

# **BELMONT HIGH SCHOOL BUILDING COMMITTEE MEETING**

FEBRUARY 27 2019

# FLOOR PLANS

BUILDING DESIGN



**SITE PLAN**

FEBRUARY 27 2019



**FLOOR PLAN - LEVEL 01**

FEBRUARY 27 2019



**FLOOR PLAN - LEVEL 02**

FEBRUARY 27 2019





**FLOOR PLAN - LEVEL 04**

FEBRUARY 27 2019

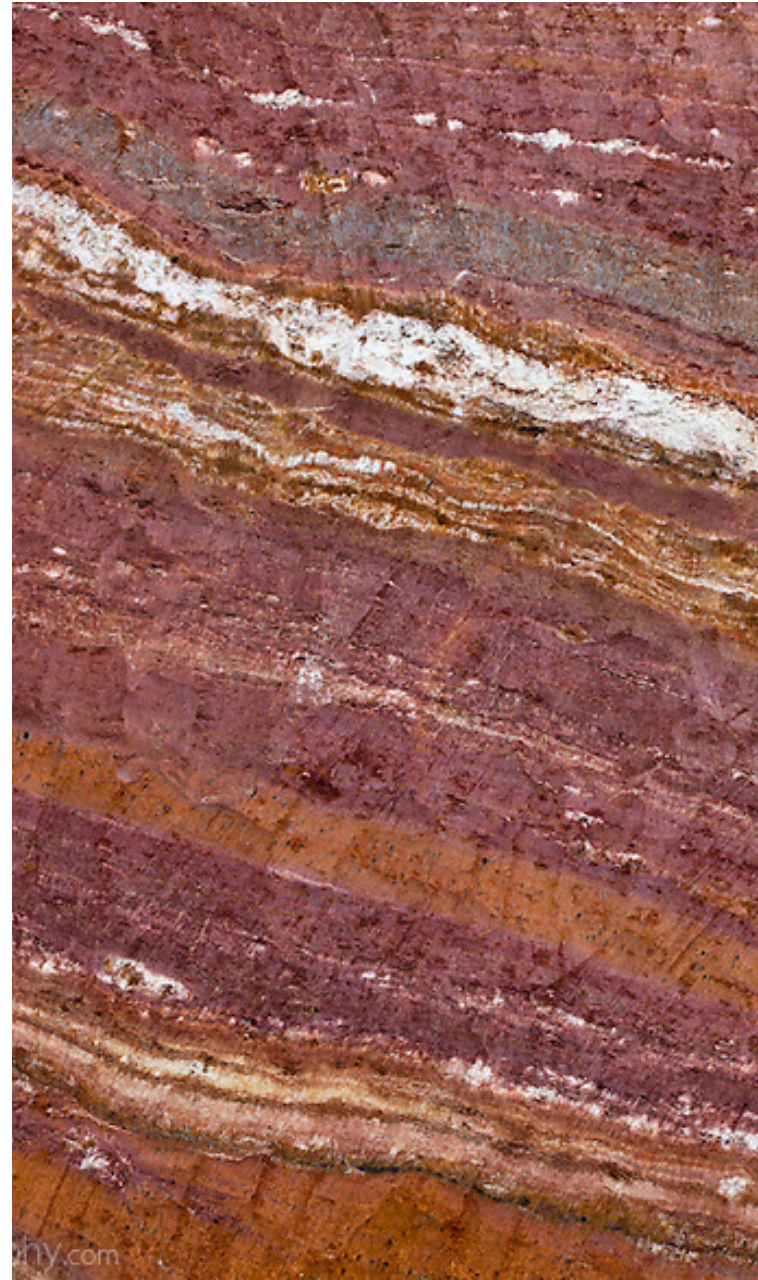
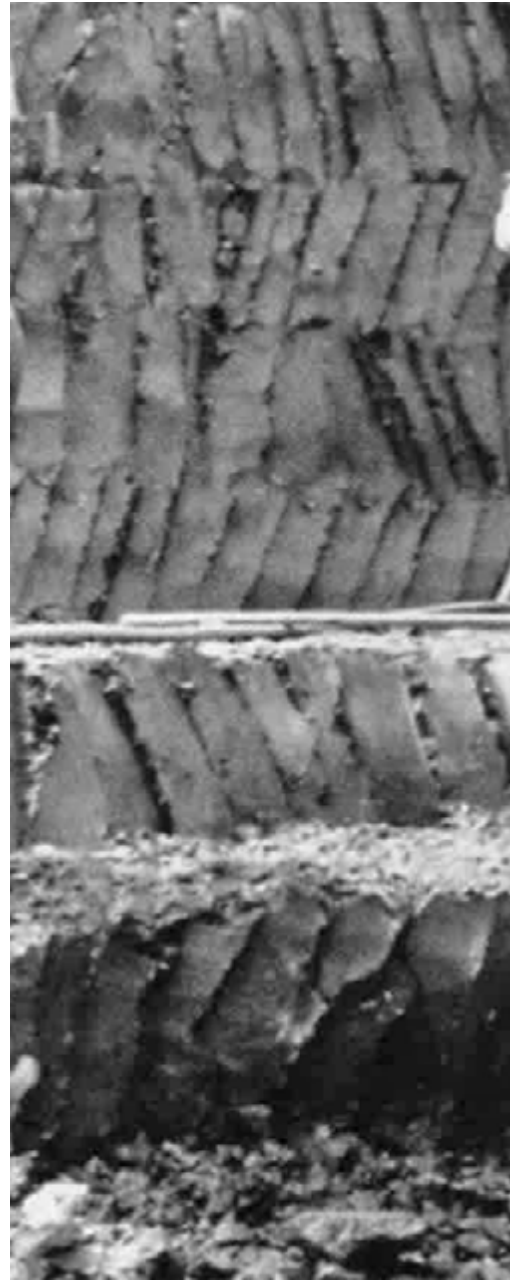


**AERIAL OF SITE**  
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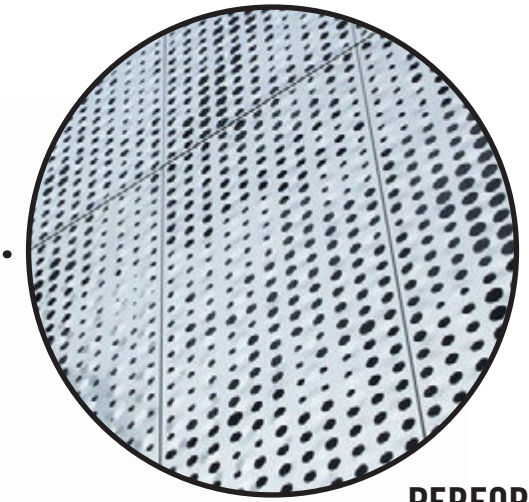
# EXTERIOR ELEVATIONS

