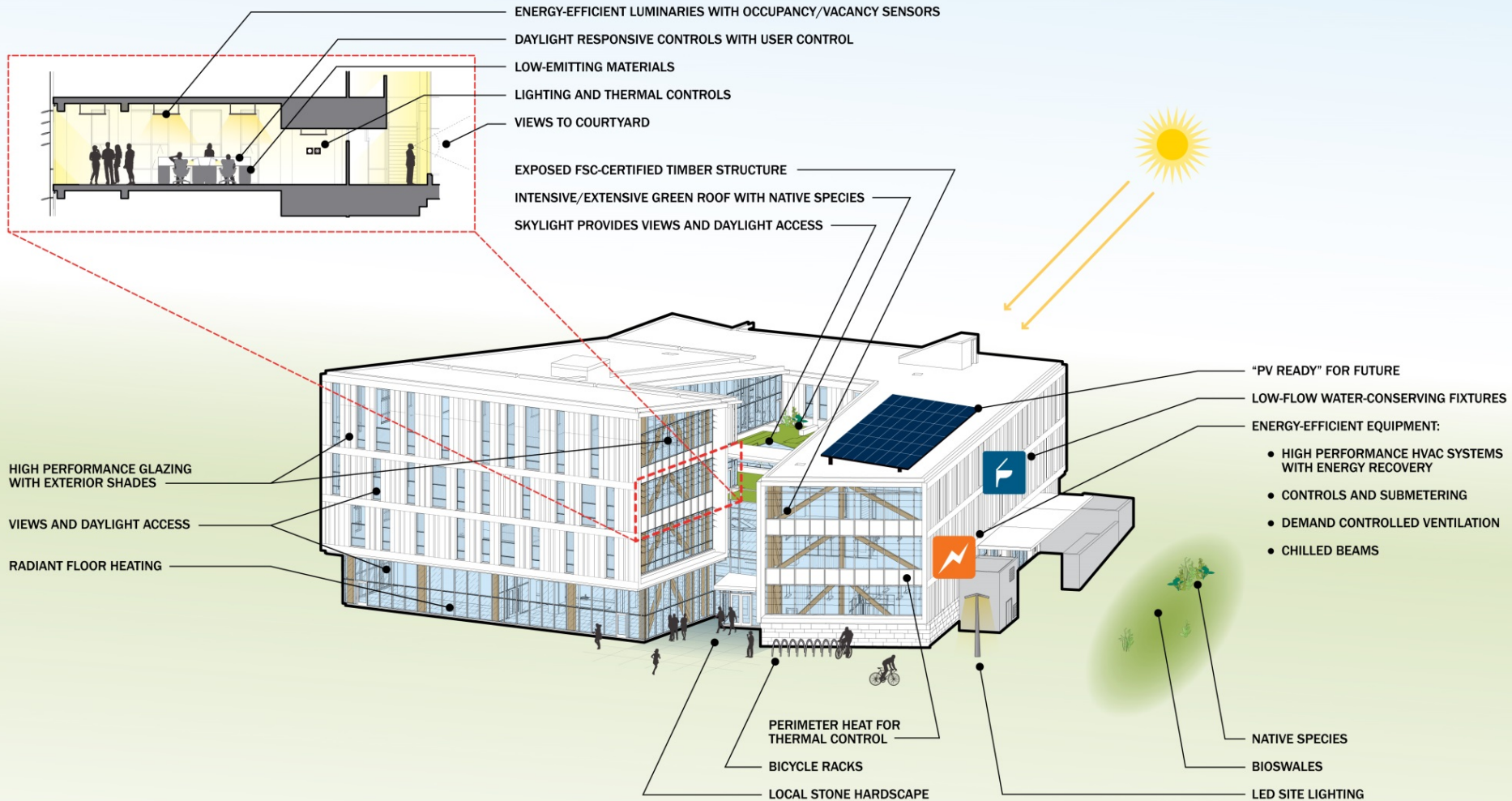


# Integrated Design Building

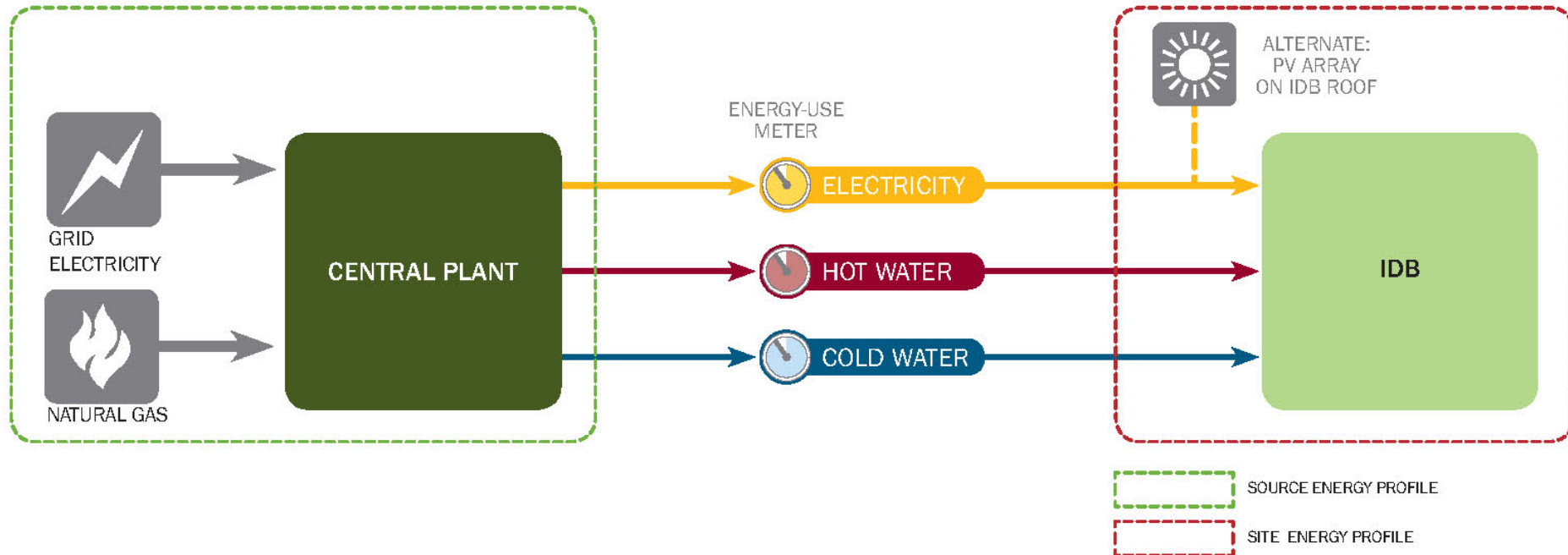
Amherst, MA

Leers Weinzapfel Associates

# Integrated Design Strategies



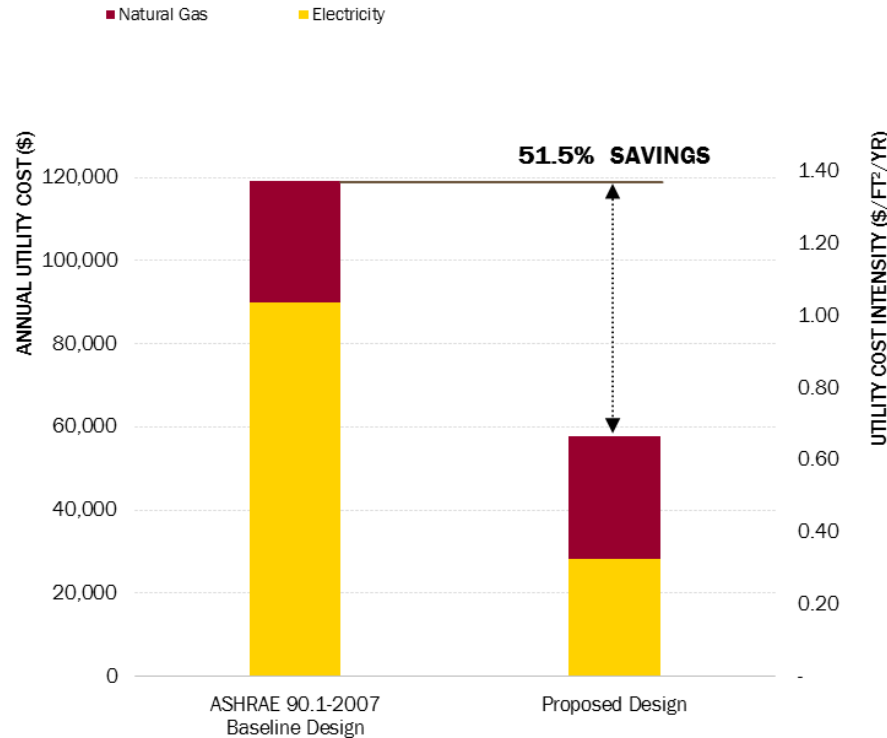
# Energy Distribution



# 60% CD Energy Model Results

## LEED Modeling Methodology

ANNUAL UTILITY COST  
7006 UMASS INTEGRATED DESIGN BUILDING



CD Model:

For LEED, when connected to a District Thermal Energy plant, modeling methodology Option 2 demonstrates cost savings and accounts for Central Plant efficiencies.

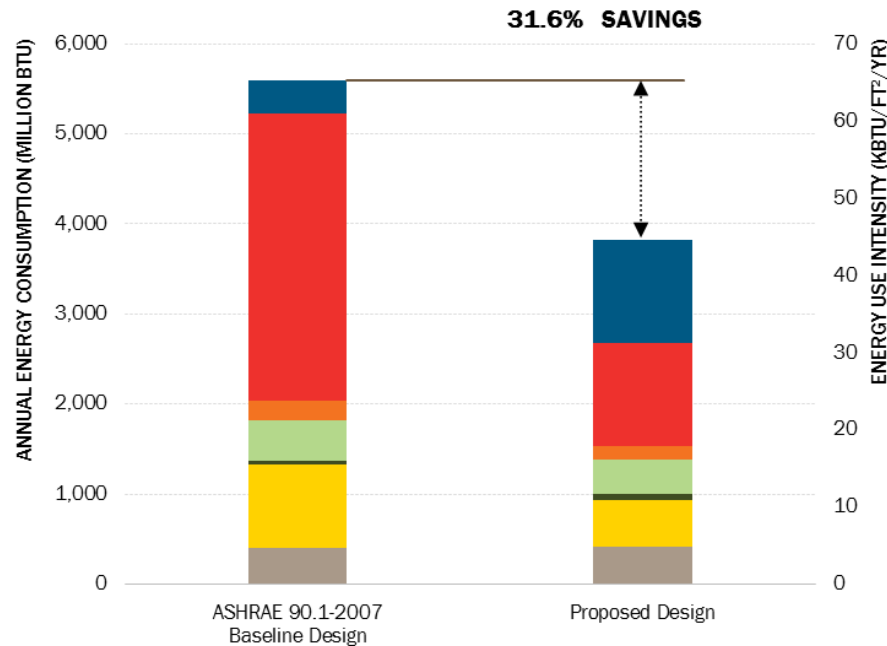
# 60% CD Energy Model Results

## LEED Modeling Methodology

### ANNUAL SITE ENERGY CONSUMPTION

7006 UMASS INTEGRATED DESIGN BUILDING

■ Chilled Water ■ Heat Reject. ■ Refrigeration ■ Steam ■ HP Supp. ■ Hot Water  
■ Vent. Fans ■ Pumps & Aux. ■ Ext. Usage ■ Task Lights ■ Area Lights ■ Misc. Equip.



CD Model: EUI 44.9 kBtu/sf/yr

Site Energy Consumption accounts for **metered chilled water and steam energy** for building operators to compare actual building energy against the predicted energy consumption (good for M&V purposes).

These are fundamentally not apples-to-apples.

(this is the correct modeling methodology for LEED, but not a true picture of site energy consumption; it doesn't account for the efficiency of energy generation)

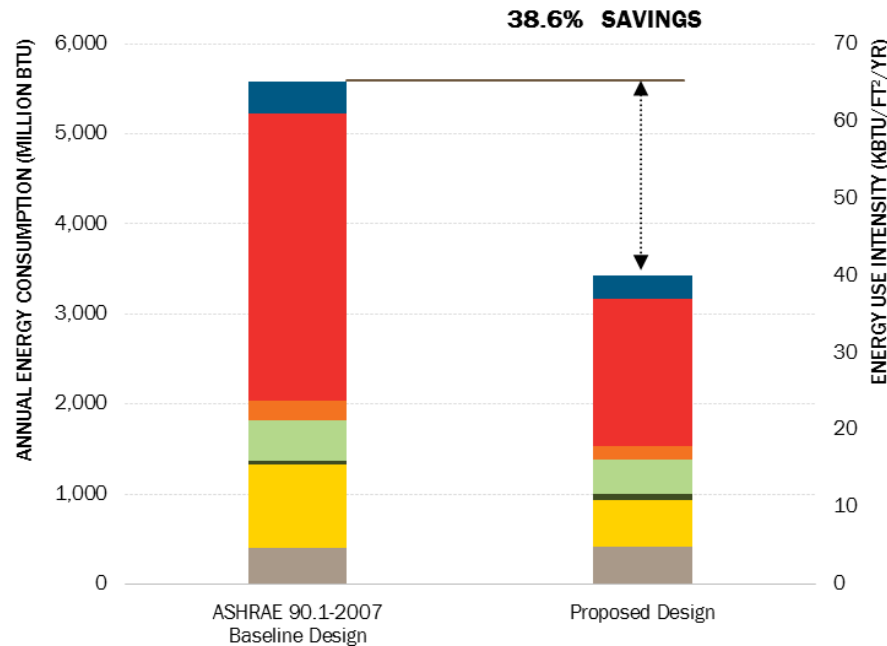
# 60% CD Energy Model Results

## Adjusted Methodology

### ANNUAL SITE ENERGY CONSUMPTION

7006 UMASS INTEGRATED DESIGN BUILDING

■ Chilled Water ■ Heat Reject. ■ Refrigeration ■ Steam ■ HP Supp. ■ Hot Water  
■ Vent. Fans ■ Pumps & Aux. ■ Ext. Usage ■ Task Lights ■ Area Lights ■ Misc. Equip.



