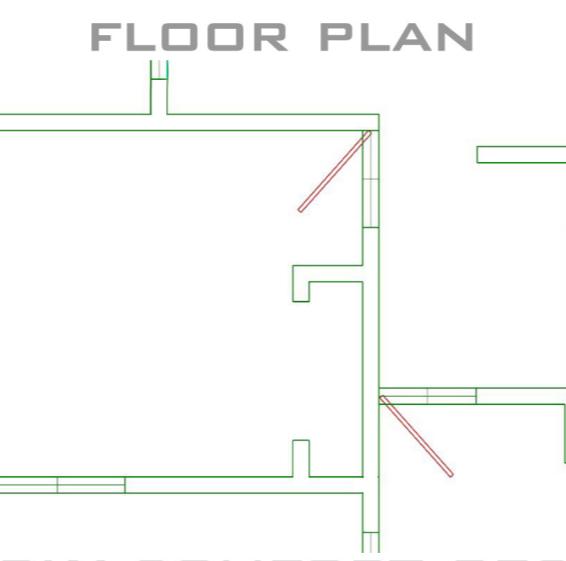
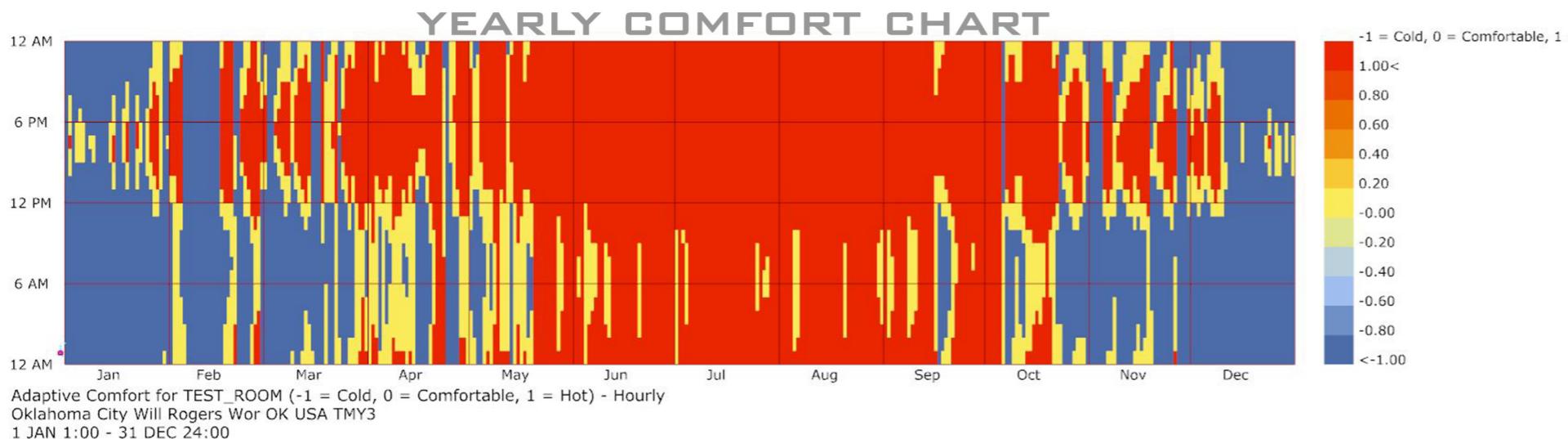
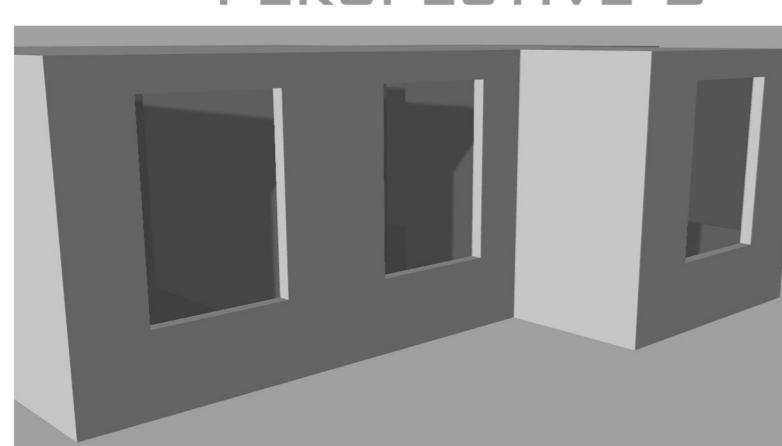
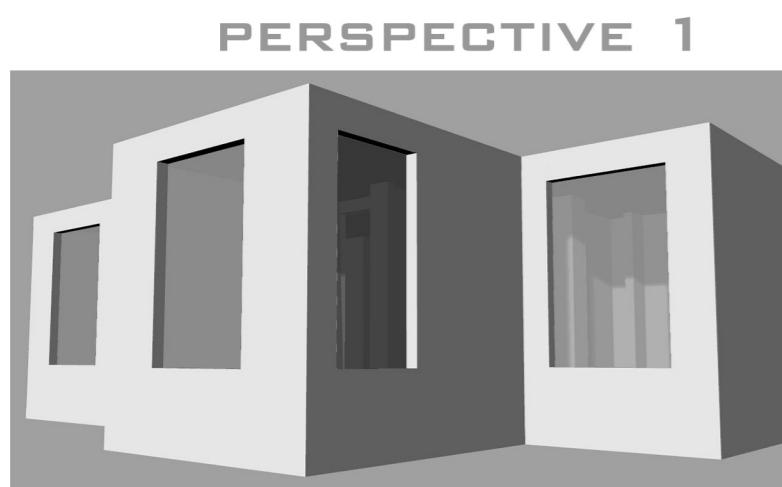
CASE 1: ADDITIONAL SOUTH WINDOW

WIND CONDITIONS:

