MILLENNIUM SCIENCE COMPLEX

Lighting Concepts

Jason Brognano – Michael Lucas – Christopher Russell

PRESENTATION OUTLINE

- IPD/BIM Thesis
- Building Overview
- Cantilever Plaza
  - Introduction
  - Mike's Design
  - Chris's Design
- Student Study Area
  - Introduction
  - Jason's Design
  - Mike's Design
  - Chris's Design
- Distinguished Office
  - Jason's Design
- Conference Room
  - Mike's Design

KGB Maser Management, Engineering, Consulting.

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BIMception

IPD/BIM THESIS

- Team of 4 – One from each discipline
- Design Integration
  - Domino Effect from Design Changes
- Collaborative Scheduling
  - Weekly Meetings
  - Deadlines Affect Other Team Members
- Team Goals Govern Design
  - Each Discipline Reacts to Team Goals

- Ultimate Structure
  - Fully-integrated, Full-service Design Firm

Millennium Science Complex

BUILDING OVERVIEW

BUILDING STATISTICS: MILLENNIUM SCIENCE COMPLEX

Site Location:	University Park, PA
Occupant:	The Pennsylvania State University
Size:	275,600 SF
Levels:	5 Levels

<u>Design Team</u>

Architect:	Rafael Viñoly Architects
Lighting Designer:	Brandston Partnership Inc.
MEP Engineer:	Flack + Kurtz
Construction Manager:	Whiting-Turner

LOCATION: UNIVERSITY PARK, PA

Cantilever Plaza

SPACE OVERVIEW

CANTILEVER PLAZA: RENDERING

CANTILEVER PLAZA: RENDERING

MIKE LUCAS

CANTILEVER PLAZA: EXISTING PLAZA ENTRANCE

MIKE LUCAS

Cantilever Plaza

MIKE LUCAS

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CANTILEVER PLAZA: PLAN VIEW

MIKE LUCAS

CANTILEVER PLAZA : LIGHT THE PATH

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CANTILEVER PLAZA : LIGHT THE SEATING

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CANTILEVER PLAZA : PENN STATE'S SITE LIGHTING

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CANTILEVER PLAZA : LIGHT THE MAIN WALKWAY

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CANTILEVER PLAZA : LIGHT THE ENTRANCE

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CANTILEVER PLAZA : HIGHLIGHT THE LANDSCAPING

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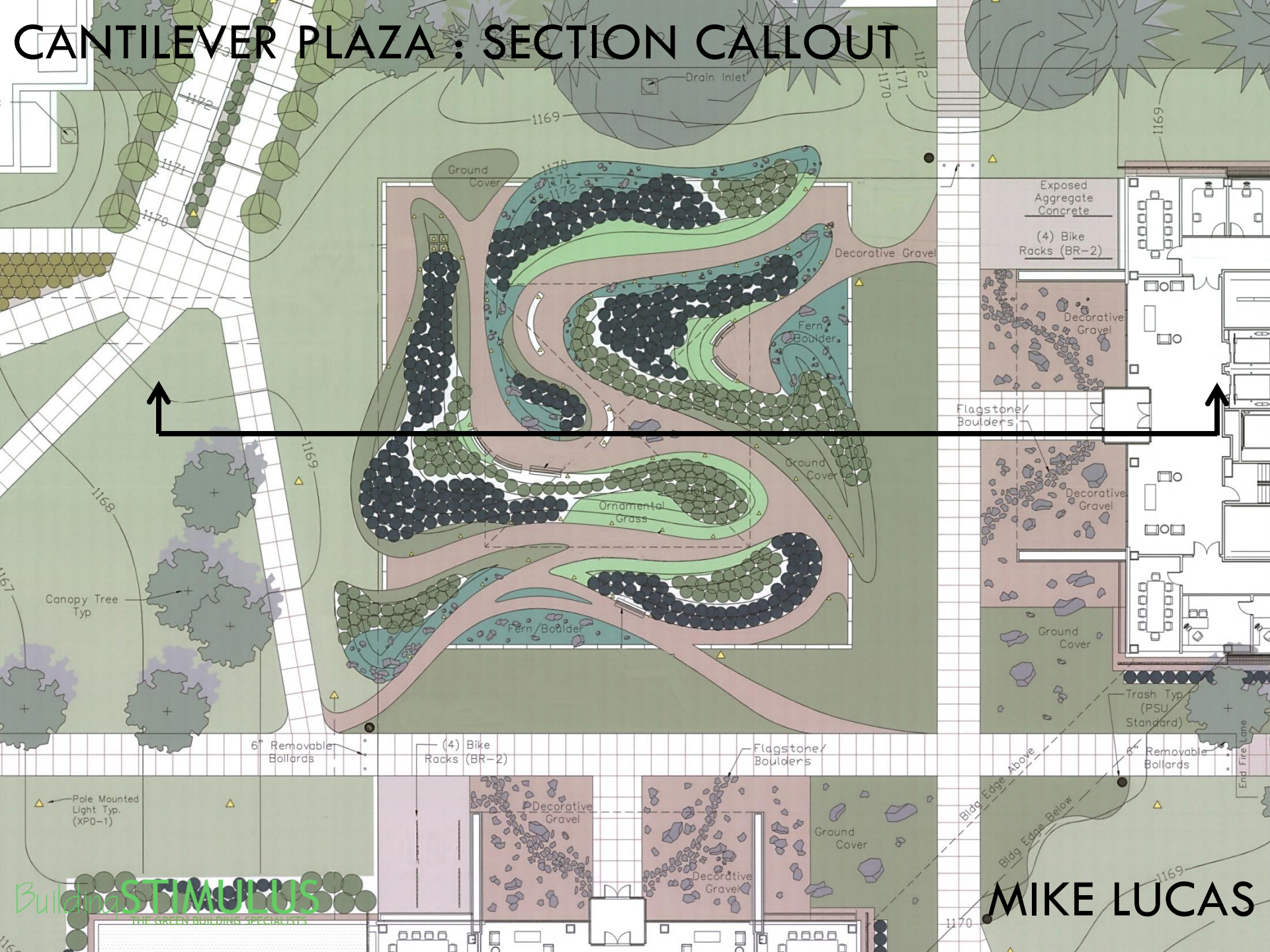
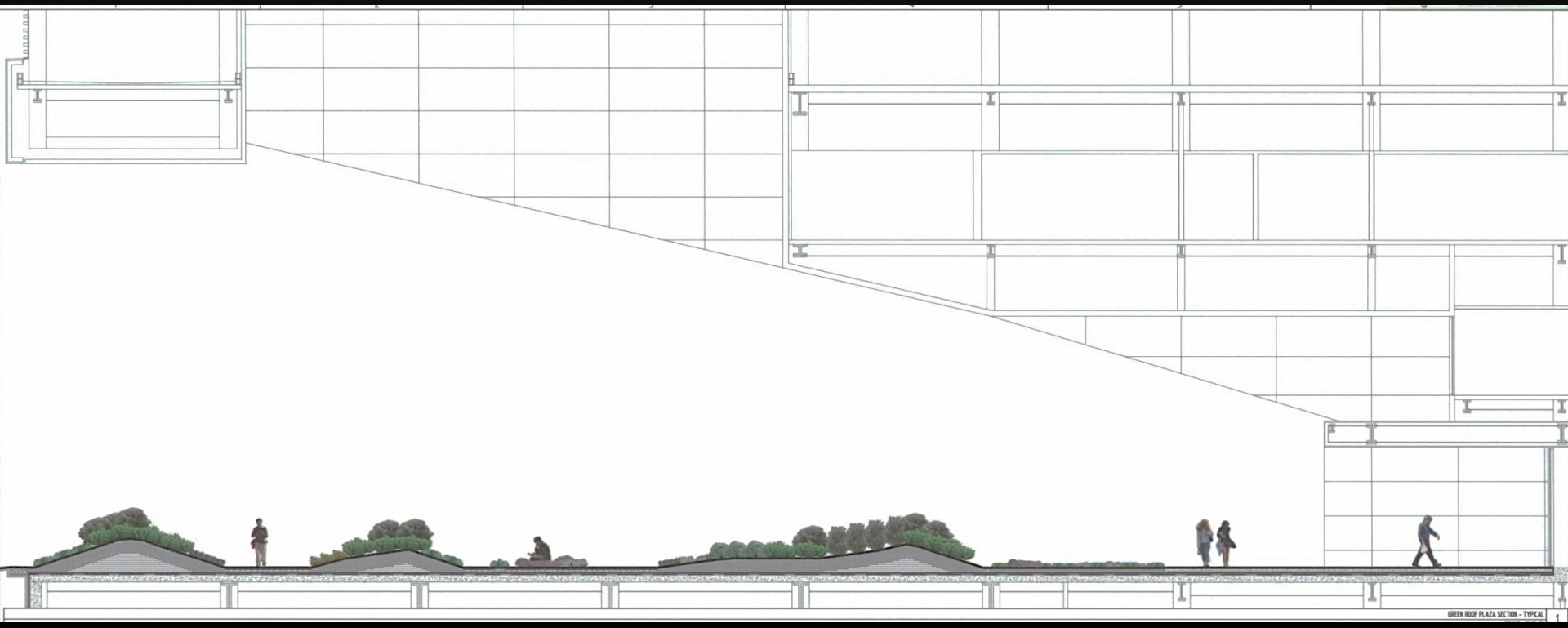
CANTILEVER PLAZA : SECTION CALLOUT



MIKE LUCAS

CANTILEVER PLAZA : SECTION VIEW



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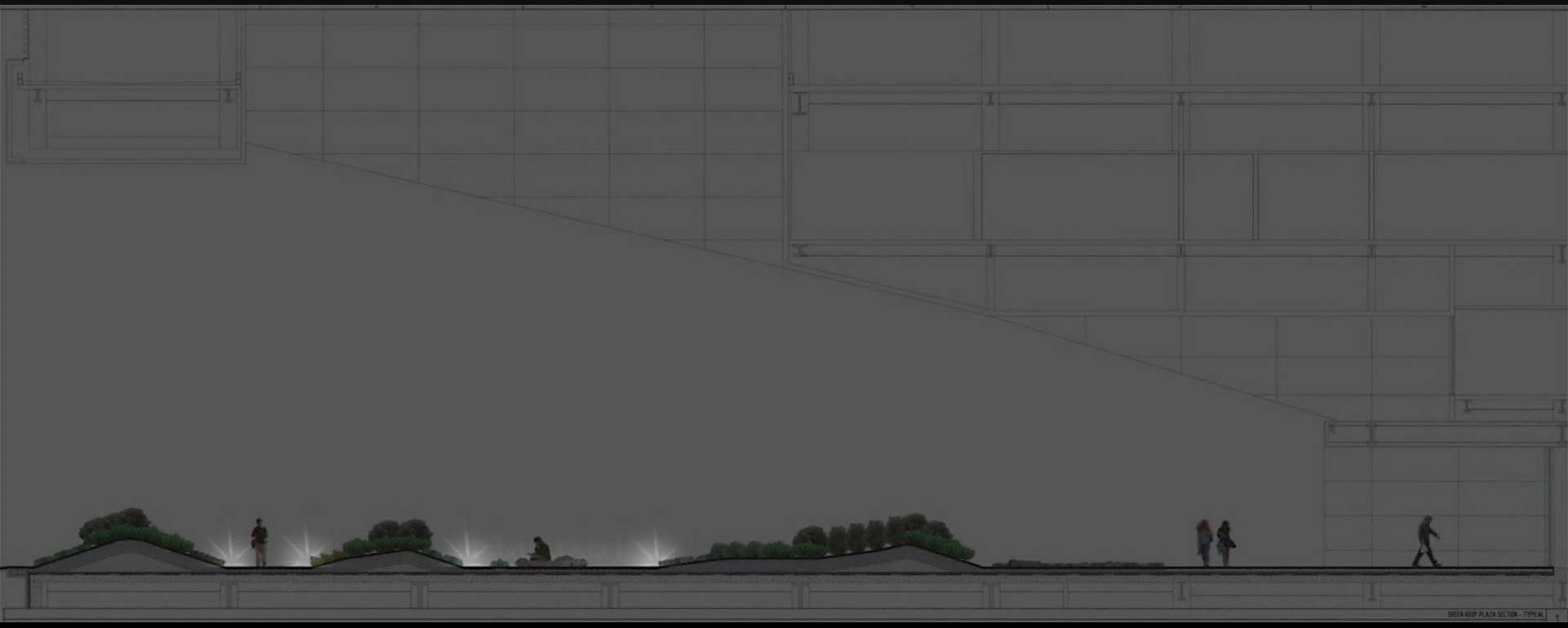
CANTILEVER PLAZA : LIGHT THE PATH



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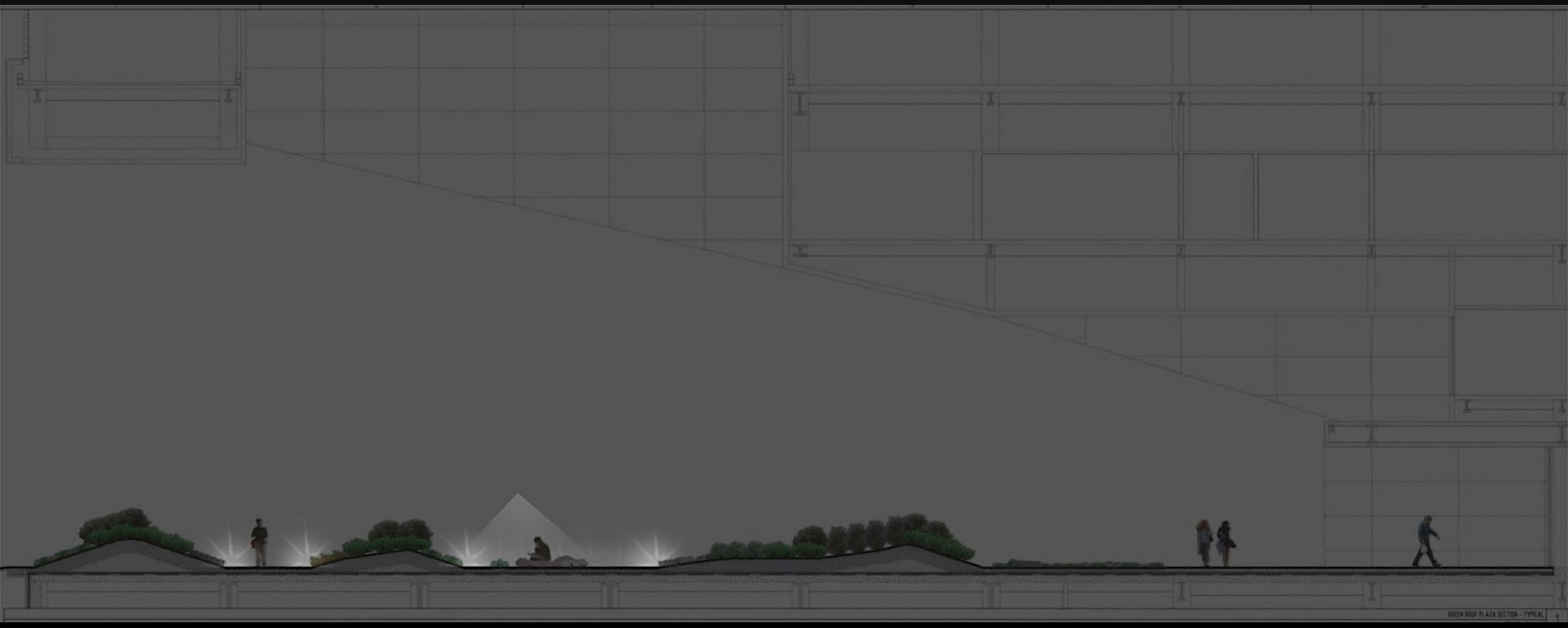
CANTILEVER PLAZA : LIGHT THE SEATING



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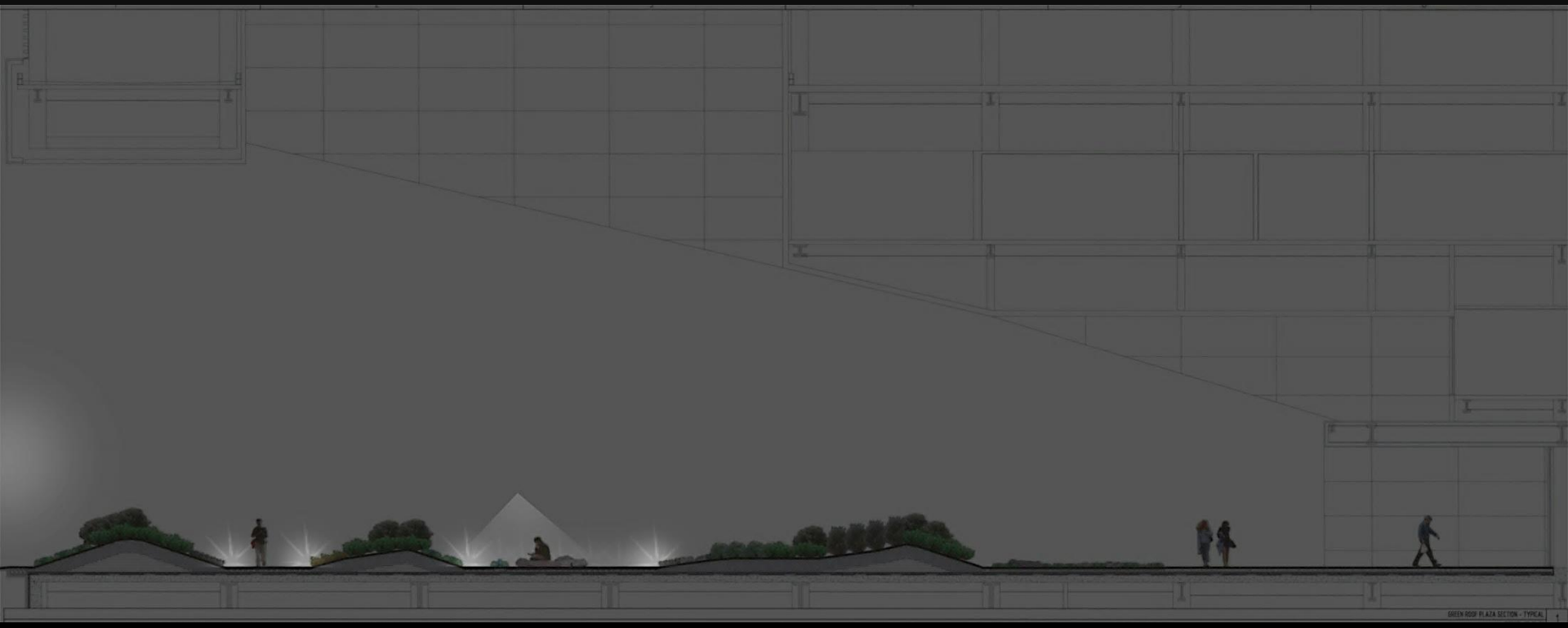
CANTILEVER PLAZA : PENN STATE'S SITE LIGHTING



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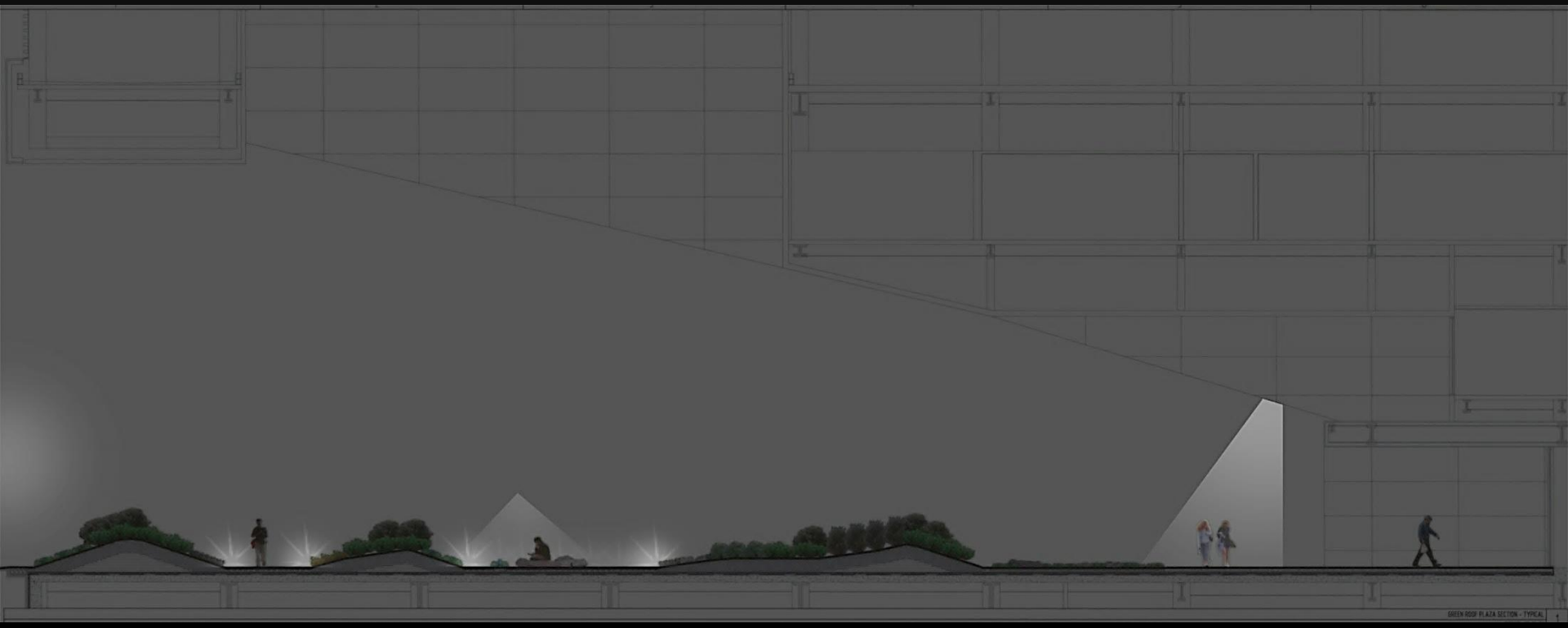
CANTILEVER PLAZA : LIGHT THE MAIN WALKWAY



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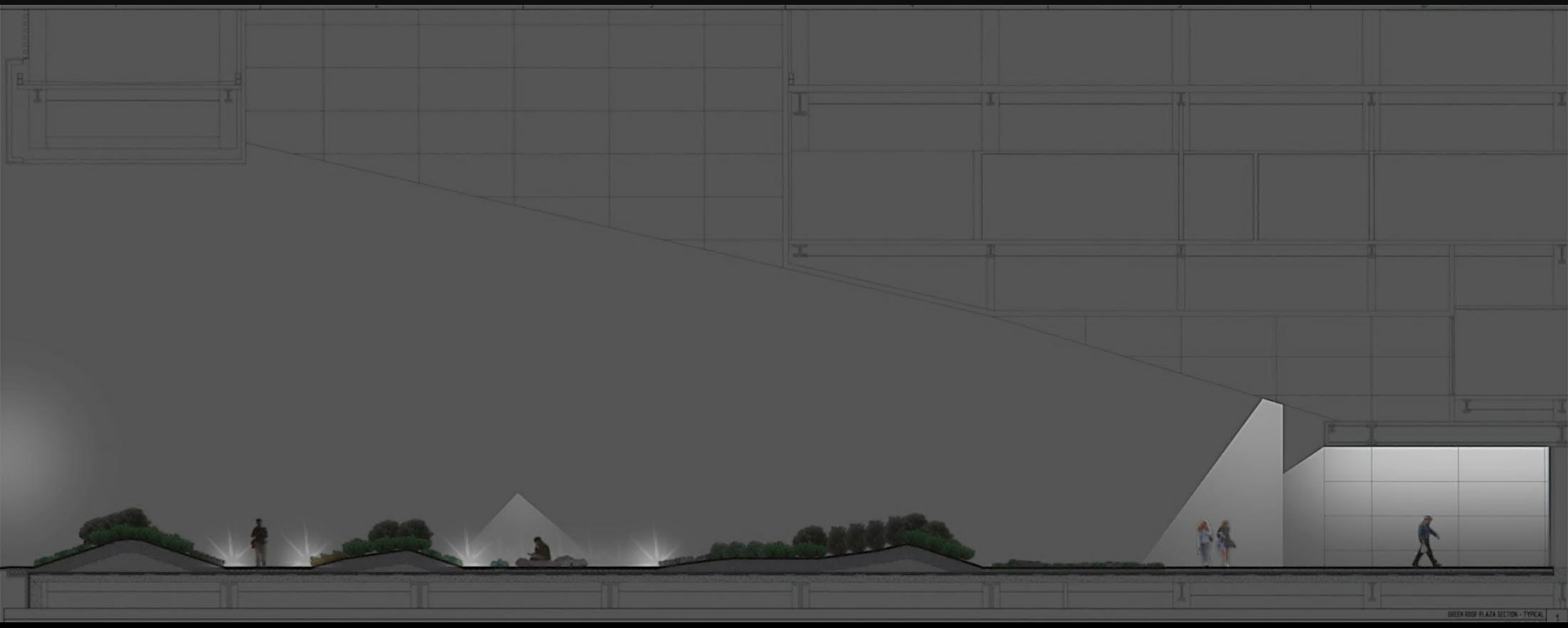
CANTILEVER PLAZA : LIGHT THE ENTRANCE