Adjusted Graph: **EUI 40.3 kBtu/sf/yr**

Baseline EUI: 65.7 kBtu/sf/yr

Site Energy Consumption, adjusted from Steam & Chilled Water (Mbtu) to **Electricity & Natural Gas** (kWh), accounts for the efficiency of energy generation at Central Plant.

This is a better, apples-to-apples comparison.

Assumes LEED minimum (conservative!) central plant efficiencies:

- Boiler Plant efficiency: 70%
- Chilled Water COP: 4.4

# 60% CD Energy Model Results

## Adjusted Methodology

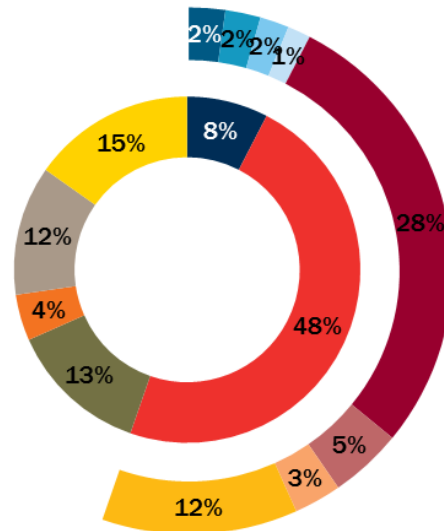
SITE ENERGY USE CHARACTERIZATION  
7006 IDB - PROPOSED BUILDING

### ENERGY END-USE

- Chilled Water
- Steam
- Pumps + Fans
- DHW
- Equipment
- Lights

### LOAD COMPONENT

- Window Solar
- Light Gains
- Equip Gains
- Occup Gains
- OA Cooling
- Window Conduction
- Wall Conduction
- Roof Conduction
- OA Heating



Key Components, Proportional breakdown:

Wall Conduction

Roof Conduction

Window Conduction

Outdoor Air Heating

Window Solar

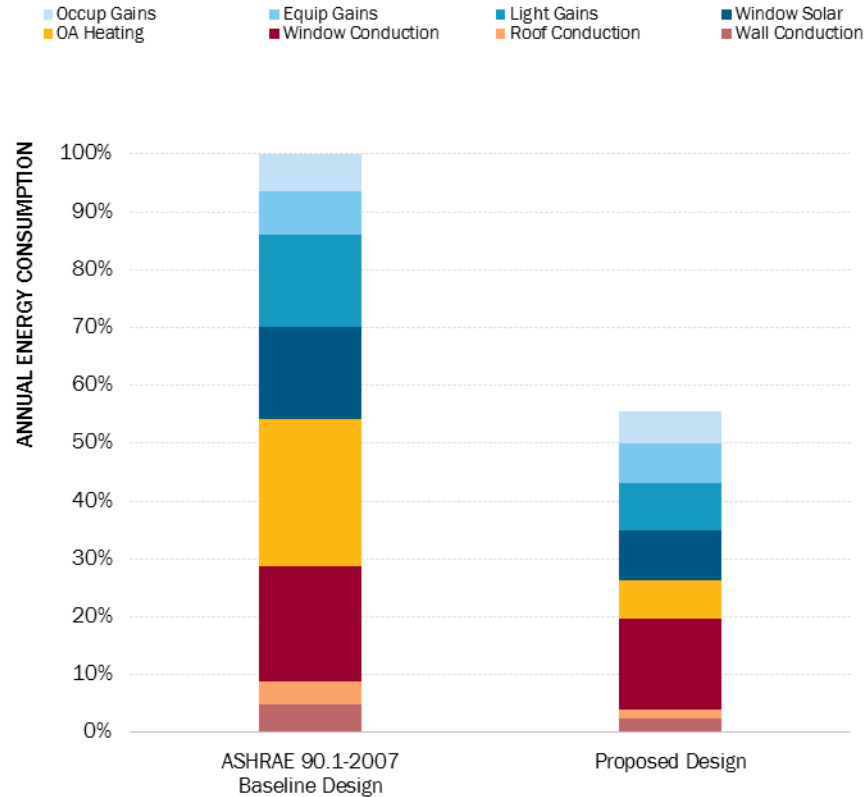
Light Gains

# 60% CD Energy Model Results

## Adjusted Methodology

### ANNUAL SITE ENERGY CONSUMPTION

7006 UMASS INTEGRATED DESIGN BUILDING



### Load Component Breakdown

#### Increase in energy savings over Baseline:

Wall Conduction	49%
Roof Conduction	61%
Window Conduction	22%
Outdoor Air Heating	74%
Window Solar	46%
Light Gains	47%



# Challenges, but Realities

## Climate

- Zone 5, energy-intensive climate. Heating-dominated: window conduction is a primary energy driver for any building in this climate.

## Orientation & Site Footprint

- Corresponds to (restricted by) North Pleasant Avenue & Arts building.

## Occupancy Schedules

- Building is occupied ~ 16 hours/day & weekend occupancy.

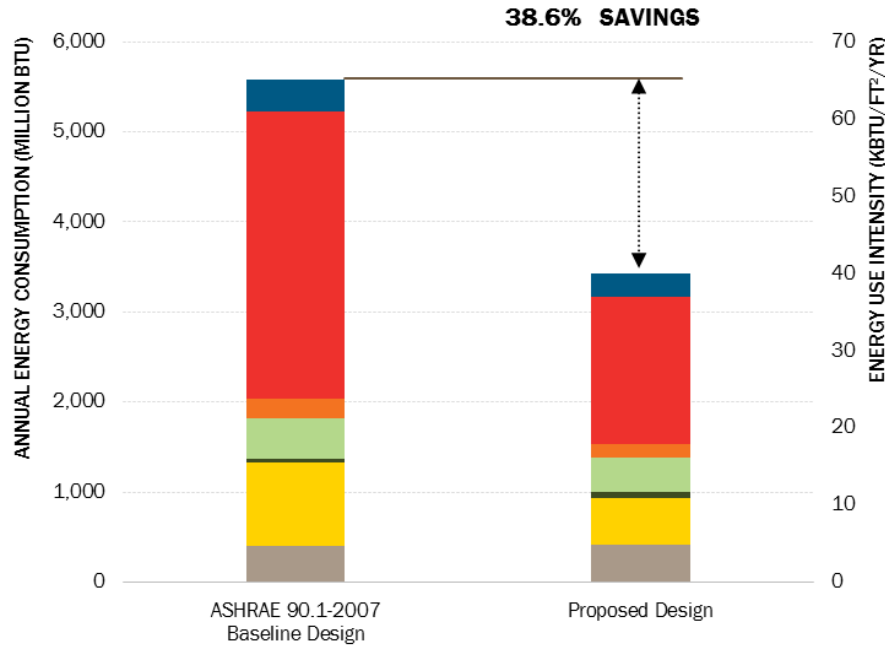
# No Glazing in Courtyard

## Adjusted Methodology, Sensitivity Test

### ANNUAL SITE ENERGY CONSUMPTION

7006 UMASS INTEGRATED DESIGN BUILDING

Chilled Water Heat Reject. Refrigeration Steam HP Supp. Hot Water  
Vent. Fans Pumps & Aux. Ext. Usage Task Lights Area Lights Misc. Equip.



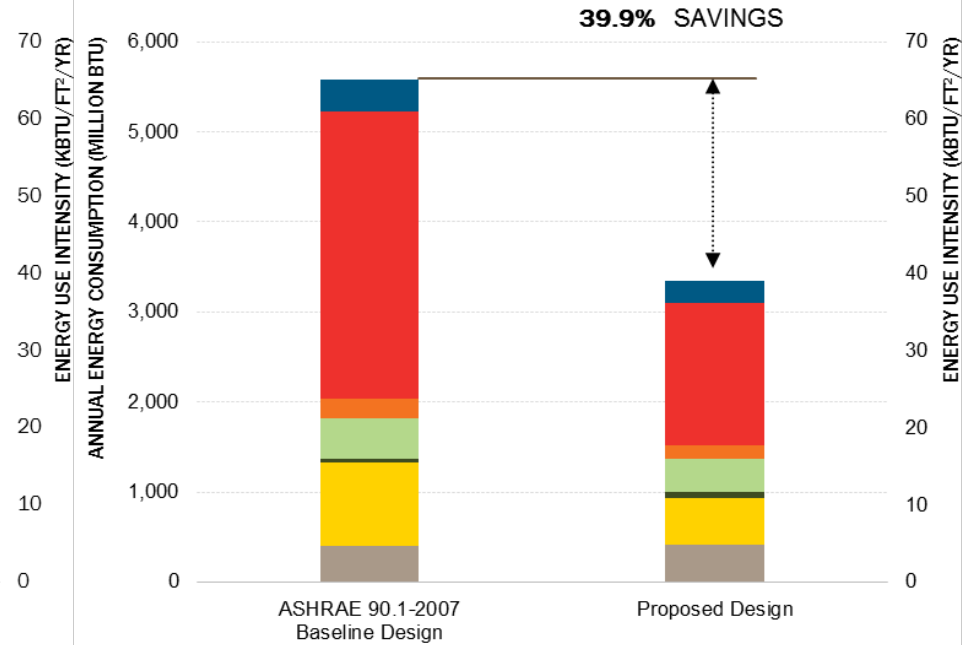
Proposed Design

(EUI 40.3 kBtu/sf/yr)

### ANNUAL SITE ENERGY CONSUMPTION

7006 UMASS INTEGRATED DESIGN BUILDING

Chilled Water Heat Reject. Refrigeration Steam HP Supp. Hot Water  
Vent. Fans Pumps & Aux. Ext. Usage Task Lights Area Lights Misc. Equip.



No Glazing at Courtyard

1.3% better

(EUI 39.4 kBtu/sf/yr)

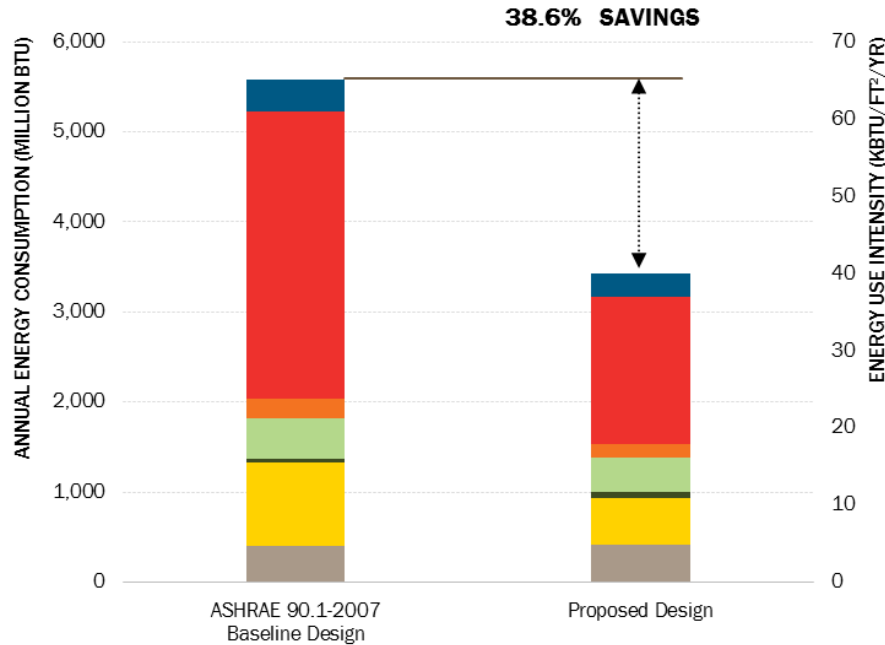
# No Glazing at "Tube Ends"

## Adjusted Methodology, Sensitivity Test

### ANNUAL SITE ENERGY CONSUMPTION

7006 UMASS INTEGRATED DESIGN BUILDING

Chilled Water Heat Reject. Refrigeration Steam HP Supp. Hot Water  
Vent. Fans Pumps & Aux. Ext. Usage Task Lights Area Lights Misc. Equip.