BUILDING DESIGN

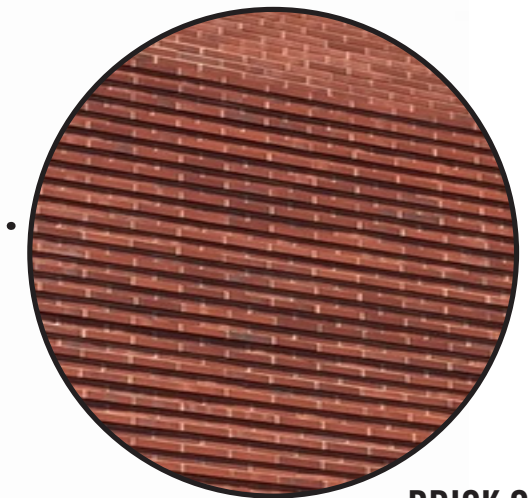


### HISTORICAL CONTEXT

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**PERFORATED METAL**



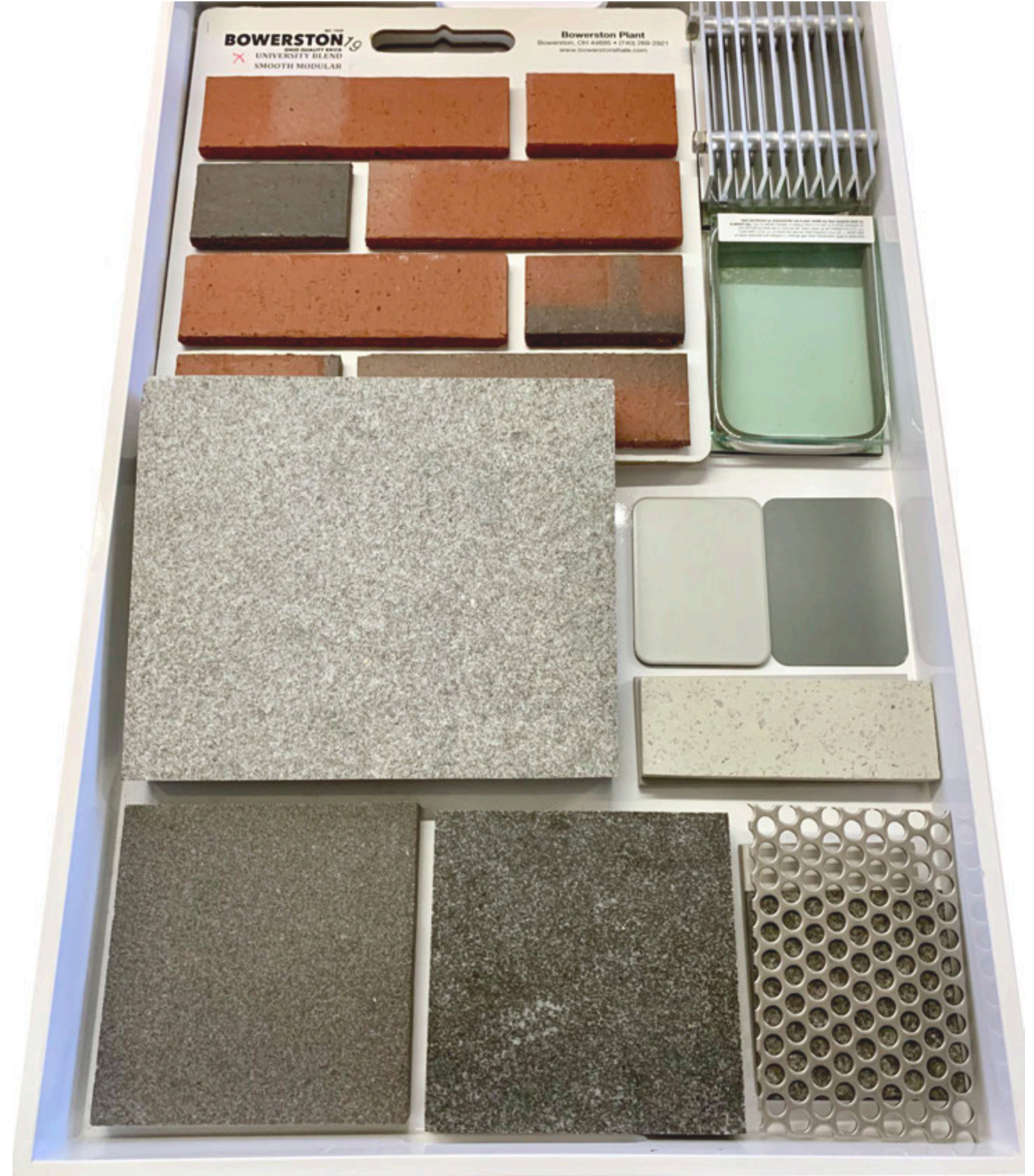
**BRICK COREBELLING**



**CEMENTITIOUS PANEL**

**EXTERIOR MATERIALS**

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**MATERIAL PALETTE**

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# P+W ENERGY LAB

DATA DRIVEN DESIGN

# SOLAR RADIATION STUDY

## Studies and Assumptions for solar thermal load reduction on fenestration from typical 2'-4" overhangs on classroom glazing

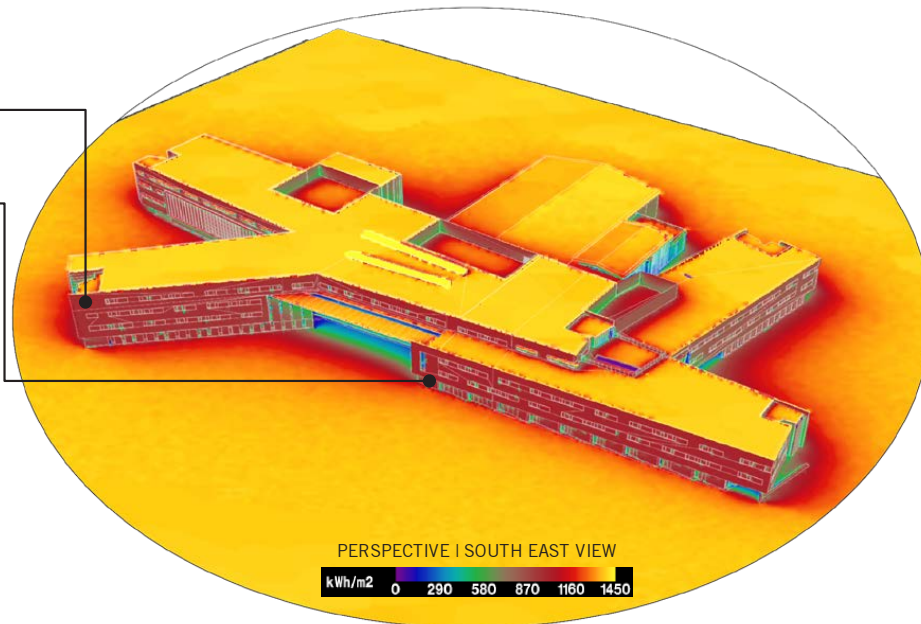
Study Period Jan 1, 1:00 AM Through December 31 12:00 AM



ROOF  
THERMAL LOAD | 450 KBTU/SF (1420 KWH/M2)  
SOUTH EAST WALLS  
THERMAL LOAD | 285 KBTU/SF (900 KWH/M2)  
SOUTH WALLS  
THERMAL LOAD | 285 KBTU/SF (900 KWH/M2)

Performance Metric: The proposed design featured overhangs on the south and the south east orientations.

- The south entrance overhangs reduce the thermal load to less than 100 kBtu/sf (approx. 300 kWh/m2).
- The fenestration shading devices reduce the thermal load from 285 kBtu/sf to slightly more than 100 kBtu/sf (approx. 350 kWh/m2).
- The orientation of the solar panels or azimuth receives more solar radiation than a horizontal orientation similarly to the roof surfaces and potentially generates more renewable energy.



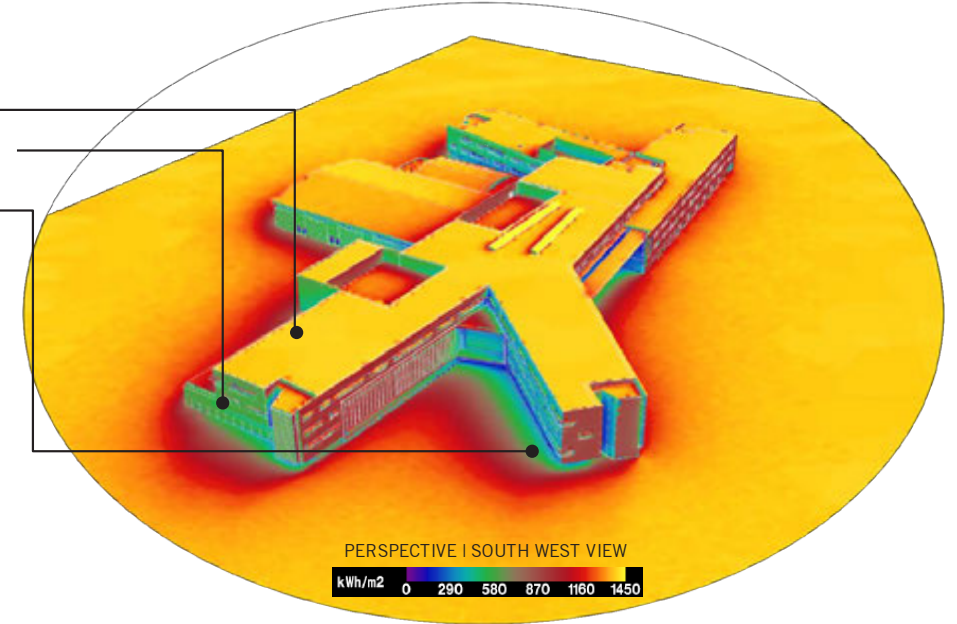
Study Period Jan 1, 1:00 AM Through December 31 12:00 AM



ROOF  
THERMAL LOAD | 450 KBTU/SF (1420 KWH/M2)  
SOUTH WEST WALLS  
THERMAL LOAD | 285 KBTU/SF (900 KWH/M2)  
WEST WALLS  
THERMAL LOAD | 95 KBTU/SF (300 KWH/M2)  
NORTH WEST WALLS  
THERMAL LOAD | 220 KBTU/SF (700 KWH/M2)

Performance Metric: The proposed design featured overhangs on the south west and west orientations.