-MINIMUM INDOOR TEMPERATURE FOR NATURAL VENTILATION: 24°C
-MAXIMUM INDOOR TEMPERATURE FOR NATURAL VENTILATION: 27°C

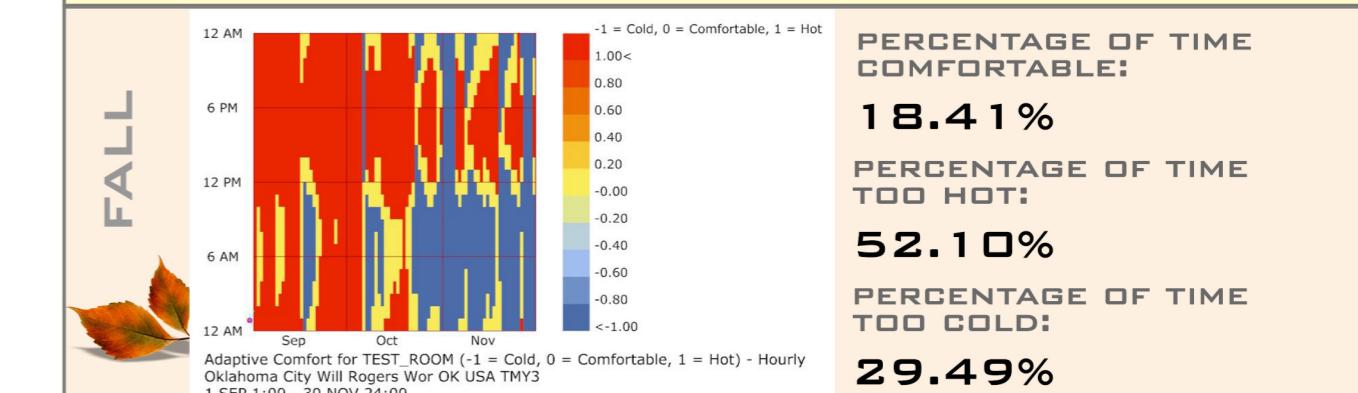
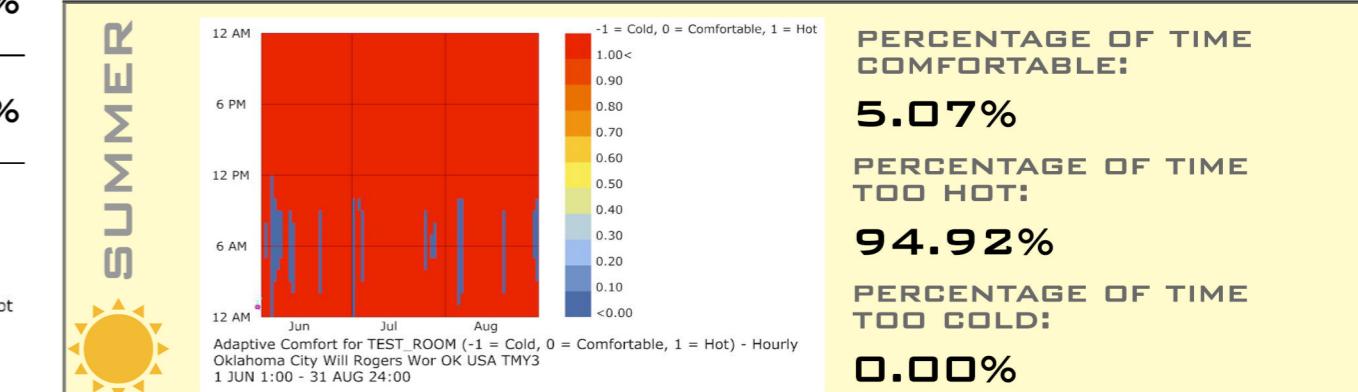
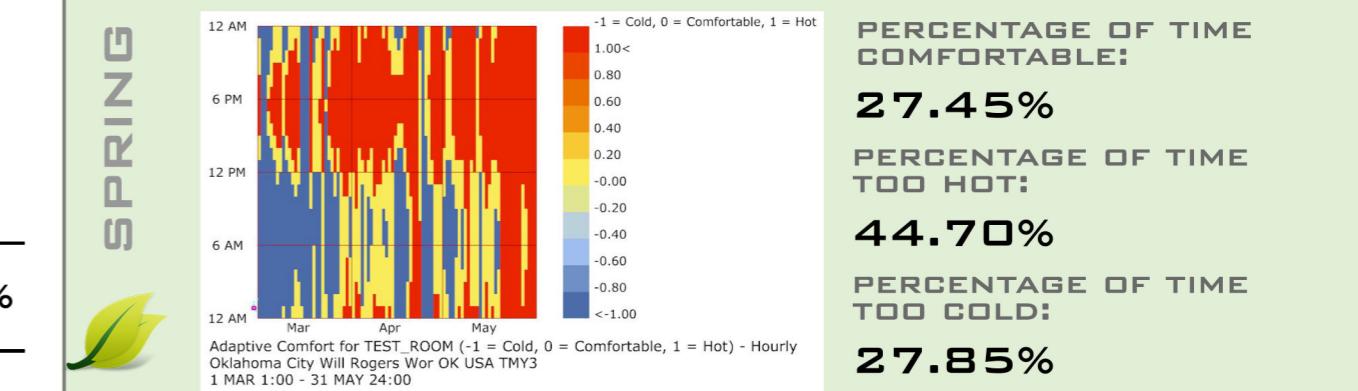
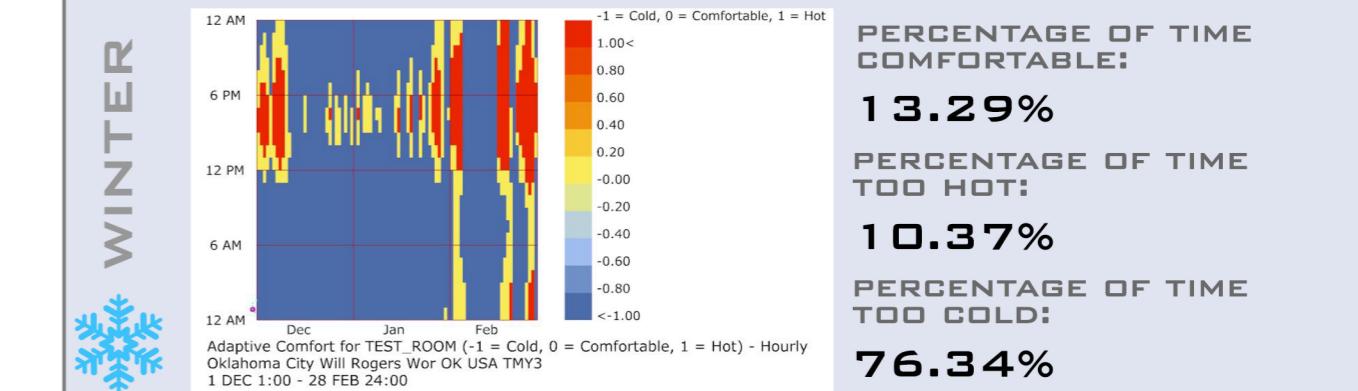
-MINIMUM OUTDOOR TEMPERATURE FOR NATURAL VENTILATION: 25°C
-MAXIMUM OUTDOOR TEMPERATURE FOR NATURAL VENTILATION: 30°C