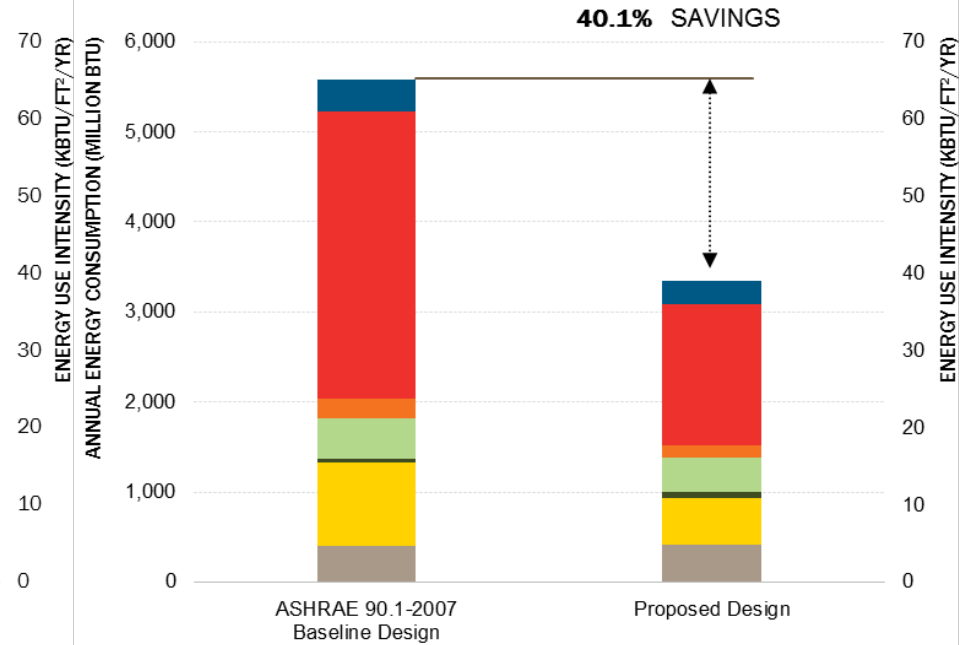
Proposed Design

(EUI 40.3 kBtu/sf/yr)

### ANNUAL SITE ENERGY CONSUMPTION

7006 UMASS INTEGRATED DESIGN BUILDING

Chilled Water Heat Reject. Refrigeration Steam HP Supp. Hot Water  
Vent. Fans Pumps & Aux. Ext. Usage Task Lights Area Lights Misc. Equip.



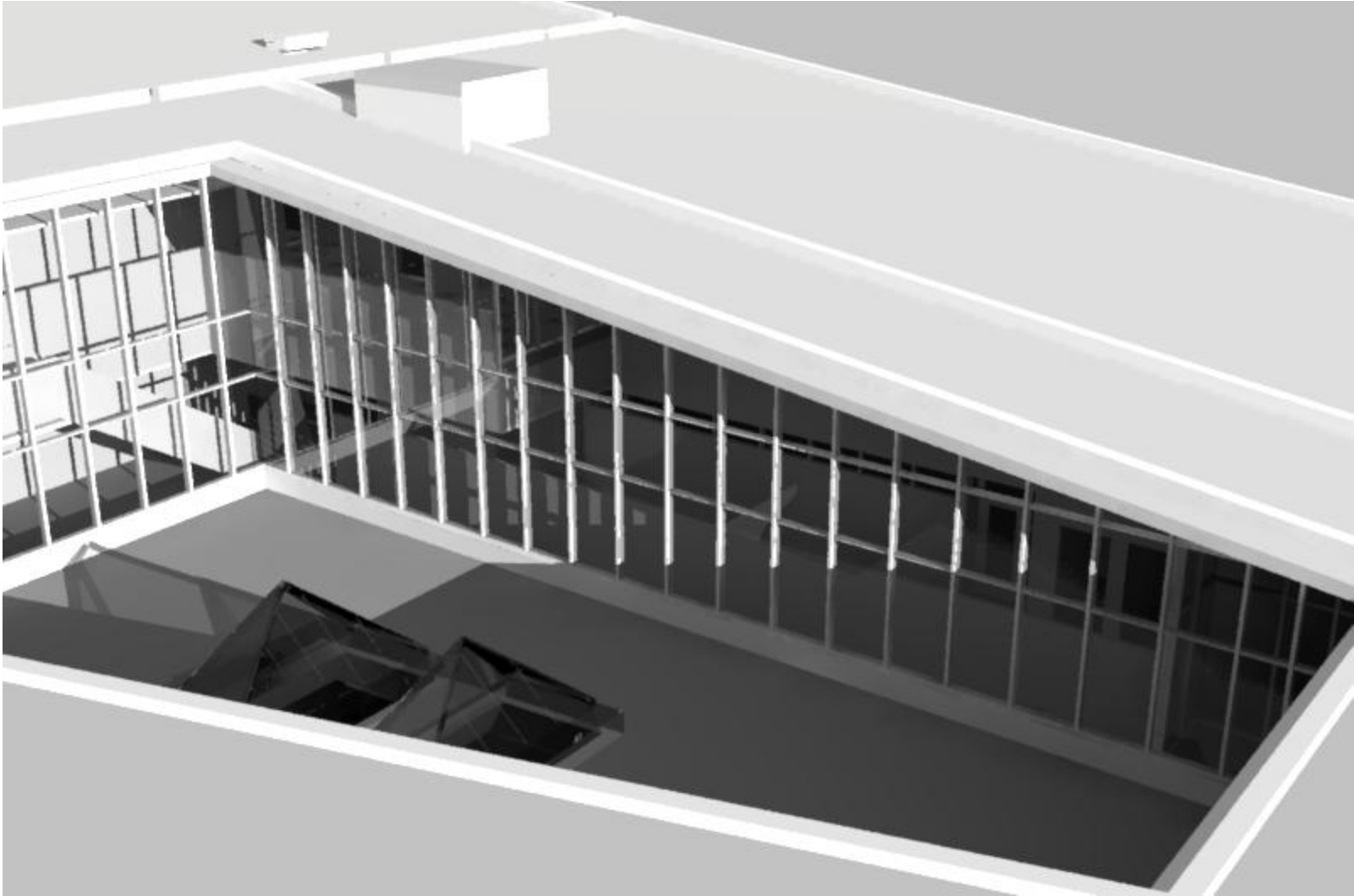
No Glazing at "Tube Ends"

1.5% better

(EUI 39.3 kBtu/sf/yr)