- The northeasterly fenestration has less thermal load due to self-shading of building configuration.
- The fenestration shading devices reduce the thermal load from 285 kBtu/sf to slightly more than 100 kBtu/sf (approx. 350 kWh/m2).
- The northwesterly walls do not benefit from building configuration self-shading.



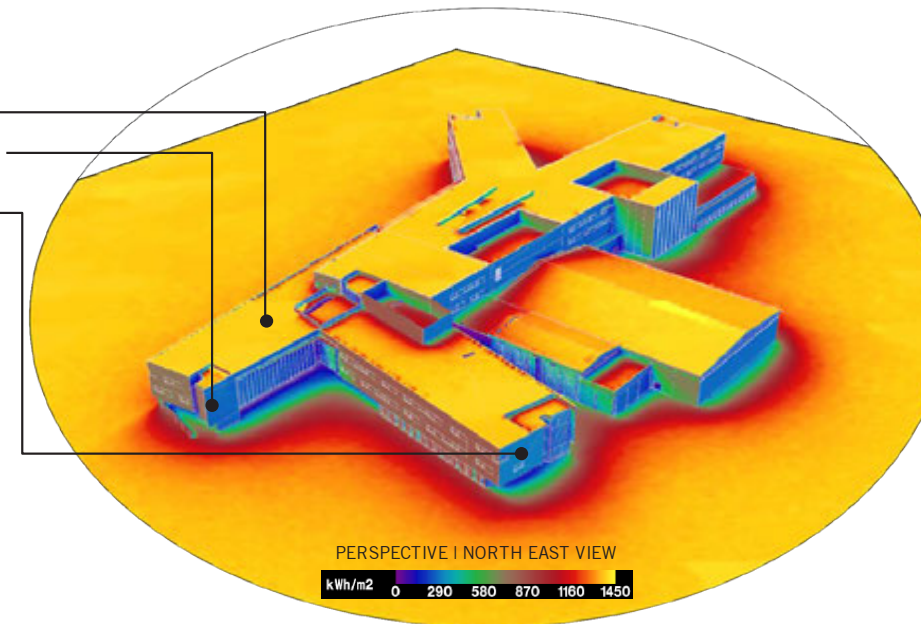
Study Period Jan 1, 1:00 AM Through December 31 12:00 AM



ROOF  
THERMAL LOAD | 450 KBTU/SF (1420 KWH/M2)  
NORTH EAST WALLS  
THERMAL LOAD | 80-125 KBTU/SF (250-400 KWH/M2)  
NORTH WALLS  
THERMAL LOAD | 95 KBTU/SF (300 KWH/M2)  
EAST WALLS  
THERMAL LOAD | 220 KBTU/SF (700 KWH/M2)

Performance Metric: The proposed design featured overhangs on the north and the north east orientations.

- The northeasterly fenestration has less thermal load due to self-shading of building configuration.
- The south fenestration shading devices reduce the thermal load from 285 kBtu/sf to slightly more than 100 kBtu/sf (approx. 350 kWh/m2).



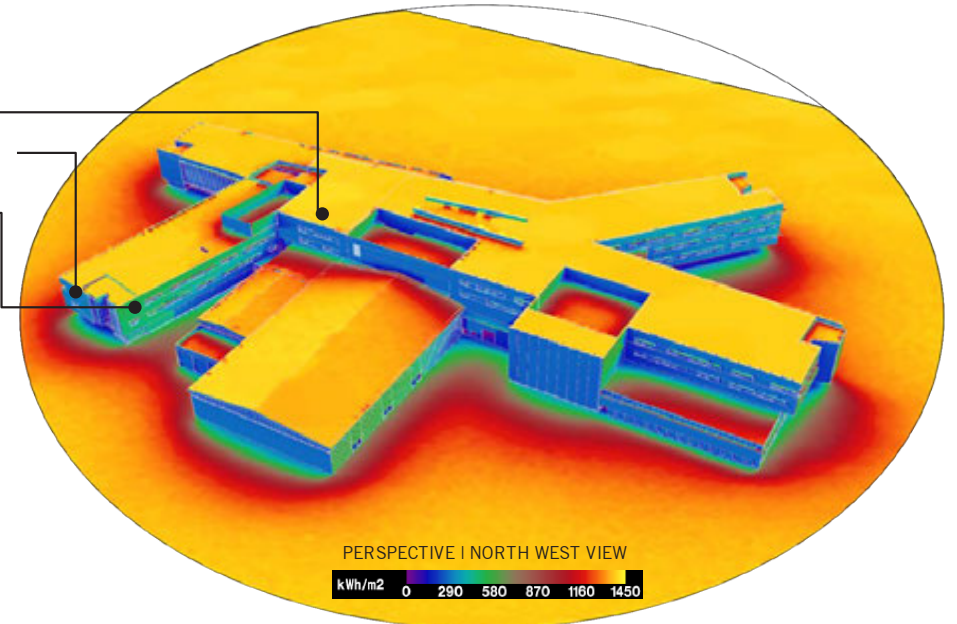
Study Period Jan 1, 1:00 AM Through December 31 12:00 AM



ROOF  
THERMAL LOAD | 450 KBTU/SF (1420 KWH/M2)  
NORTH WALLS  
THERMAL LOAD | 80 KBTU/SF (250 KWH/M2)  
NORTH WEST WALLS  
THERMAL LOAD | 184 KBTU/SF (580 KWH/M2)

Performance Metric: The proposed design featured overhangs on the north and north west orientations.

- The northwesterly walls receive thermal load but the fenestration benefit from shading devices which lower the thermal load to less than 100 kBtu/sf (approx. 300 kWh/m2).
- The walls oriented to the north do not generally require shading devices.



### CLASSROOM SHADING STRATEGY

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# PROPOSED DESIGN ANNUAL SOLAR RADIATION SE WALLS

Study Period Jan 1, 1:00 AM Through December 31 12:00 AM



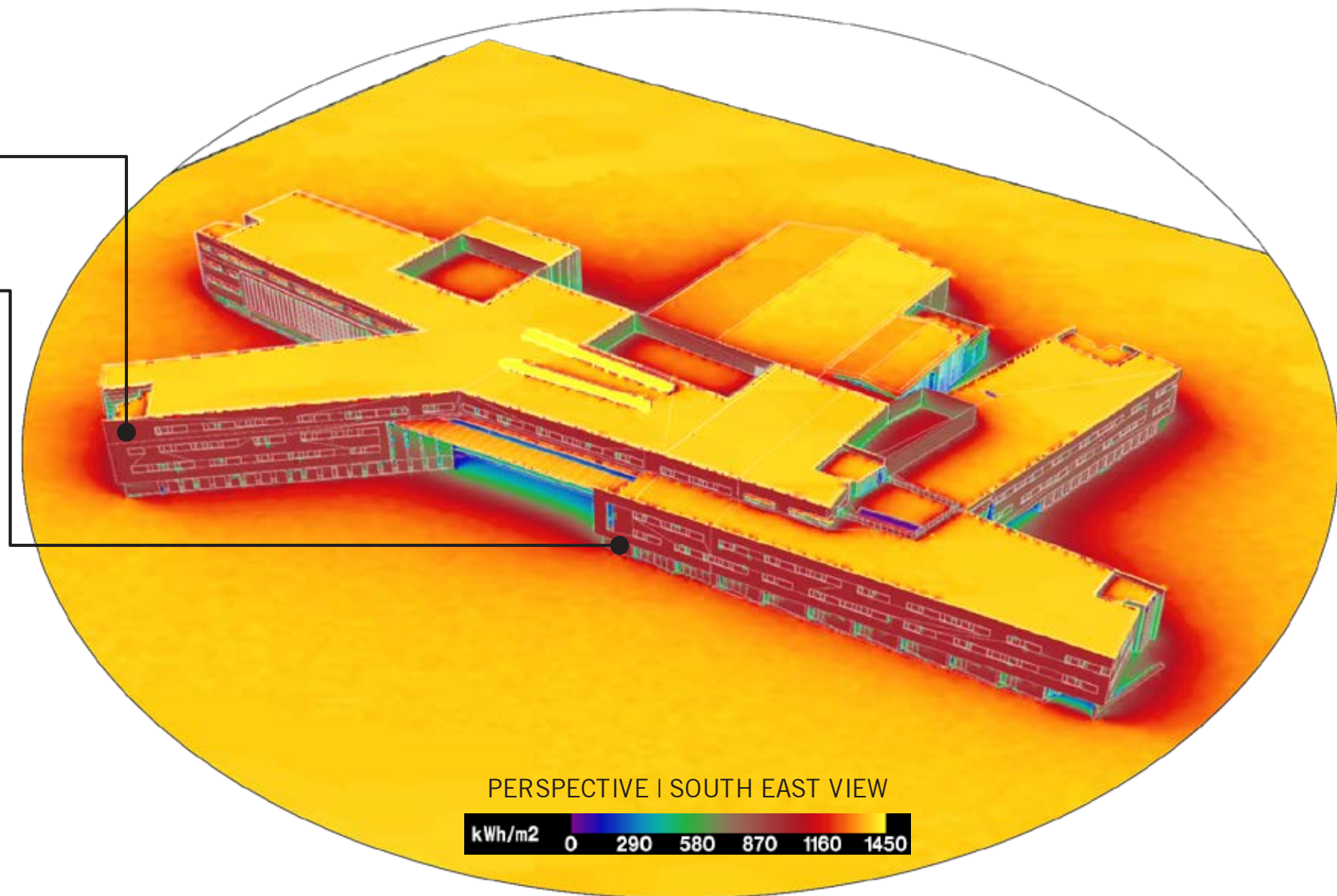
ROOF  
THERMAL LOAD | 450 KBTU/SF (1420 KWH/M2)