CASE 1: ADDITIONAL SOUTH WINDOW



YEARLY COMFORT RESULTS

PERCENTAGE OF TIME COMFORTABLE	16.06%
PERCENTAGE OF TIME TOO HOT	50.74%
PERCENTAGE OF TIME TOO COLD	33.19%



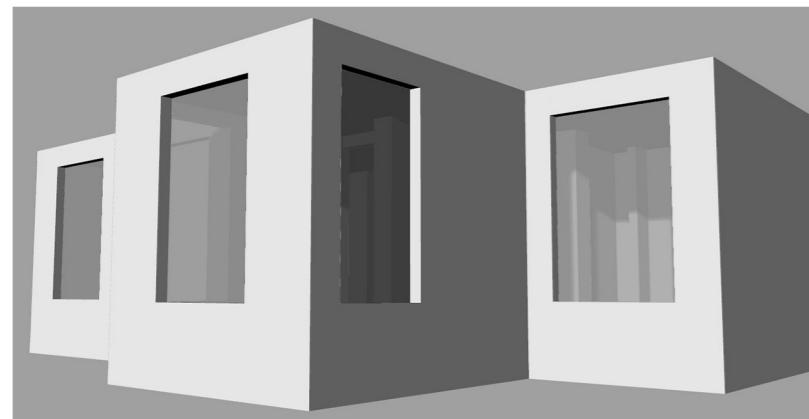
CASE 2: ADDITIONAL SOUTH + NORTH WINDOW

WIND CONDITIONS:

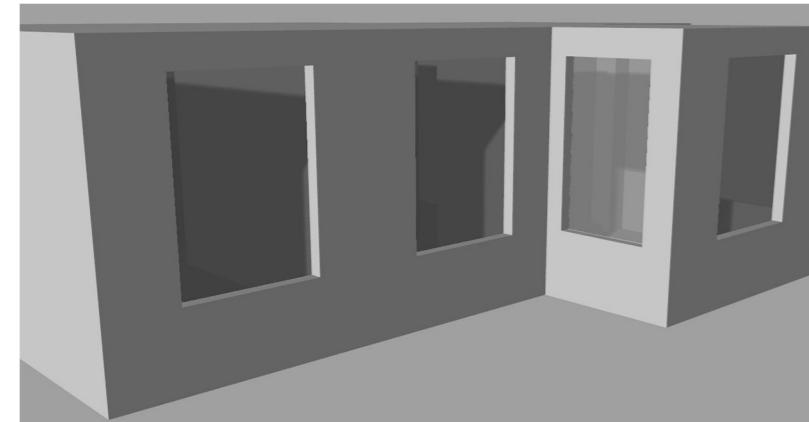
-MINIMUM INDOOR TEMPERATURE FOR NATURAL VENTILATION: 24°C
-MAXIMUM INDOOR TEMPERATURE FOR NATURAL VENTILATION: 27°C

-MINIMUM OUTDOOR TEMPERATURE FOR NATURAL VENTILATION: 25°C
-MAXIMUM OUTDOOR TEMPERATURE FOR NATURAL VENTILATION: 30°C

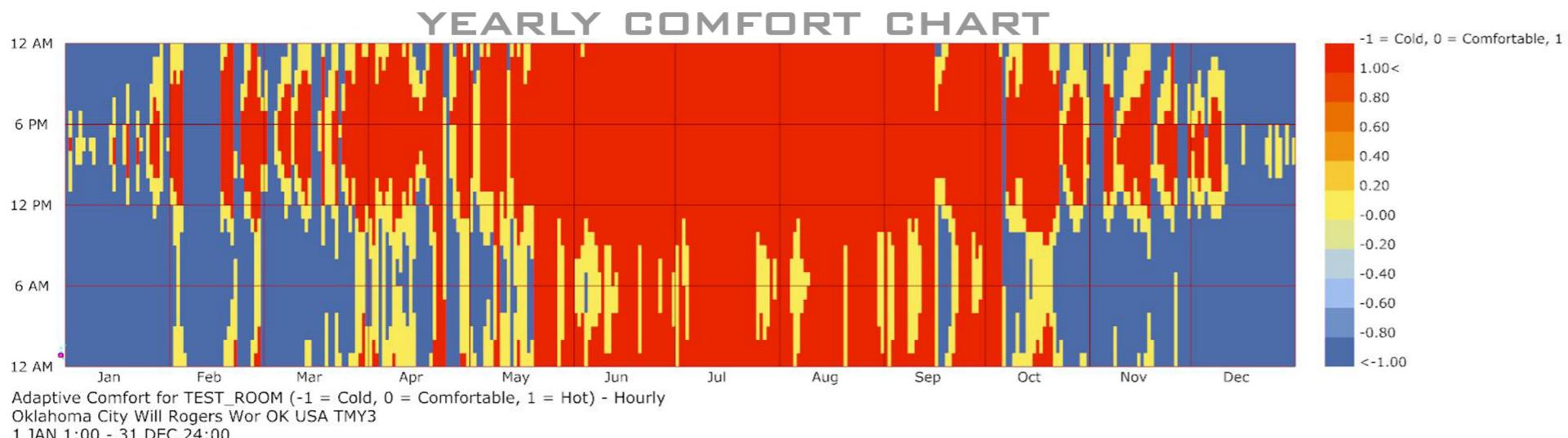
CASE 2: ADDITIONAL SOUTH+NORTH WINDOW



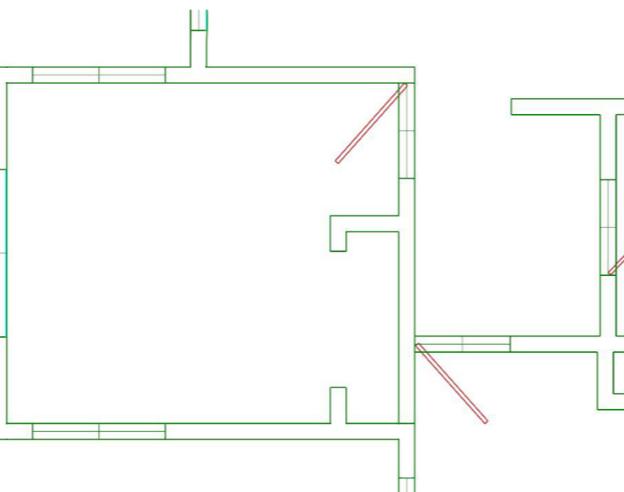
PERSPECTIVE 1



PERSPECTIVE 2



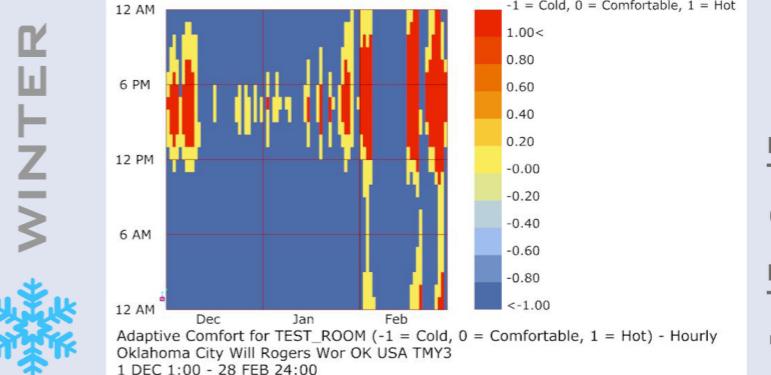
FLOOR PLAN



YEARLY COMFORT RESULTS

PERCENTAGE OF TIME COMFORTABLE	16.18%
PERCENTAGE OF TIME TOO HOT	48.32%
PERCENTAGE OF TIME TOO COLD	35.50%

WINTER



PERCENTAGE OF TIME COMFORTABLE:

11.62%

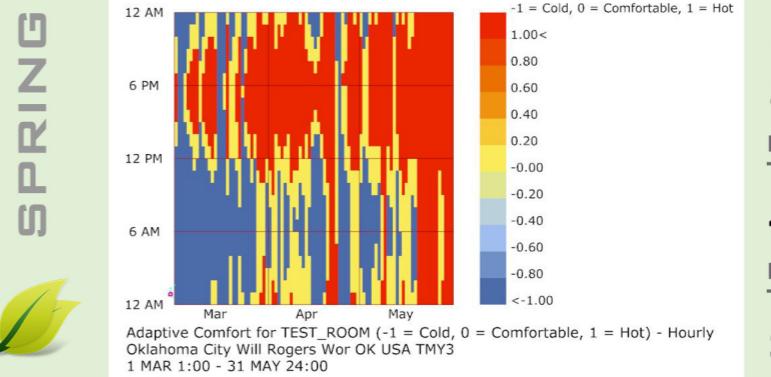
PERCENTAGE OF TIME TOO HOT:

9.63%

PERCENTAGE OF TIME TOO COLD:

78.75%

SPRING



PERCENTAGE OF TIME COMFORTABLE:

25.50%

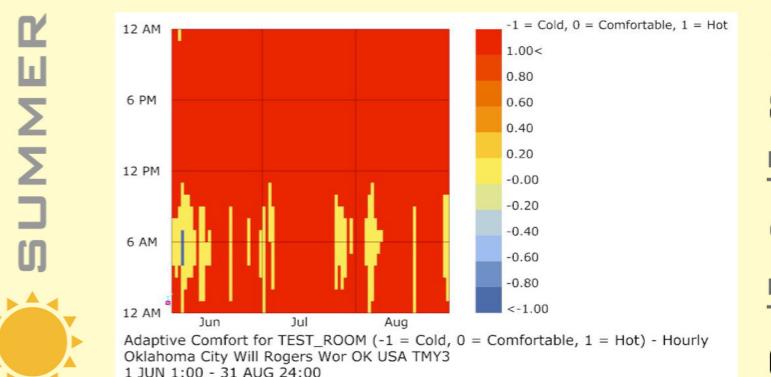
PERCENTAGE OF TIME TOO HOT:

43.16%

PERCENTAGE OF TIME TOO COLD:

31.34%

SUMMER



PERCENTAGE OF TIME COMFORTABLE:

8.56%

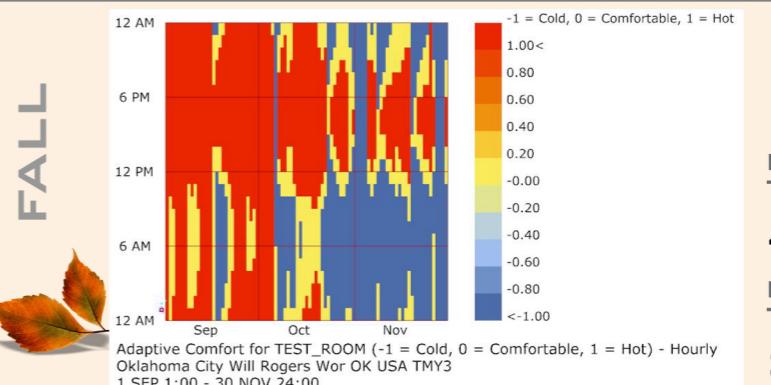
PERCENTAGE OF TIME TOO HOT:

91.30%

PERCENTAGE OF TIME TOO COLD:

0.14%

FALL



PERCENTAGE OF TIME COMFORTABLE:

18.96%

PERCENTAGE OF TIME TOO HOT:

48.35%

PERCENTAGE OF TIME TOO COLD:

32.69%

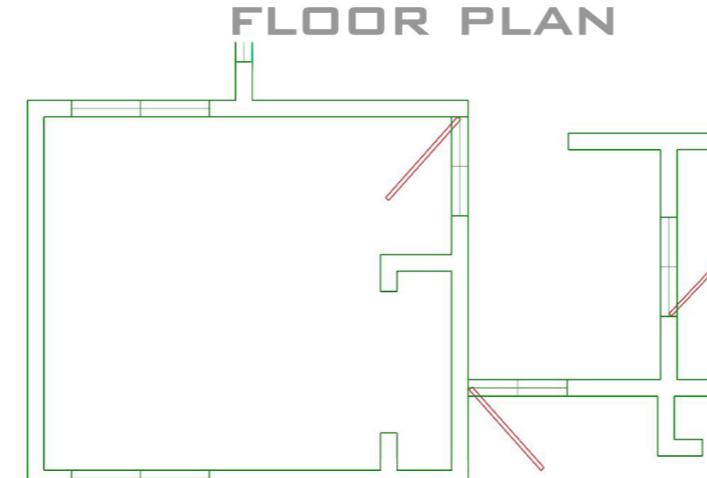
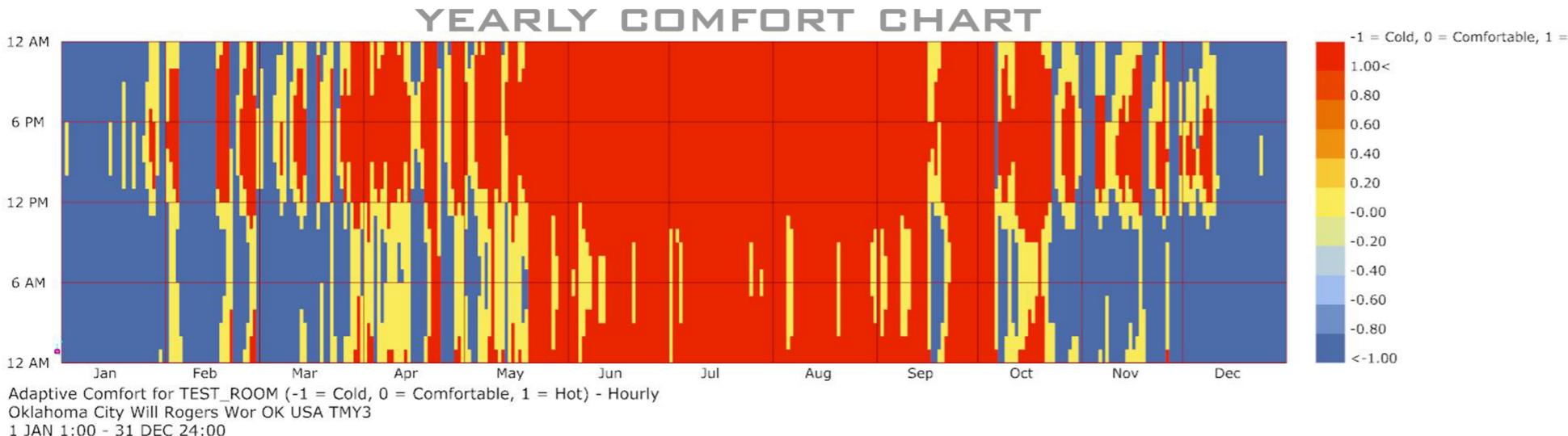
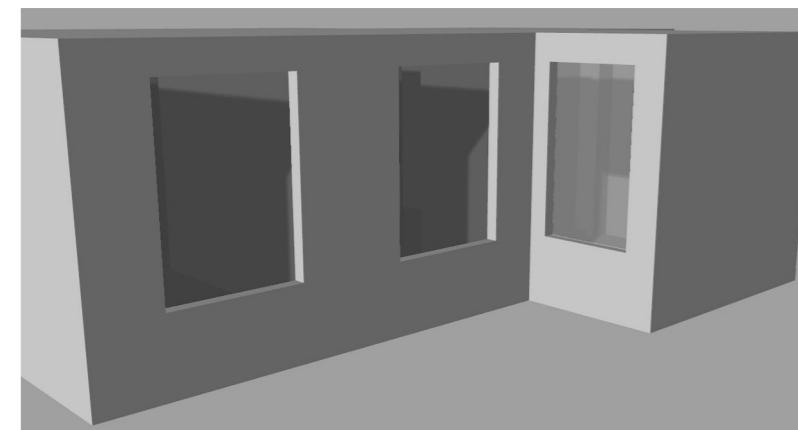
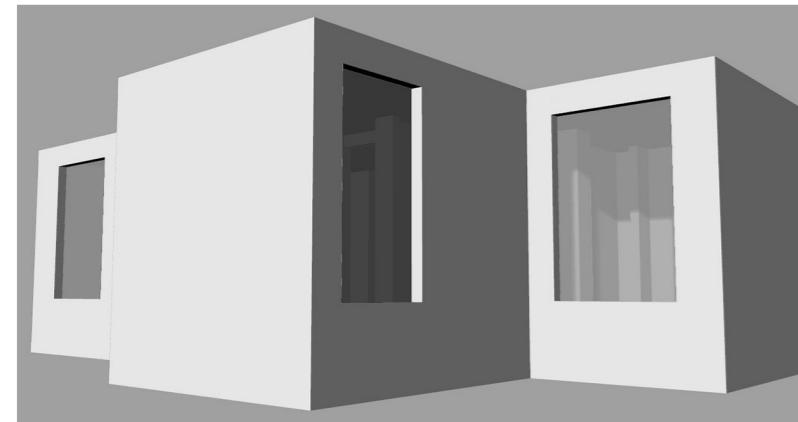
CASE 3: ONLY SOUTH + NORTH WINDOW