# Daylight Visualizations

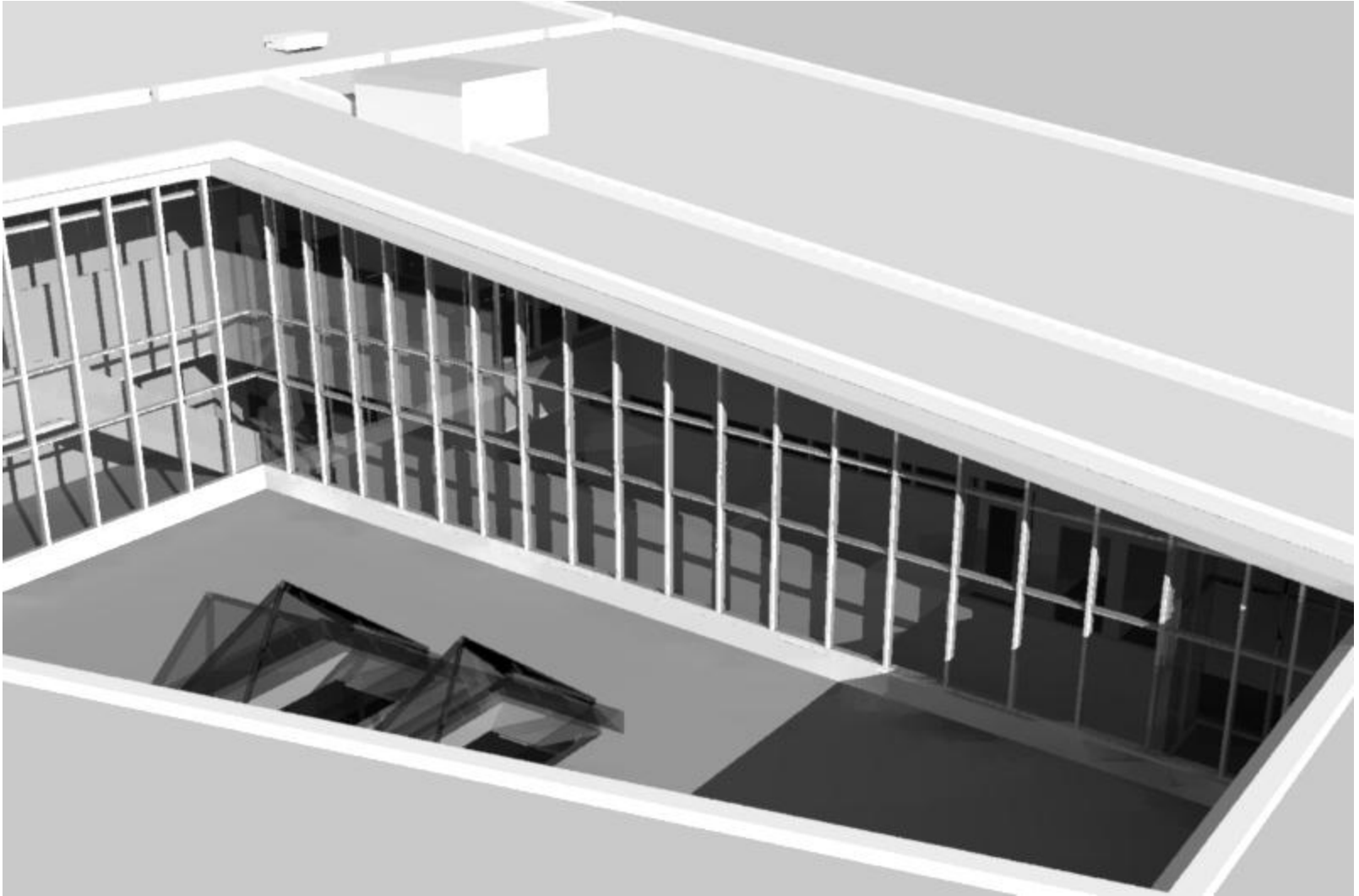
## Exterior Courtyard



Equinox 7am

# Daylight Visualizations

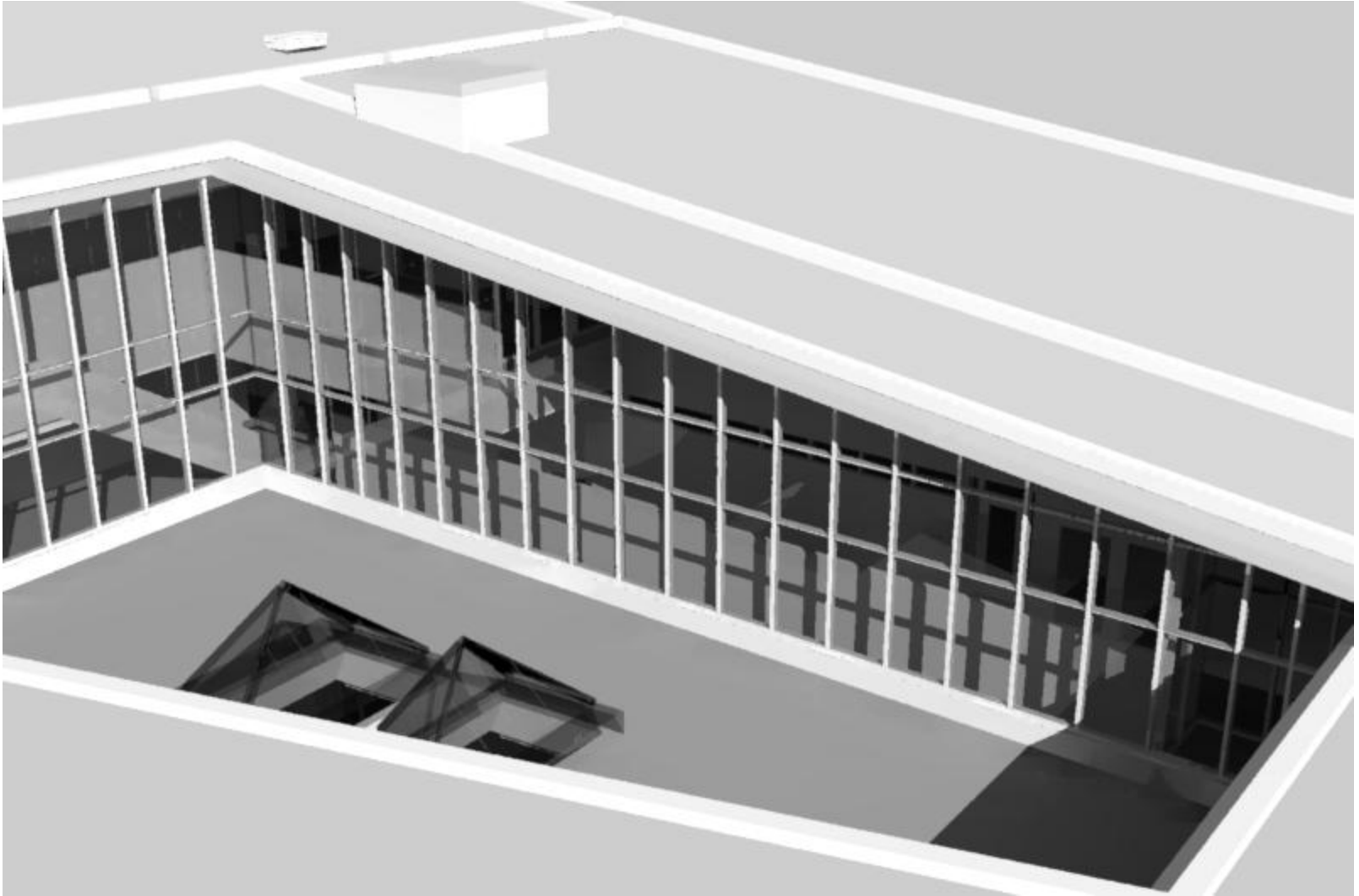
## Exterior Courtyard



Equinox 8am

# Daylight Visualizations

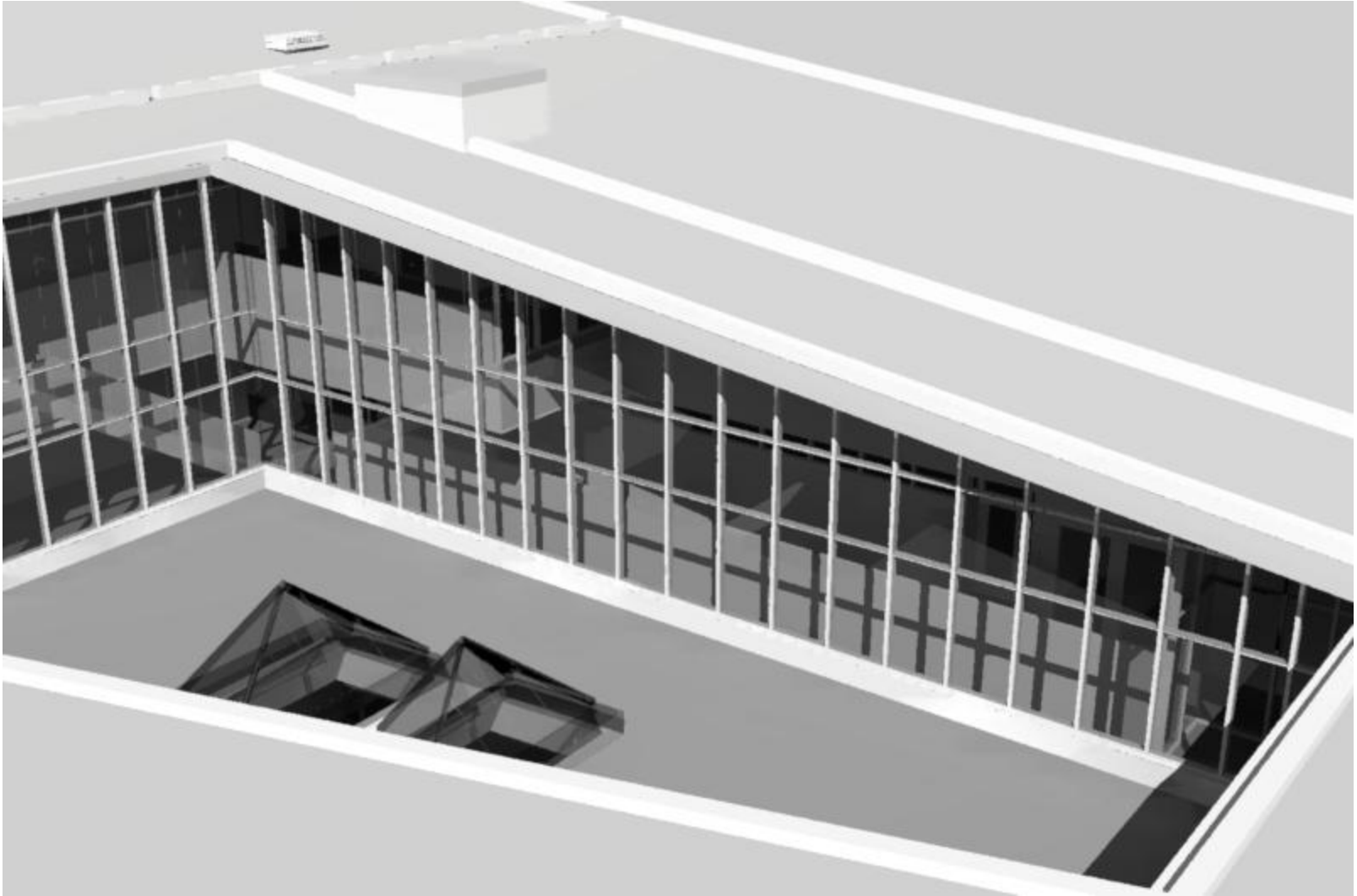
## Exterior Courtyard



Equinox 9am

# Daylight Visualizations

## Exterior Courtyard



Equinox 10am

# Daylight Visualizations

## Exterior Courtyard



Equinox 11am



# Daylight Visualizations

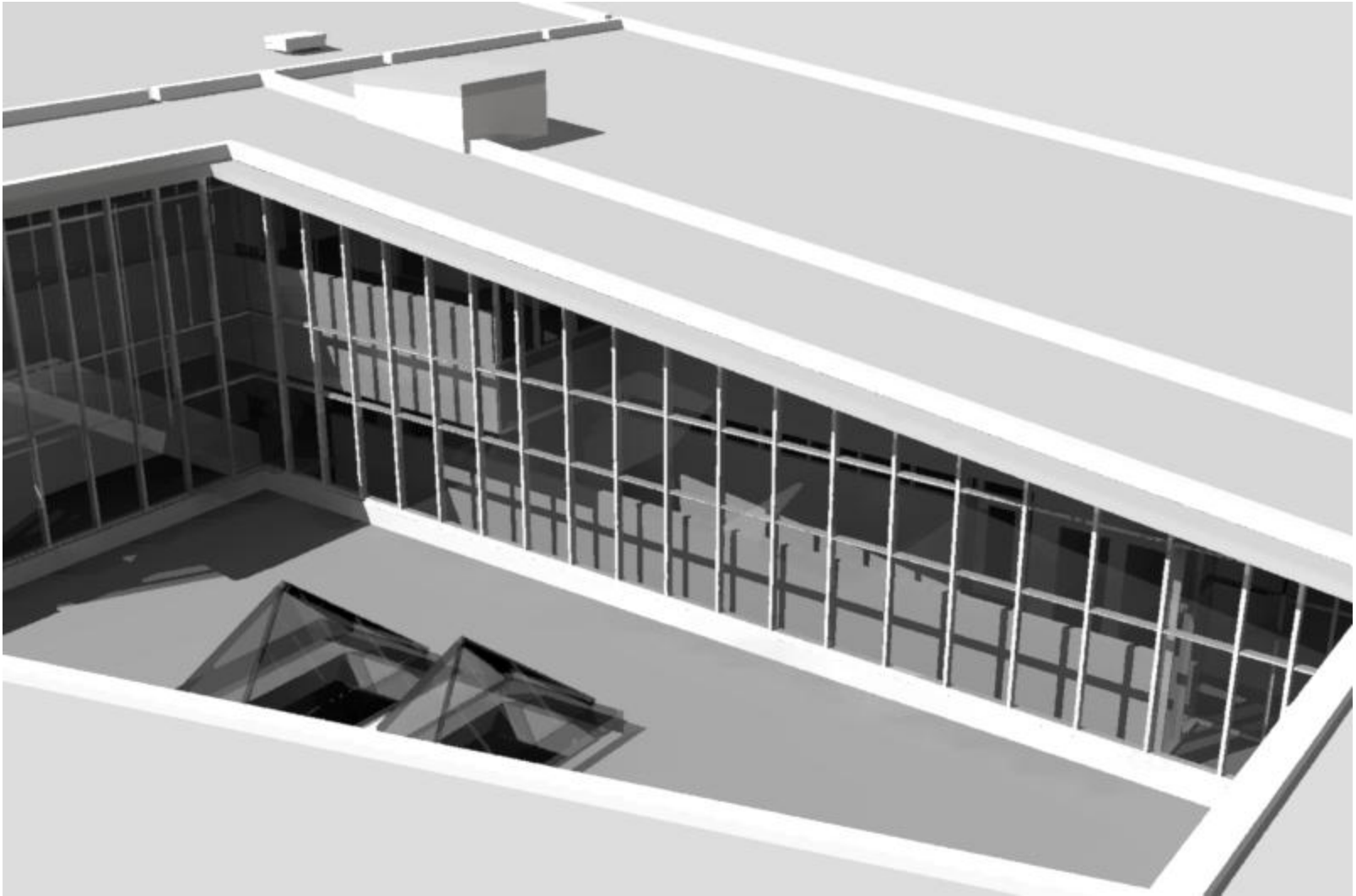
## Exterior Courtyard



Equinox 12pm

# Daylight Visualizations

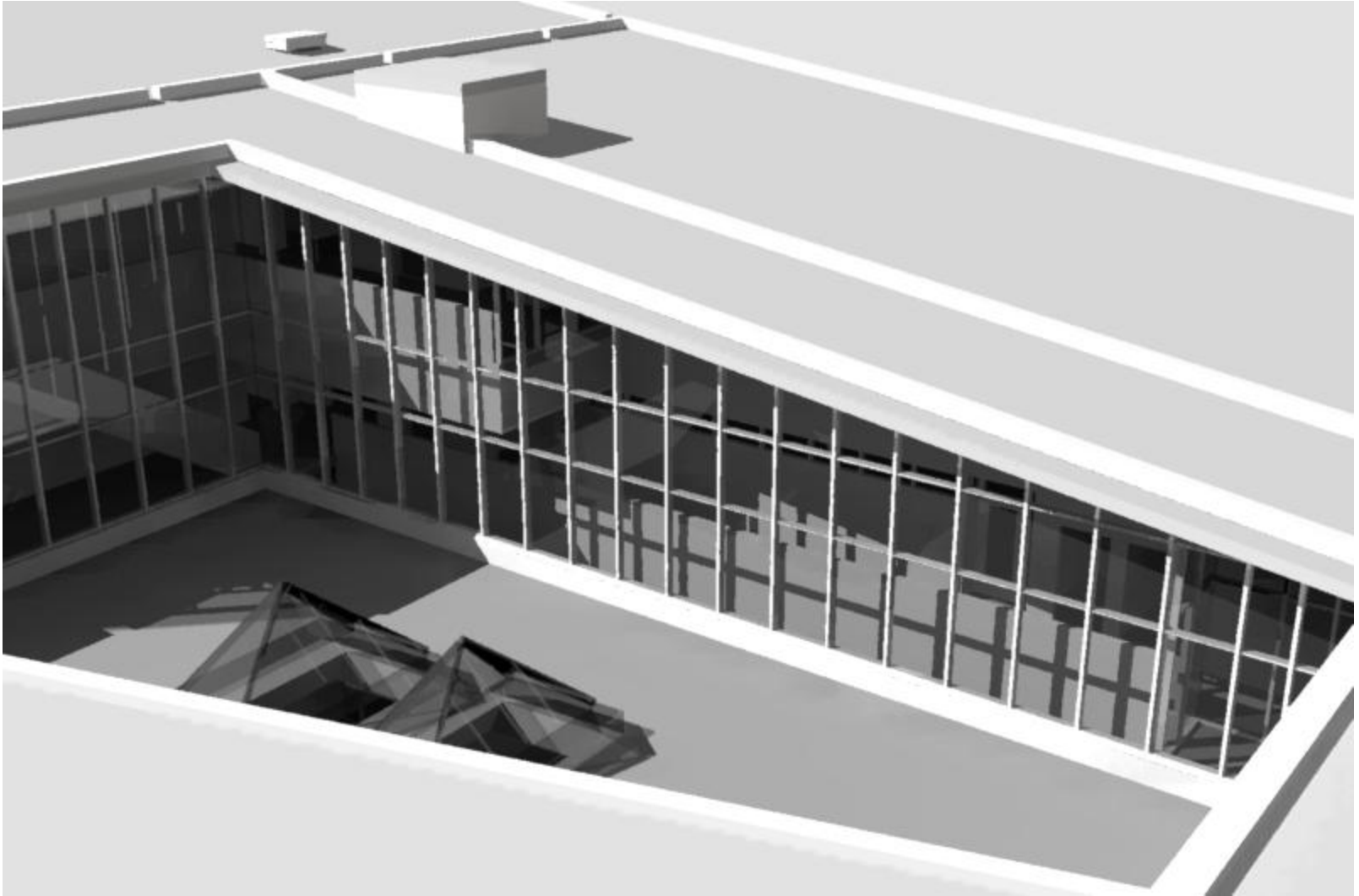