SOUTH EAST WALLS  
THERMAL LOAD | 285 KBTU/SF (900 KWH/M2)

SOUTH WALLS  
THERMAL LOAD | 285 KBTU/SF (900 KWH/M2)

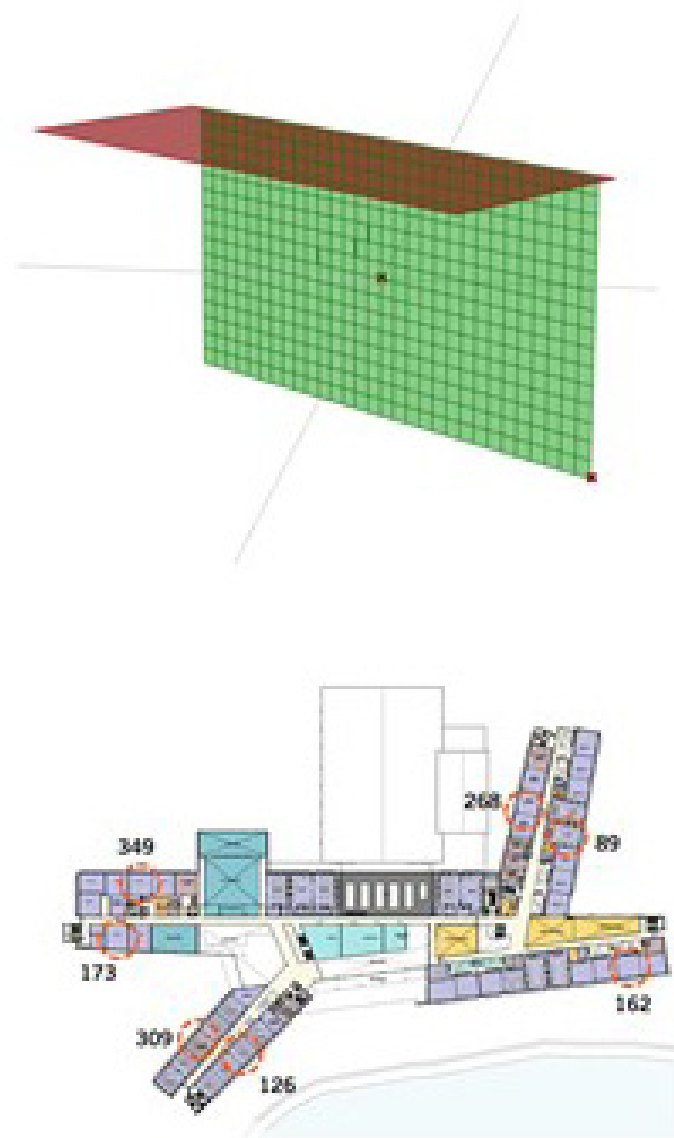
Performance Metric: The proposed design featured overhangs on the south and the south east orientations.

- **The south entrance overhangs reduce the thermal load** to less than 100 kBtu/sf (approx. 300 kWh/m<sup>2</sup>).
- **The fenestration shading devices reduce the thermal load** from 285 kBtu/sf to slightly more than 100 kBtu/sf (approx. 350 kWh/m<sup>2</sup>).
- **The orientation of the solar panels or azimuth receives more solar radiation** than a horizontal orientation similarly to the roof surfaces and potentially generates more renewable energy.

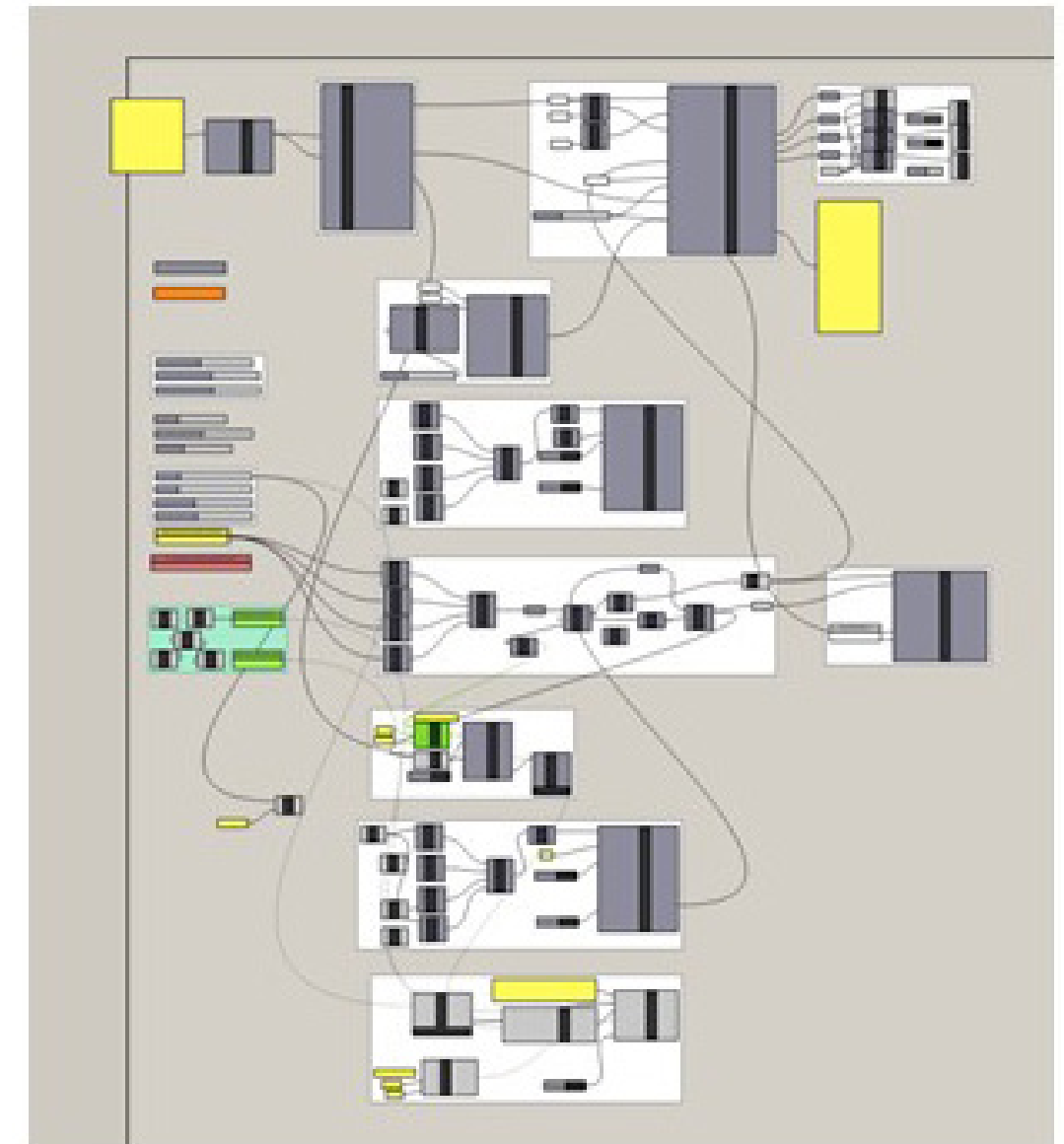


# CLASSROOM SHADING STUDY

- Typical window size: 5'4" x 10'
- Typical overhang depth (0', 1', 2', 3', 4')
- Orientations (268,89,162,126,309,173,349)
- Weather file:  
[https://energyplus.net/weather-download/north\\_and\\_central\\_america\\_wmo\\_region\\_4/USA/MA/USA\\_MA\\_Boston-Logan.Intl.AP.725090\\_TMY3/all](https://energyplus.net/weather-download/north_and_central_america_wmo_region_4/USA/MA/USA_MA_Boston-Logan.Intl.AP.725090_TMY3/all)