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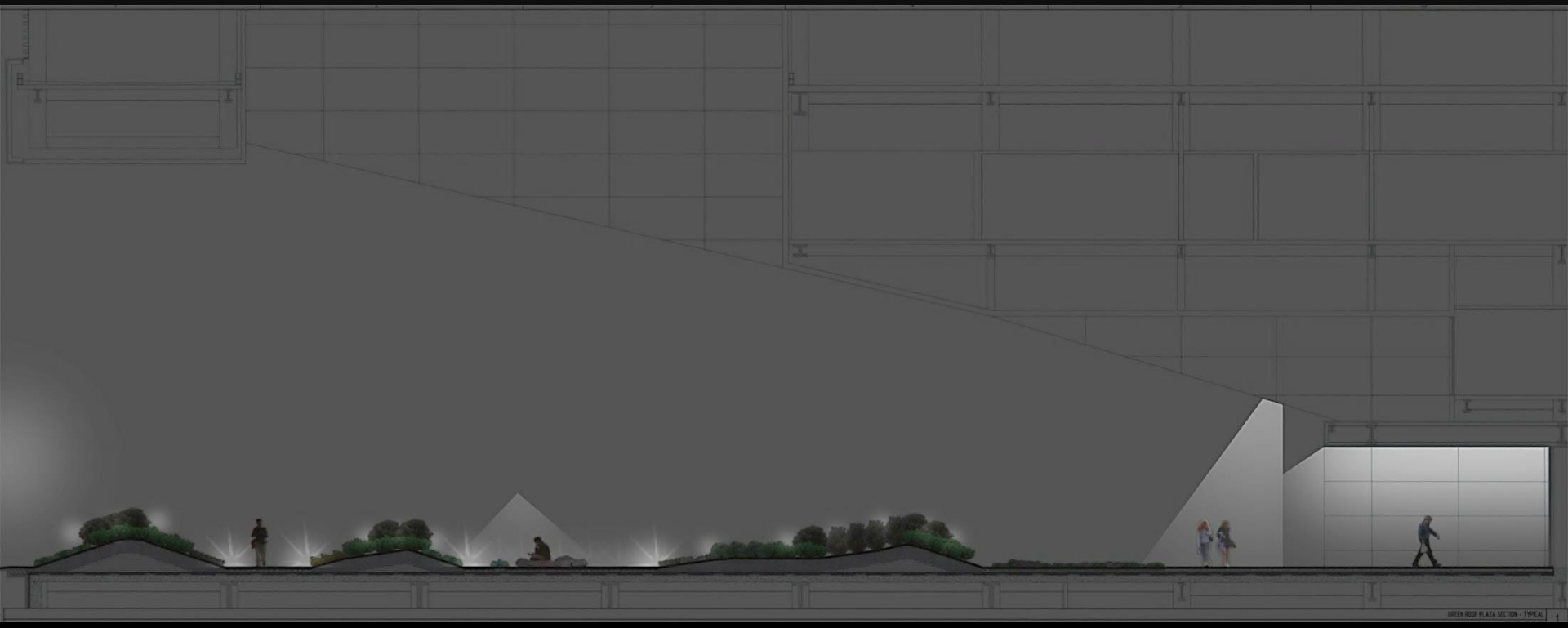
THE GREEN BUILDING SPECIALISTS

MIKE LUCAS

CANTILEVER PLAZA : HIGHLIGHT THE LANDSCAPING



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TOOLS TO ACHIEVE THIS DESIGN

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Cantilever Plaza

CHRIS RUSSELL

CANTILEVER PLAZA

BIMception

CHRIS
RUSSELL

CANTILEVER PLAZA

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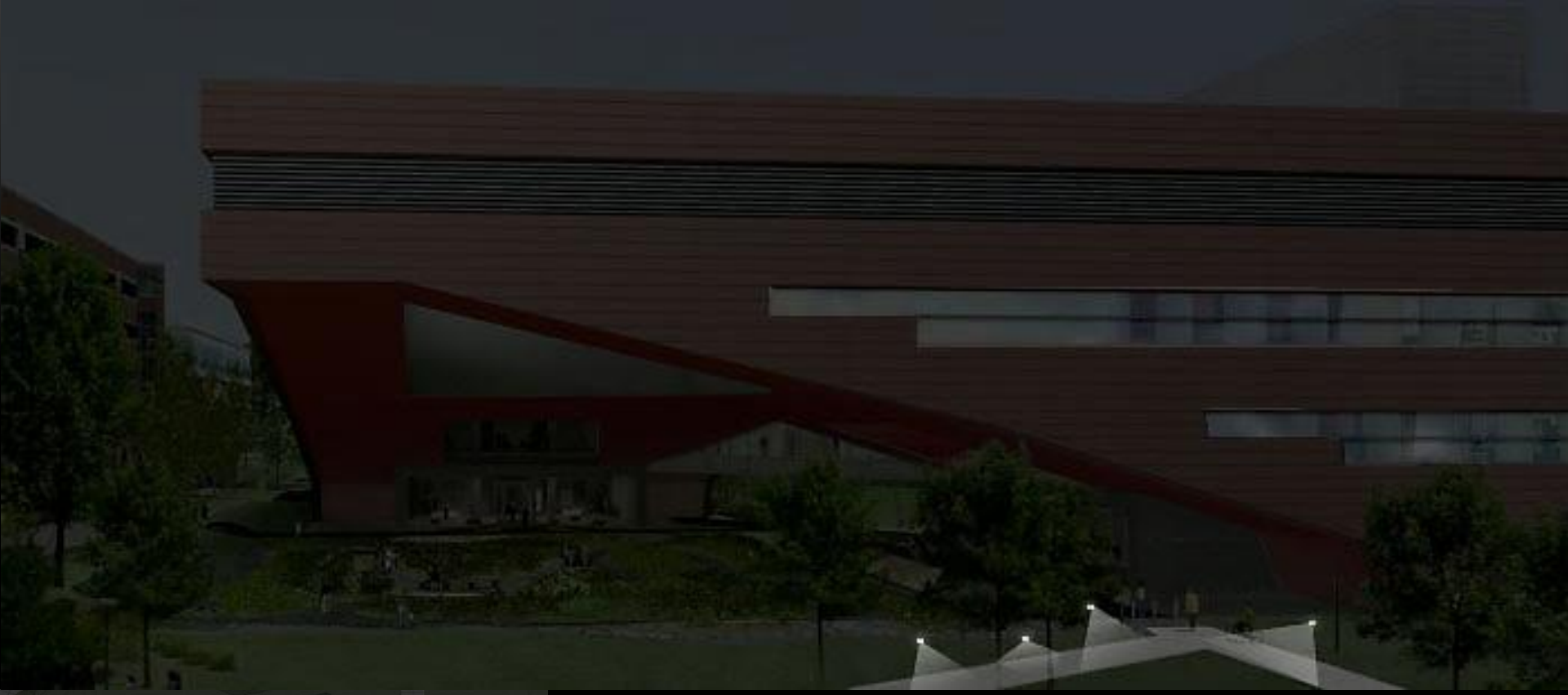

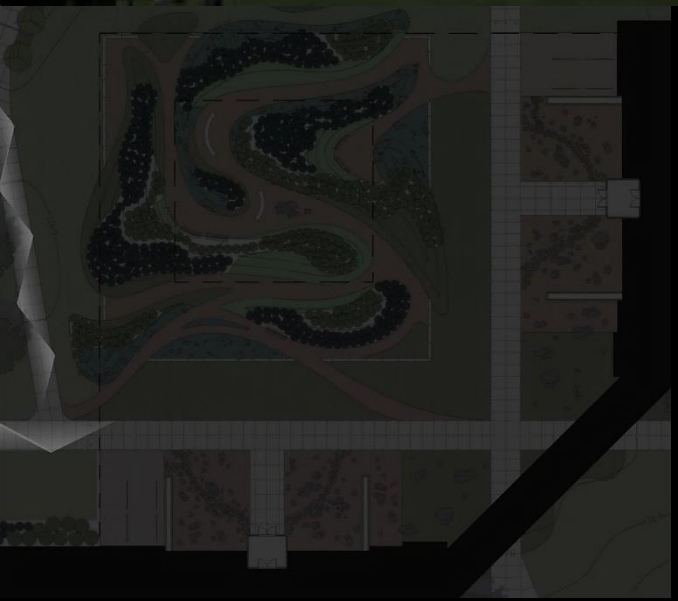

CANTILEVER PLAZA: CAMPUS LIGHTING

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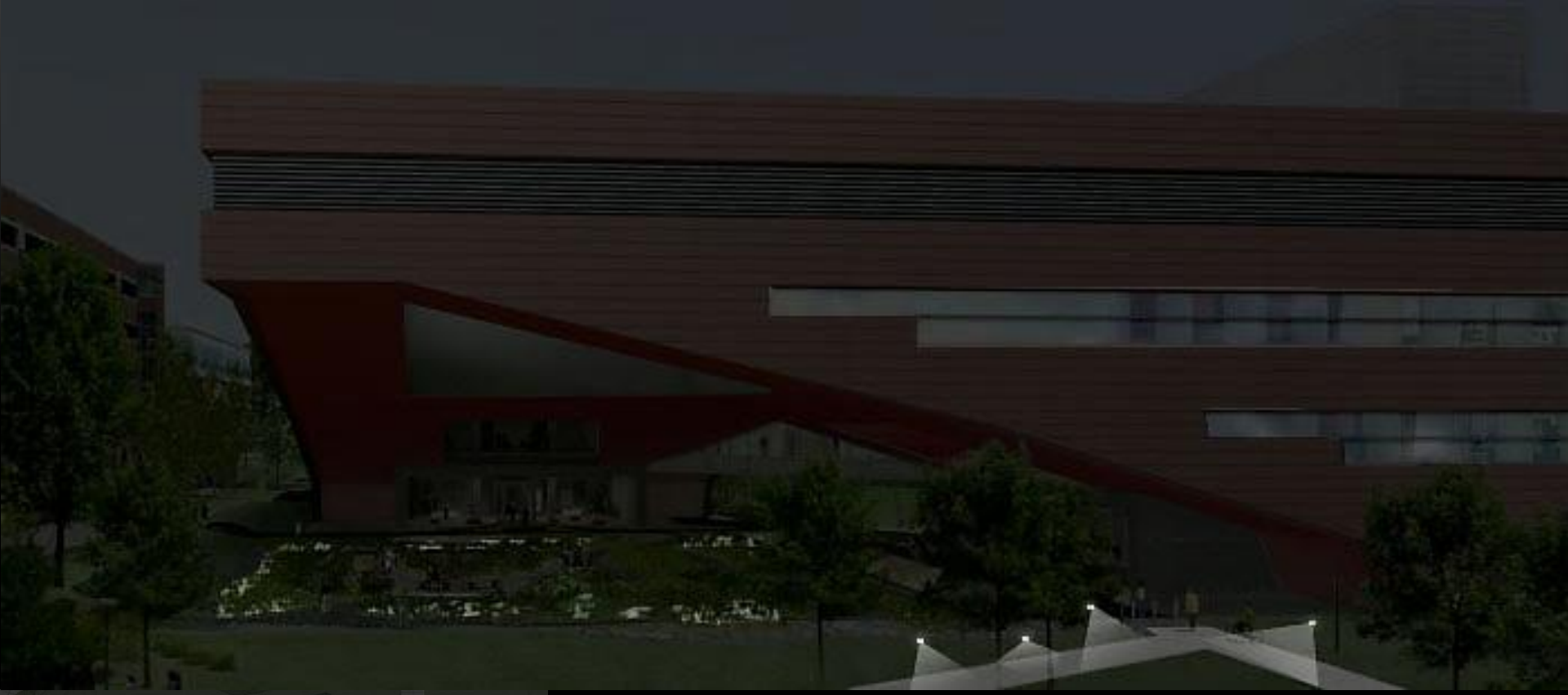

CANTILEVER PLAZA: FRAMING THE PLAZA

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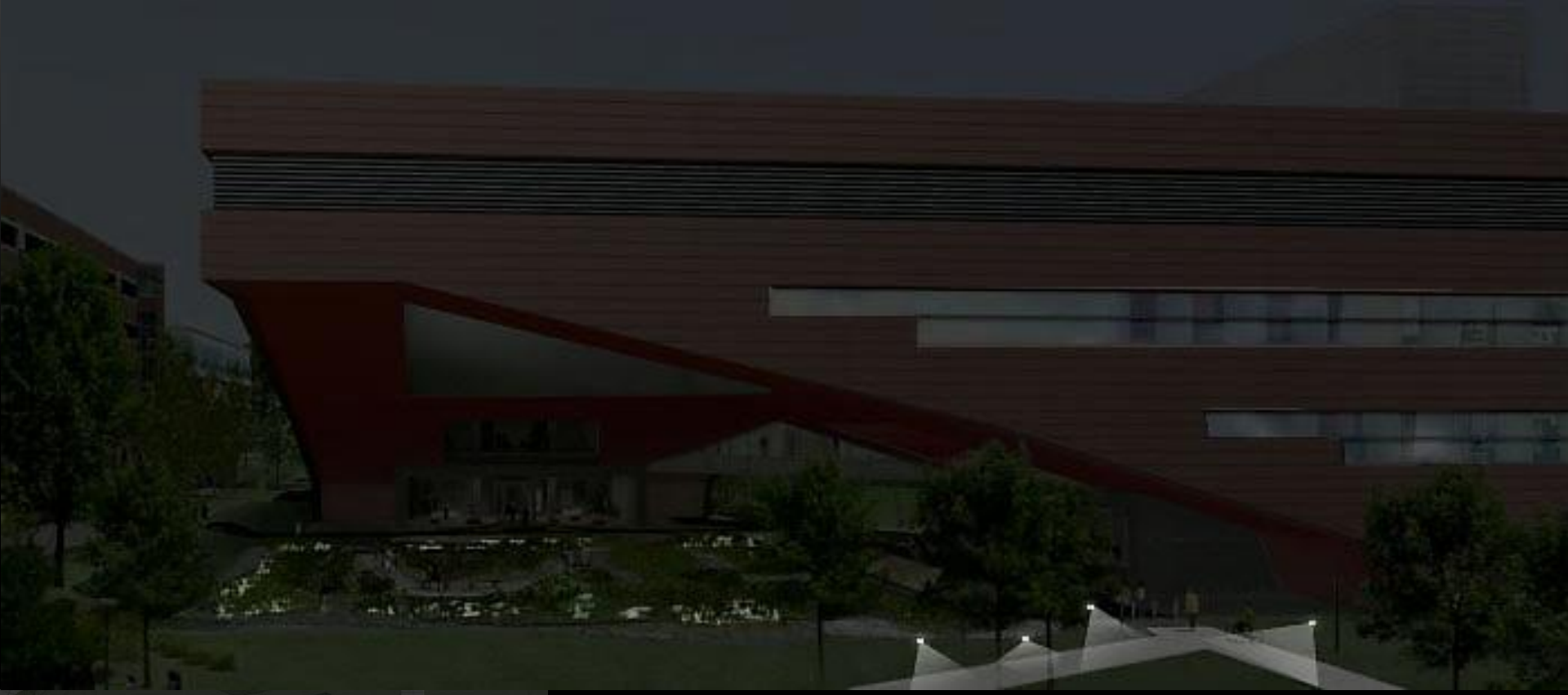
CHRIS RUSSELL



CANTILEVER PLAZA: PATH LIGHTING

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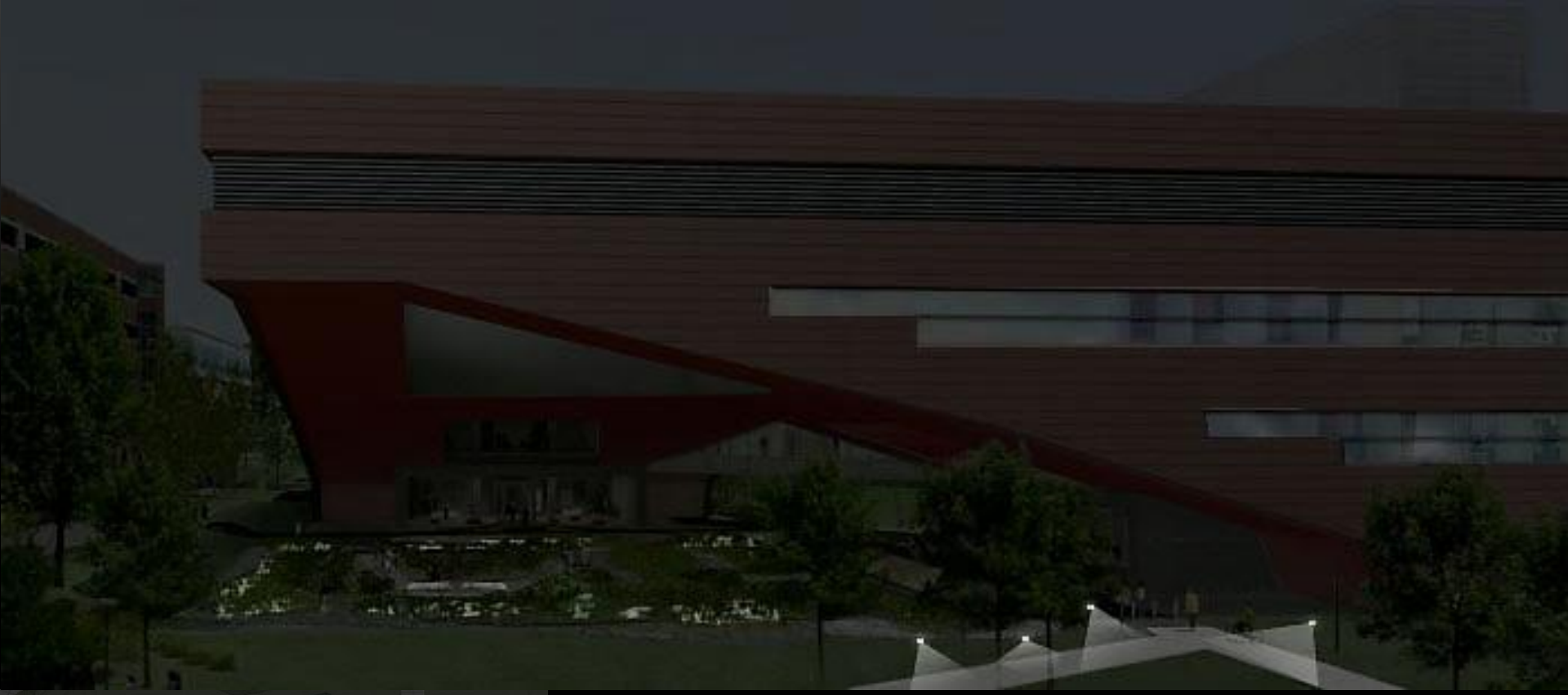
CHRIS RUSSELL



CANTILEVER PLAZA: ACCENT LIGHTING

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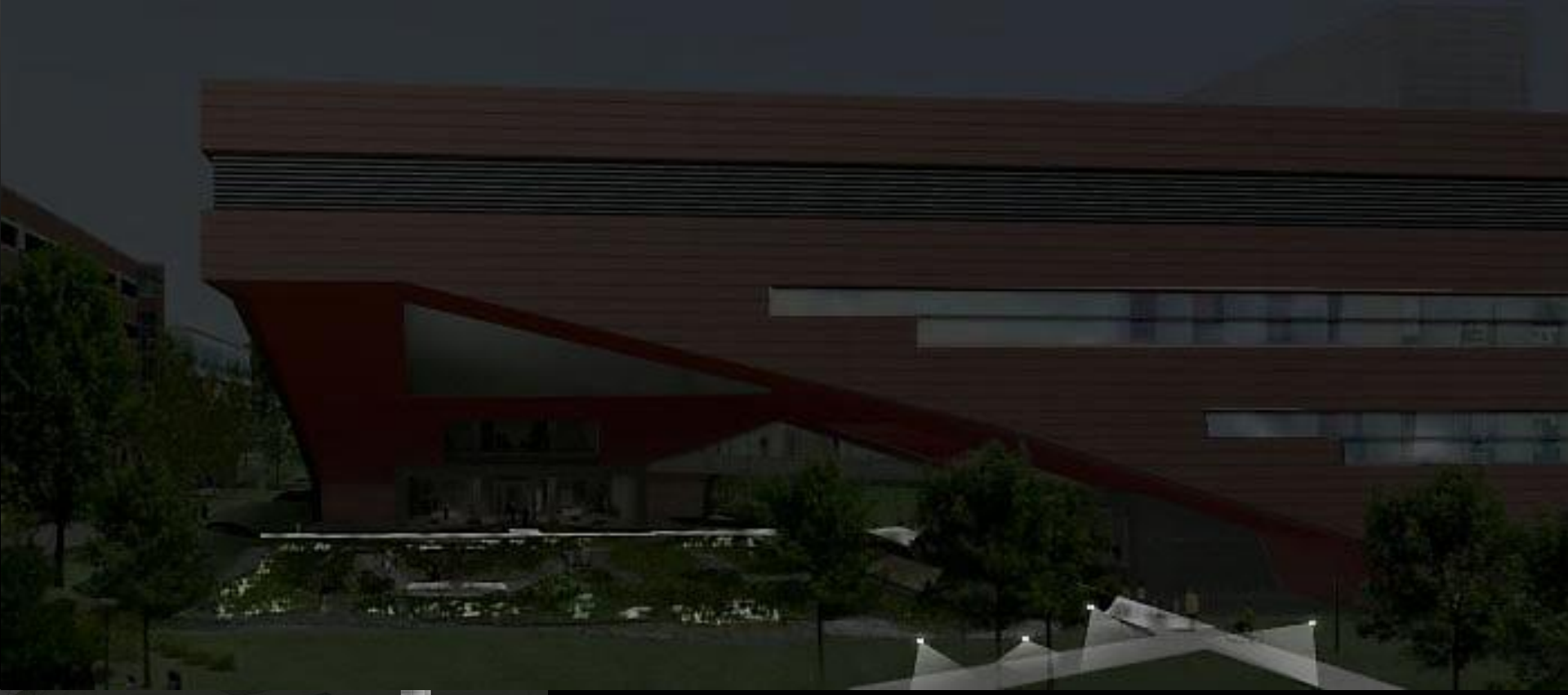
CHRIS RUSSELL



CANTILEVER PLAZA: SIDEWALK LIGHTING

BIMception

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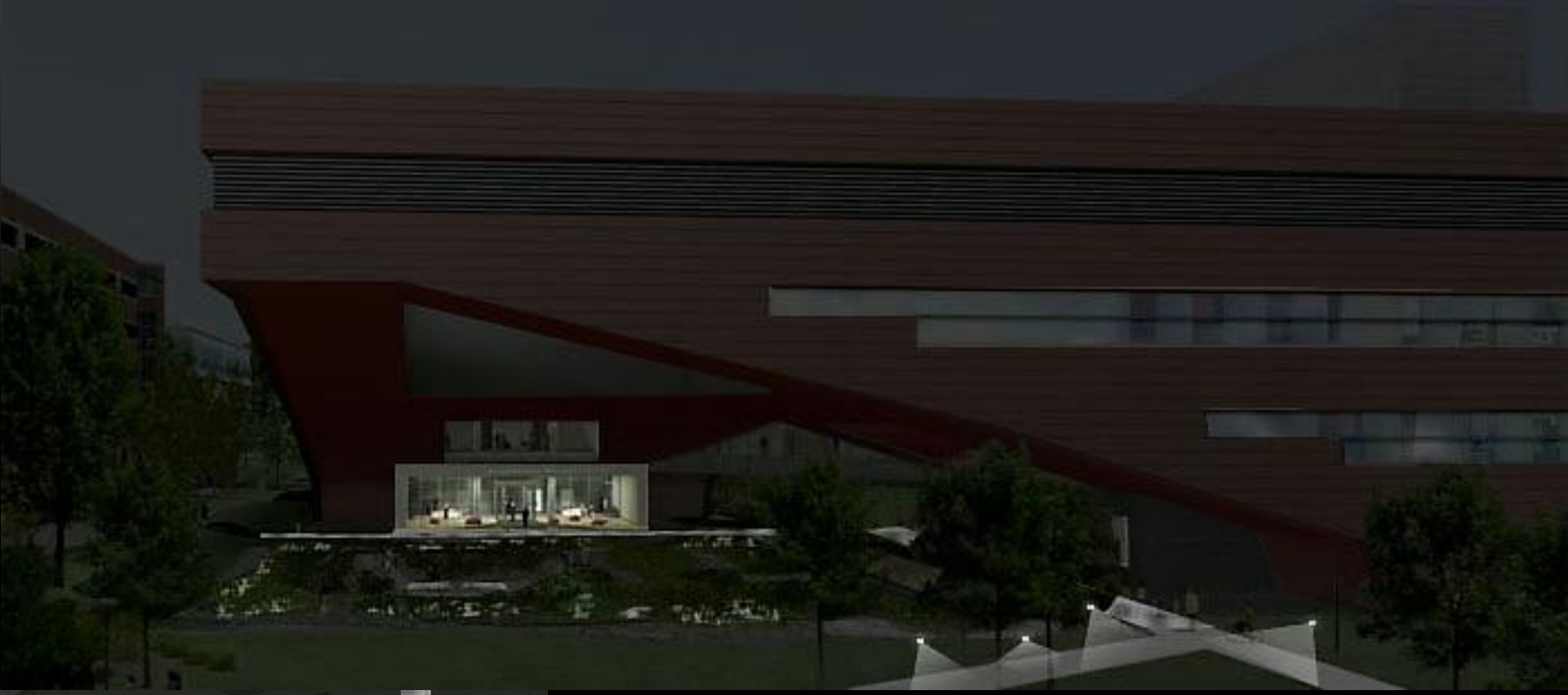
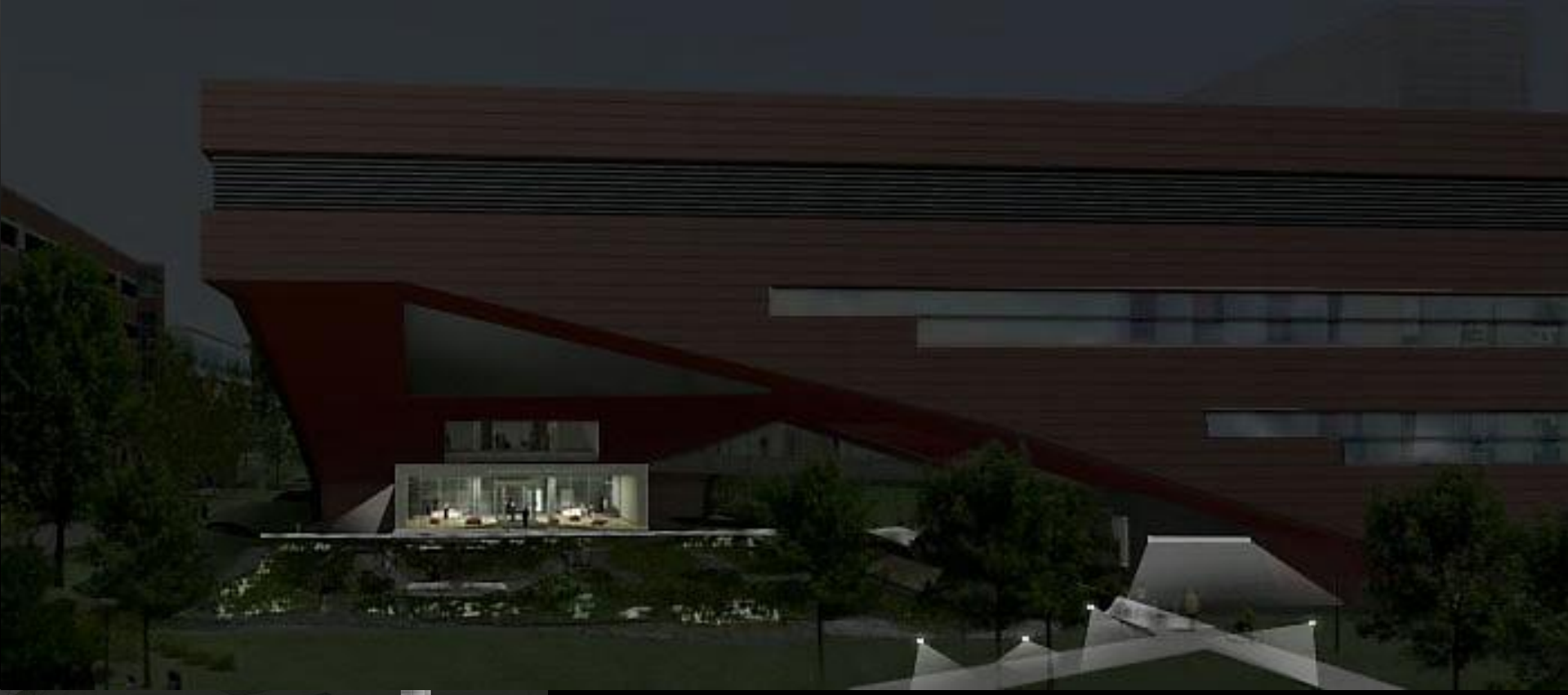