## Exterior Courtyard



Equinox 1pm

# Daylight Visualizations

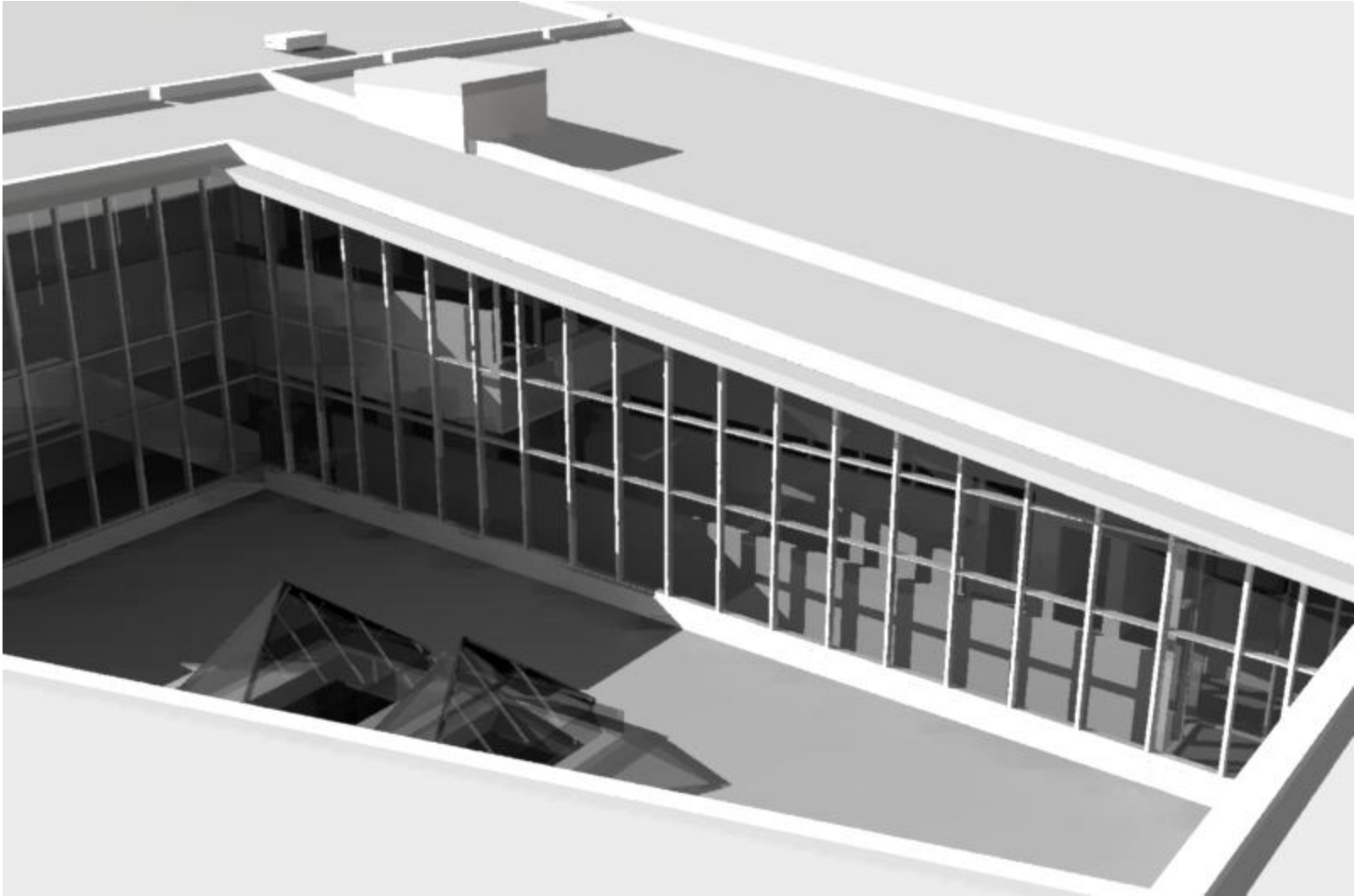
## Exterior Courtyard



Equinox 2pm

# Daylight Visualizations

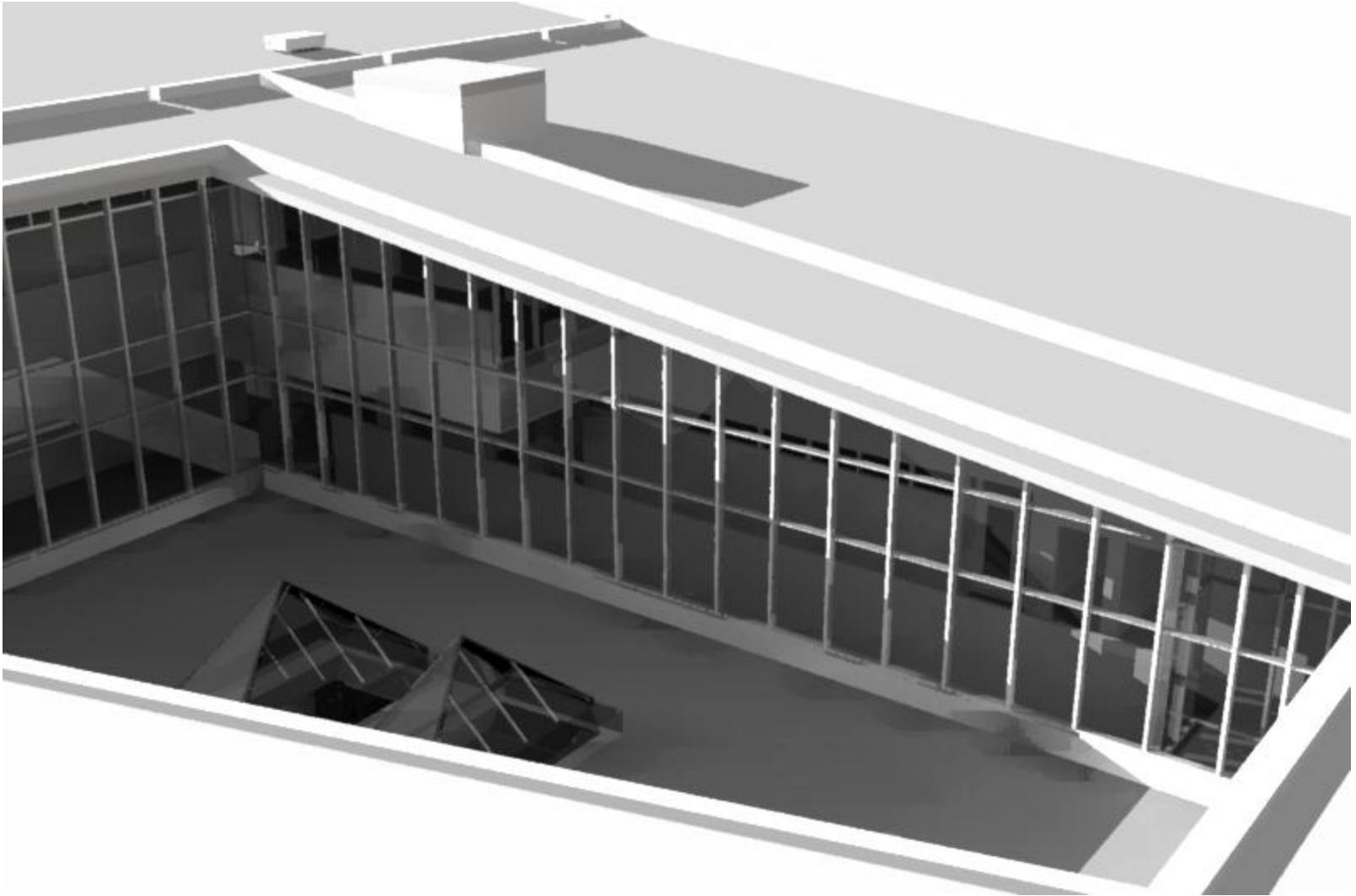
## Exterior Courtyard



Equinox 3pm

# Daylight Visualizations

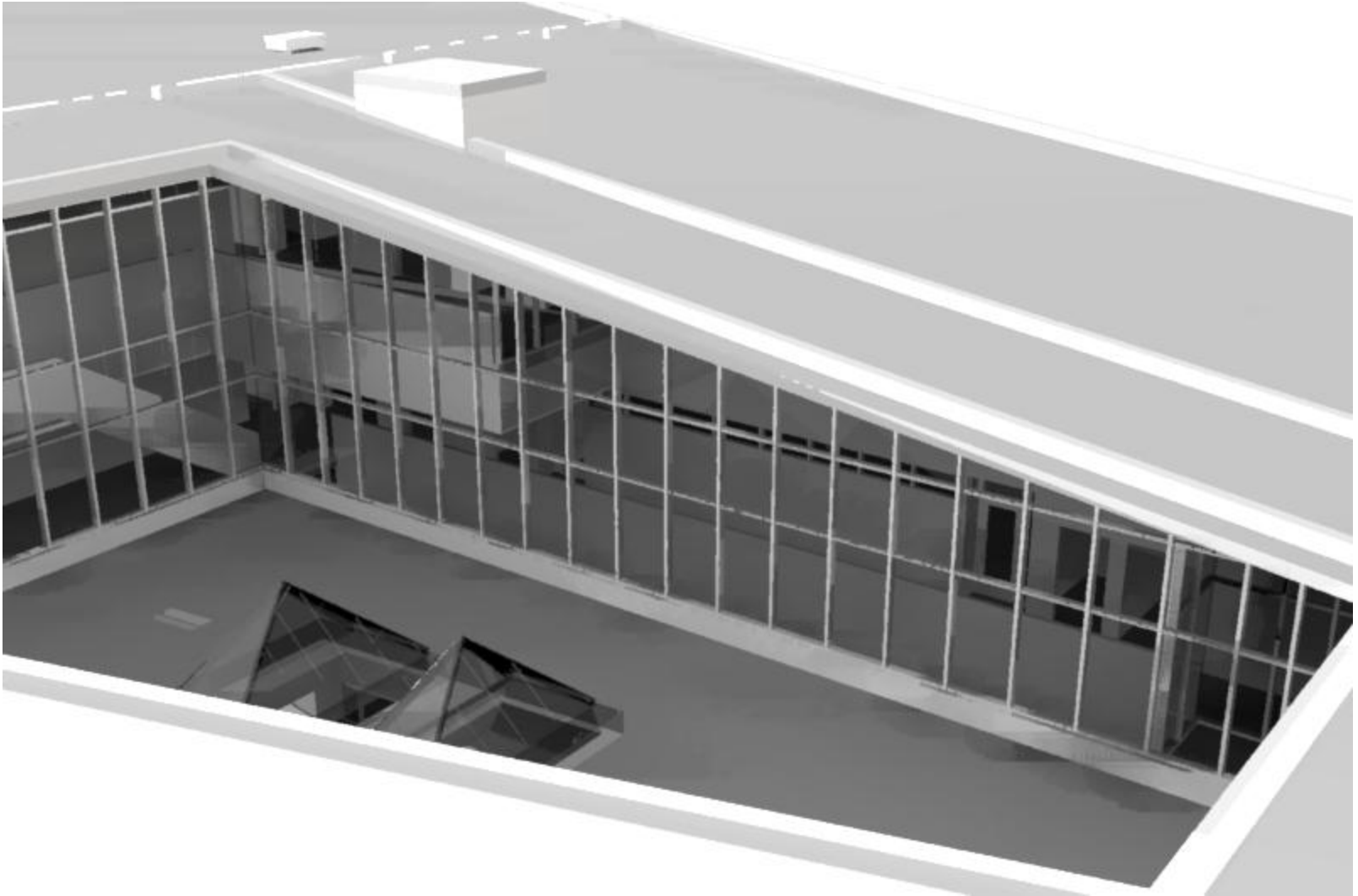
## Exterior Courtyard



Equinox 4pm

# Daylight Visualizations

## Exterior Courtyard

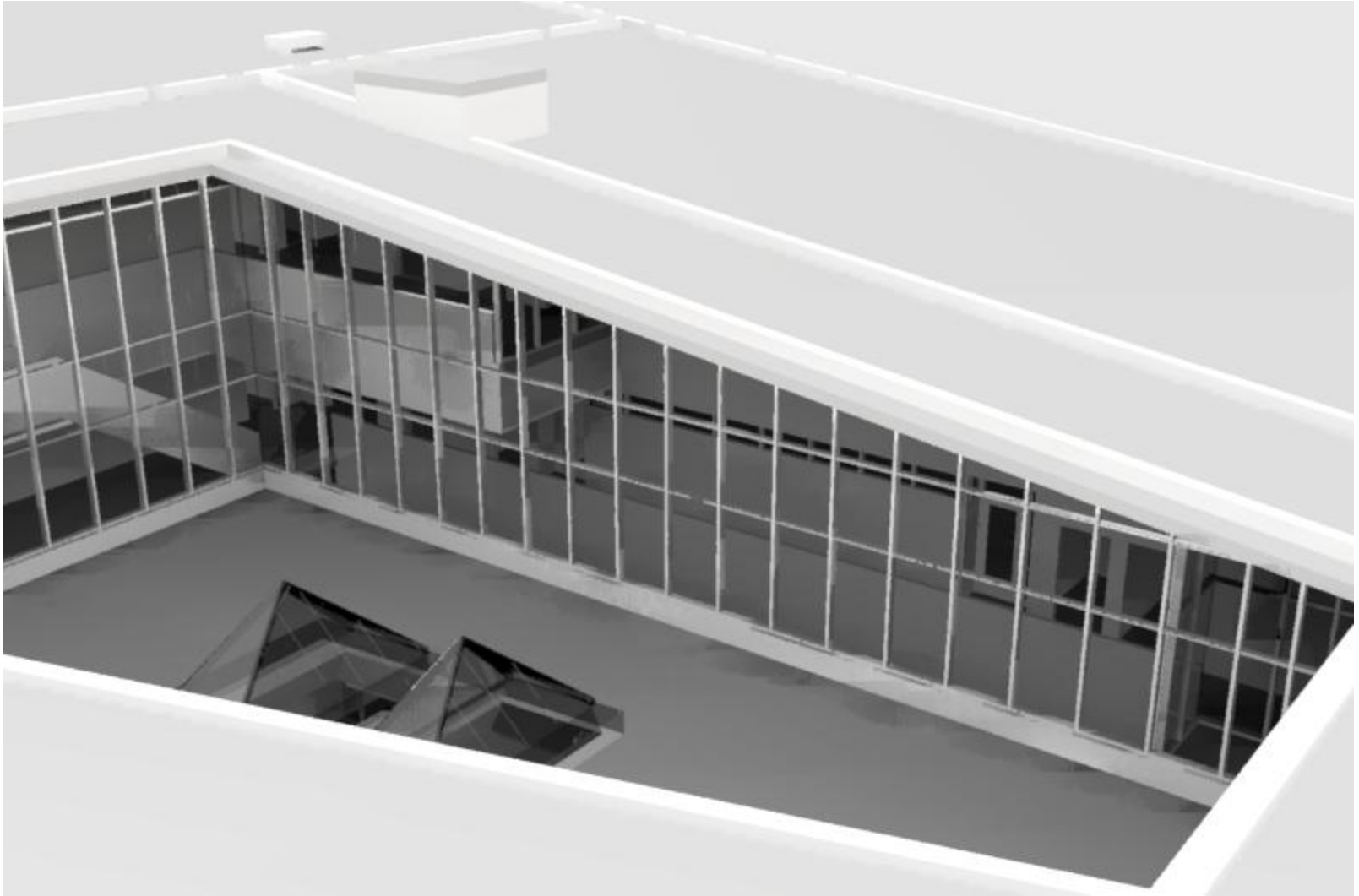


Equinox 5pm



# Daylight Visualizations

## Exterior Courtyard



Equinox 6pm

# Daylight Visualizations

## Third Floor Corridor

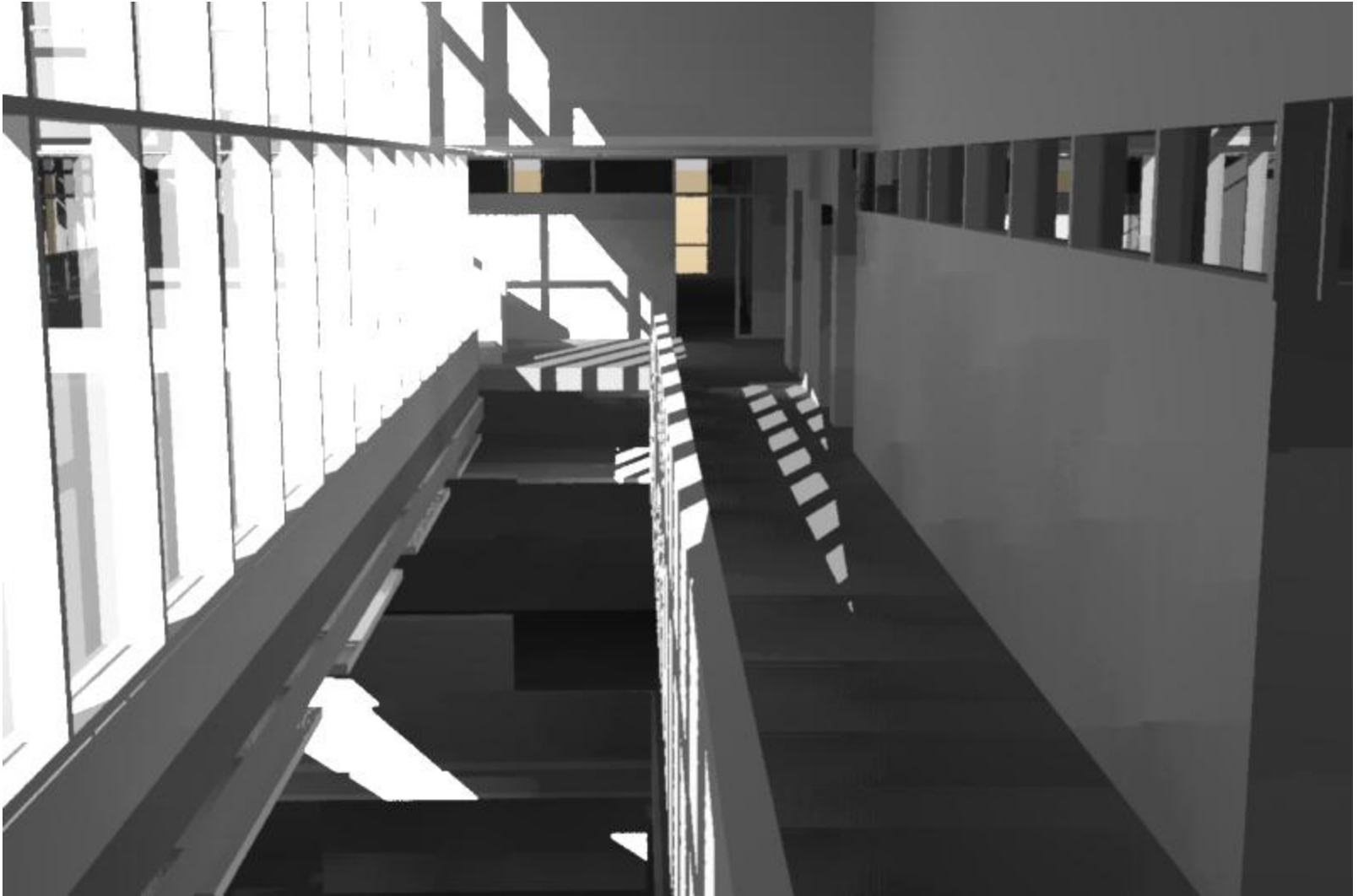


Equinox 7am