# ASSUMPTIONS AND VARIABLES



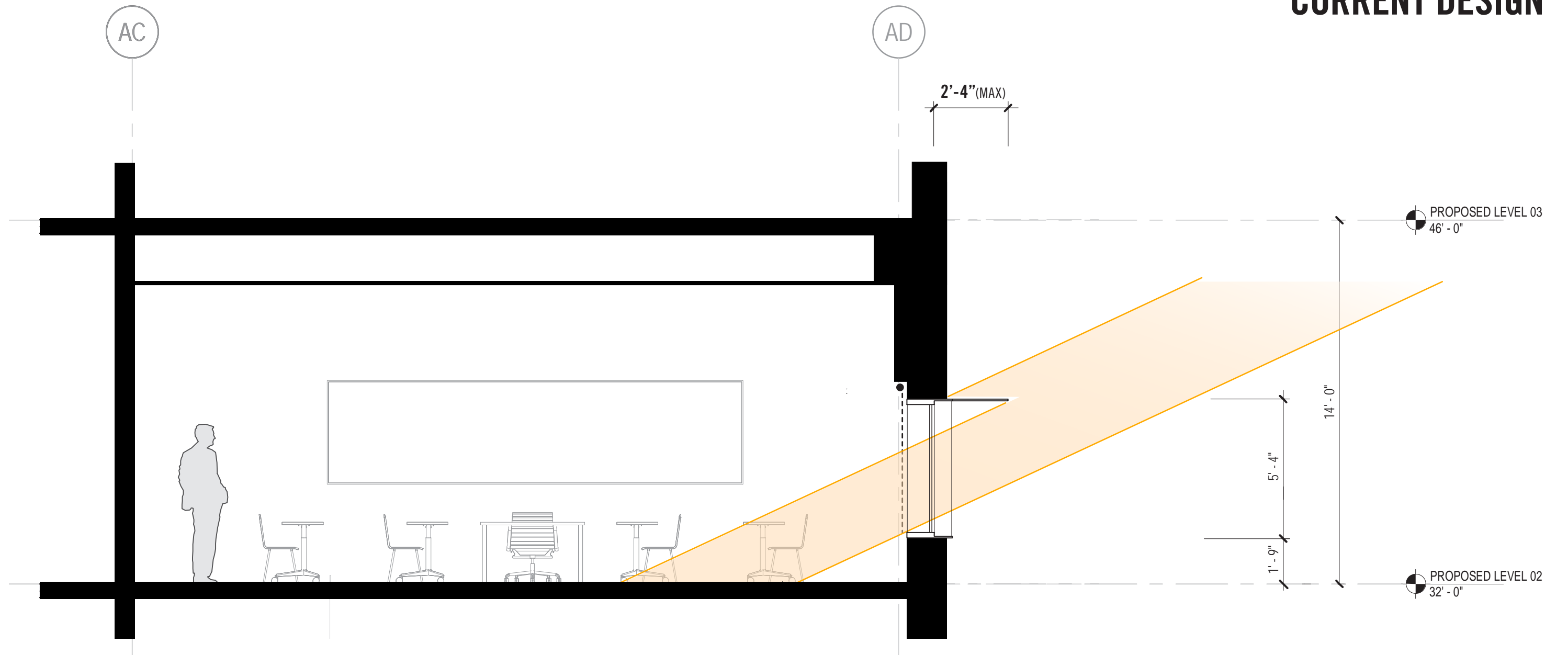


# CLASSROOM SUNSHADES

BUILDING DESIGN



# CURRENT DESIGN

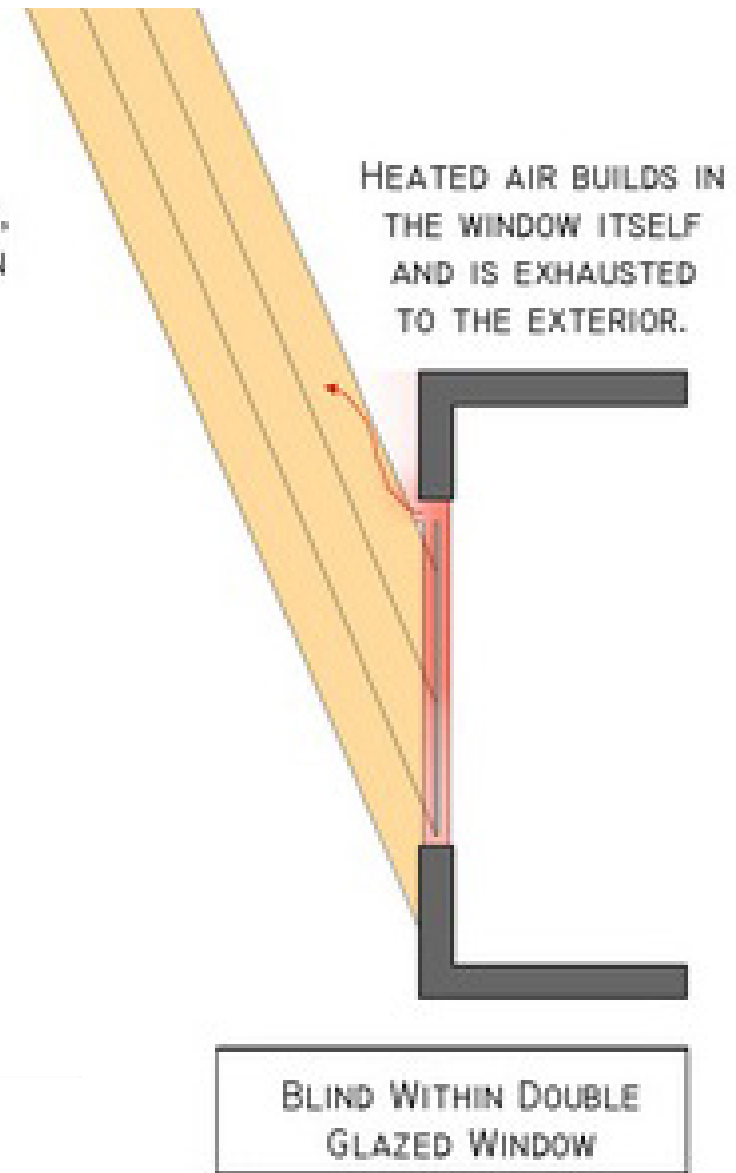
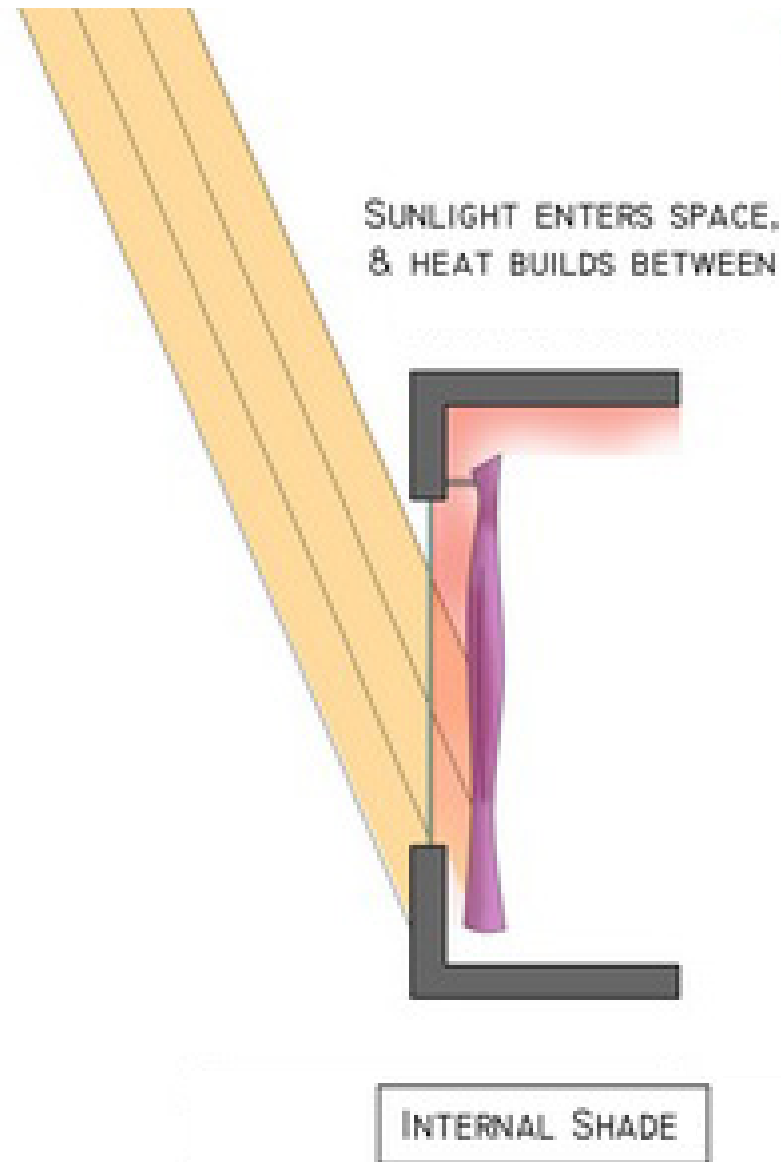
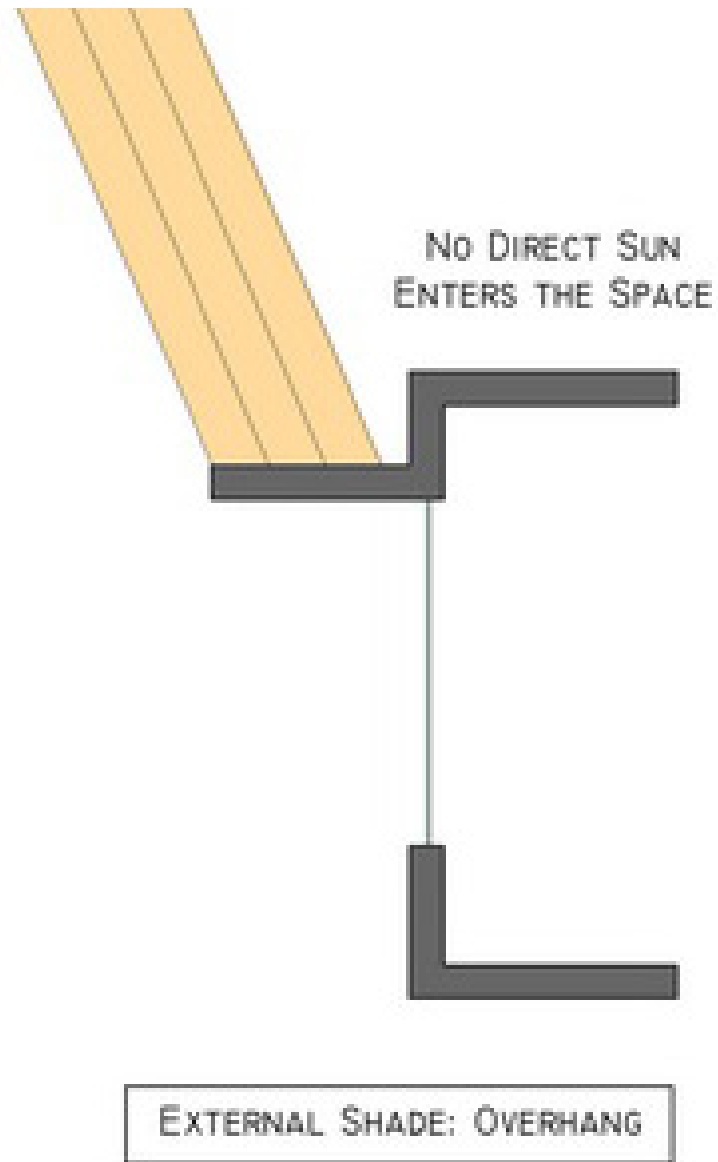