CANTILEVER PLAZA: ENTRANCE LOBBY

BIMception

CHRIS RUSSELL



CANTILEVER PLAZA: BIKE RACK LIGHTING

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CANTILEVER PLAZA: WASHING THE CANTILEVER

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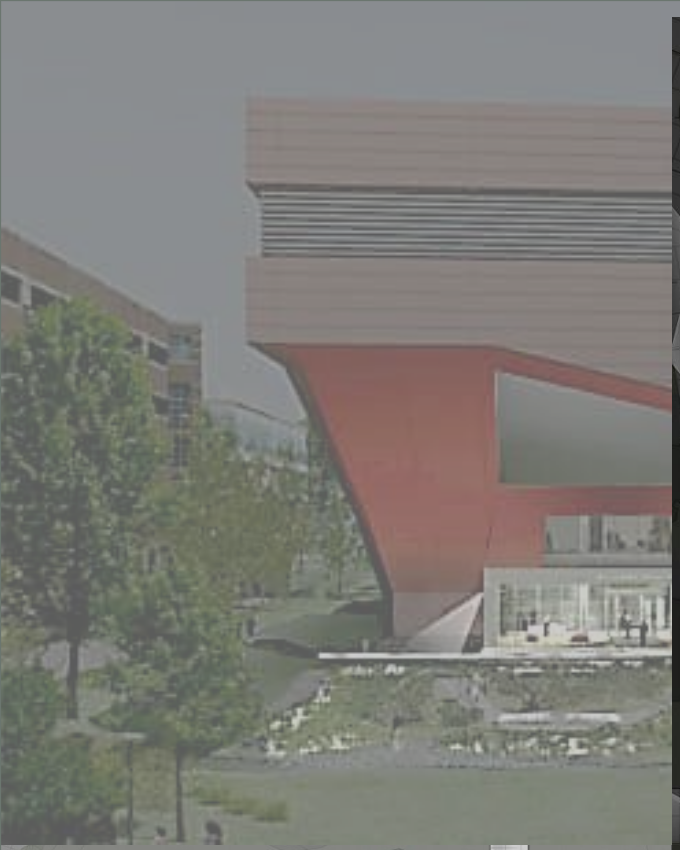
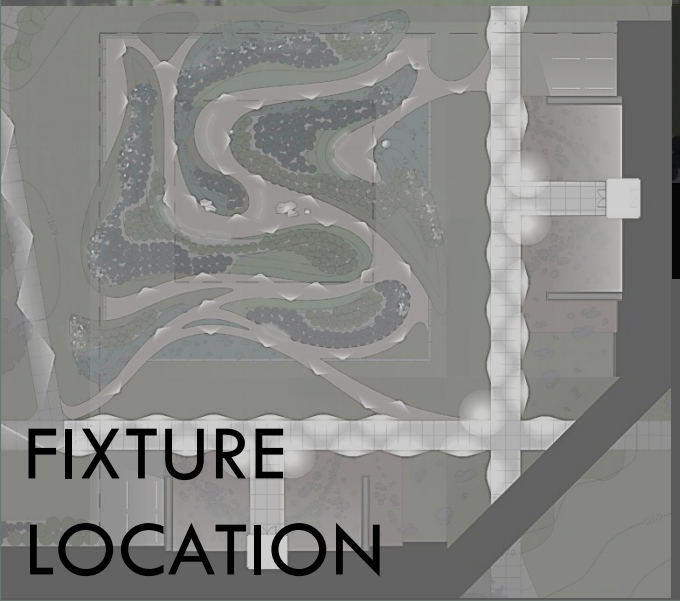
CHRIS RUSSELL





FIXTURE LOCATION

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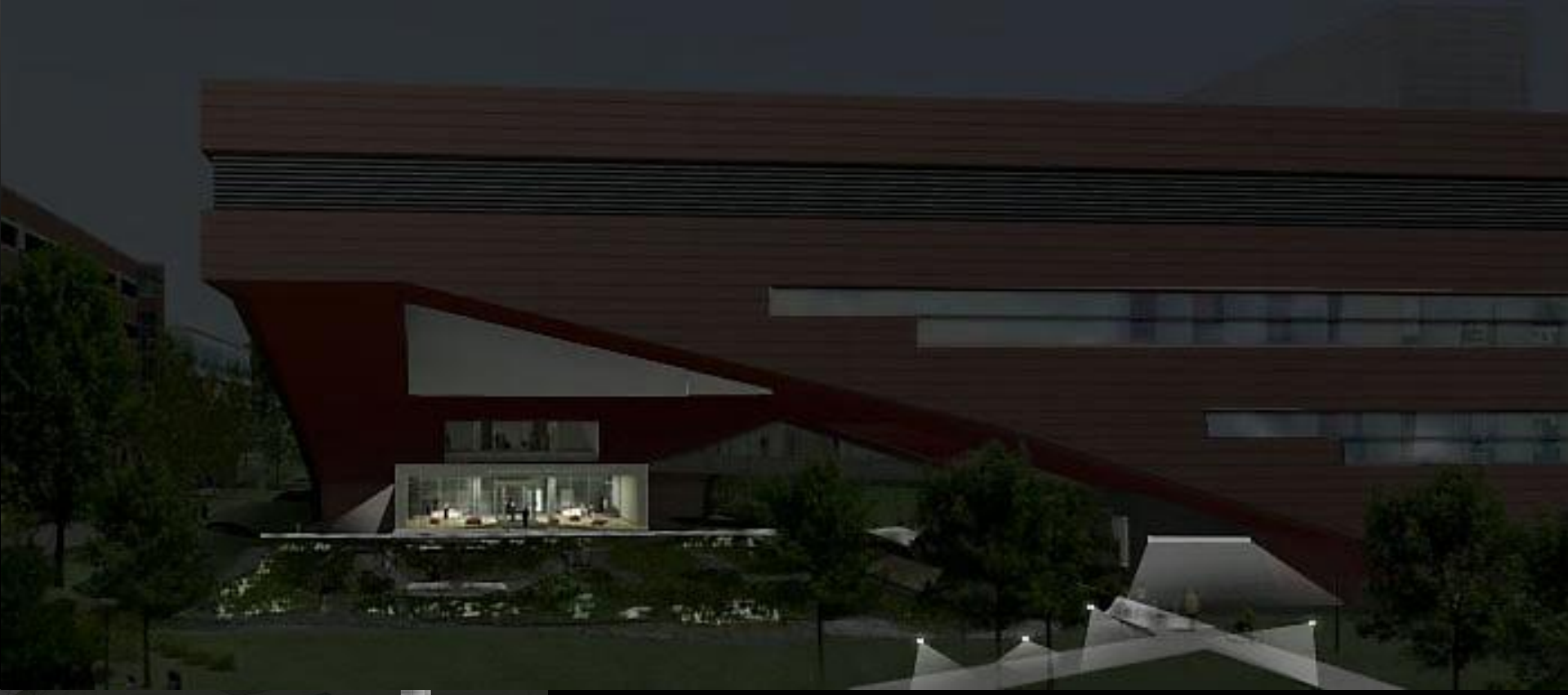
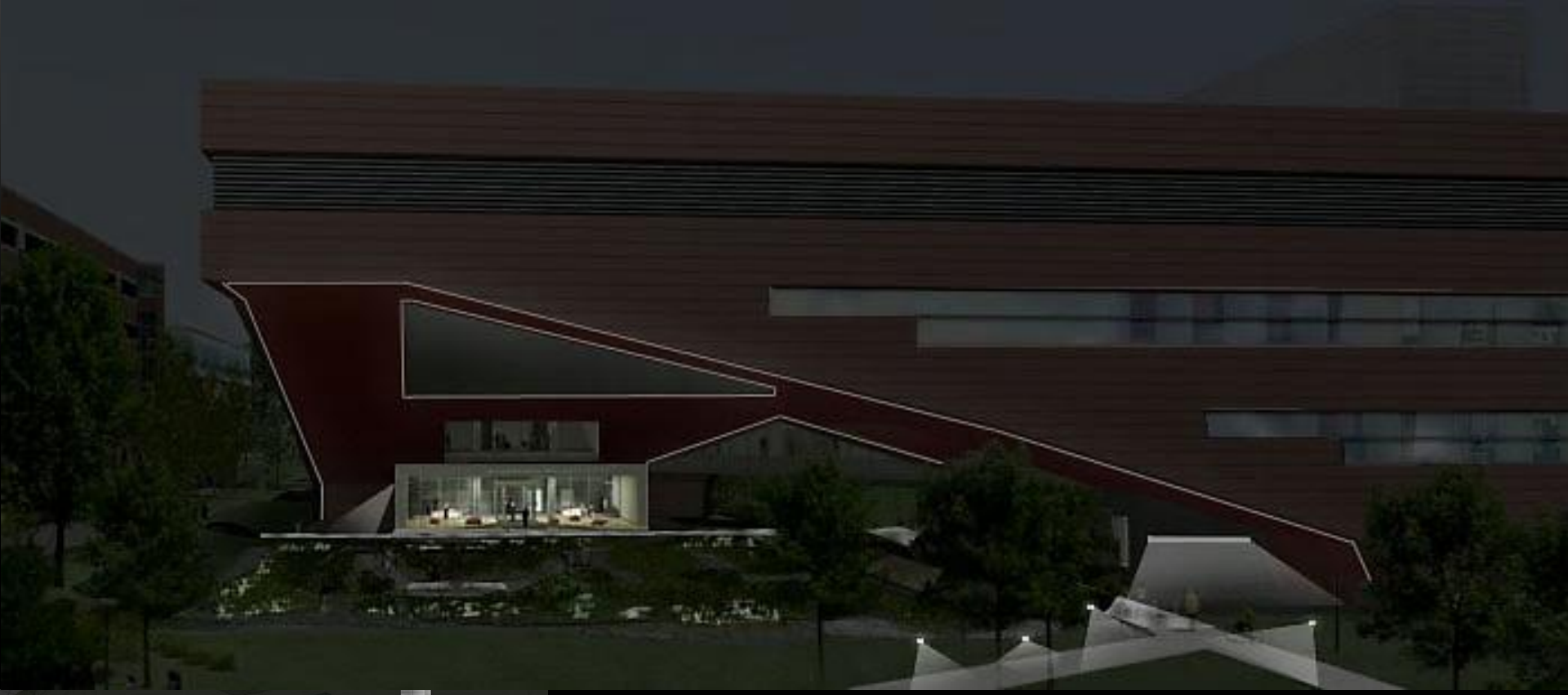


CANTILEVER PLAZA: LIGHTING THE VOID

BIMception

CHRIS RUSSELL



CANTILEVER PLAZA: OUTLINING THE CANTILEVER

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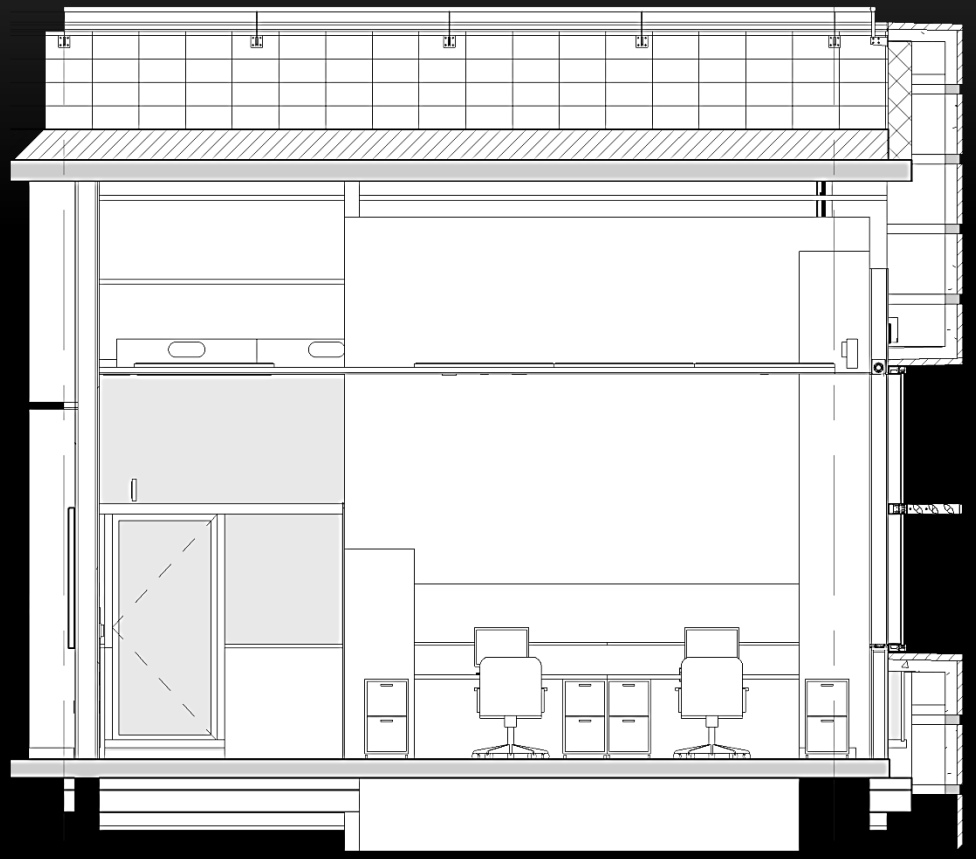
Student Study Area

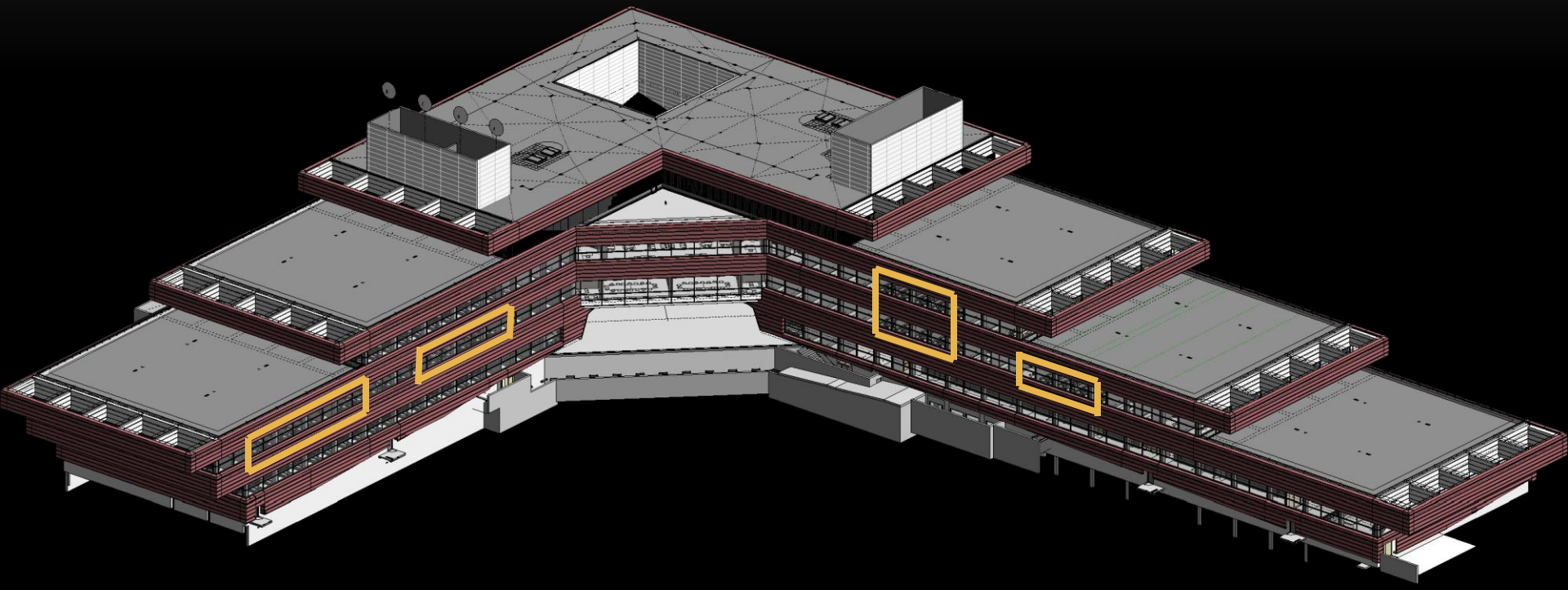
OVERVIEW

STUDENT STUDY AREA: OVERVIEW

- Perimeter locations
- Early solar gains
- Façade redesign for all teams
- Mechanical system energy considerations
- Structural and constructability considerations