# Daylight Visualizations

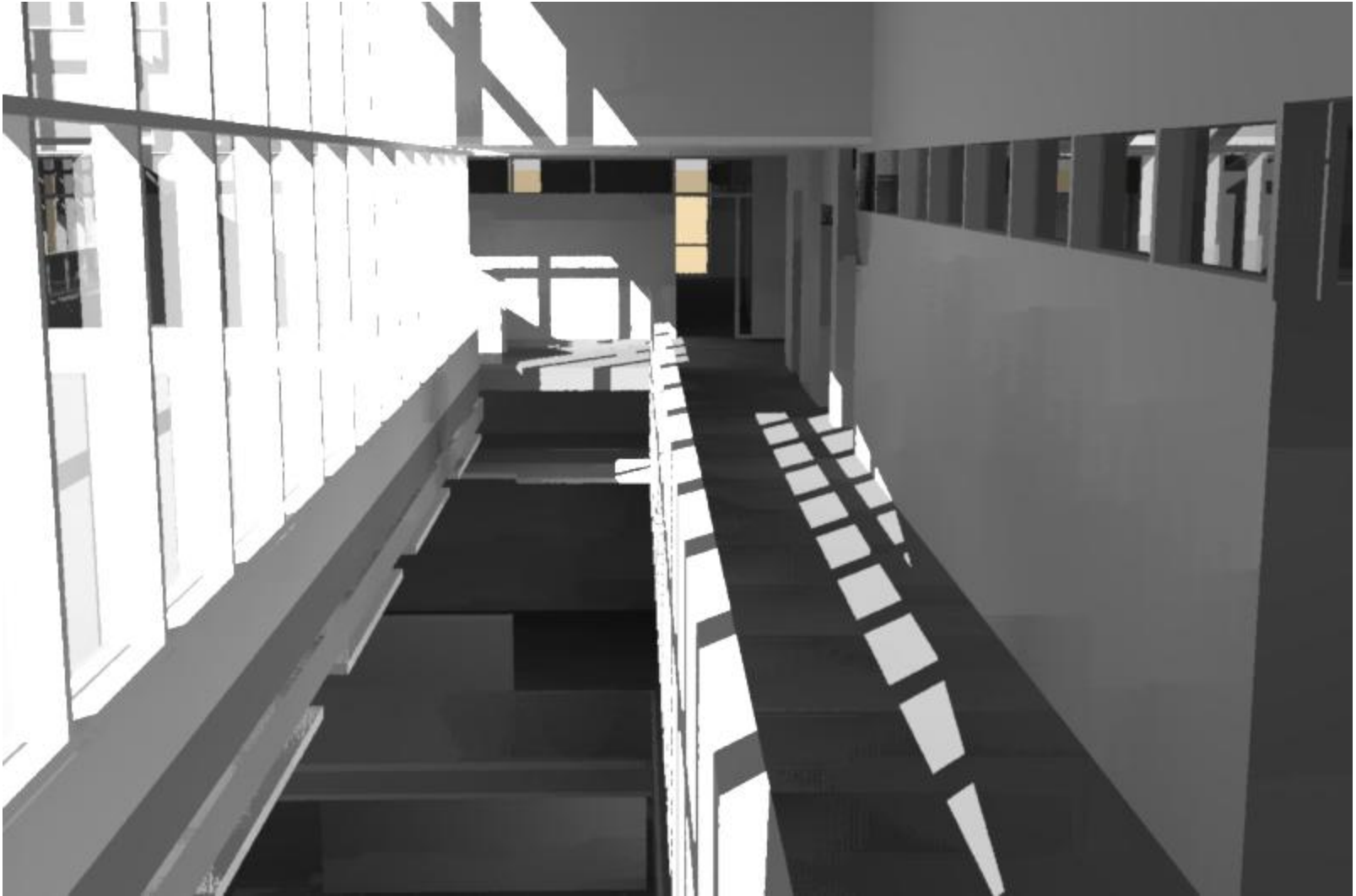
## Third Floor Corridor



Equinox 8am

# Daylight Visualizations

## Third Floor Corridor



Equinox 9am

# Daylight Visualizations

## Third Floor Corridor



Equinox 10am

# Daylight Visualizations

## Third Floor Corridor



Equinox 11am

# Daylight Visualizations

## Third Floor Corridor



Equinox 12pm

# Daylight Visualizations

## Third Floor Corridor



Equinox 1pm

# Daylight Visualizations

## Third Floor Corridor



Equinox 2pm

# Daylight Visualizations

## Third Floor Corridor



Equinox 3pm



# Daylight Visualizations



Equinox 4pm