WIND CONDITIONS:

-MINIMUM INDOOR TEMPERATURE FOR NATURAL VENTILATION: 24°C
-MAXIMUM INDOOR TEMPERATURE FOR NATURAL VENTILATION: 27°C

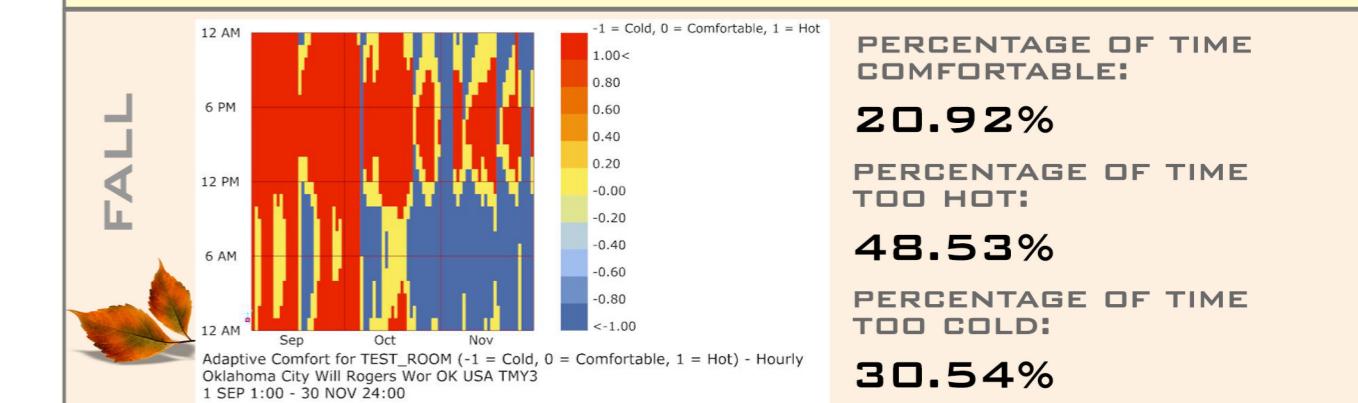
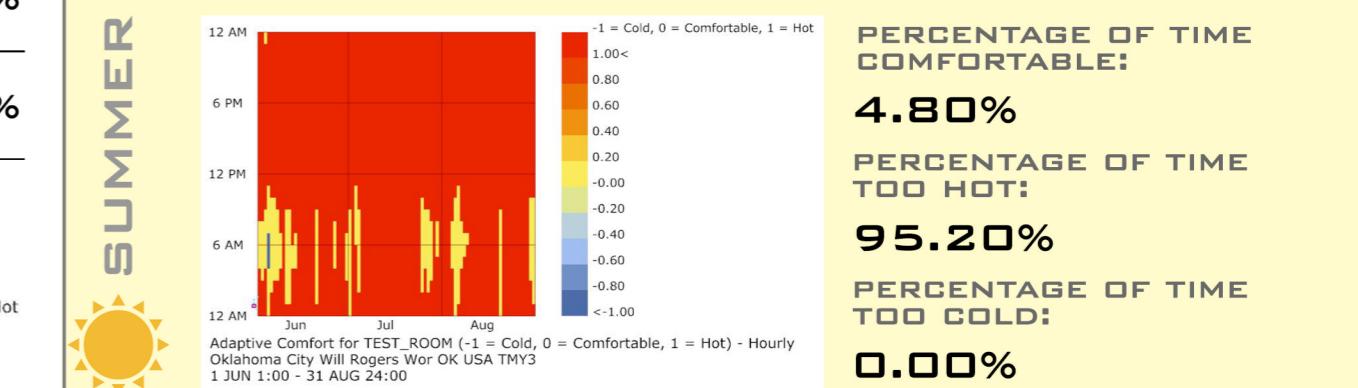
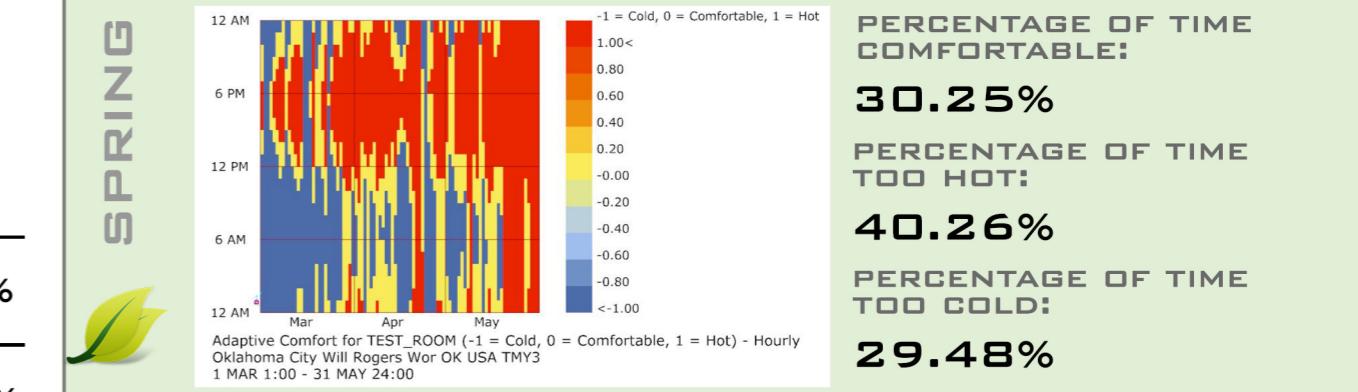
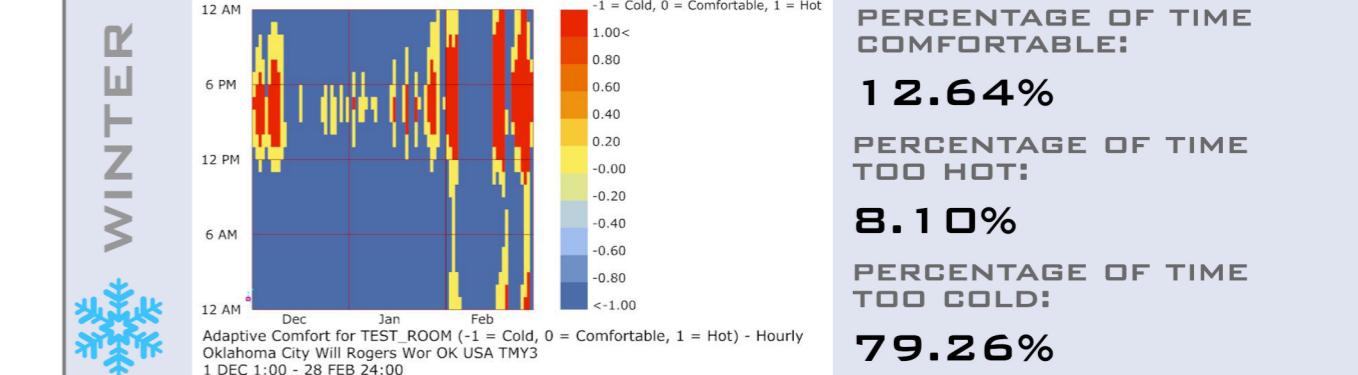
-MINIMUM OUTDOOR TEMPERATURE FOR NATURAL VENTILATION: 25°C
-MAXIMUM OUTDOOR TEMPERATURE FOR NATURAL VENTILATION: 30°C