WINTER SOLSTICE  
Angular Altitude - 25°

## CLASSROOM SUNSHADE

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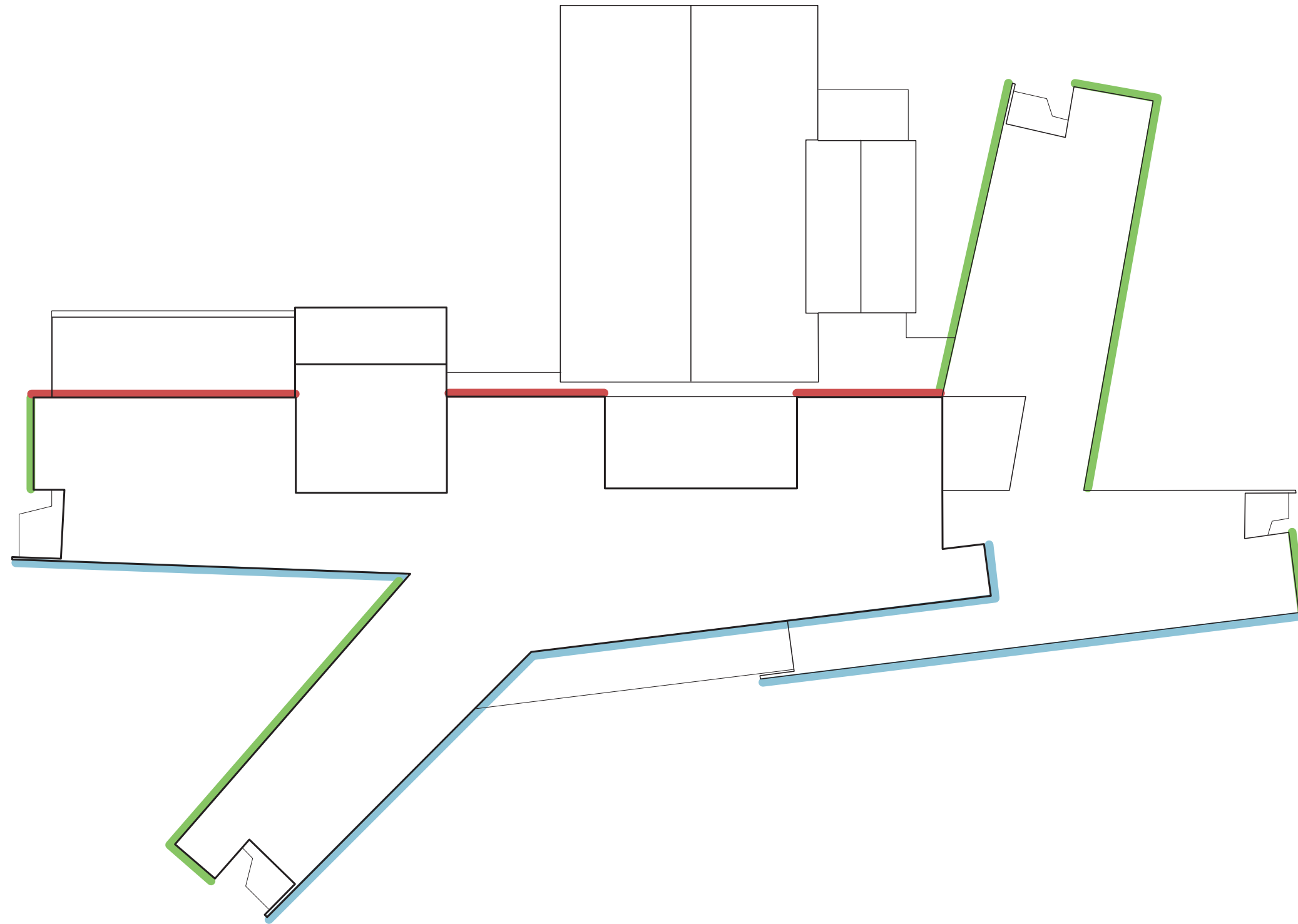
# EXTERNAL VS. INTERNAL SHADING