# Daylight Visualizations

## Third Floor Corridor



Equinox 5pm

# Daylight Visualizations

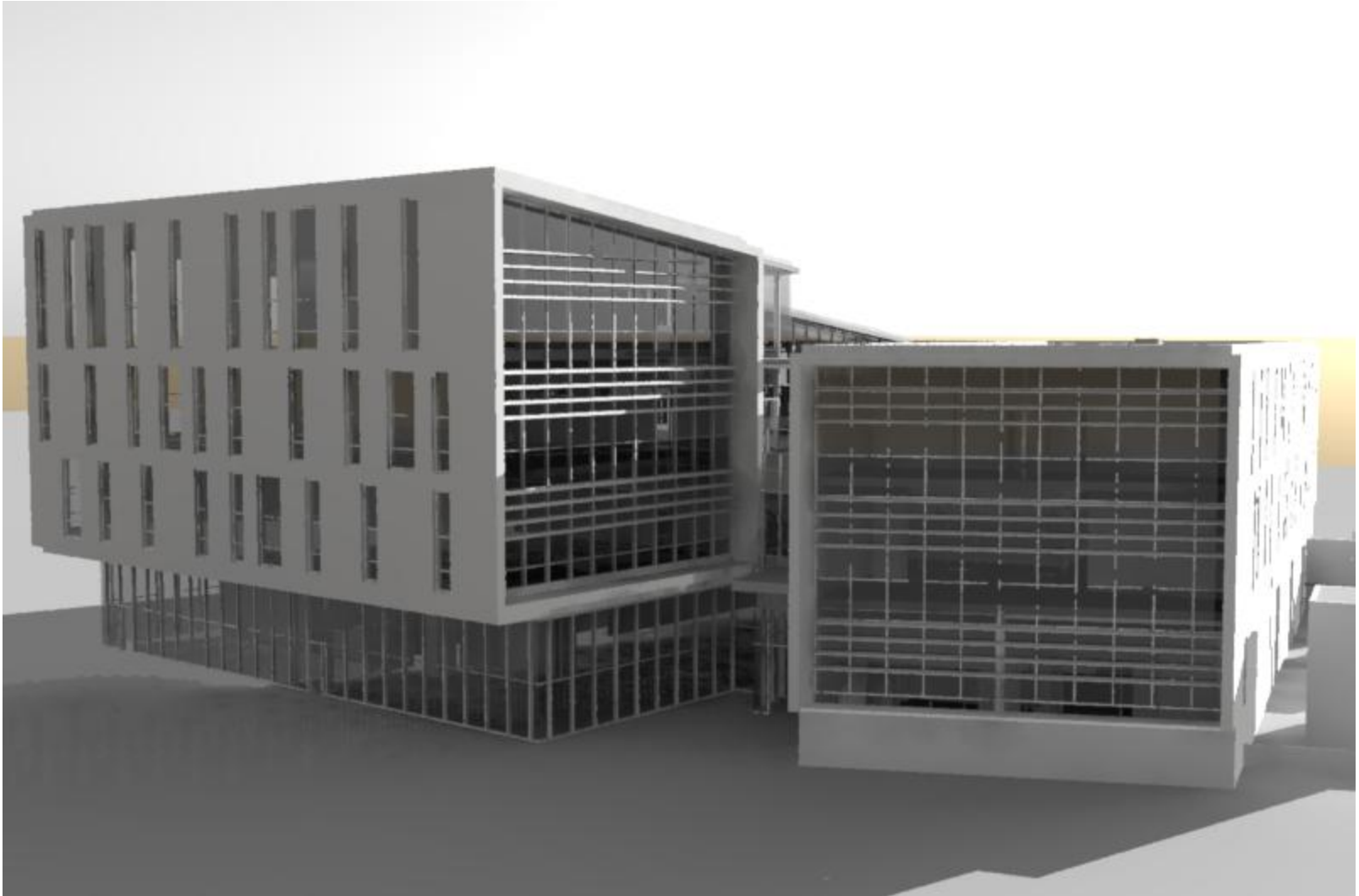
## Third Floor Corridor



Equinox 6pm

# Daylight Visualizations

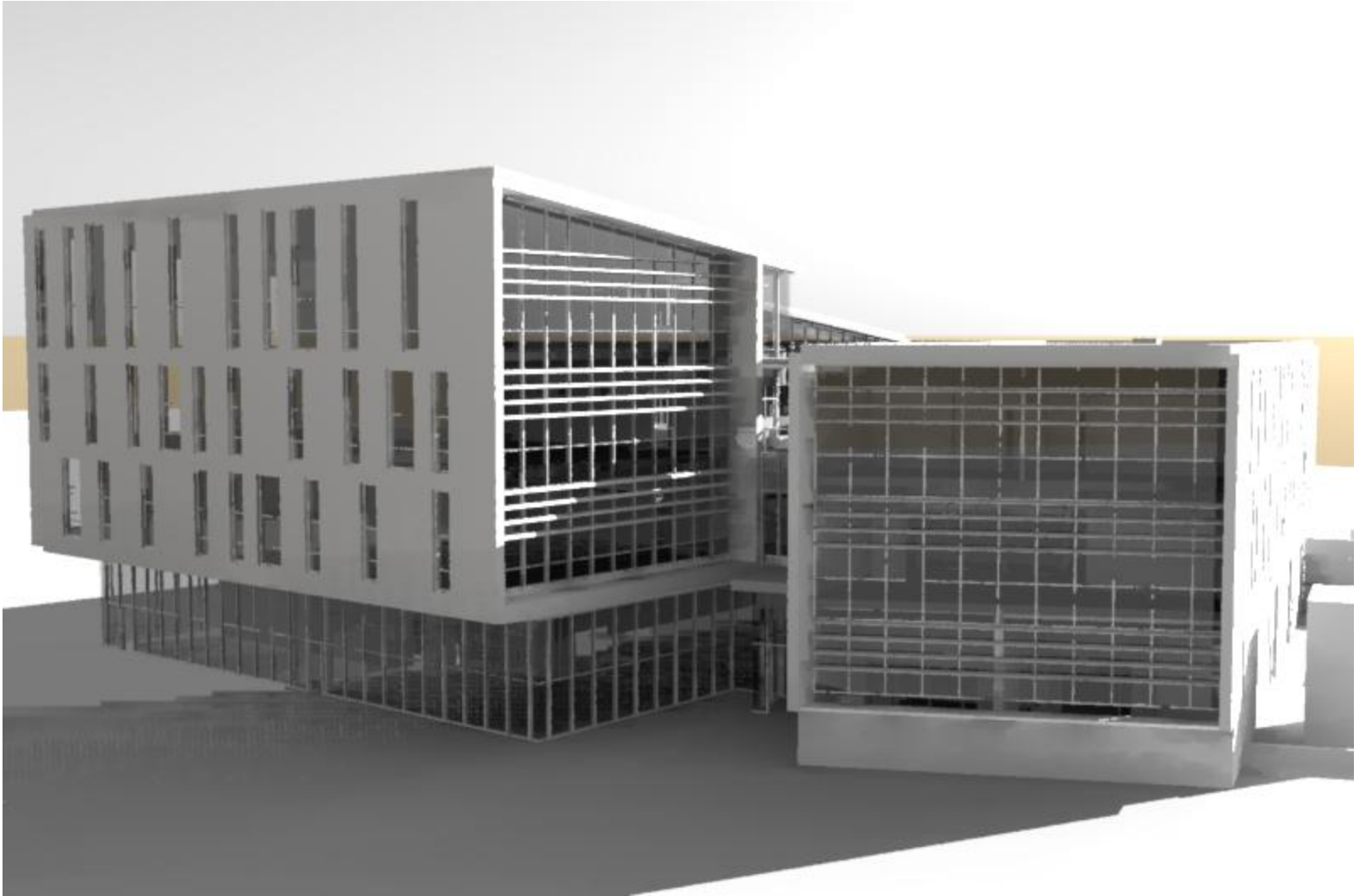
## South & West Facades



Equinox 7am

# Daylight Visualizations

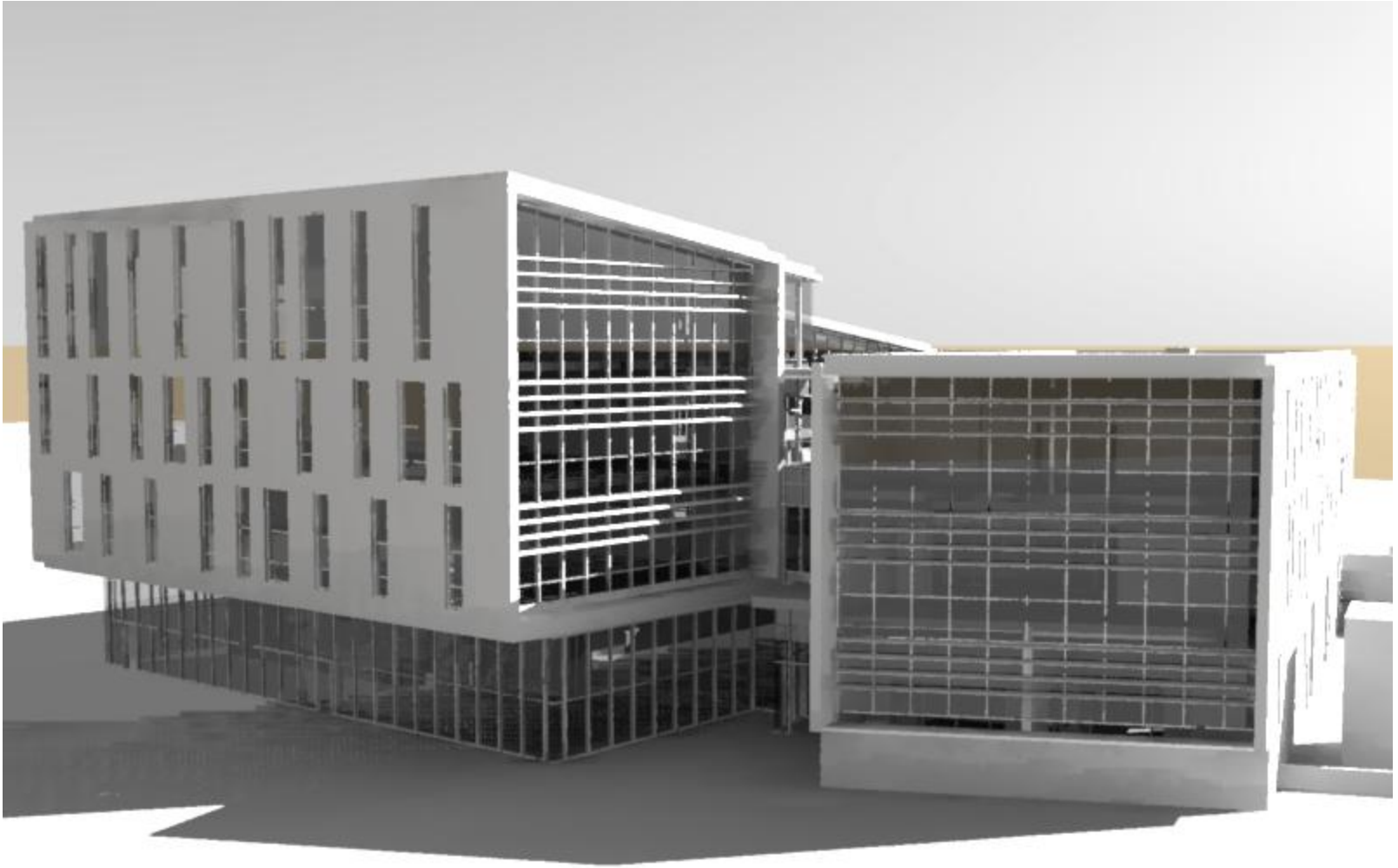
## South & West Facades



Equinox 8am

# Daylight Visualizations

## South & West Facades



Equinox 9am

# Daylight Visualizations

## South & West Facades



Equinox 10am



# Daylight Visualizations

## South & West Facades

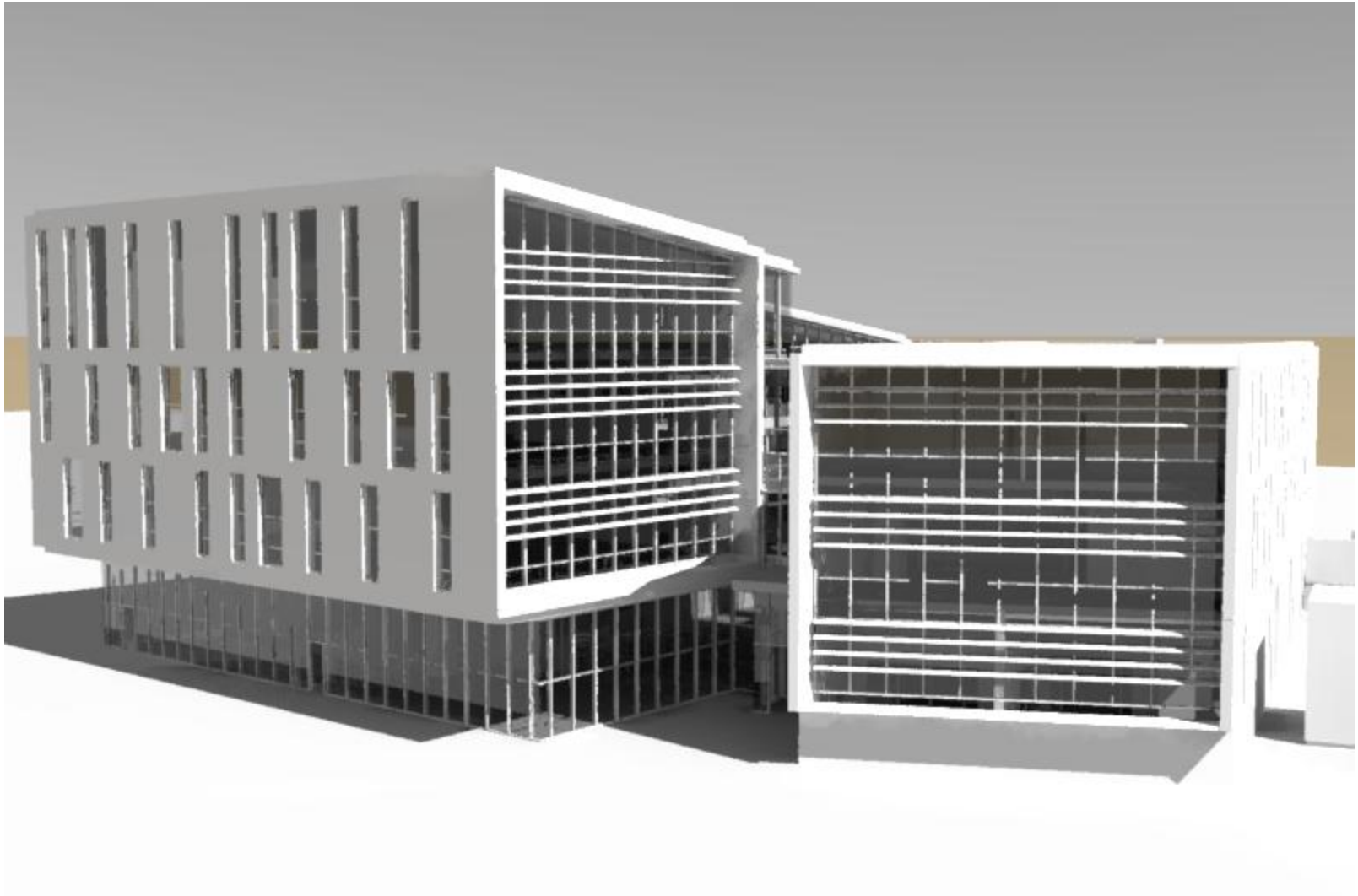


Equinox 11am