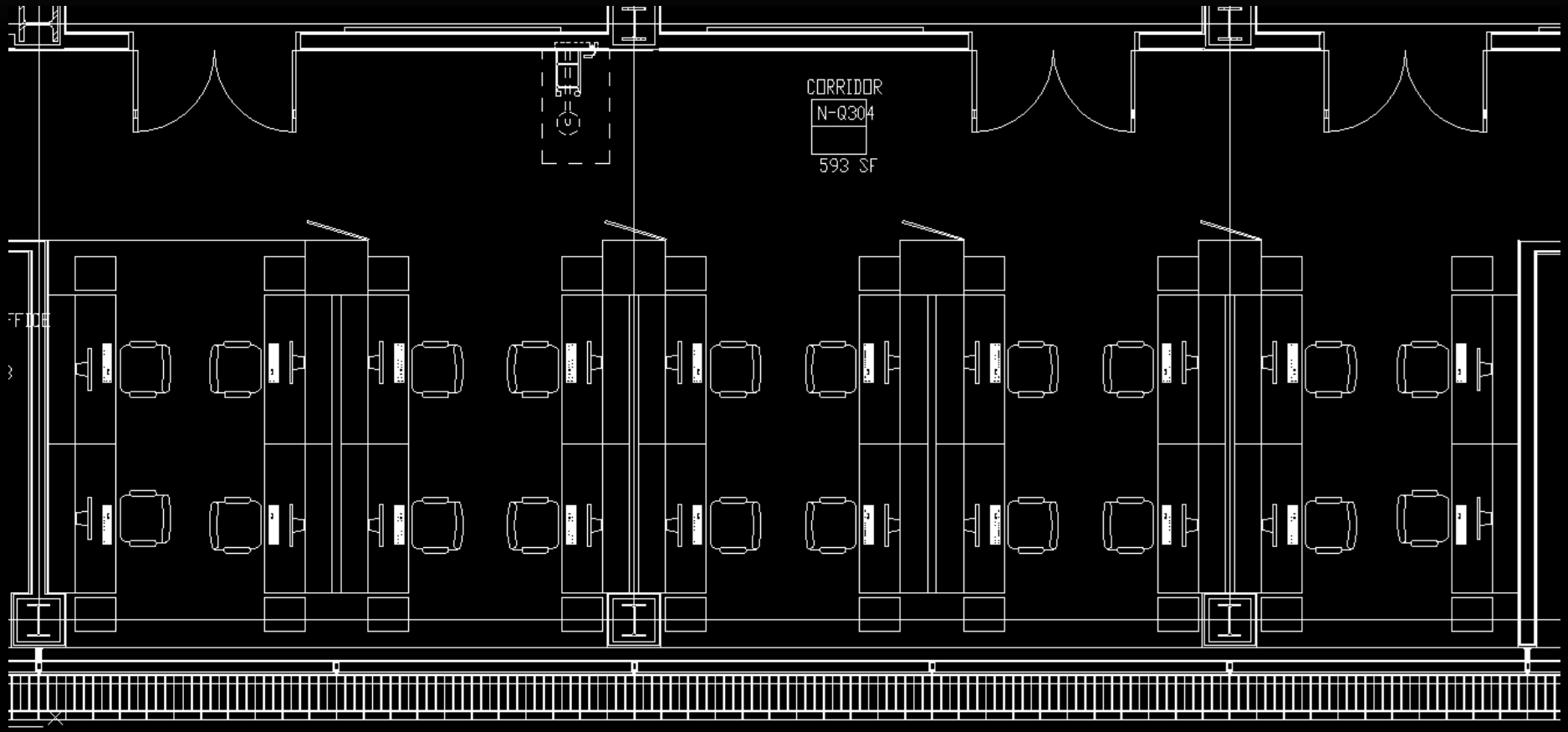


STUDENT STUDY AREA: LOCATIONS

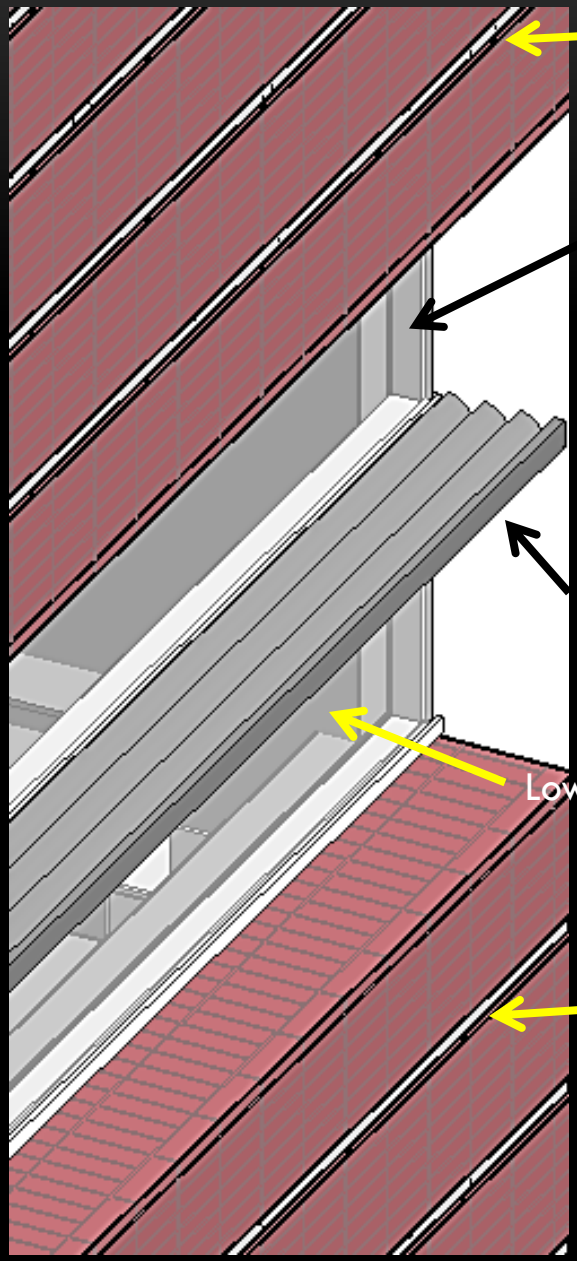


- Similar locations on opposite side of building

STUDENT STUDY AREA: PLAN VIEW



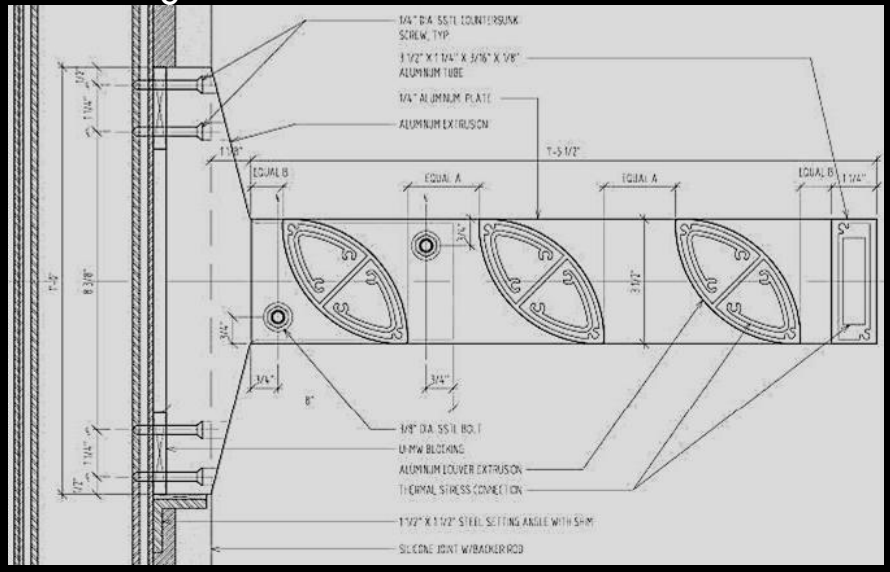
STUDENT STUDY AREA: ENCLOSURE DETAILS



Precast Panel providing 2’ overhang

Upper Glazing: 40% Frit

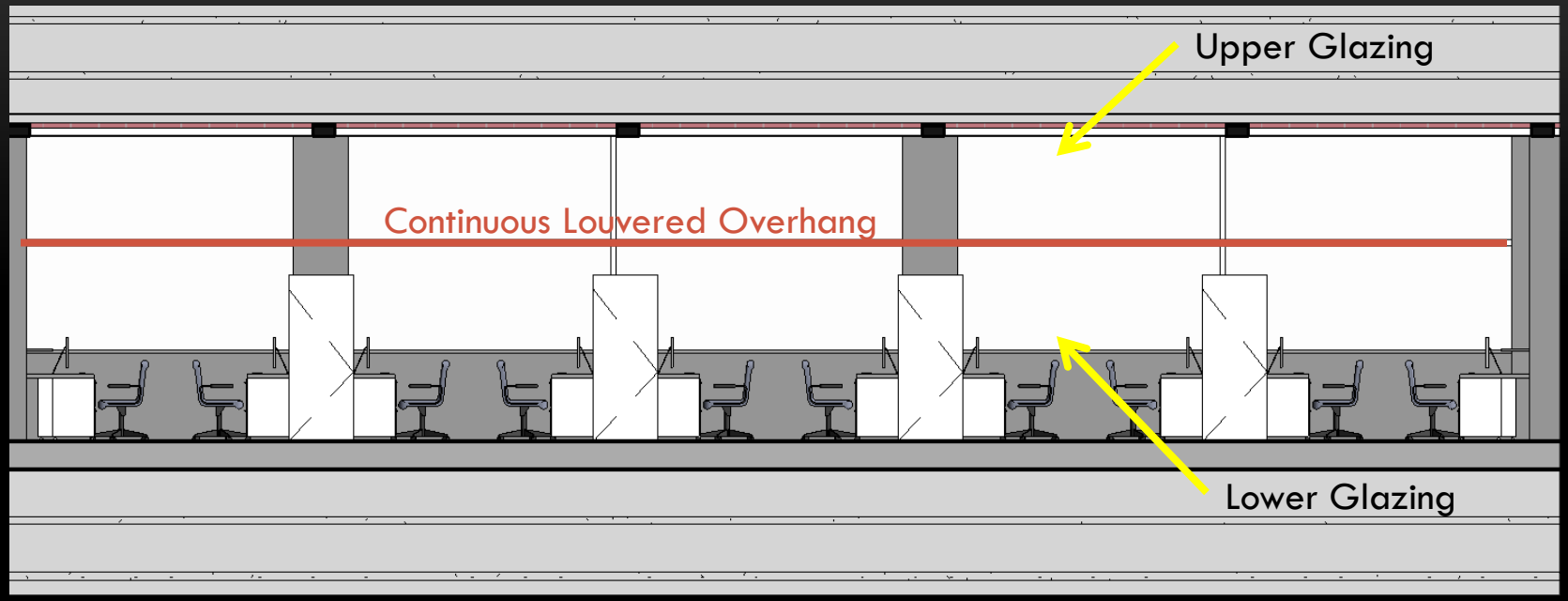
Continuous Louvered Overhang



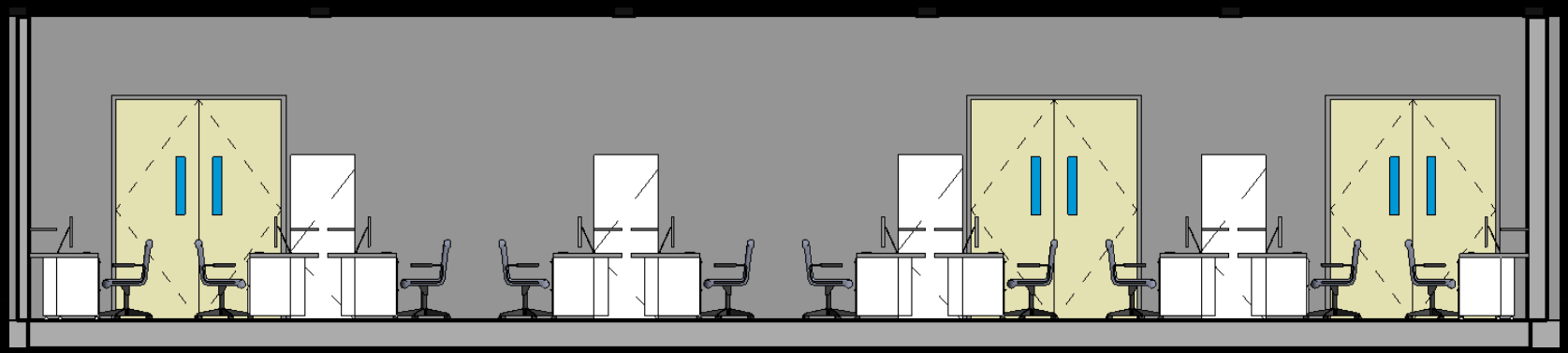
Lower Glazing

Precast Panel

STUDENT STUDY AREA : SECTIONS



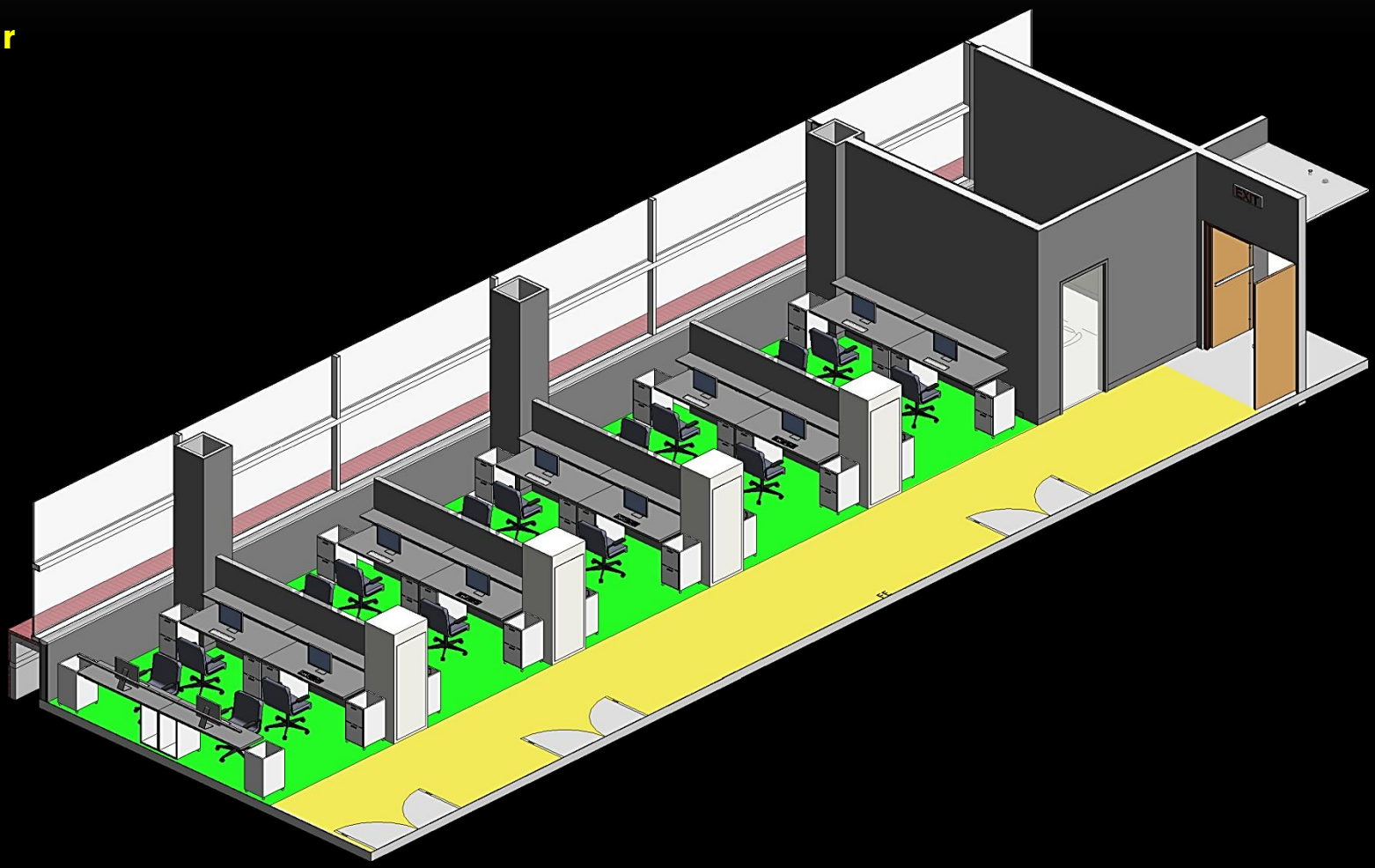
SOUTH SECTION



NORTH SECTION

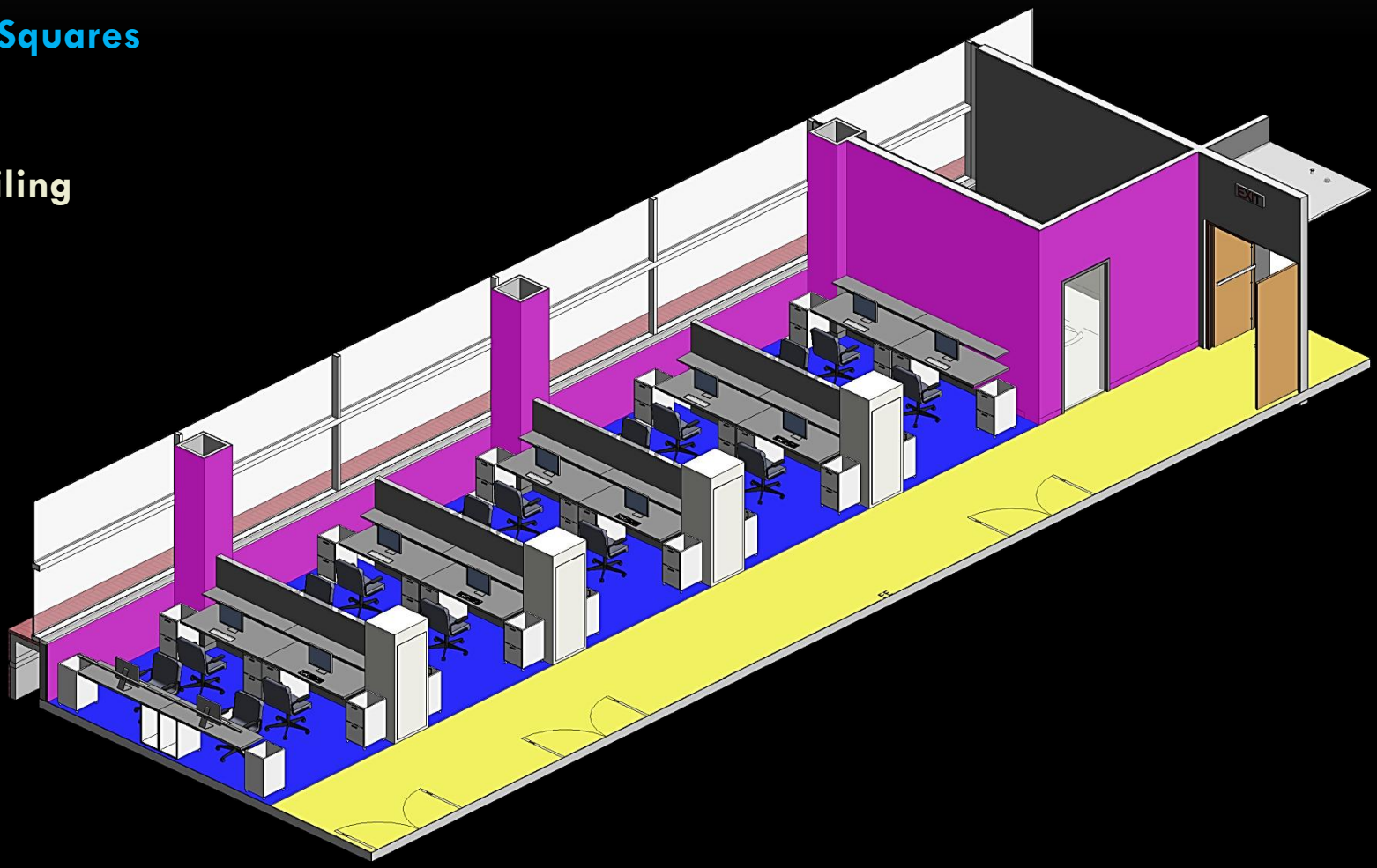
STUDENT STUDY AREA : SPACE TYPES

- Two space types
  - **Study areas**
  - **Corridor**



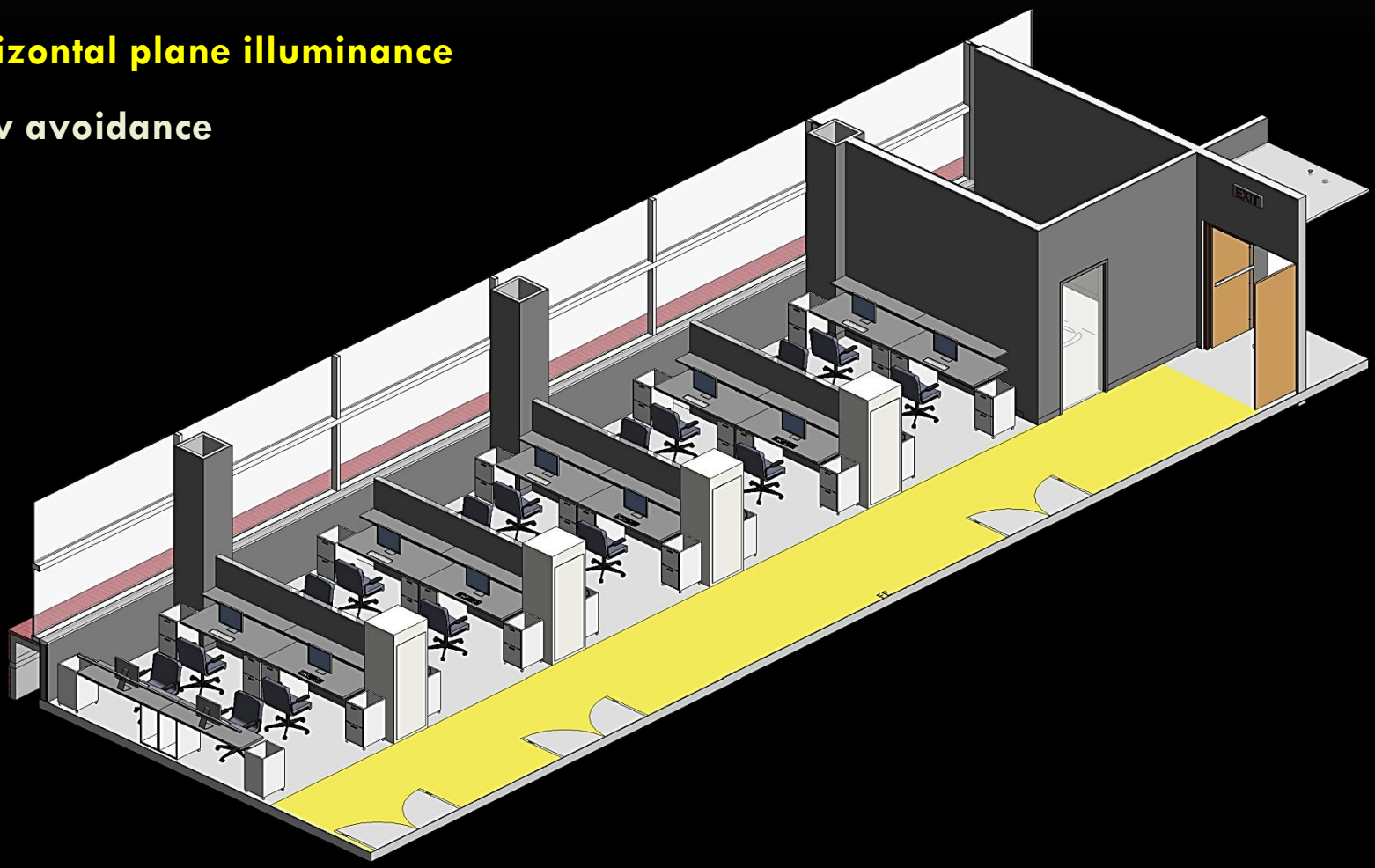
STUDENT STUDY AREA : ROOM MATERIALS

- Materials
  - **Painted GWB**
  - **Carpet Squares**
  - **VCT**
  - **ACT ceiling**



STUDENT STUDY AREA : IES DESIGN CRITERIA

- Main Corridor Design Issues:
  - **5fc horizontal plane illuminance**
  - **Shadow avoidance**



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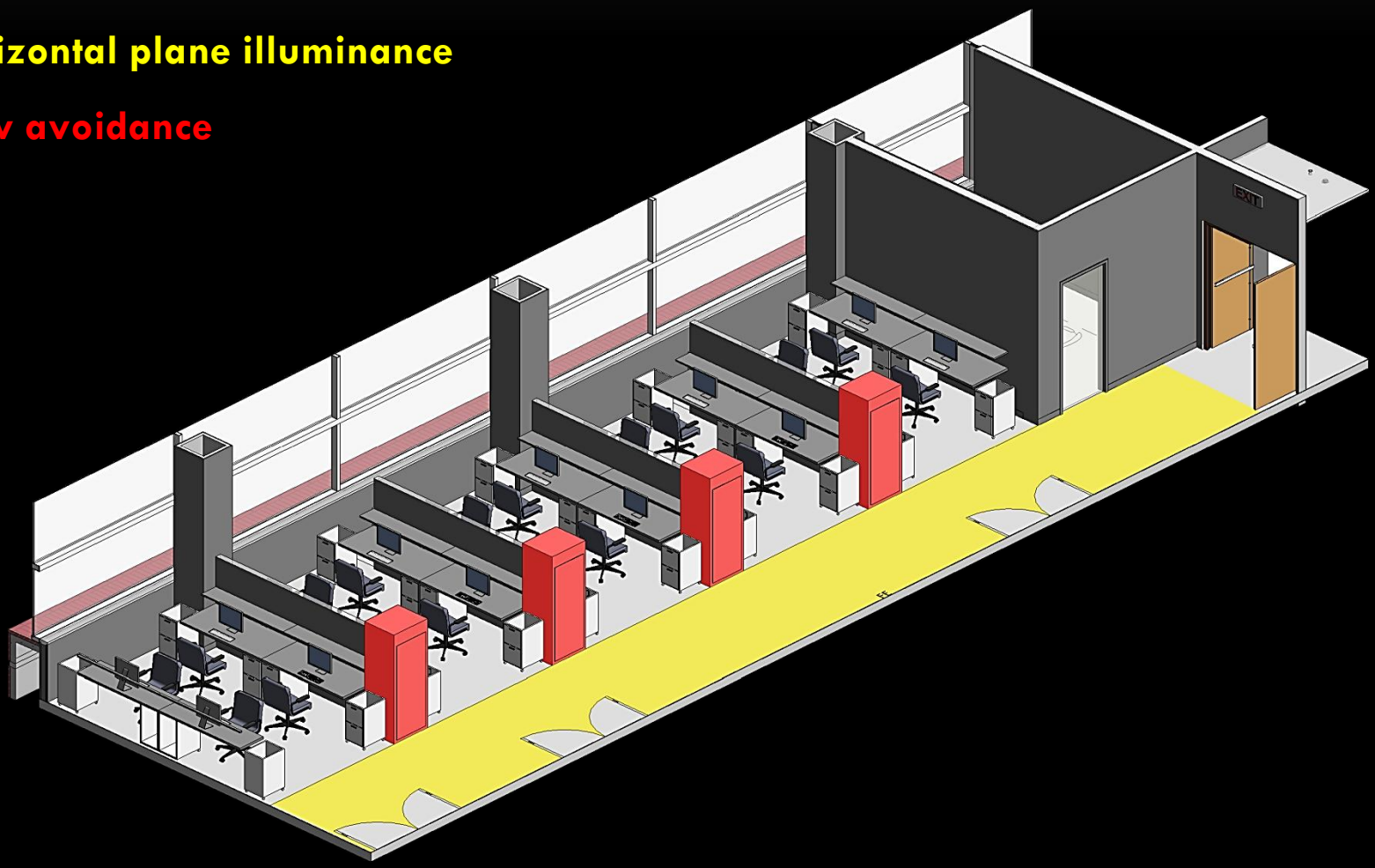
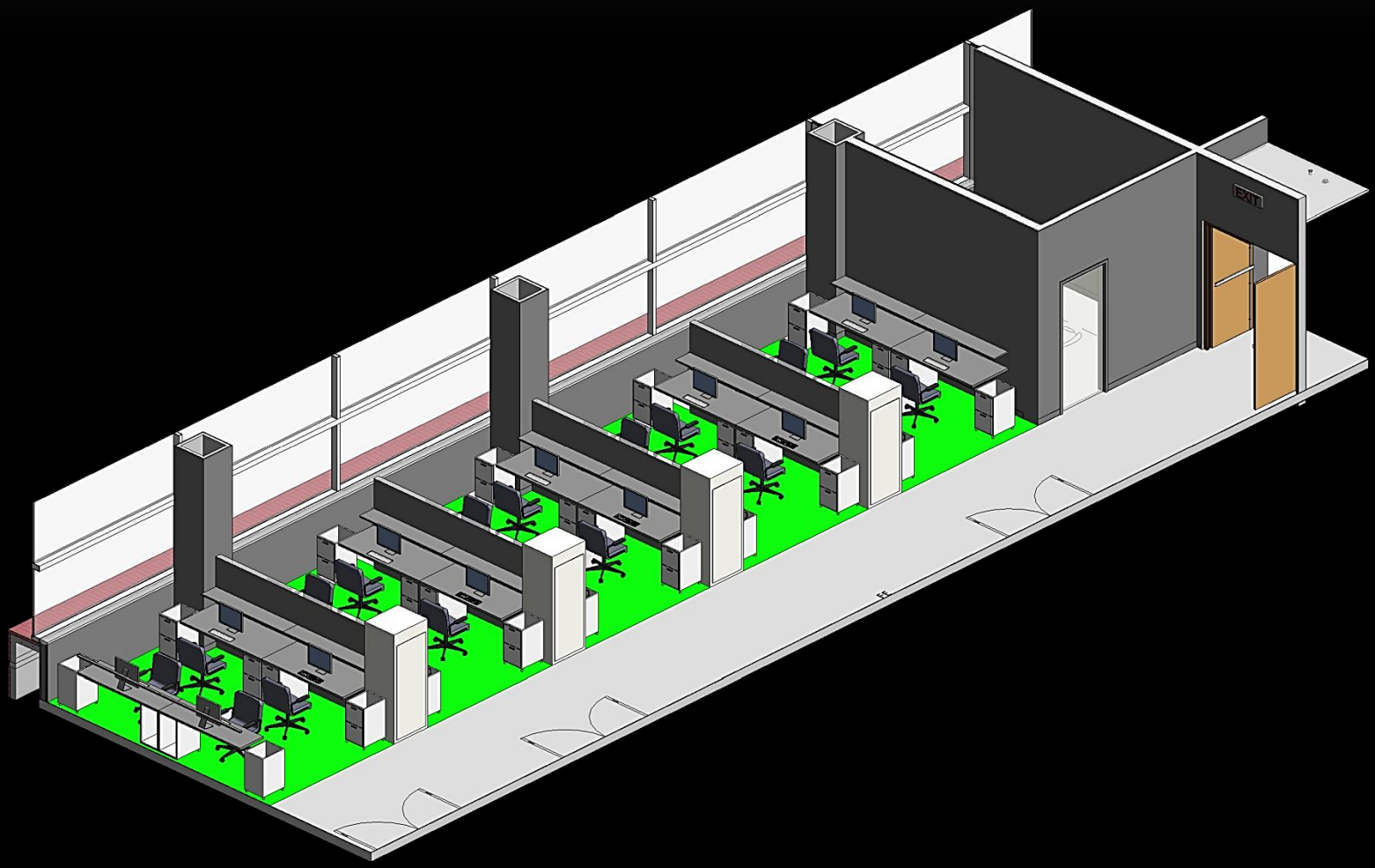


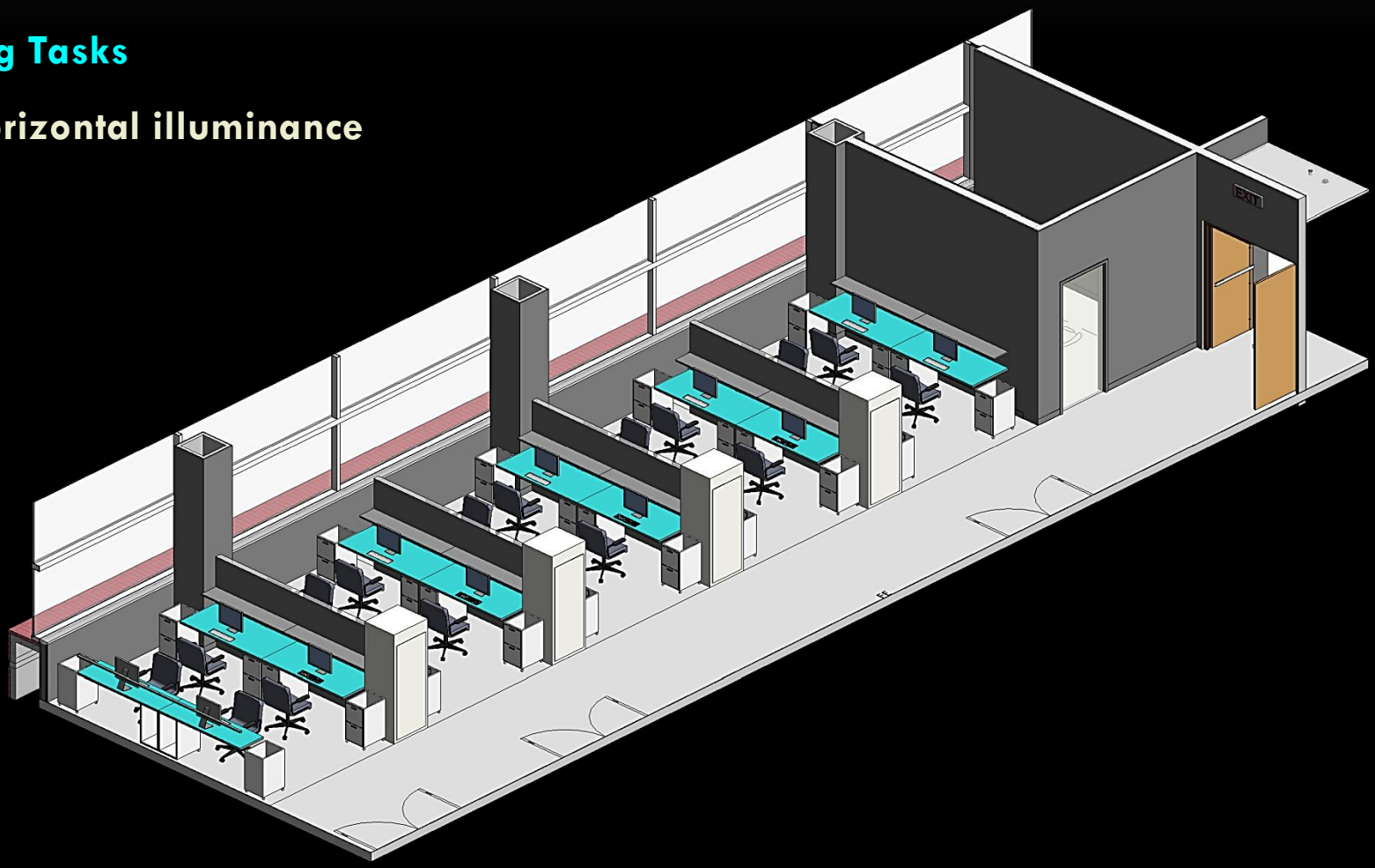
STUDENT STUDY AREA : IES DESIGN CRITERIA