CASE 3: ONLY SOUTH+NORTH WINDOWS



YEARLY COMFORT RESULTS

PERCENTAGE OF TIME COMFORTABLE	17.17%
PERCENTAGE OF TIME TOO HOT	48.24%
PERCENTAGE OF TIME TOO COLD	34.59%



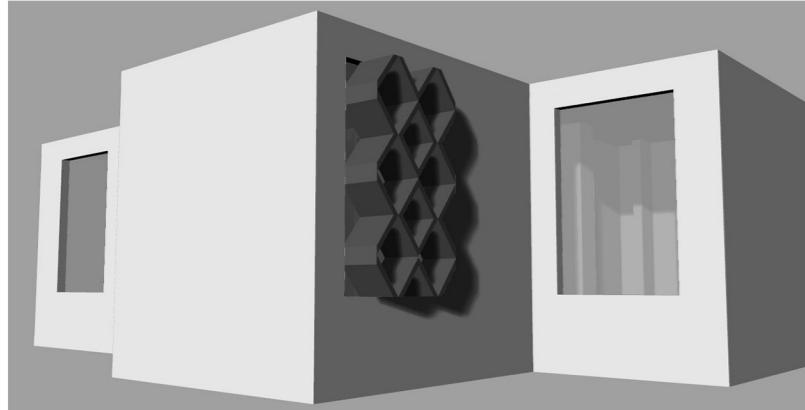
CASE 4: ONLY SOUTH + NORTH WINDOW WITH SHADING SYSTEM

WIND CONDITIONS:

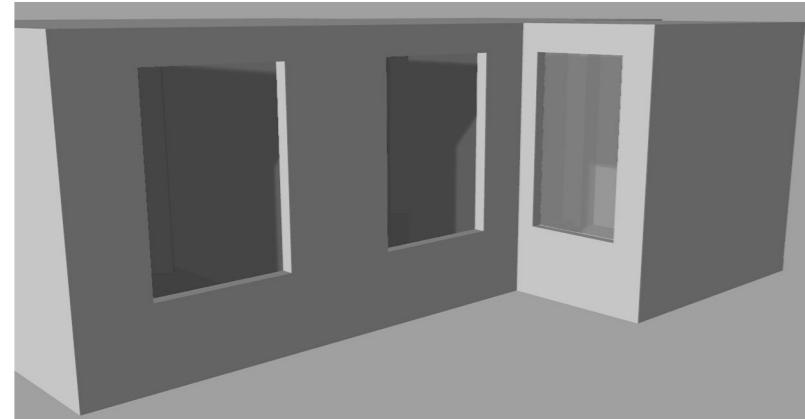
-MINIMUM INDOOR TEMPERATURE FOR NATURAL VENTILATION: 24°C
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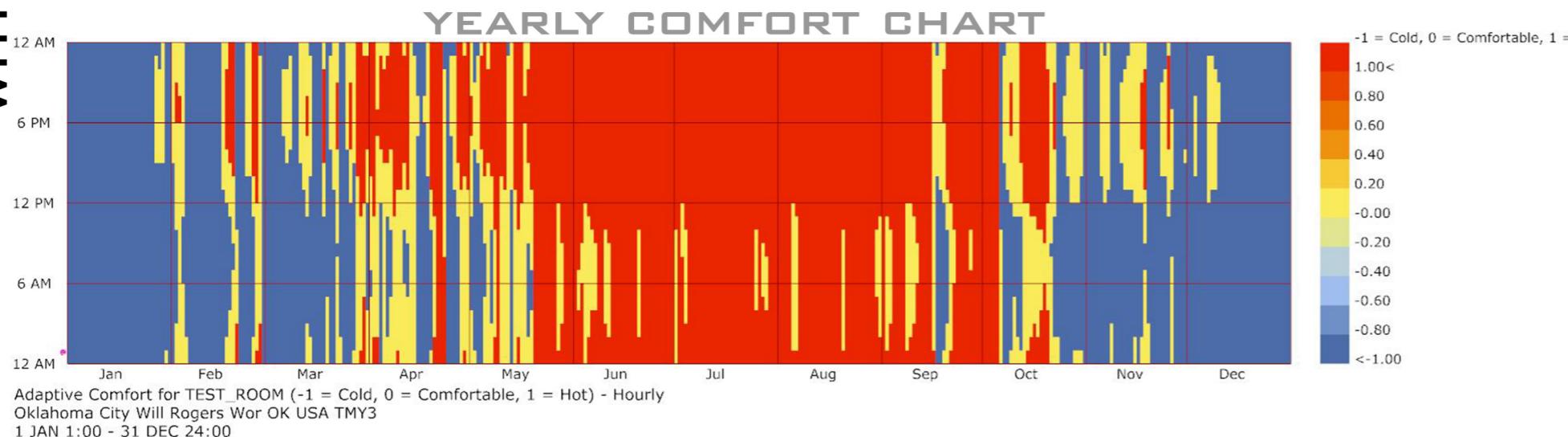
CASE 4: ONLY SOUTH SHADING + NORTH WINDOW SYSTEM