## CLASSROOM SUNSHADE

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# SHADING DEPTH VARIATIONS



- 2'-4" Depth
- 2'-0" Depth
- 1'-0" Depth

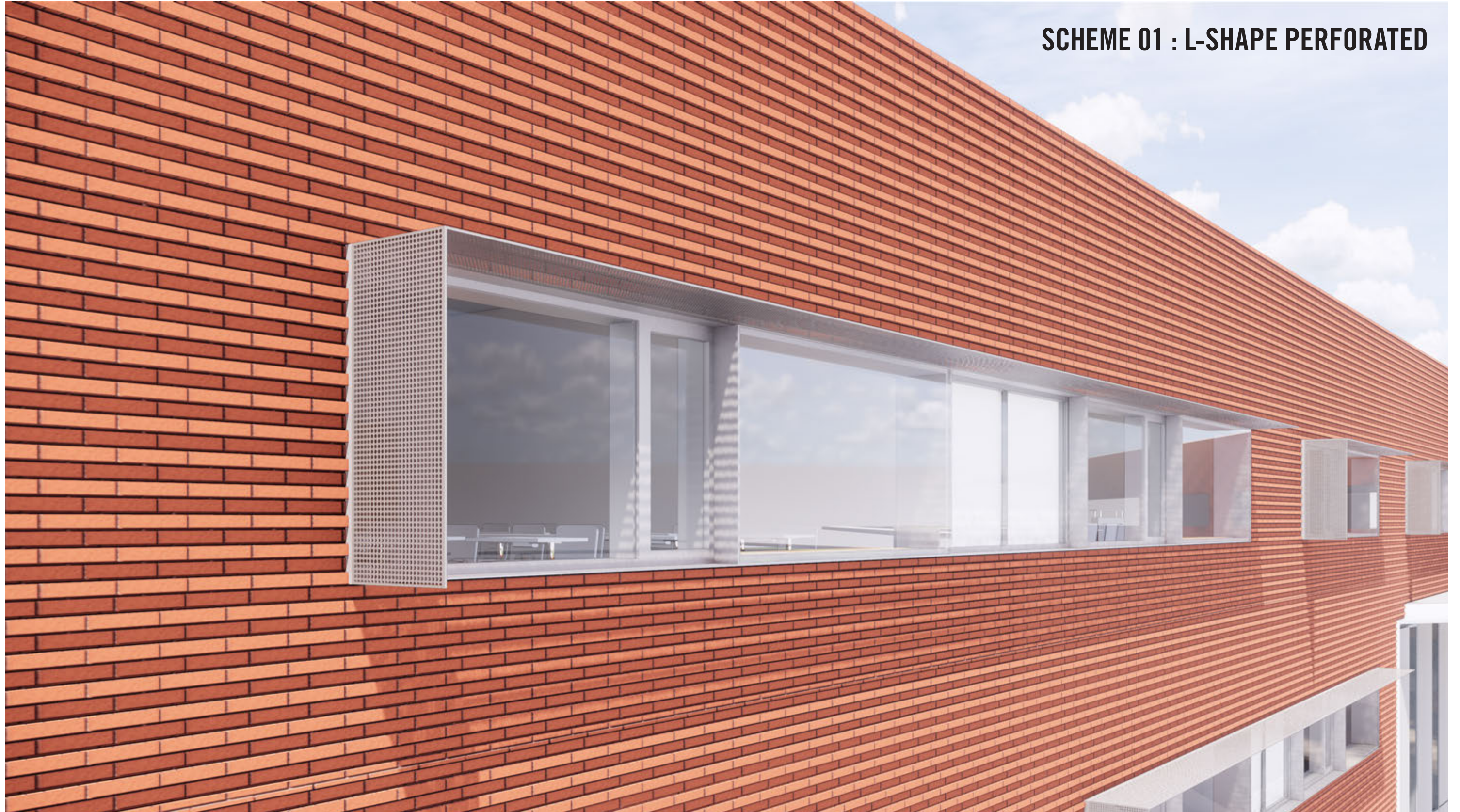
## CLASSROOM SUNSHADE : DEPTH DIAGRAM

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# EXTERNAL SUNSHADE OPTIONS

BUILDING DESIGN

**SCHEME 01 : L-SHAPE PERFORATED**



**CLASSROOM SUNSHADE : SCHEME**

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**SCHEME 01 : L-SHAPE PERFORATED**



**CLASSROOM SUNSHADE : SCHEME**

FEBRUARY 27 2019



**SCHEME 01 : L-SHAPE PERFORATED**



**CLASSROOM SUNSHADE : SCHEME**

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**SCHEME 02 : L-SHAPE SLATS**



**CLASSROOM SUNSHADE : SCHEME**

FEBRUARY 27 2019

**SCHEME 02 : L-SHAPE SLATS**



**CLASSROOM SUNSHADE : SCHEME**

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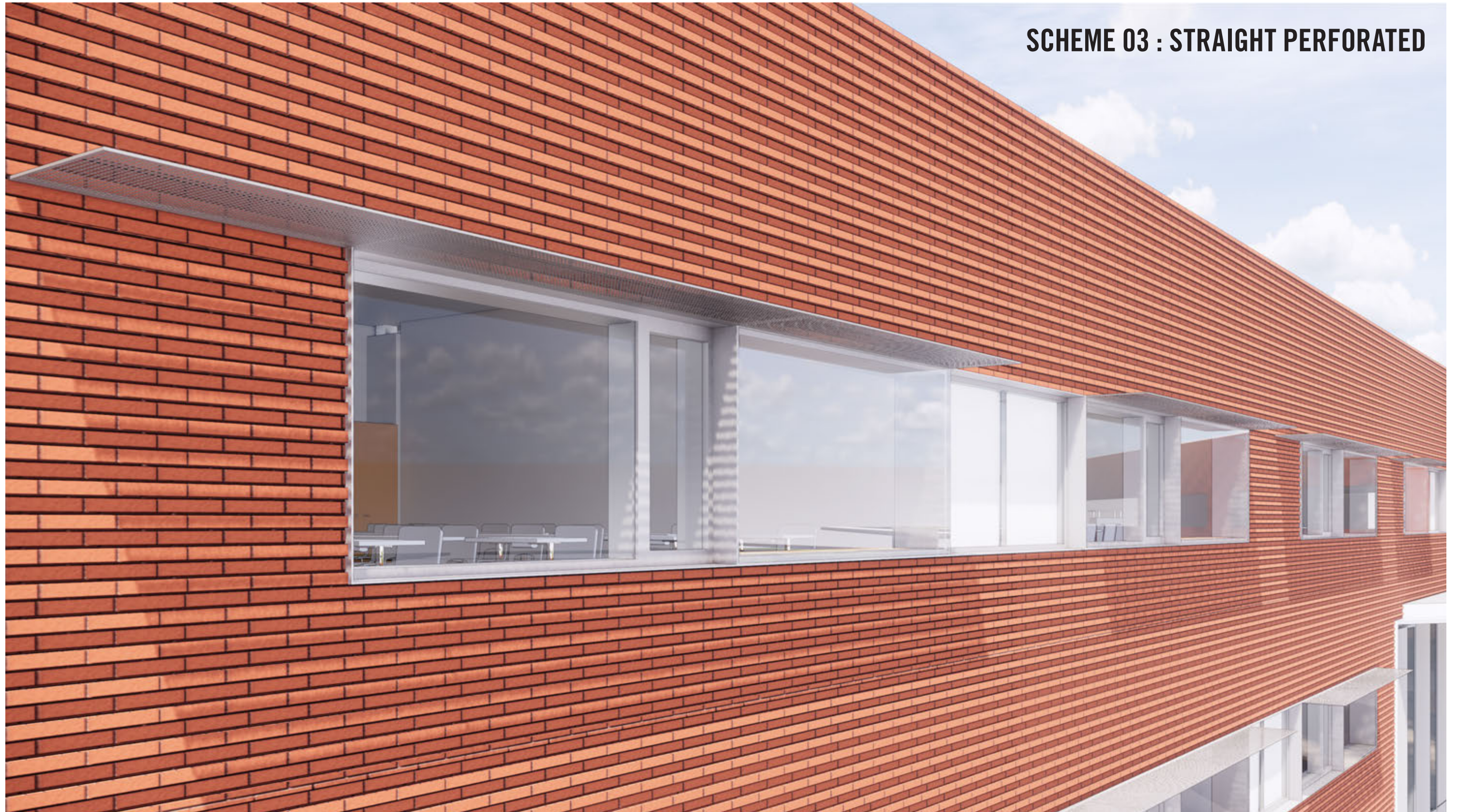
**SCHEME 02 : L-SHAPE SLATS**



**CLASSROOM SUNSHADE : SCHEME**

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**SCHEME 03 : STRAIGHT PERFORATED**