- Study Area Design Issues:



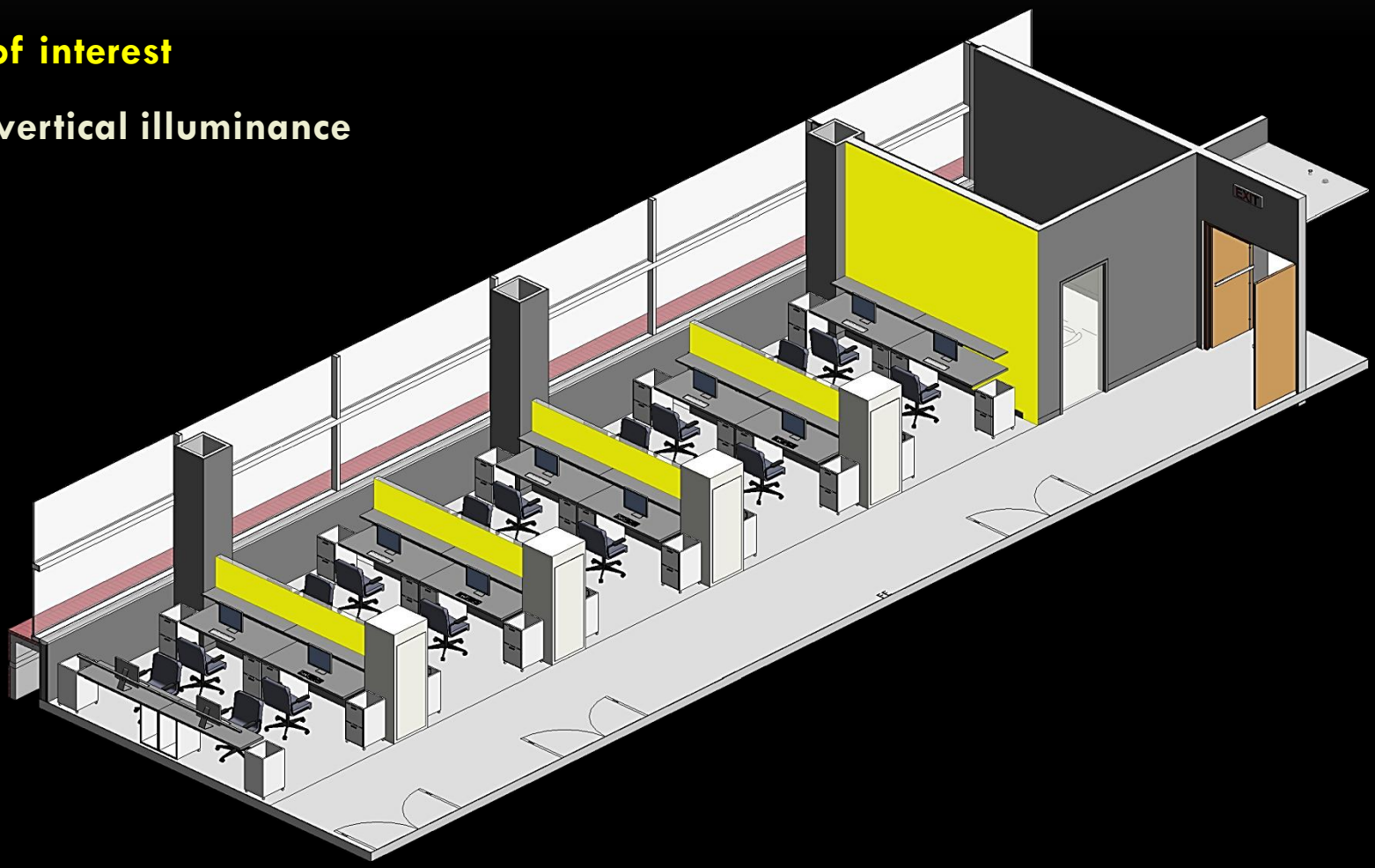
STUDENT STUDY AREA : IES DESIGN CRITERIA

- Study Area Design Issues:
  - **Reading Tasks**
  - **30fc horizontal illuminance**



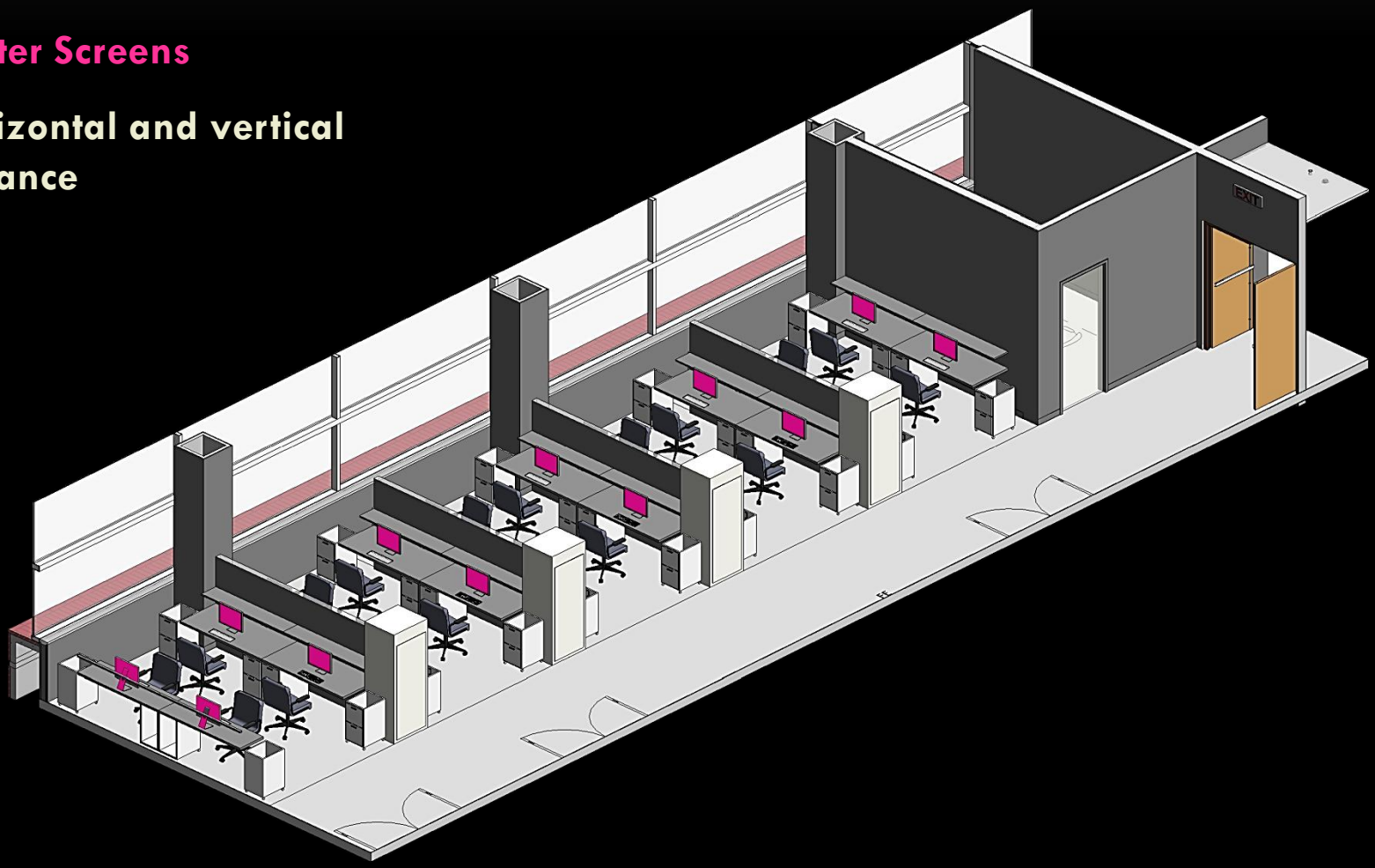
STUDENT STUDY AREA : IES DESIGN CRITERIA

- Study Area Design Issues:
  - **Points of interest**
  - **3-10fc vertical illuminance**



STUDENT STUDY AREA : IES DESIGN CRITERIA

- Study Area Design Issues:
  - **Computer Screens**
  - **3fc horizontal and vertical illuminance**



Student Study Area

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KGB MASER TEAM GOALS

- Energy consumption reduction

- Integration between mechanical system and lighting

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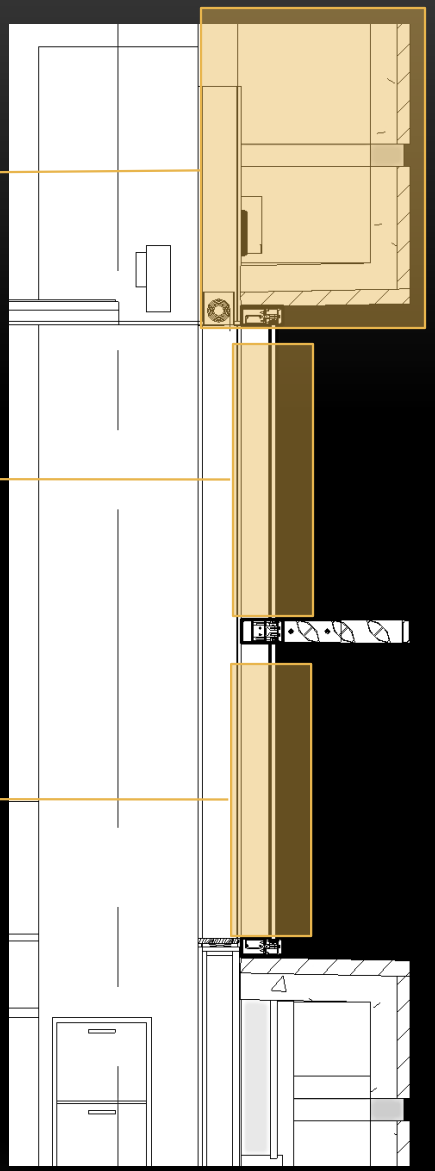
KGB MASER INTEGRATED REDESIGN

- Design considerations from other disciplines:
  - Thinner panels
  - Phase change material

- Spectrally selective glazing



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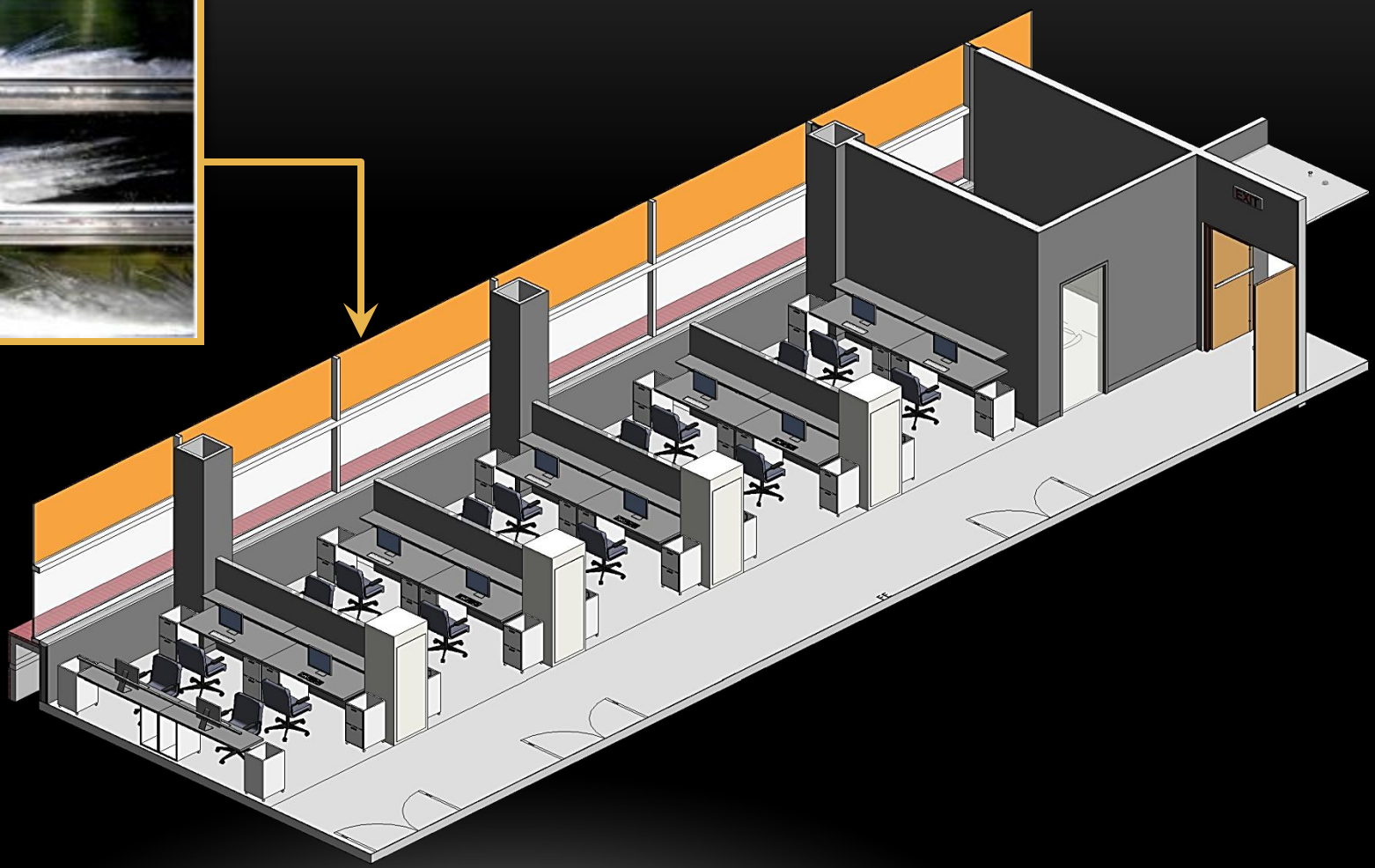
KGB MASER INTEGRATED REDESIGN



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KGB MASER INTEGRATED REDESIGN

- Goal for PCM: Avoid all-day roller shade use
- Turn shading into positive impact on space

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LIGHTING DESIGN THEME

- Match building theme in public areas
- Floating building → Floating luminaires

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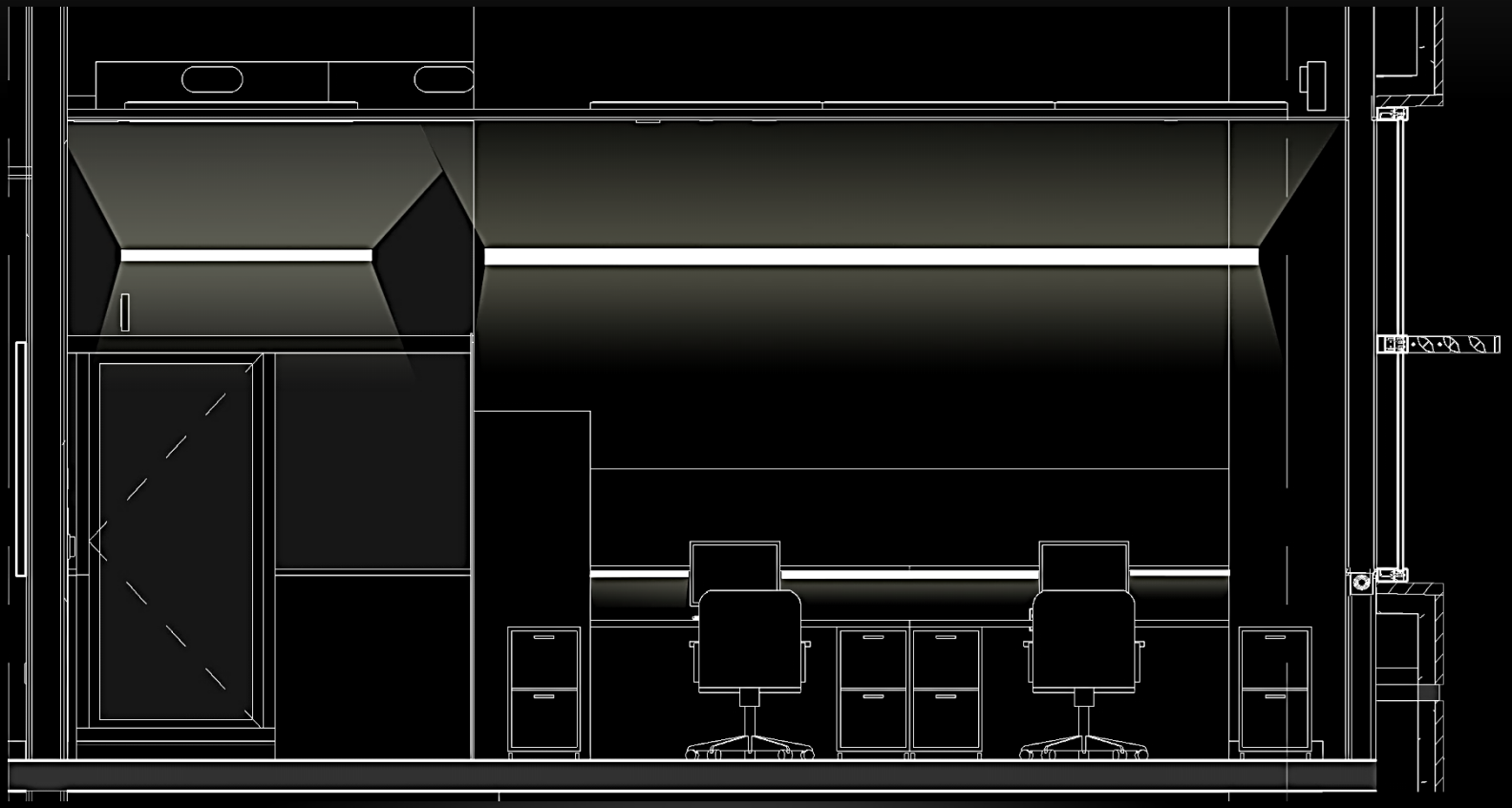
STUDENT STUDY AREA DESIGN



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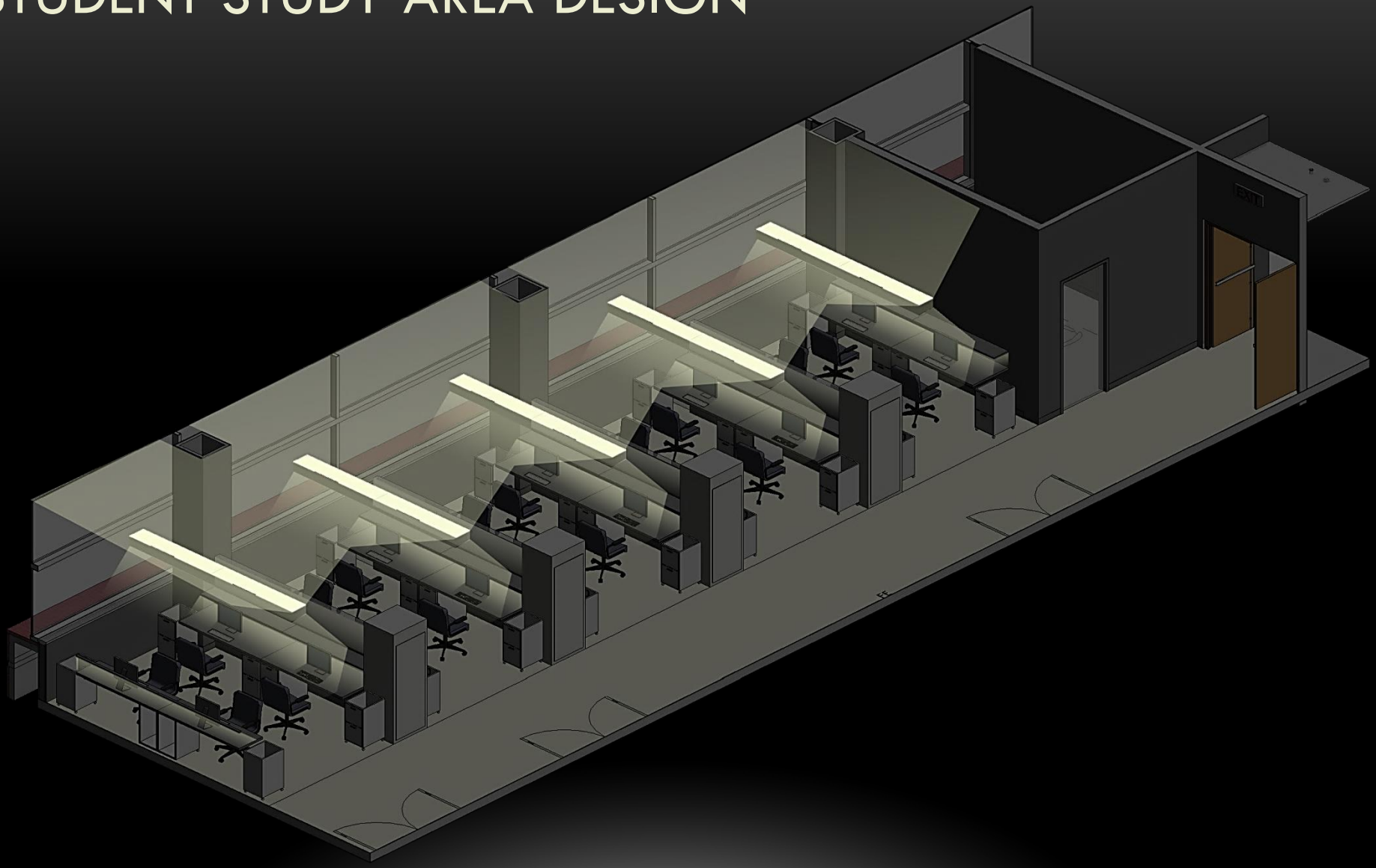
STUDENT STUDY AREA DESIGN



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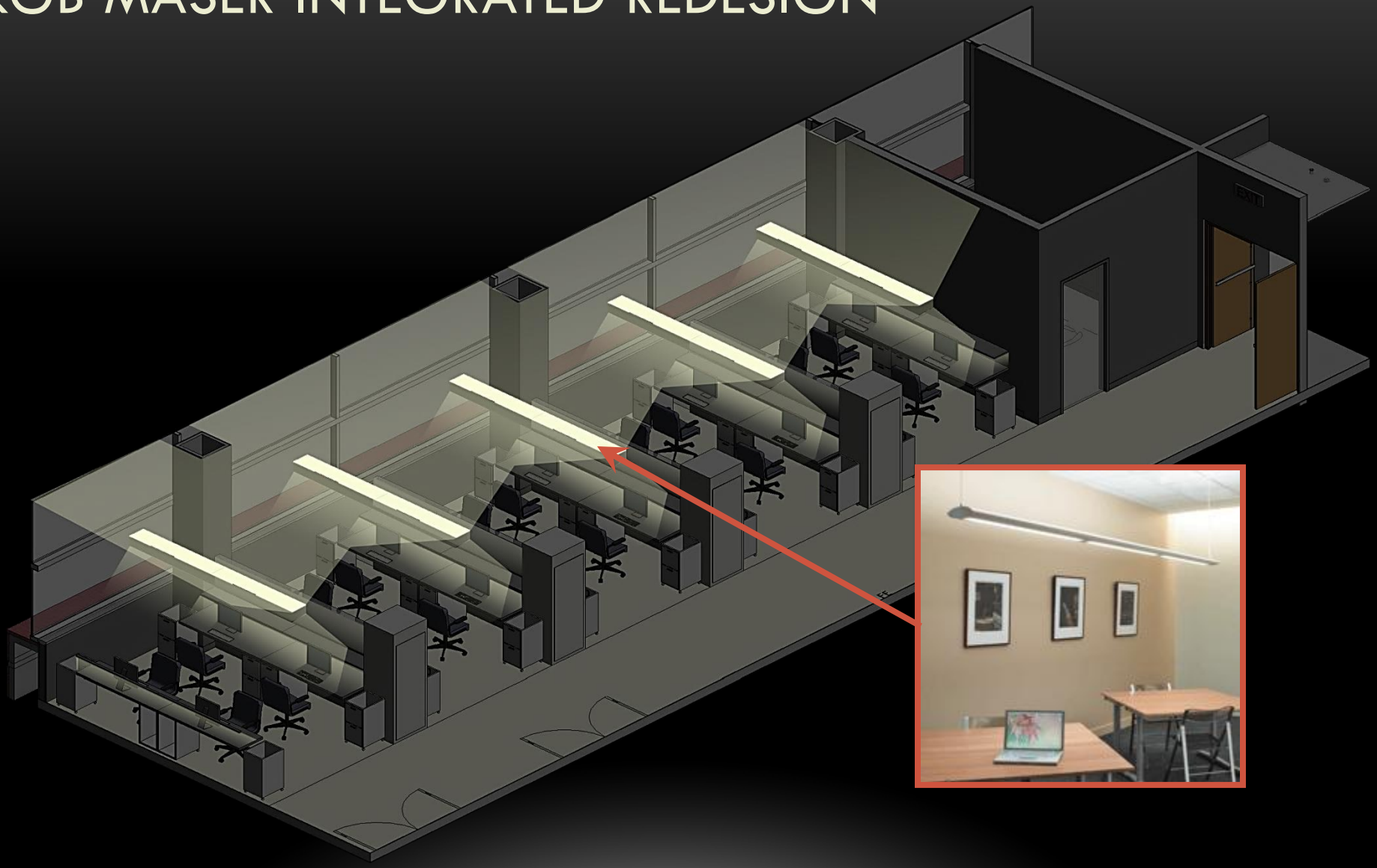