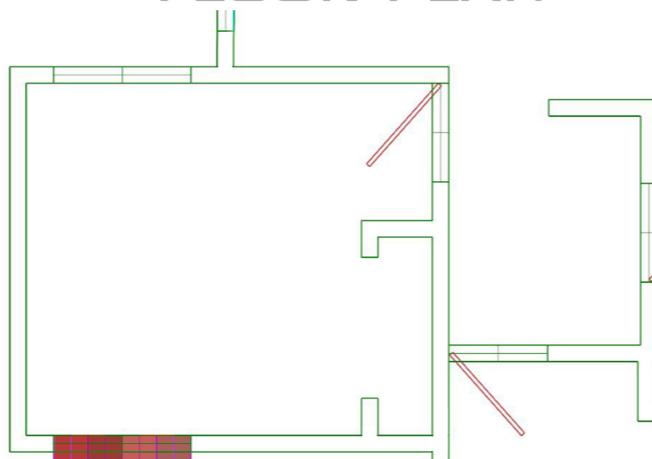
PERSPECTIVE 1



PERSPECTIVE 2

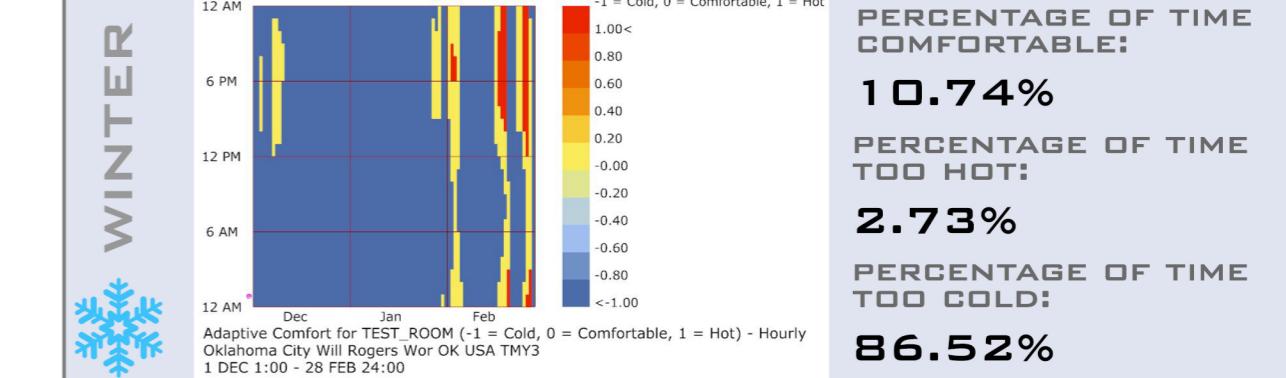


FLOOR PLAN



YEARLY COMFORT RESULTS

PERCENTAGE OF TIME COMFORTABLE	18.08%
PERCENTAGE OF TIME TOO HOT	42.15%
PERCENTAGE OF TIME TOO COLD	39.76%



PERCENTAGE OF TIME COMFORTABLE:

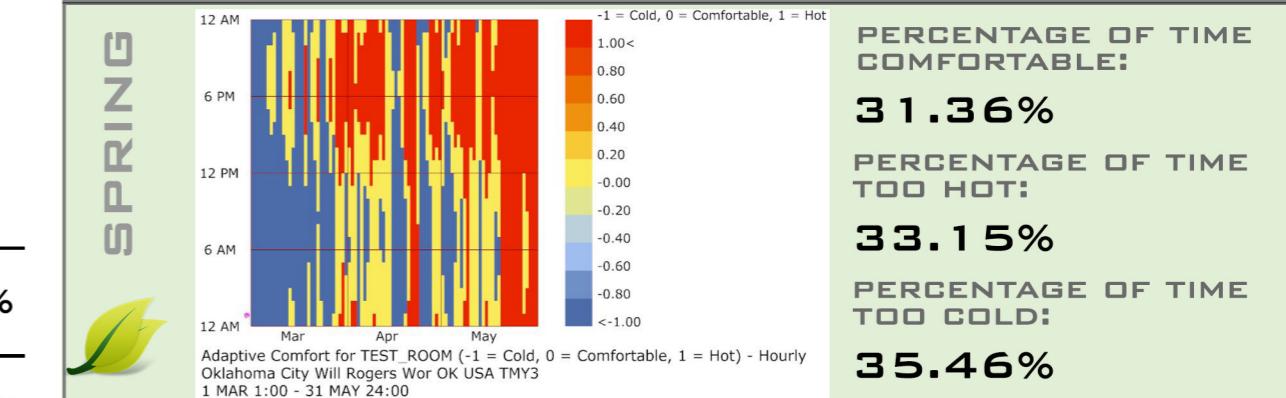
10.74%

PERCENTAGE OF TIME TOO HOT:

2.73%

PERCENTAGE OF TIME TOO COLD:

86.52%



PERCENTAGE OF TIME COMFORTABLE:

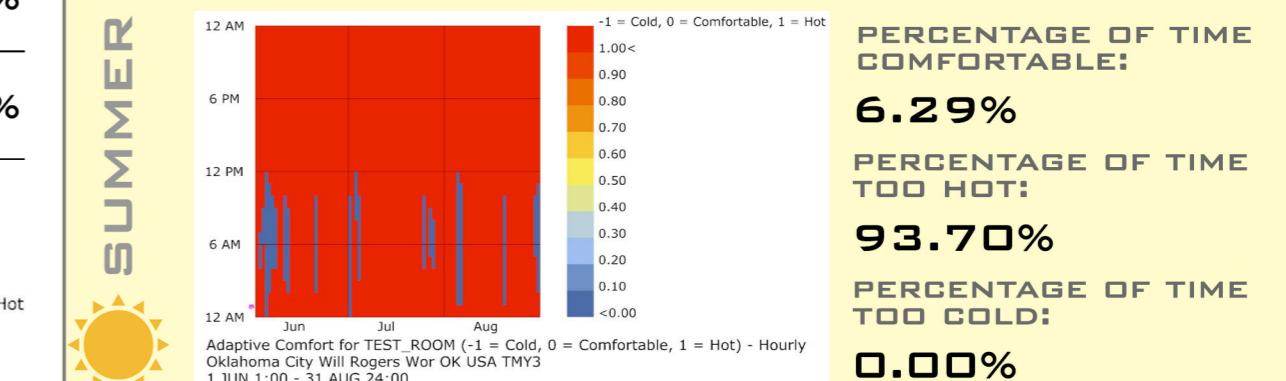
31.36%

PERCENTAGE OF TIME TOO HOT:

33.15%

PERCENTAGE OF TIME TOO COLD:

35.46%



PERCENTAGE OF TIME COMFORTABLE:

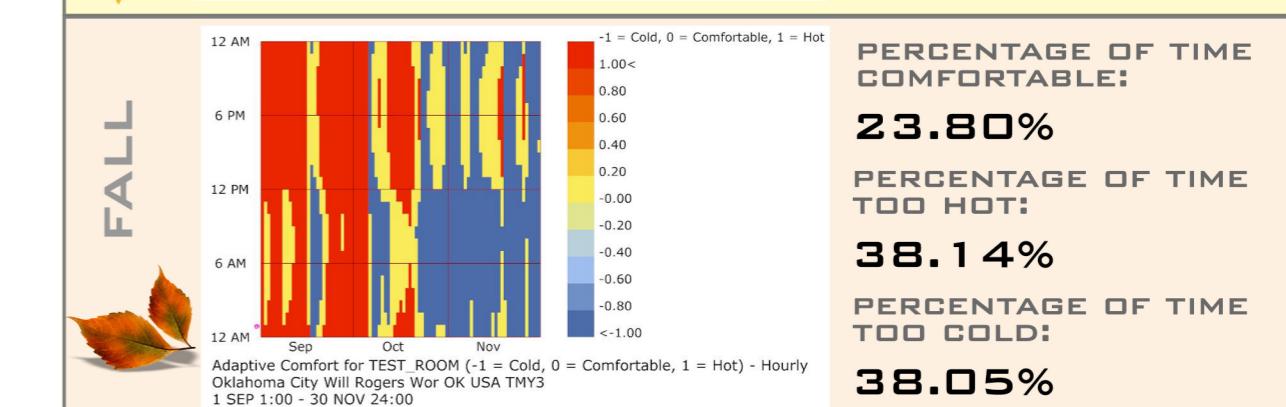
6.29%

PERCENTAGE OF TIME TOO HOT:

93.70%

PERCENTAGE OF TIME TOO COLD:

0.00%



PERCENTAGE OF TIME COMFORTABLE:

23.80%

PERCENTAGE OF TIME TOO HOT:

38.14%

PERCENTAGE OF TIME TOO COLD:

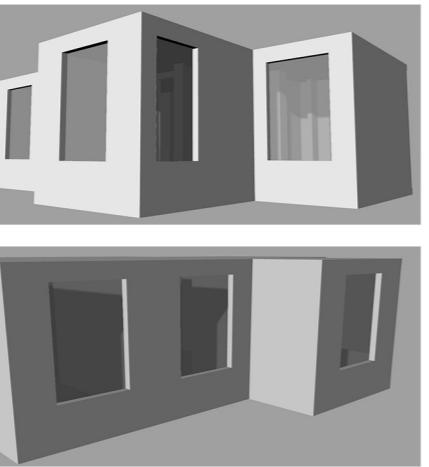
38.05%

CONCLUSIONS

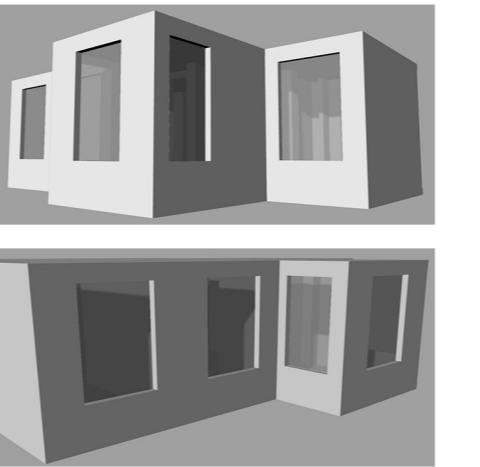
LEGEND:

- ✓ = 1ST PLACE
- ⊖+ = 2ND PLACE
- ⊖+ = 3RD PLACE
- ✗ = 4TH PLACE

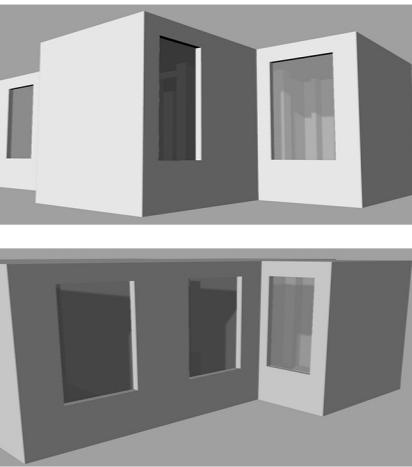
CASE 1:
ADDITIONAL
SOUTH WINDOW



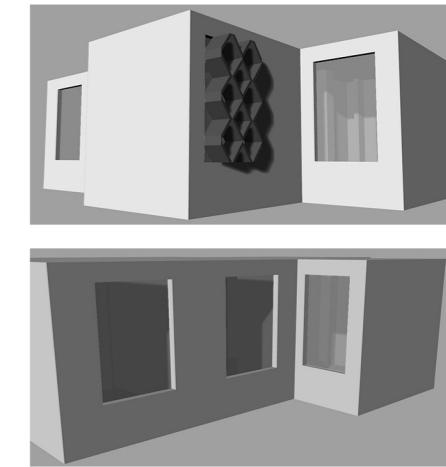
CASE 2:
ADDITIONAL
SOUTH+NORTH WINDOWS



CASE 3:
ONLY
SOUTH+NORTH WINDOWS



CASE 4:
SOUTH+NORTH WINDOWS
WITH SHADING SYSTEM



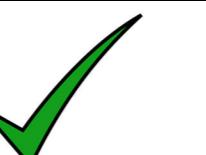
CONCLUSIONS



YEAR



WINTER



SPRING



SUMMER



FALL