# Daylight Visualizations

## South & West Facades



Equinox 12pm

# Daylight Visualizations

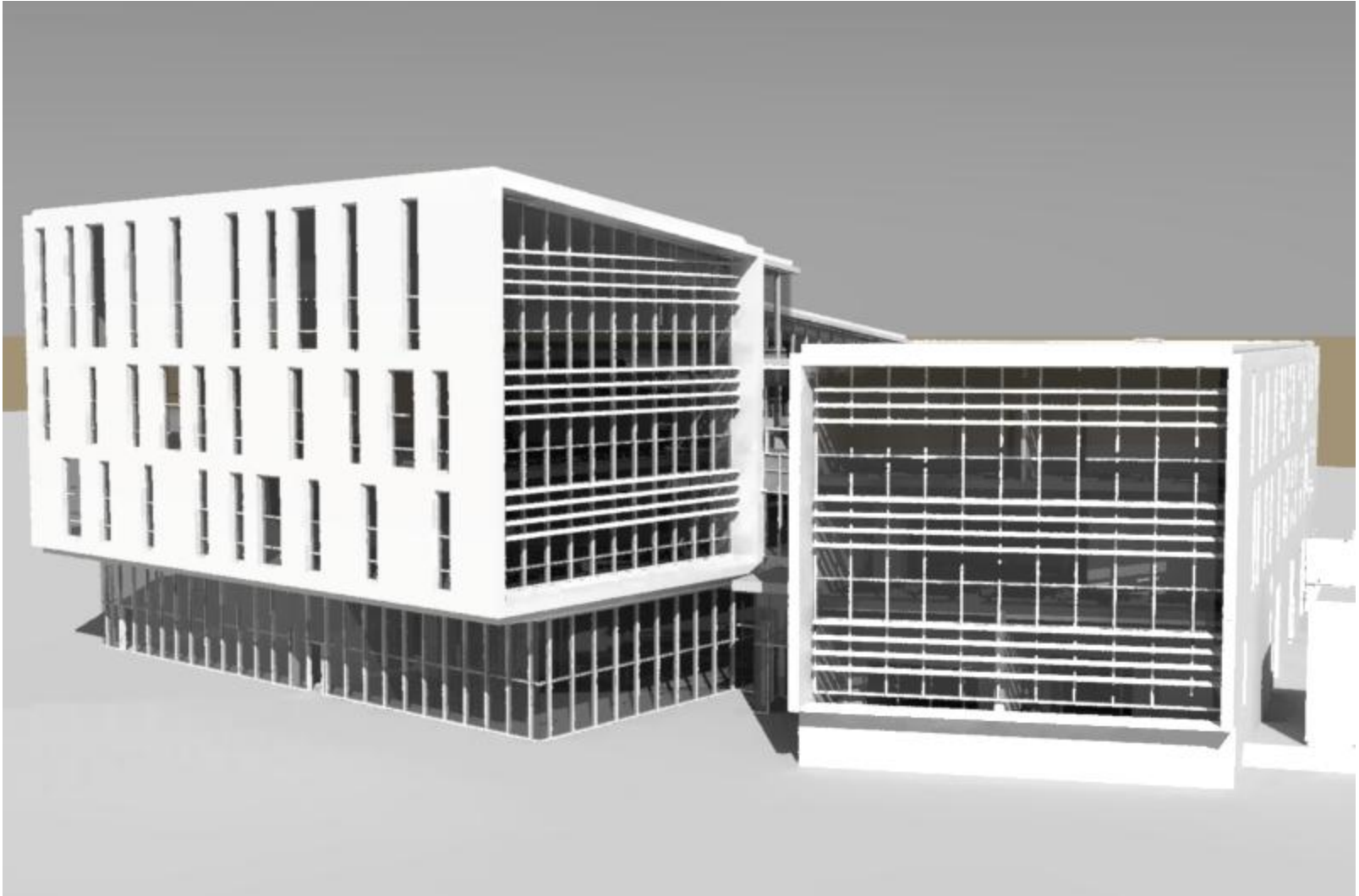
## South & West Facades



Equinox 1pm

# Daylight Visualizations

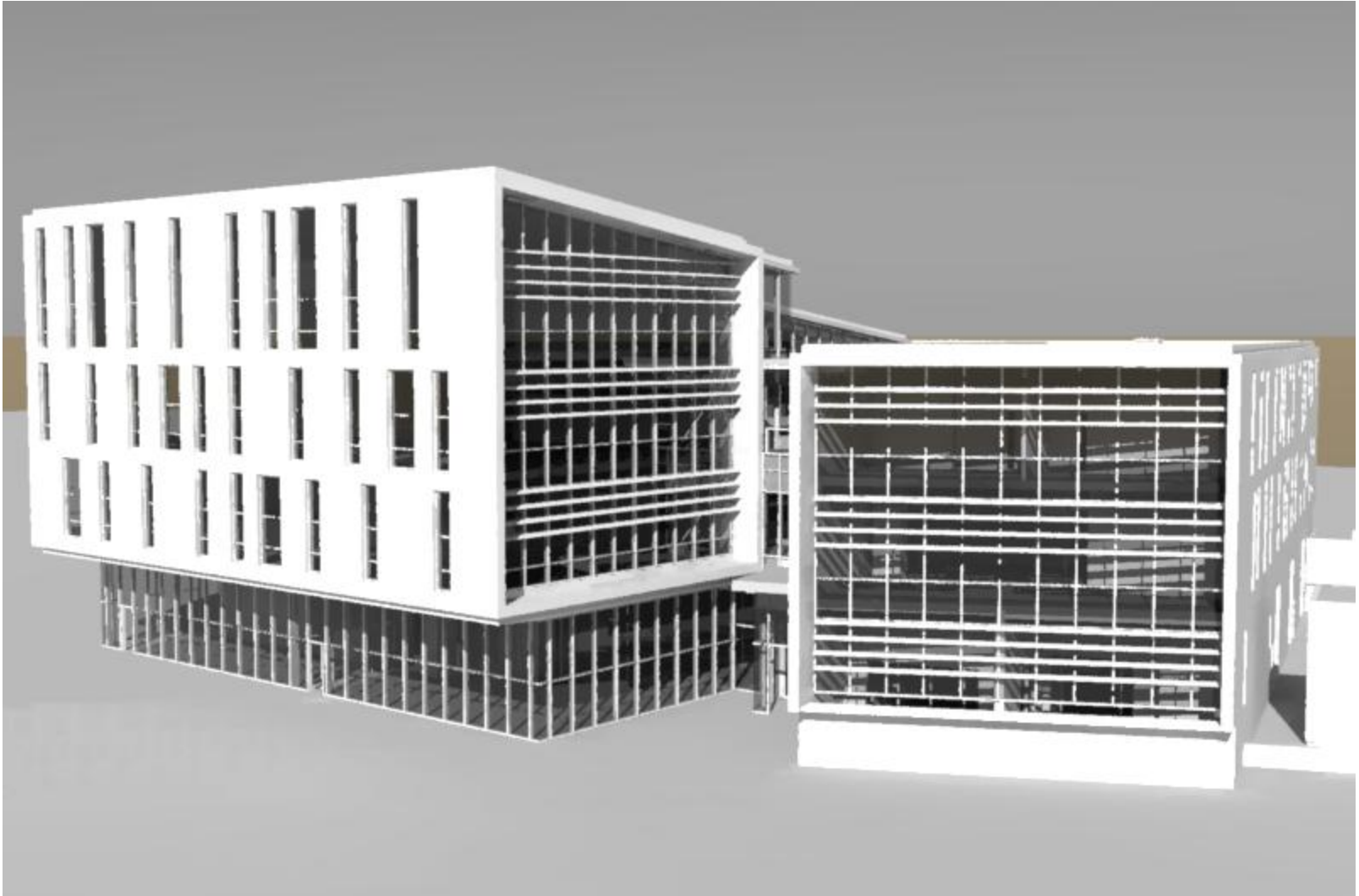
## South & West Facades



Equinox 2pm

# Daylight Visualizations

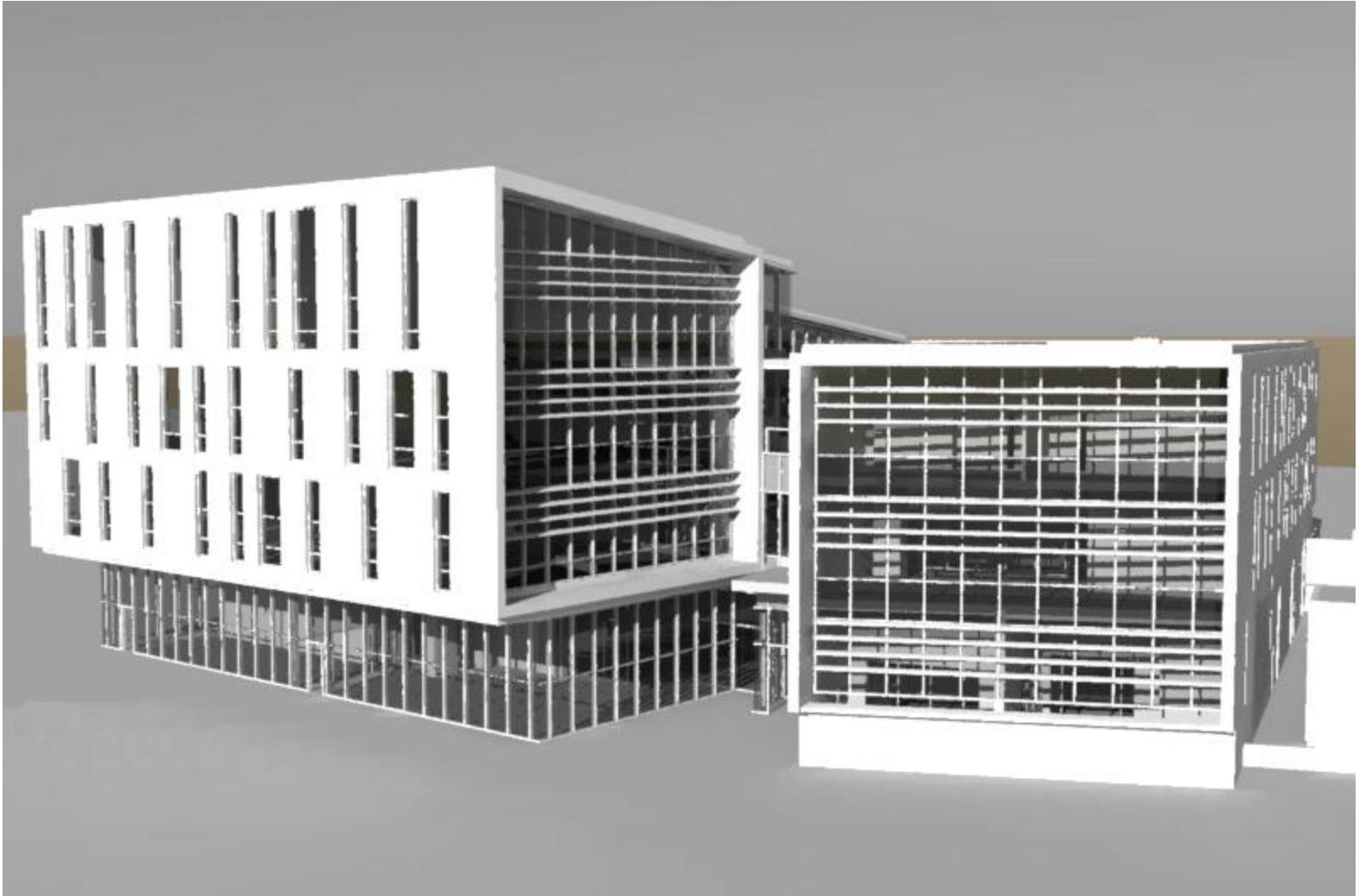
## South & West Facades



Equinox 3pm

# Daylight Visualizations

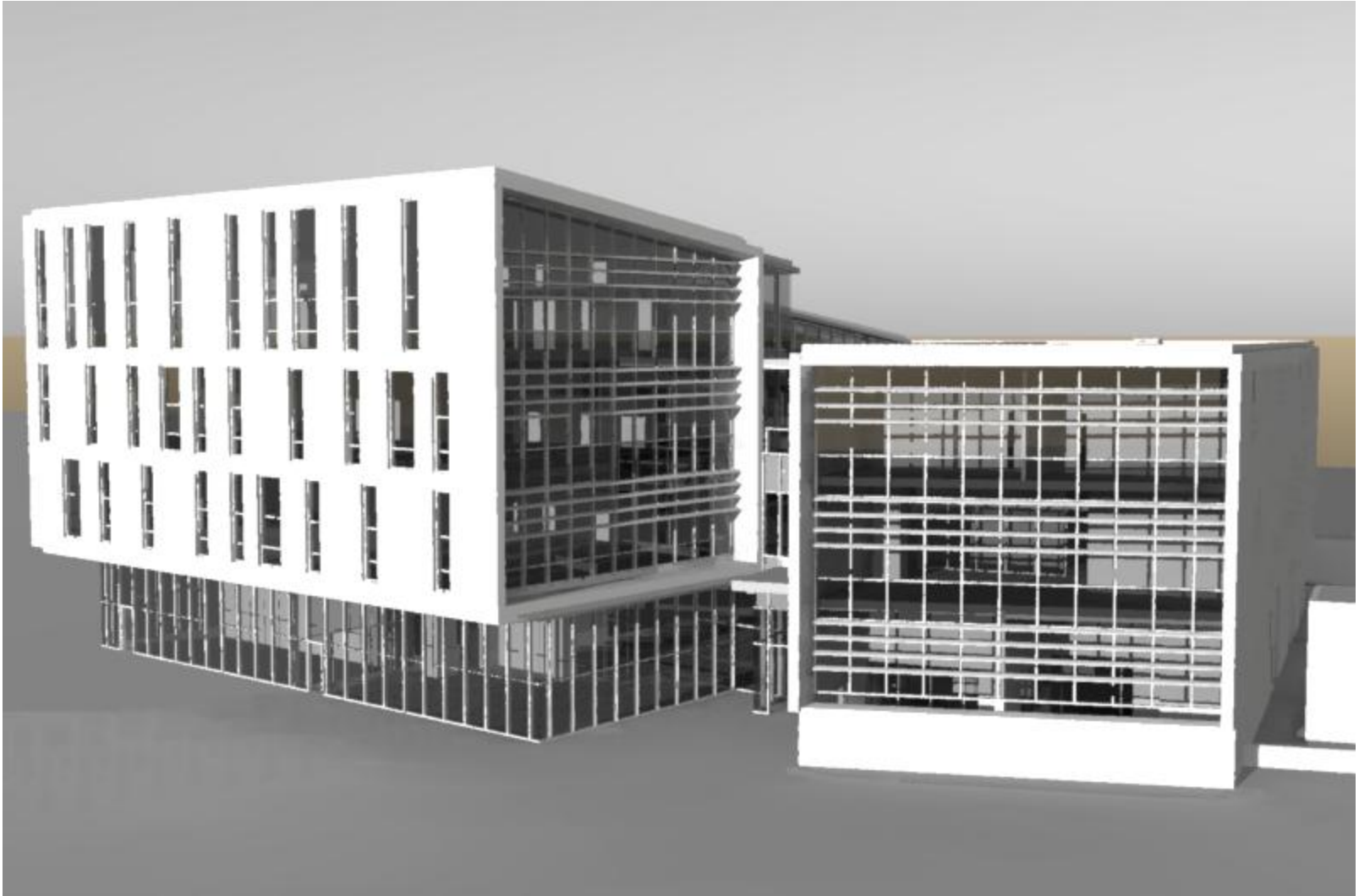
## South & West Facades



Equinox 4pm

# Daylight Visualizations

## South & West Facades



Equinox 5pm



# Daylight Visualizations

## South & West Facades



Equinox 6pm