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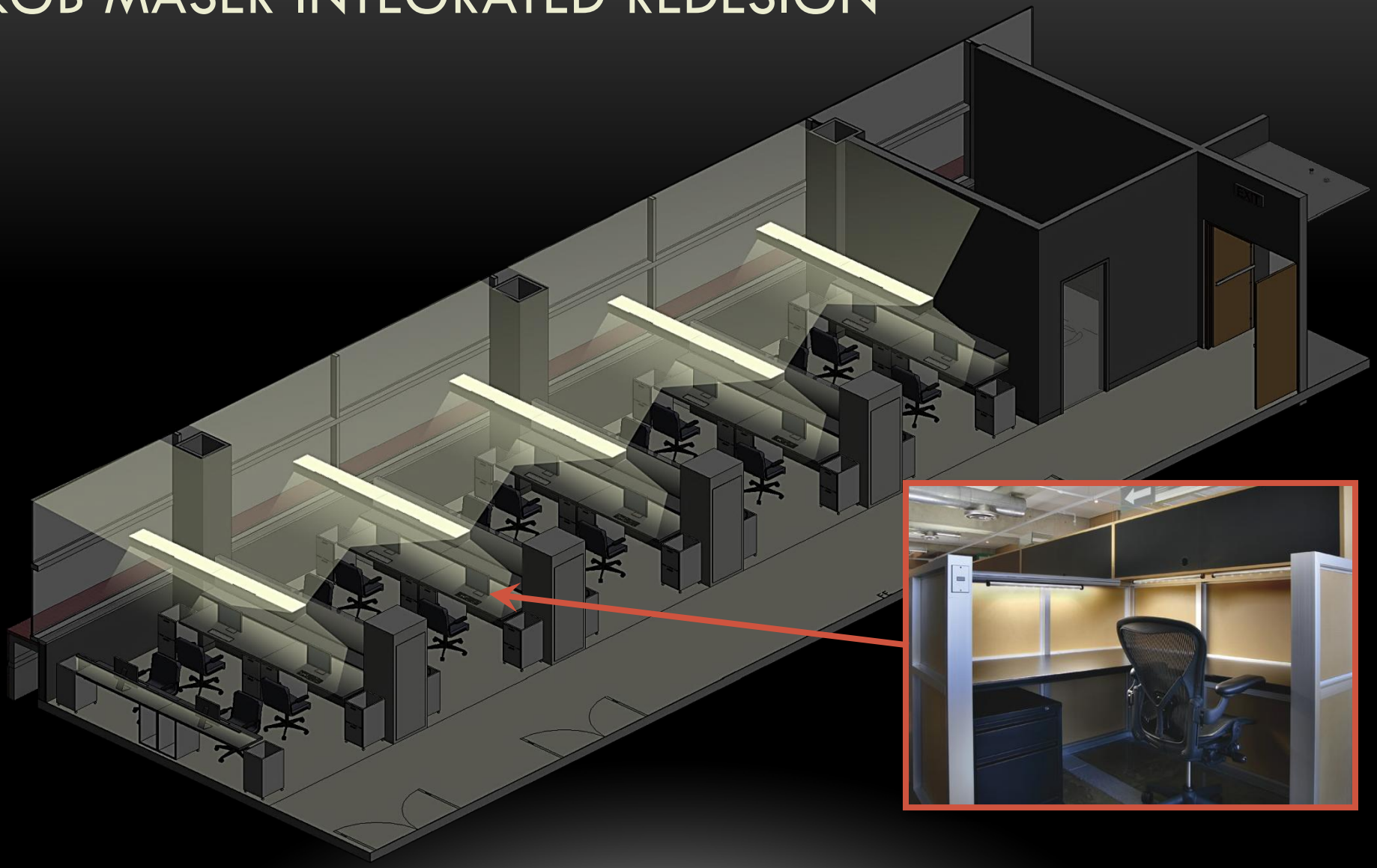

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Student Study Area

MIKE LUCAS

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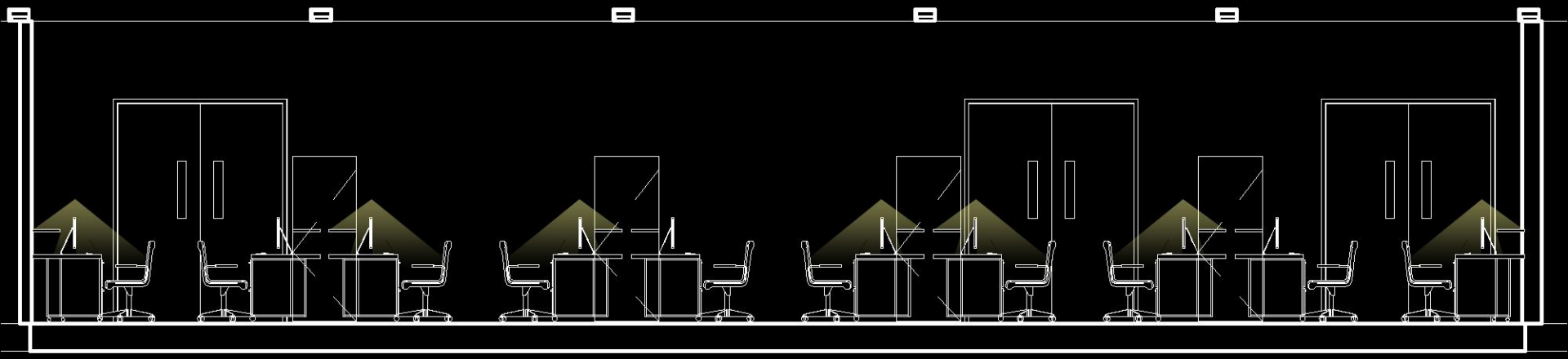
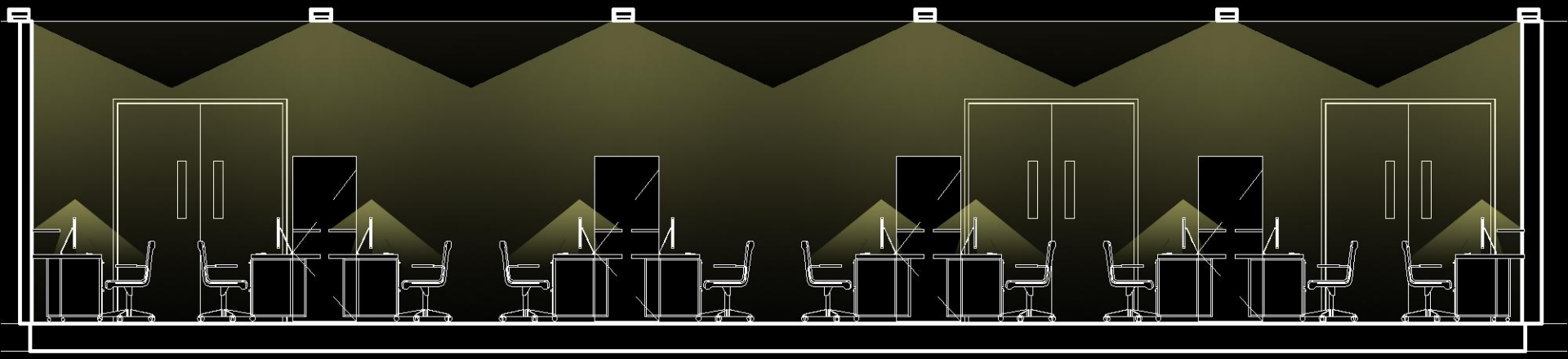
STUDENT STUDY AREA: TASK LIGHTING



STUDENT STUDY AREA: HALLWAY LIGHTING



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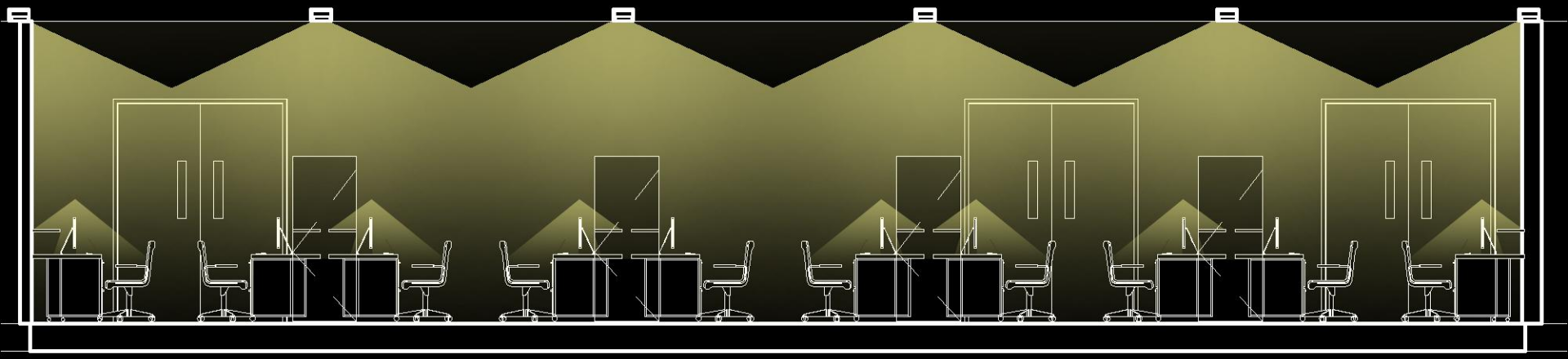
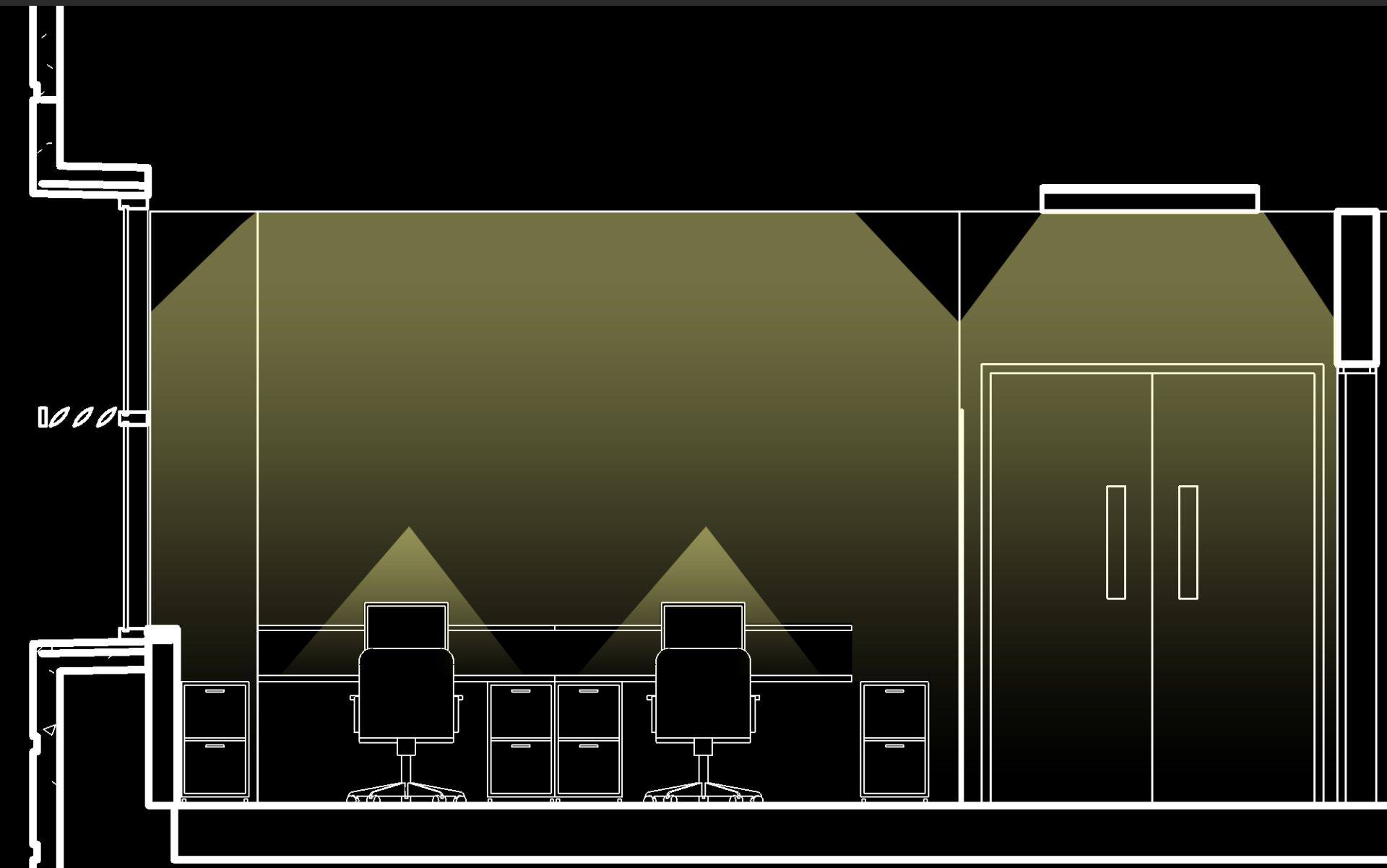
STUDENT STUDY AREA: AREA LIGHTING



Building STIMULUS
THE GREEN BUILDING SPECIALISTS

MIKE LUCAS

STUDENT STUDY AREA: AREA LIGHTING



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TOOLS TO ACHIEVE THIS DESIGN

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Student Study Area

MIKE LUCAS: INTEGRATION WITH BIM

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EXISTING ENCLOSURE DESIGN: DAYLIGHTING ASPECTS

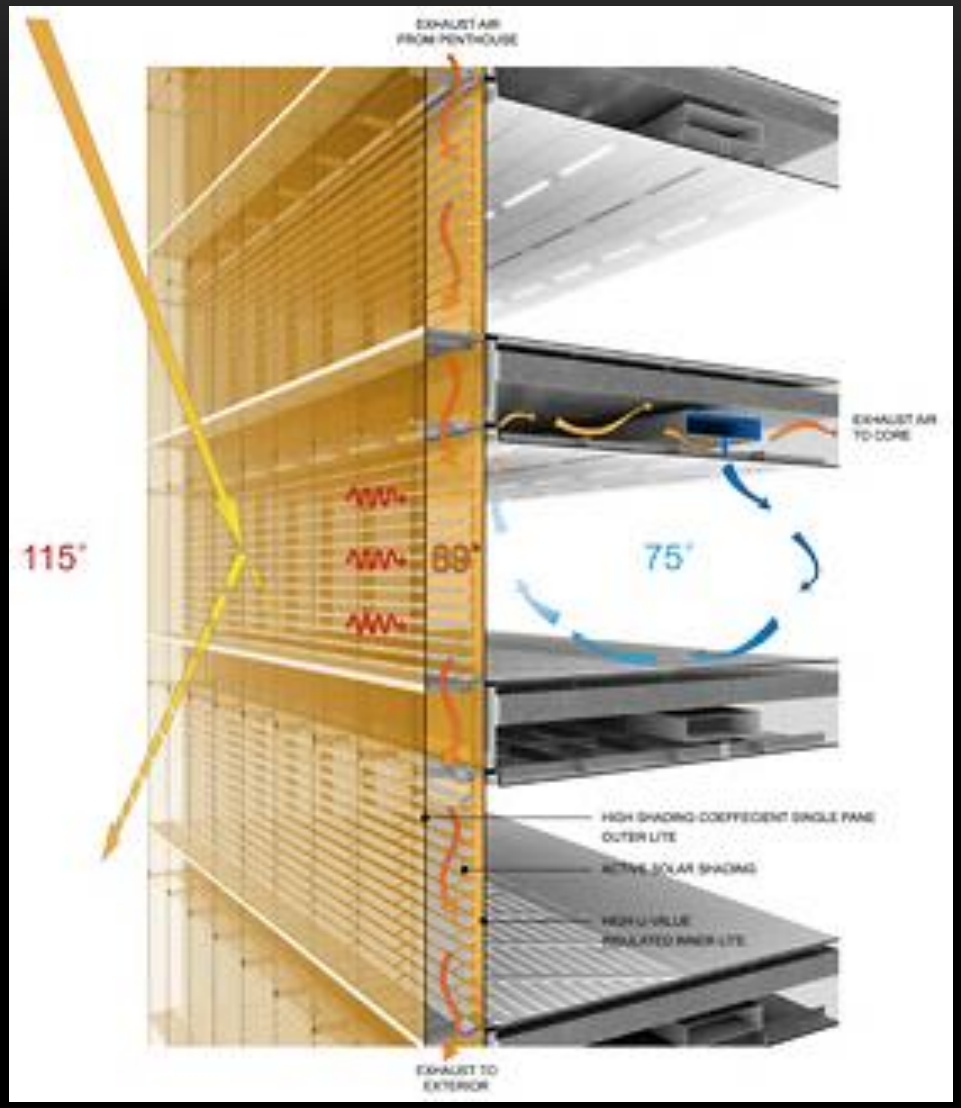
Advantages

- Exterior Visual Uniformity
- Lightweight
- Somewhat easy installation
- Cost vs. Alternatives

Disadvantages

- Not designed for specific orientations.
- No low solar angle shading
- High heat gain at low solar angles

DOUBLE SKIN FACADE



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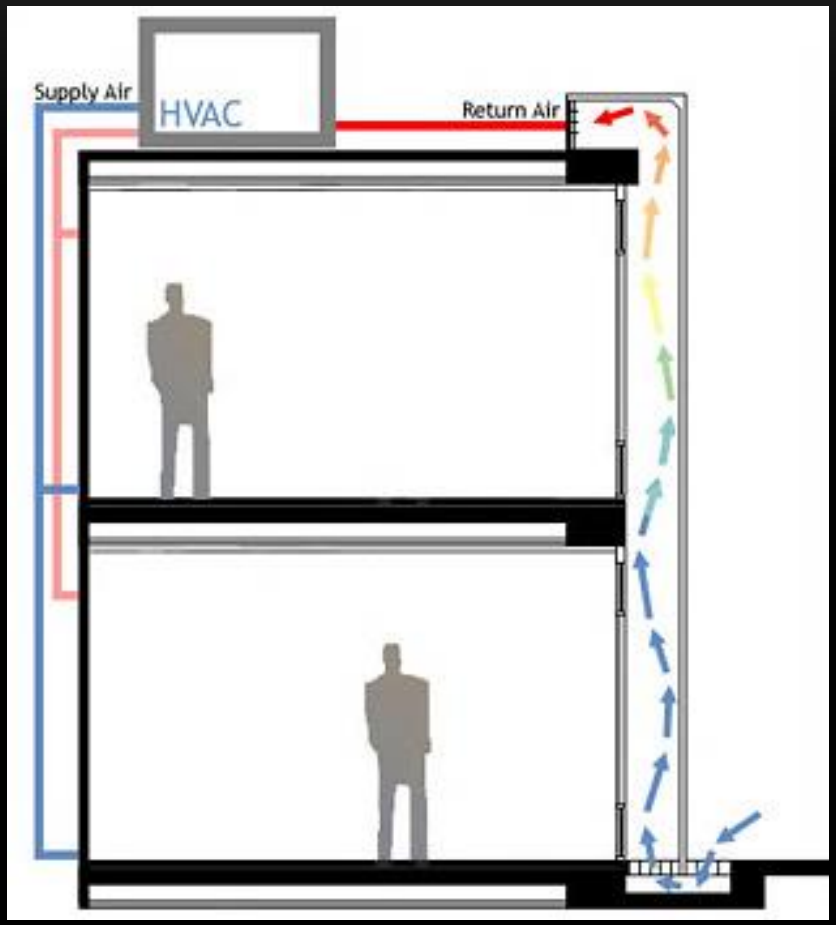
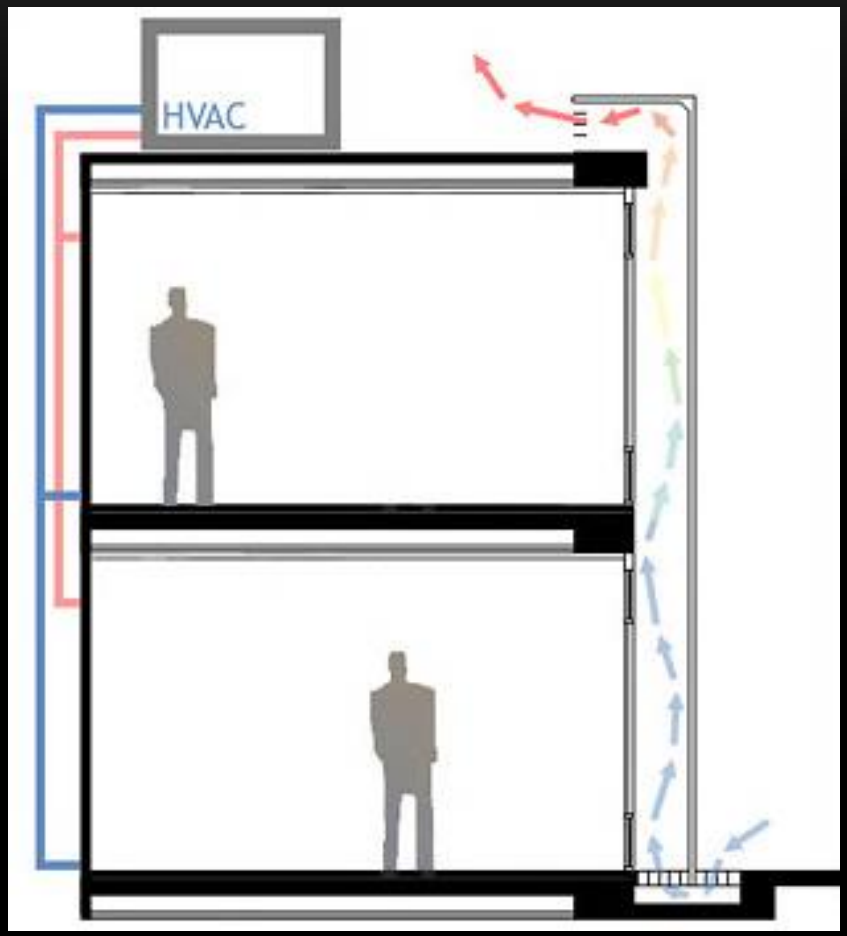
DOUBLE SKIN FACADE

Heat Recovery



Heat Extraction



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Cambridge Public Library
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Student Study Area

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BIMception TEAM GOALS

Energy Savings

- Façade Redesign
  - Wall Composition
  - Window to Wall Ratio
  - Shading Devices

Integration

- Window to Wall Ratio
  - Mechanical Loads
  - Daylight Delivery System

BIMception

CHRIS RUSSELL

BIM*ception* INTEGRATED APPROACH

Mechanical Perspective

- Wall Composition - Flatten load Profile
  - Less Concrete
  - Air Gap
  - Insulation
  - Phase Change Impregnated Concrete
- Window to Wall Ratio
  - Mechanical Loads

BIMception

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BIM*ception* INTEGRATED APPROACH

Lighting/Electrical Perspective

- Window to Wall Ratio
  - Useful Illuminance - 100-2000 lux
  - Daylight Autonomy - 300 lux
- Shading Devices
  - Profile Angle Study
  - Light Shelf Height
- Control
  - Automatic vs. Manual

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STUDENT STUDY AREA

BIMception

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STUDENT STUDY AREA

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STUDENT STUDY: AMBIENT LIGHTING

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STUDENT STUDY AREA: LIGHTING THE CEILING

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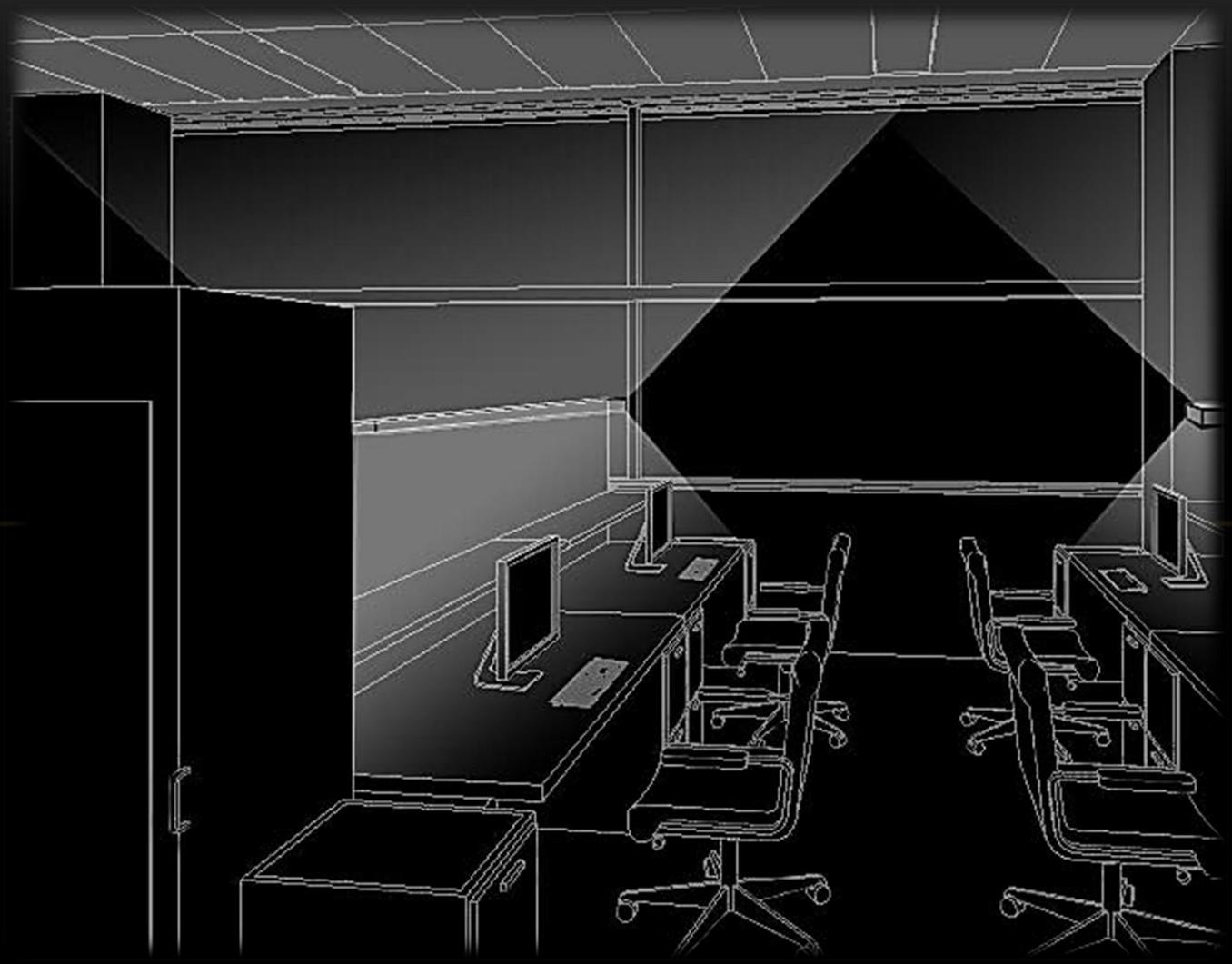
STUDENT STUDY AREA: TASK LIGHTING