**CLASSROOM SUNSHADE : SCHEME**

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**SCHEME 03 : STRAIGHT PERFORATED**



**CLASSROOM SUNSHADE : SCHEME**

FEBRUARY 27 2019

**SCHEME 03 : STRAIGHT PERFORATED**



**CLASSROOM SUNSHADE : SCHEME**

FEBRUARY 27 2019

**SCHEME 04 : STRAIGHT SLATS**



**CLASSROOM SUNSHADE : SCHEME**

FEBRUARY 27 2019



**SCHEME 04 : STRAIGHT SLATS**



**CLASSROOM SUNSHADE : SCHEME**

FEBRUARY 27 2019

**SCHEME 04 : STRAIGHT SLATS**



**CLASSROOM SUNSHADE : SCHEME**

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# SUNSHADE PRECEDENTS

BUILDING DESIGN

**AMHERST COLLEGE**  
GREENWAY  
RESIDENCES



**SUNSHADE PRECEDENT**

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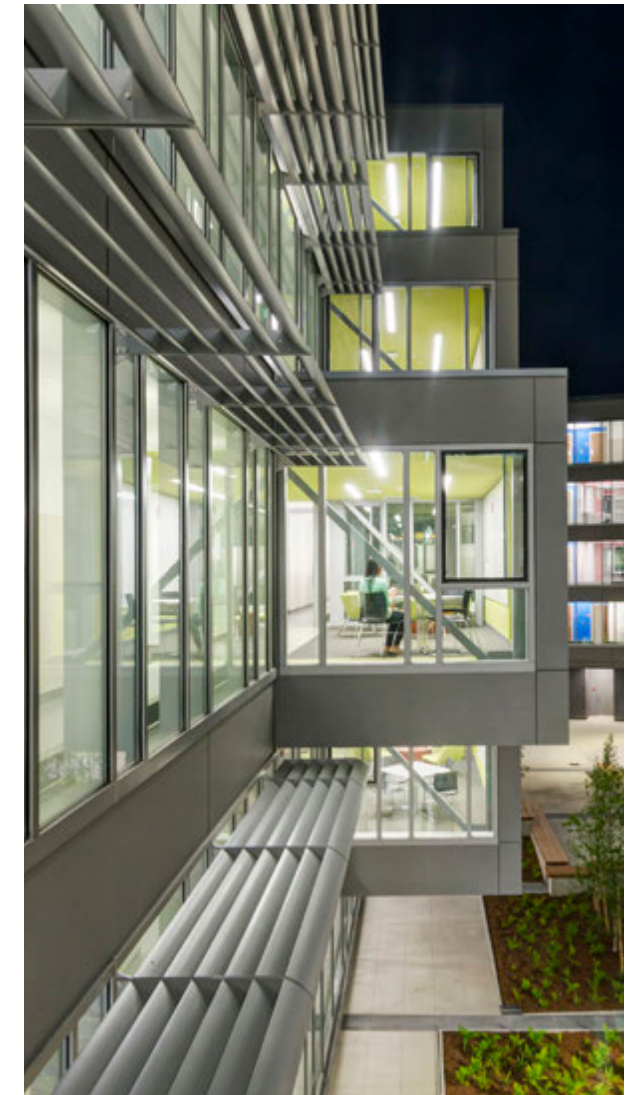
**WAYLAND HIGH  
SCHOOL**  
WAYLAND, MA



**SUNSHADE PRECEDENT**

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**BRIDGEWATER  
STATE UNIVERSITY**  
WEYGAND HALL



**SUNSHADE PRECEDENT**

FEBRUARY 27 2019



**WINTHROP MIDDLE-  
HIGH SCHOOL**  
WINTHROP, MA

**SUNSHADE PRECEDENT**

FEBRUARY 27 2019



**BOSTON UNIVERSITY**  
YAWKEY CENTER  
FOR STUDENT  
SERVICES

**SUNSHADE PRECEDENT**

FEBRUARY 27 2019



# BUILDING PERSPECTIVES

BUILDING DESIGN



**BUILDING PERSPECTIVE**

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**BUILDING PERSPECTIVE**

FEBRUARY 27 2019



**BUILDING PERSPECTIVE**

FEBRUARY 27 2019



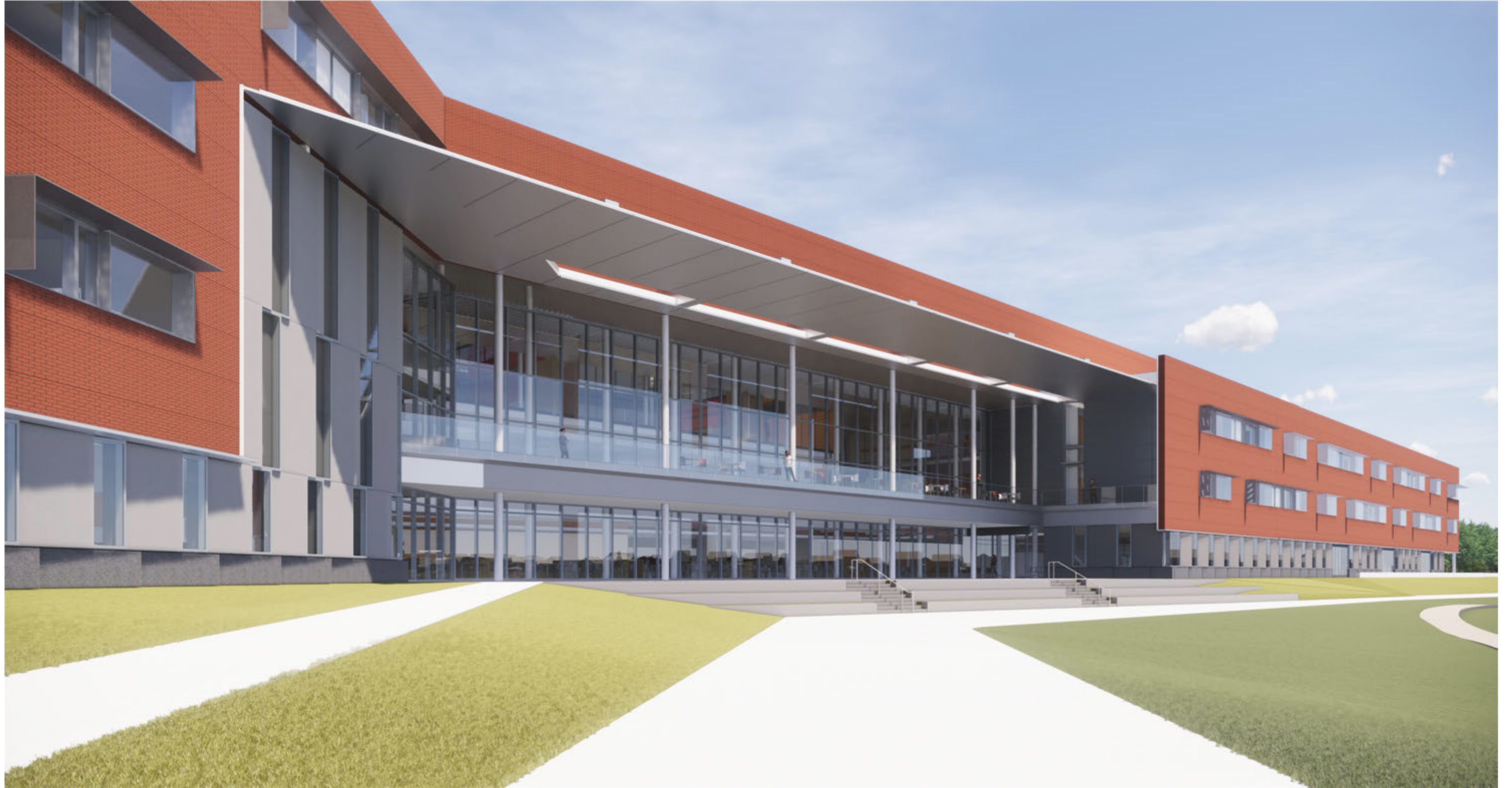
**BUILDING PERSPECTIVE**

FEBRUARY 27 2019



**BUILDING PERSPECTIVE**

FEBRUARY 27 2019



**BUILDING PERSPECTIVE**

FEBRUARY 27 2019



**BUILDING PERSPECTIVE**

FEBRUARY 27 2019





**BUILDING PERSPECTIVE**

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**BUILDING PERSPECTIVE**

FEBRUARY 27 2019



**BUILDING PERSPECTIVE**

FEBRUARY 27 2019



**BUILDING PERSPECTIVE**

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