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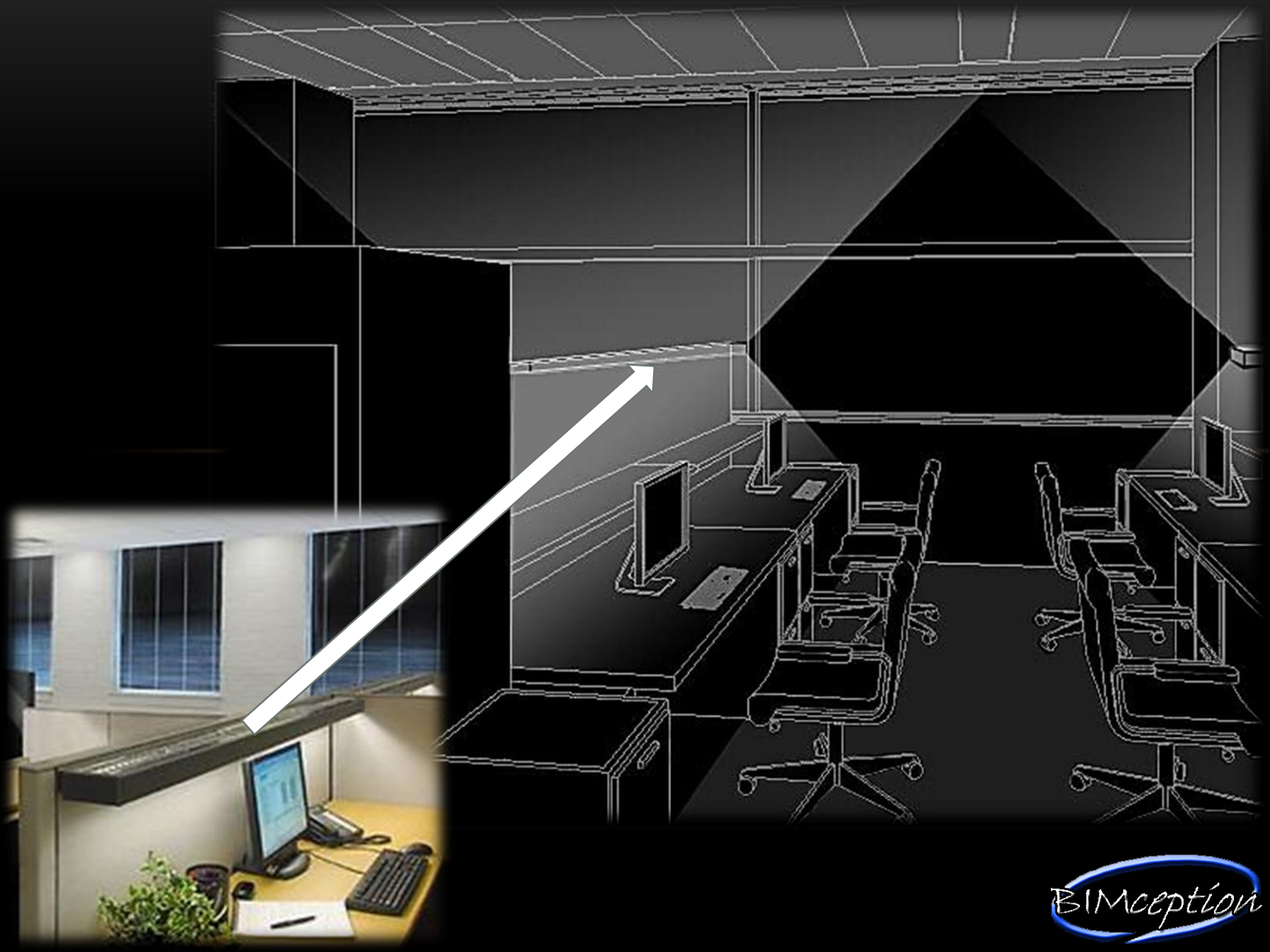
STUDENT STUDY AREA: POSSIBLE EQUIPMENT



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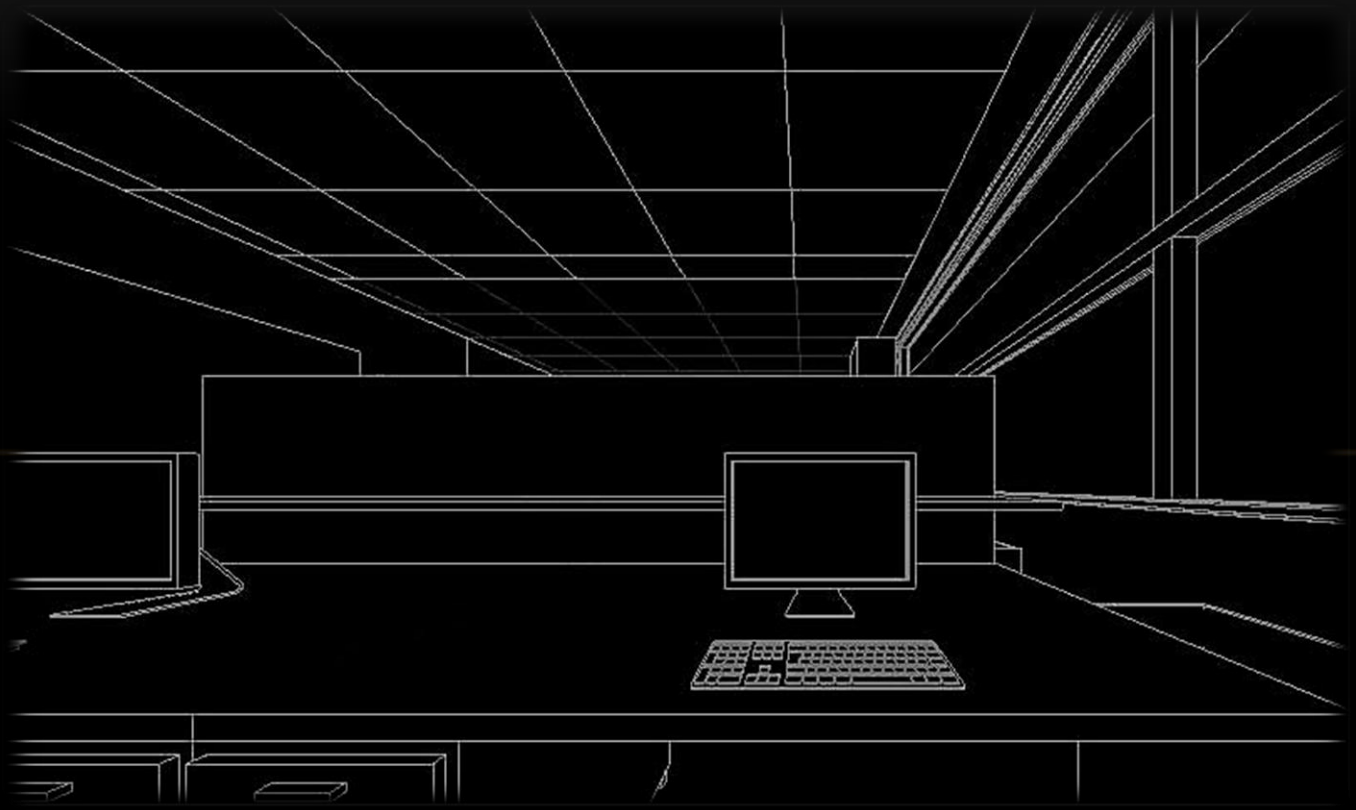
STUDENT STUDY AREA



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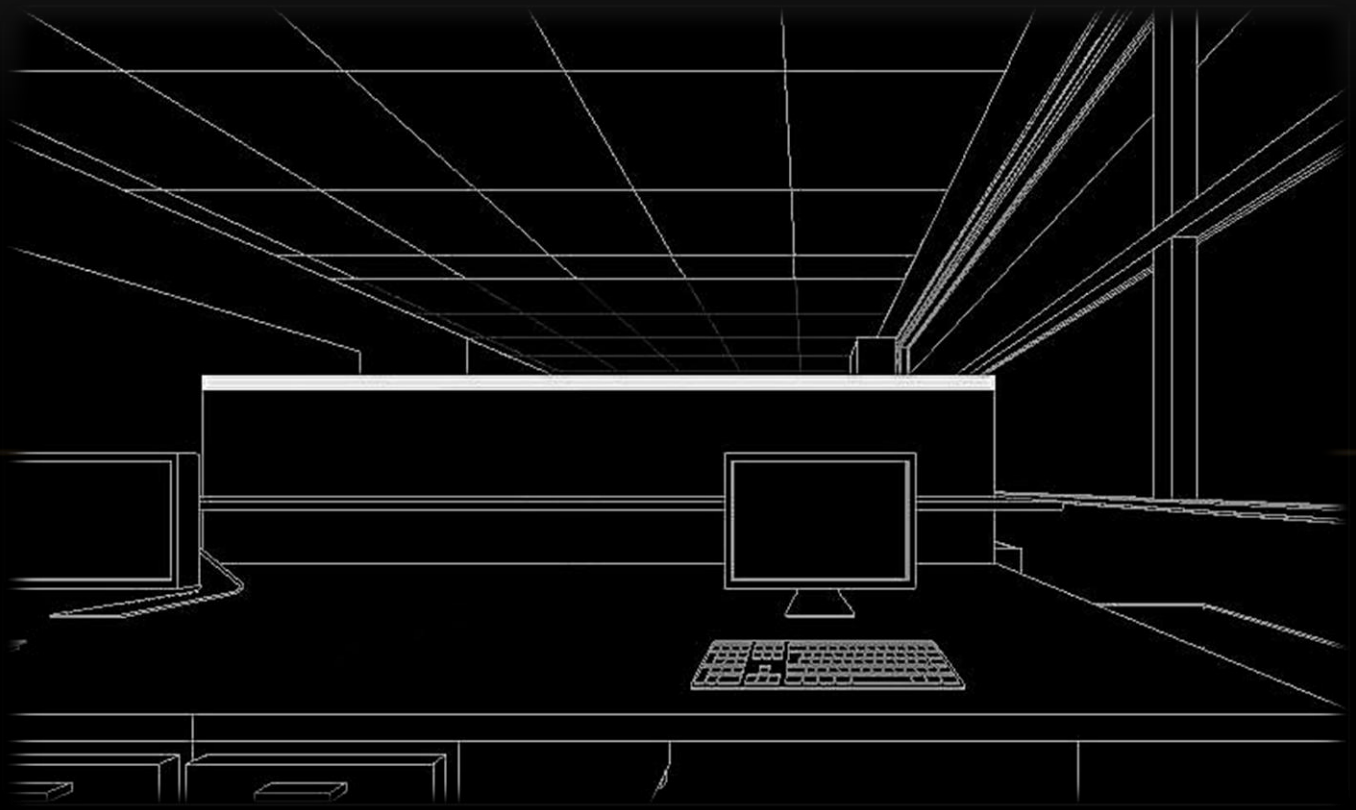
STUDENT STUDY AREA



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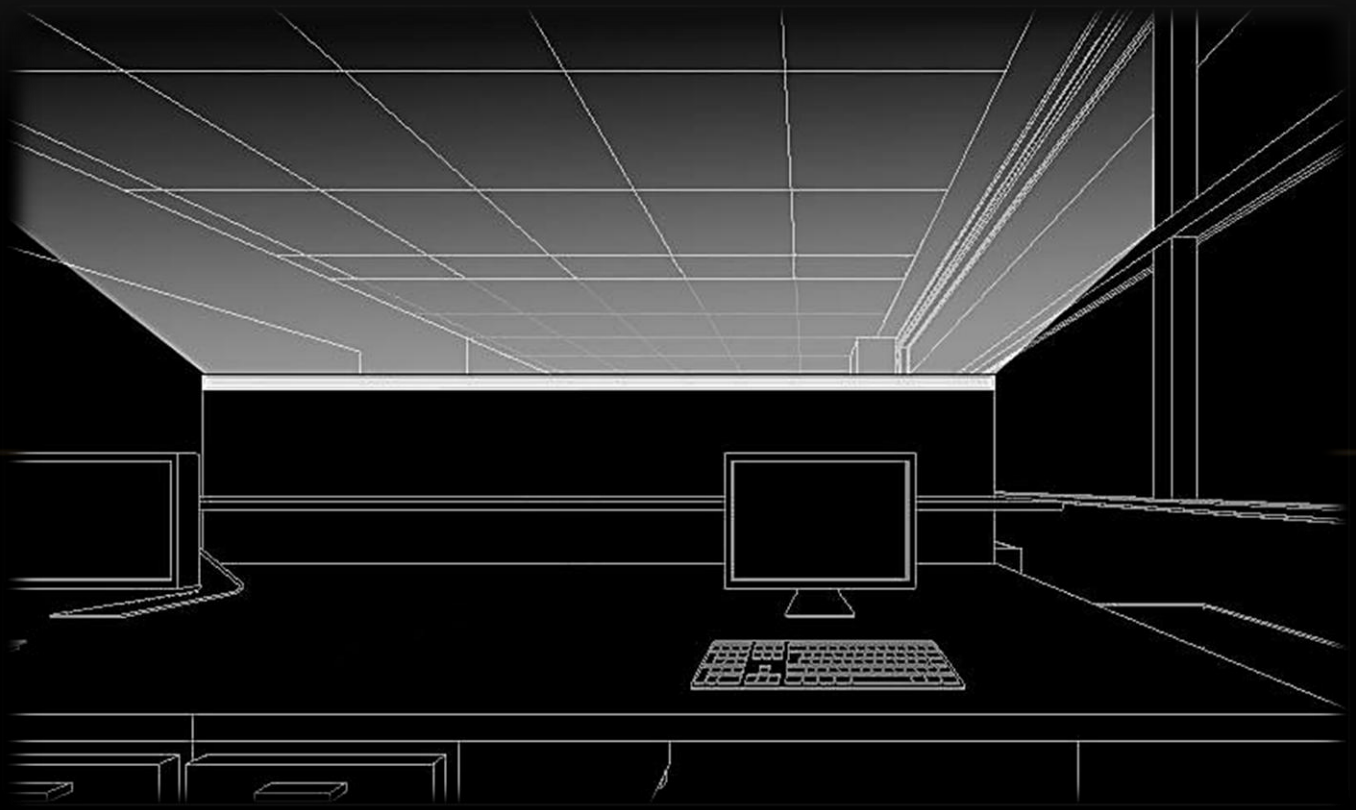
STUDENT STUDY AREA: AMBIENT LIGHTING



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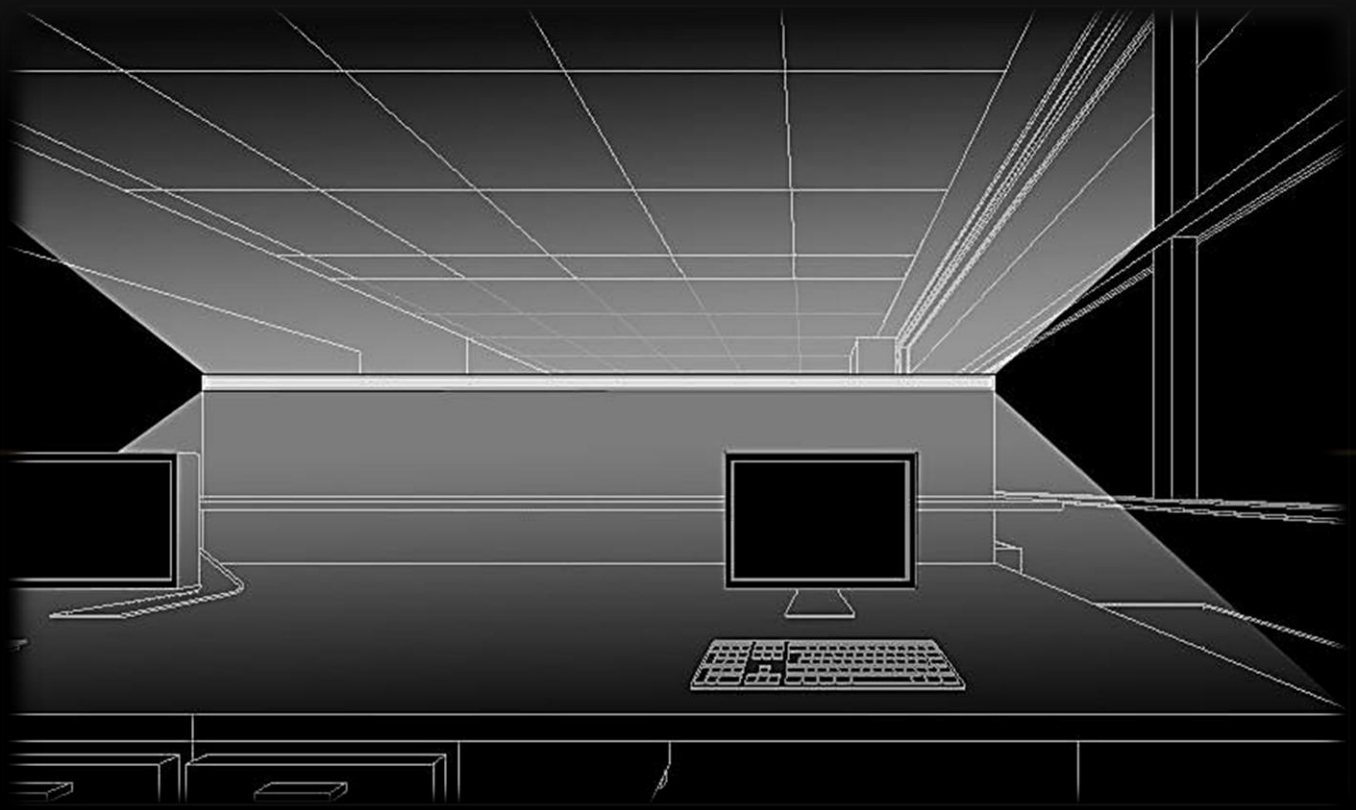
STUDENT STUDY AREA: TASK LIGHTING



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STUDENT STUDY AREA: DAYLIGHT PENETRATION

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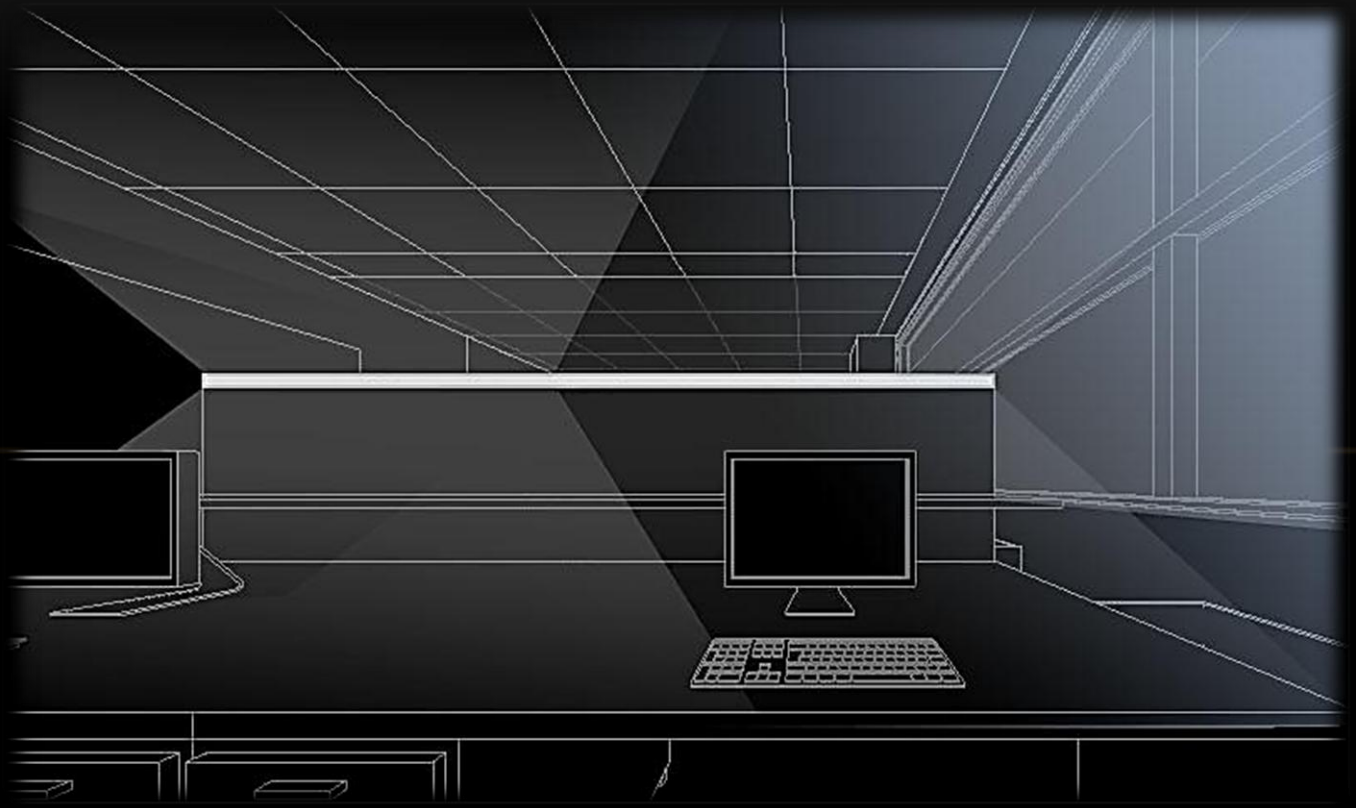
STUDENT STUDY AREA: CONTROLS DIMMING



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STUDENT STUDY AREA: CONTROLS SWITCHING

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Distinguished Office

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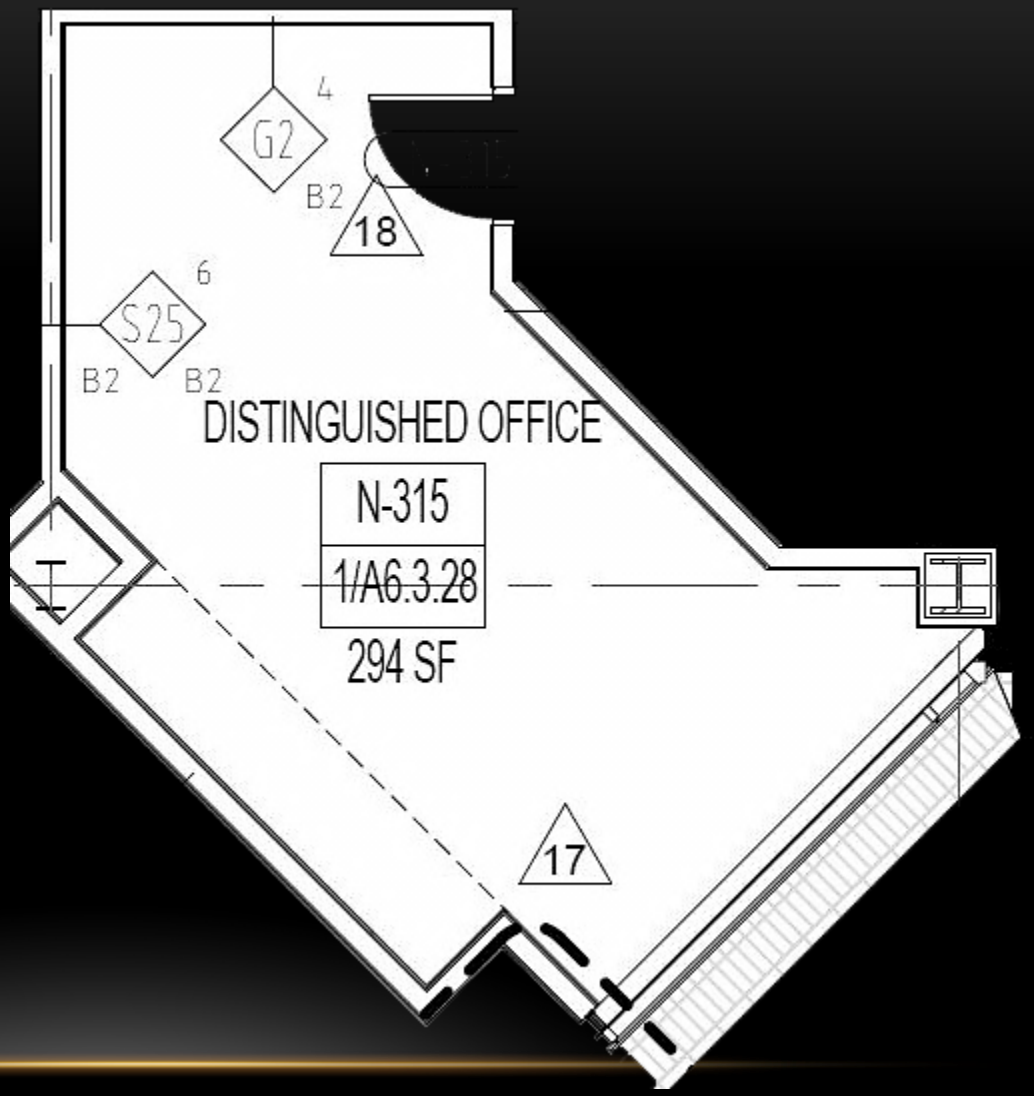
DISTINGUISHED OFFICE: OVERVIEW

- Perimeter locations
- Early solar gains
- Façade redesign
- Active chilled beams with integrated lighting



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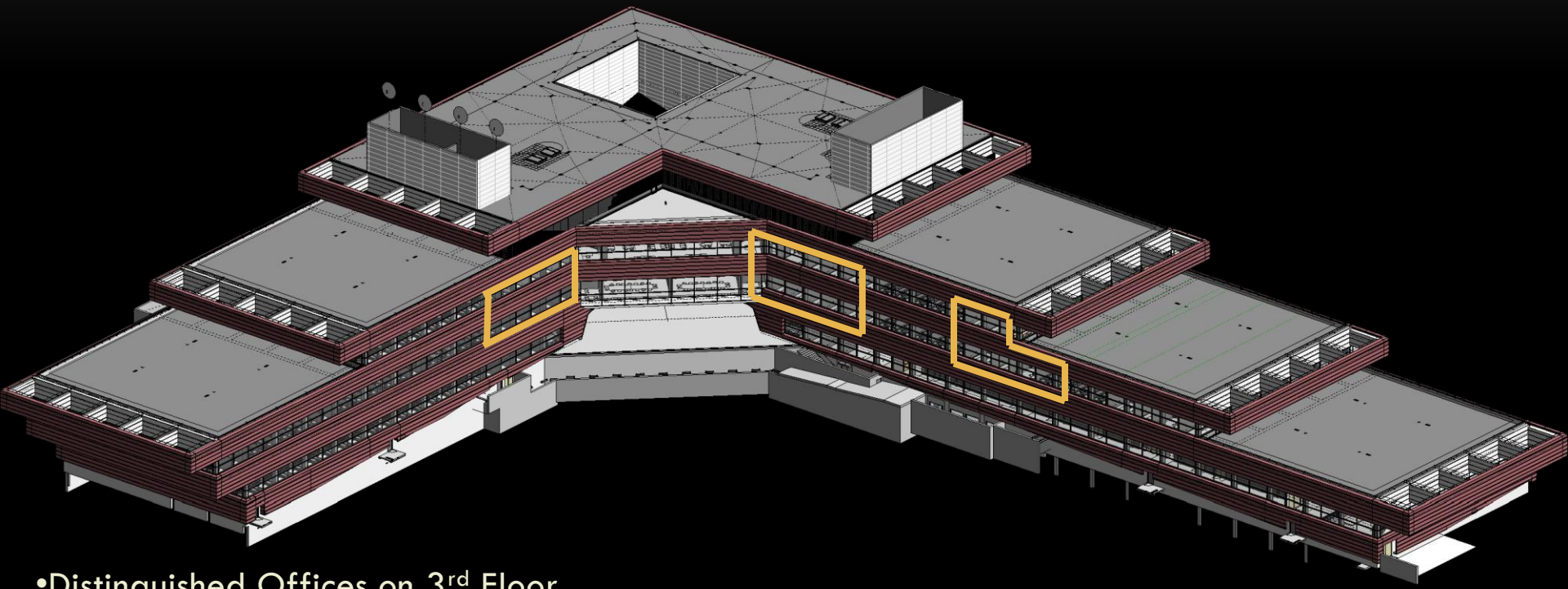
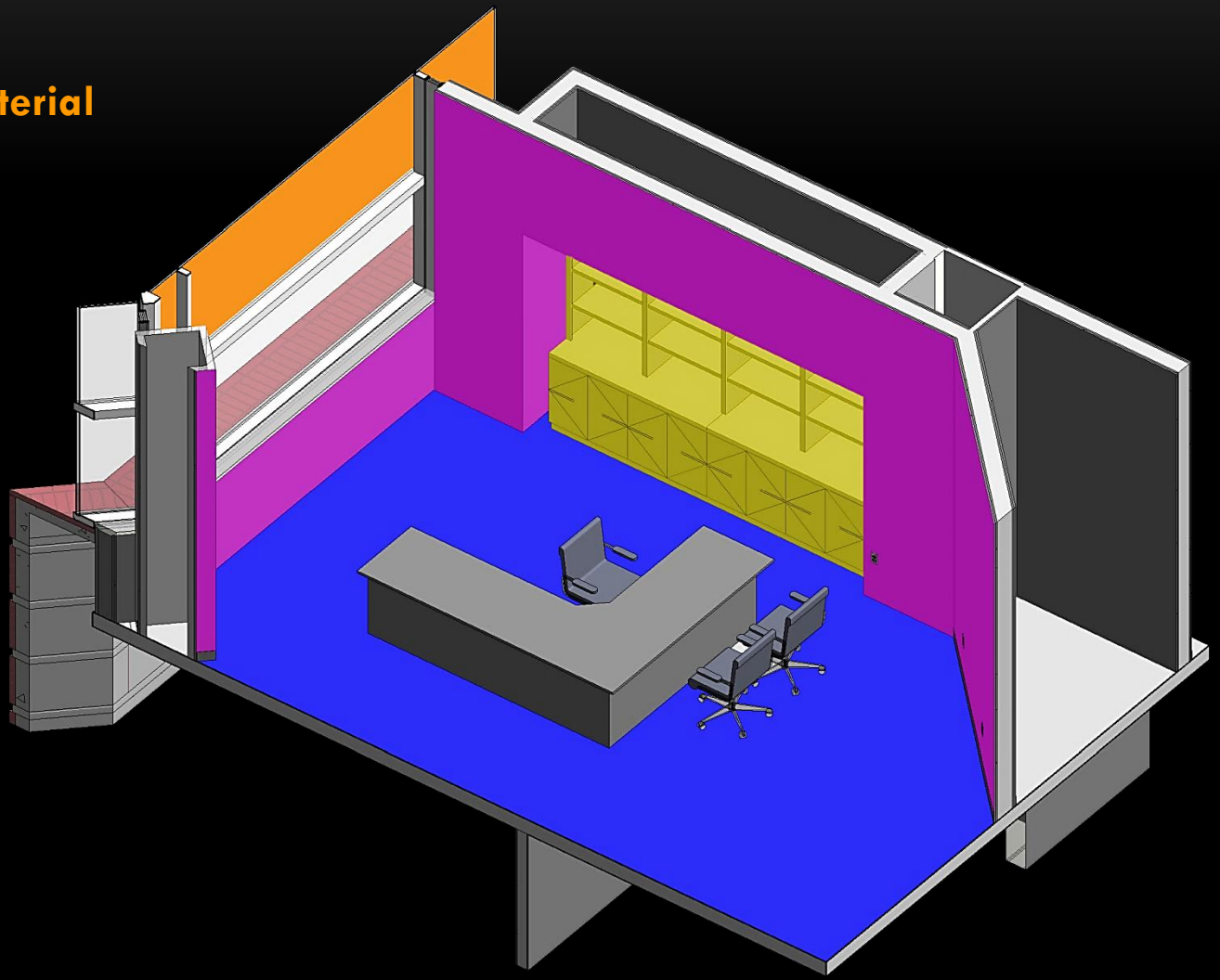
DISTINGUISHED OFFICE: LOCATIONS



- Distinguished Offices on 3rd Floor
- General Faculty offices otherwise
- Similar layout on other side of building

DISTINGUISHED OFFICE: ROOM MATERIALS

- Materials
  - Phase Change Material
  - Painted GWB
  - Carpet Squares
  - Wood Cabinets
  - ACT ceiling



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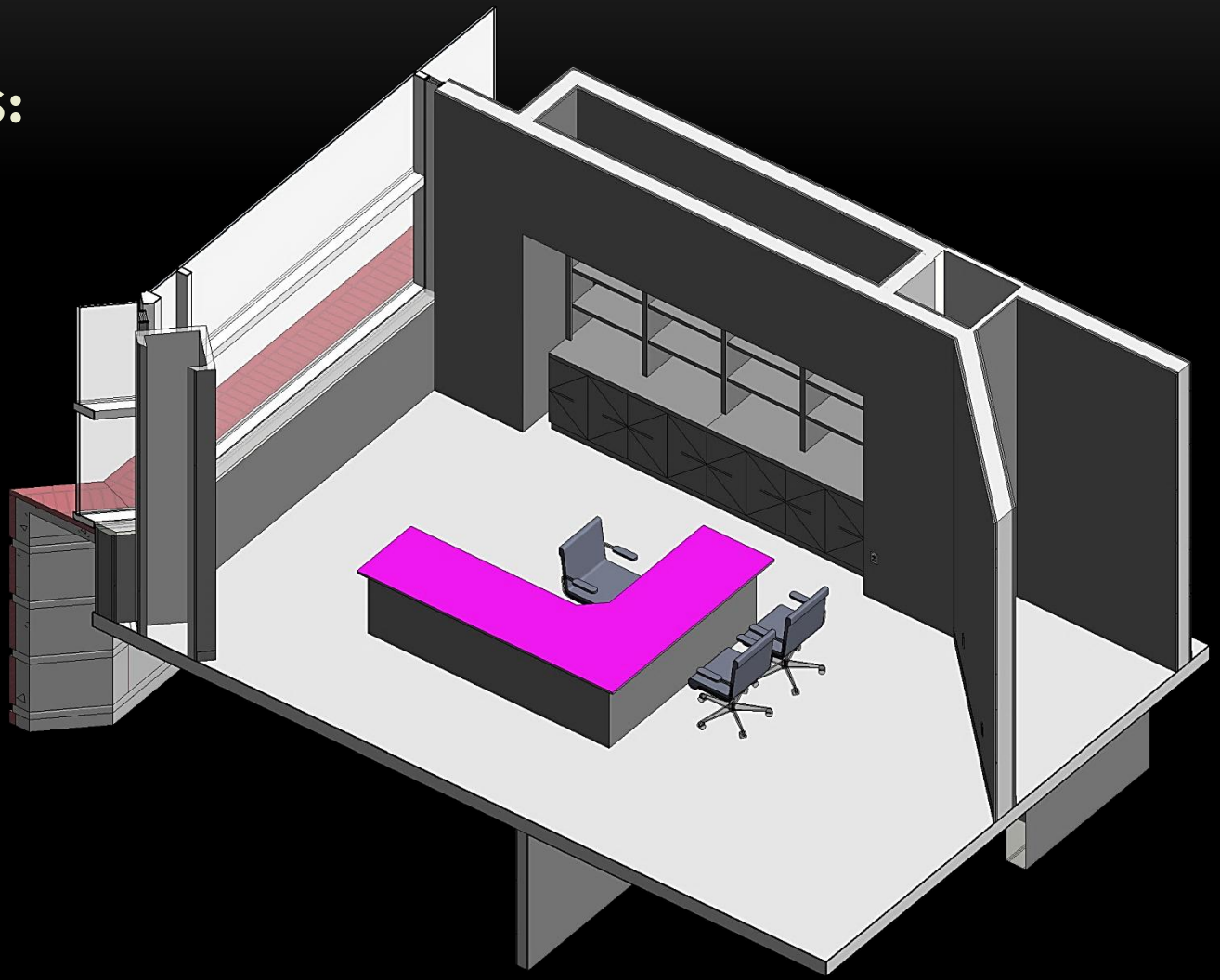
DISTINGUISHED OFFICE: IES DESIGN CRITERIA

- Main Office Design Issues:
  - **Reading Tasks**
  - **30fc horizontal illuminance**
  - **5fc vertical illuminance**



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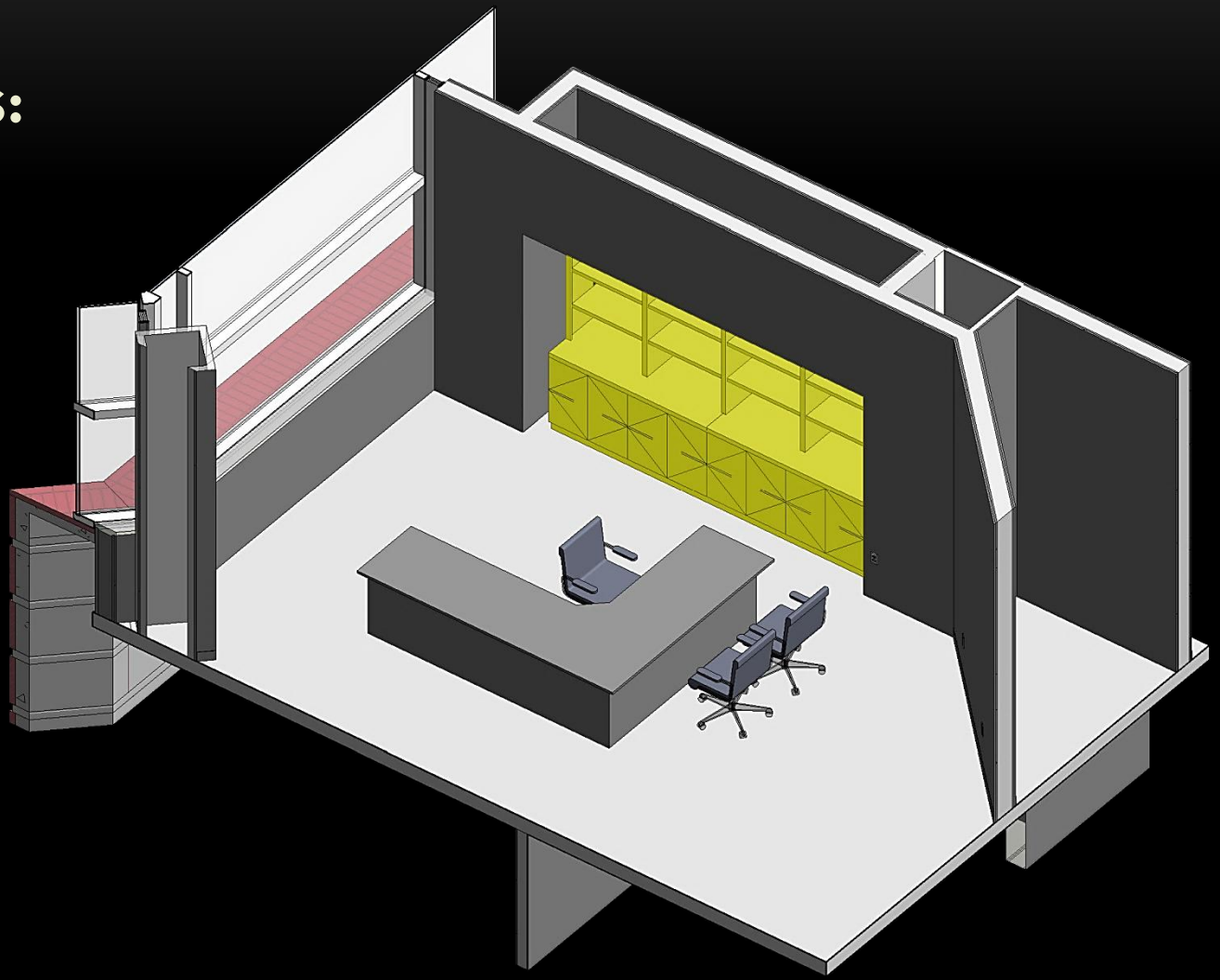
DISTINGUISHED OFFICE: IES DESIGN CRITERIA

- Main Office Design Issues:
  - **Filing and Storage**
  - **5fc vertical illuminance**



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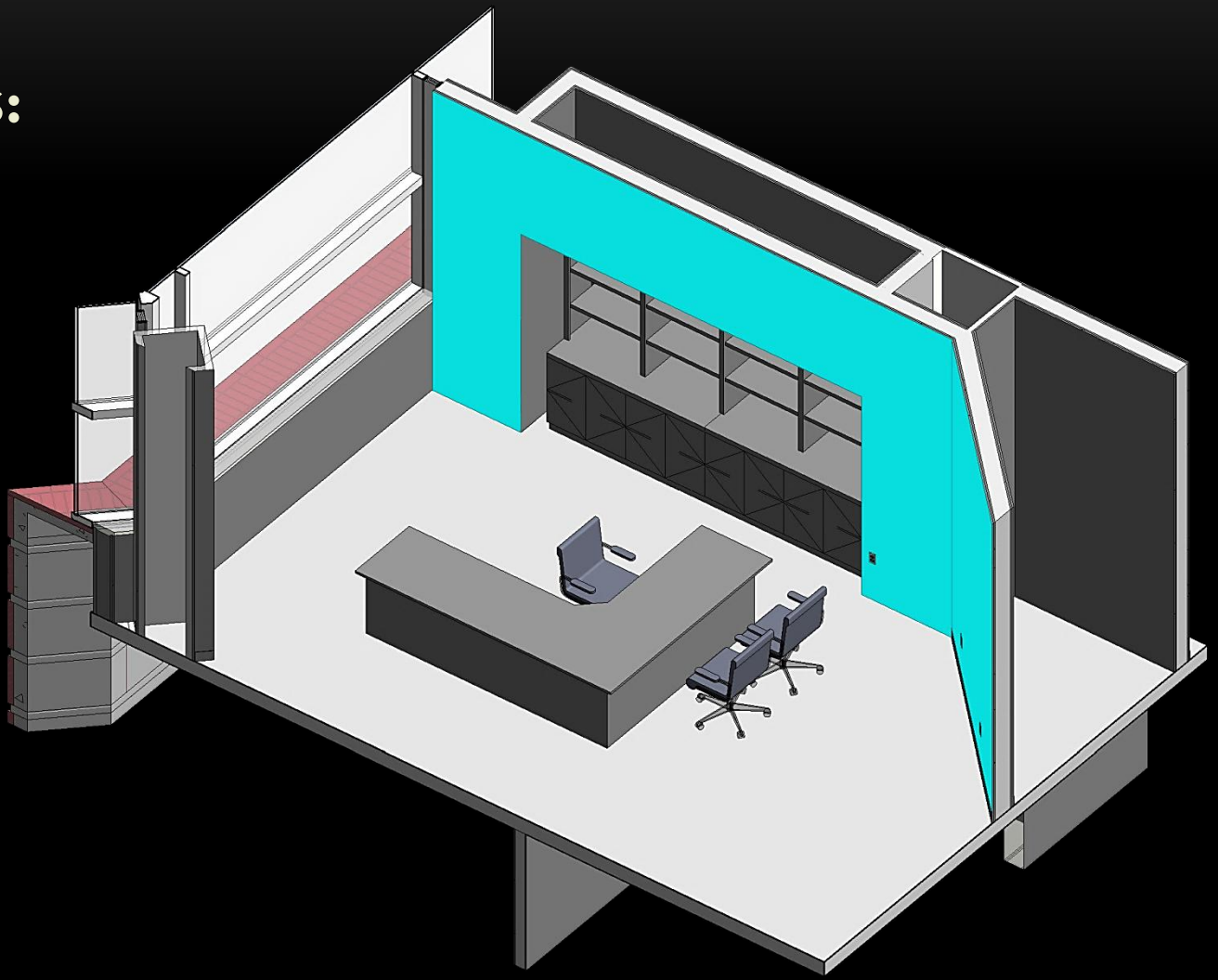
DISTINGUISHED OFFICE: IES DESIGN CRITERIA

- Main Office Design Issues:
  - **Points of Interest**
  - **Accolades**
  - **Calendars**
  - **Office Decoration**
  - **3-10fc vertical illuminance**



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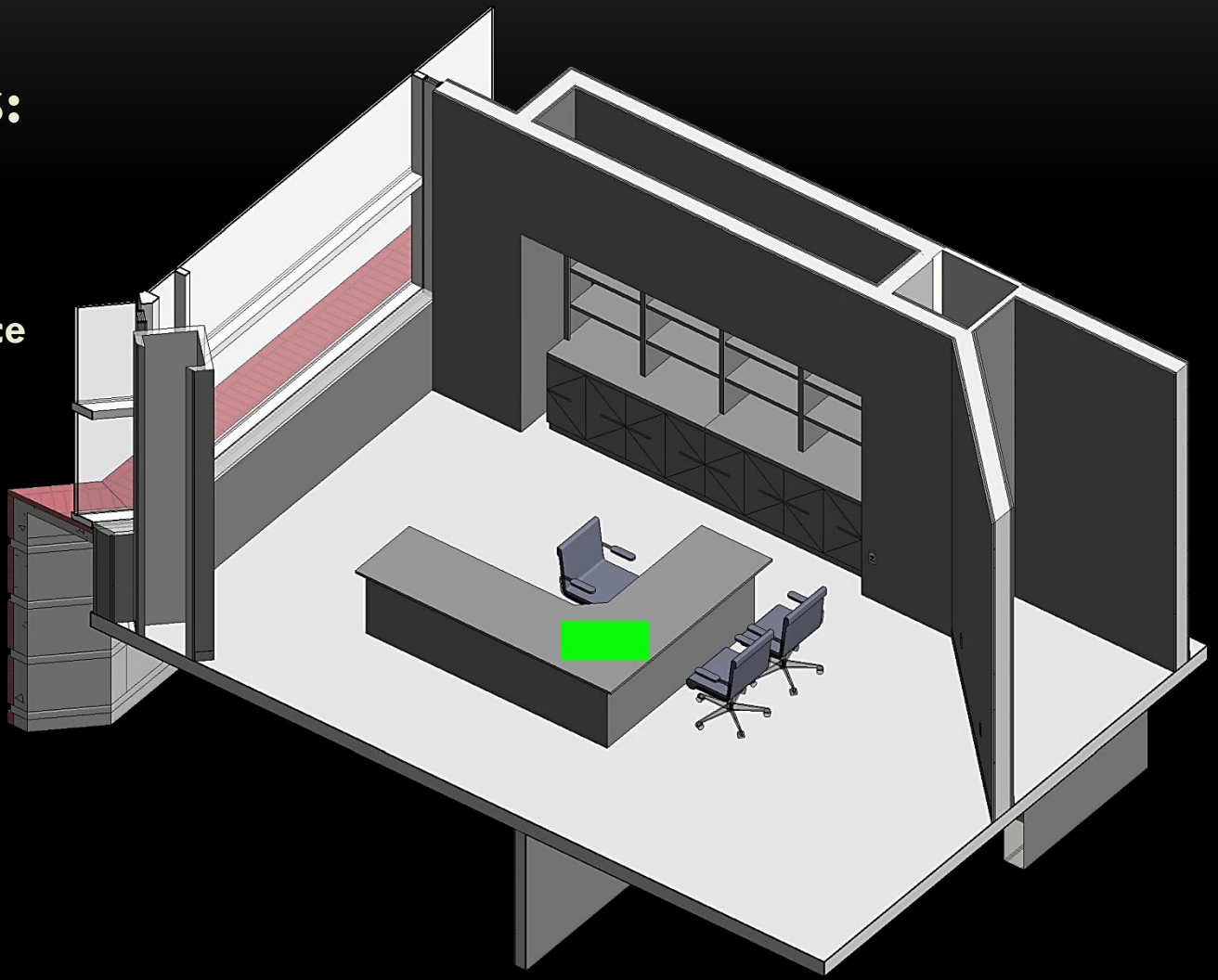
DISTINGUISHED OFFICE: IES DESIGN CRITERIA

- Main Office Design Issues:
  - **Computer Screen**
  - **3fc horizontal and vertical illuminance**



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DISTINGUISHED OFFICE: DESIGN INTEGRATION

- Mechanical system integration
- Active chilled beam with integrated lighting
  - Match recessed luminaires with aesthetics of chilled beam
  - Use task-specific luminaires to address other considerations

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DISTINGUISHED OFFICE DESIGN

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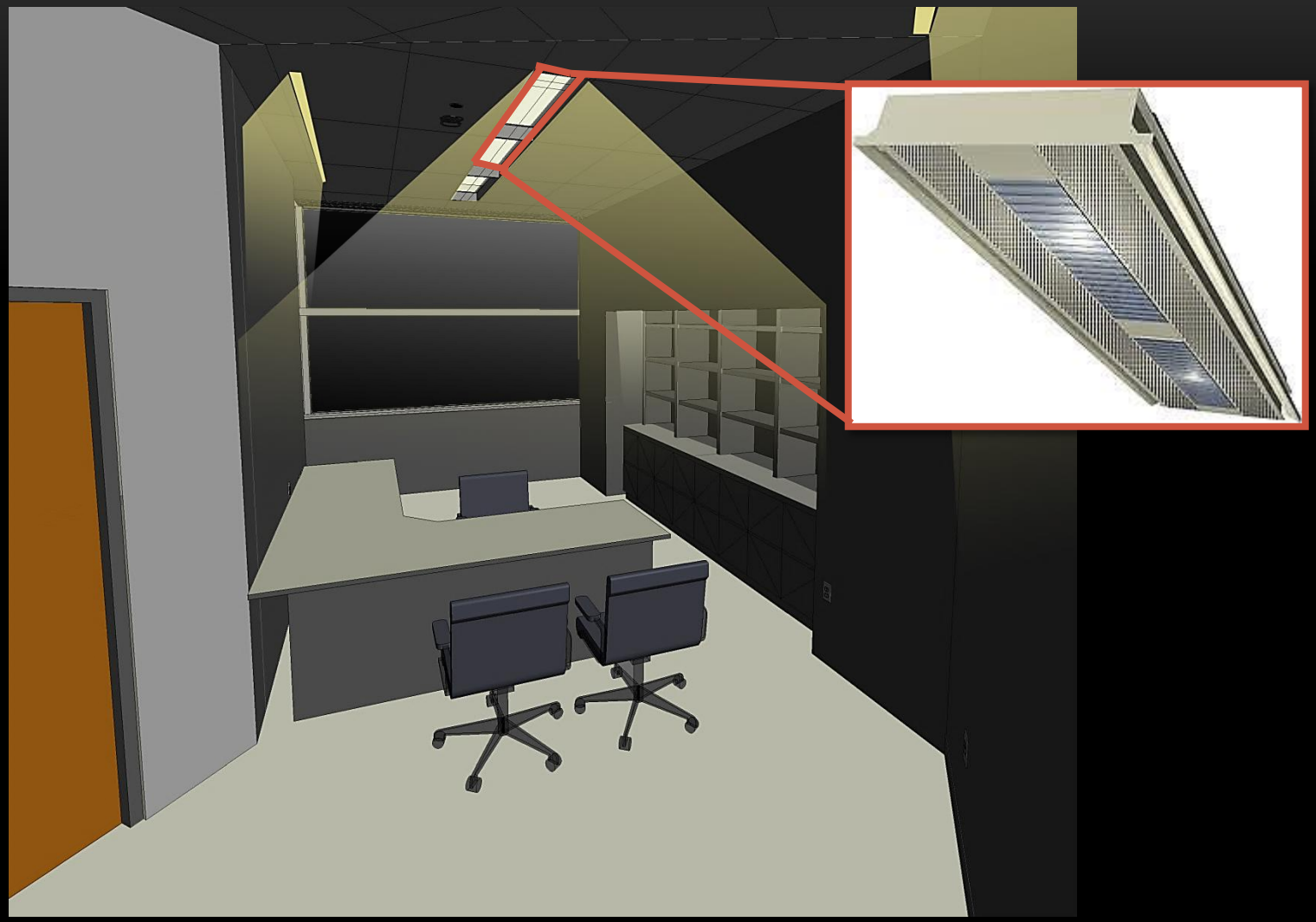
DISTINGUISHED OFFICE DESIGN



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DISTINGUISHED OFFICE DESIGN

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Conference Room

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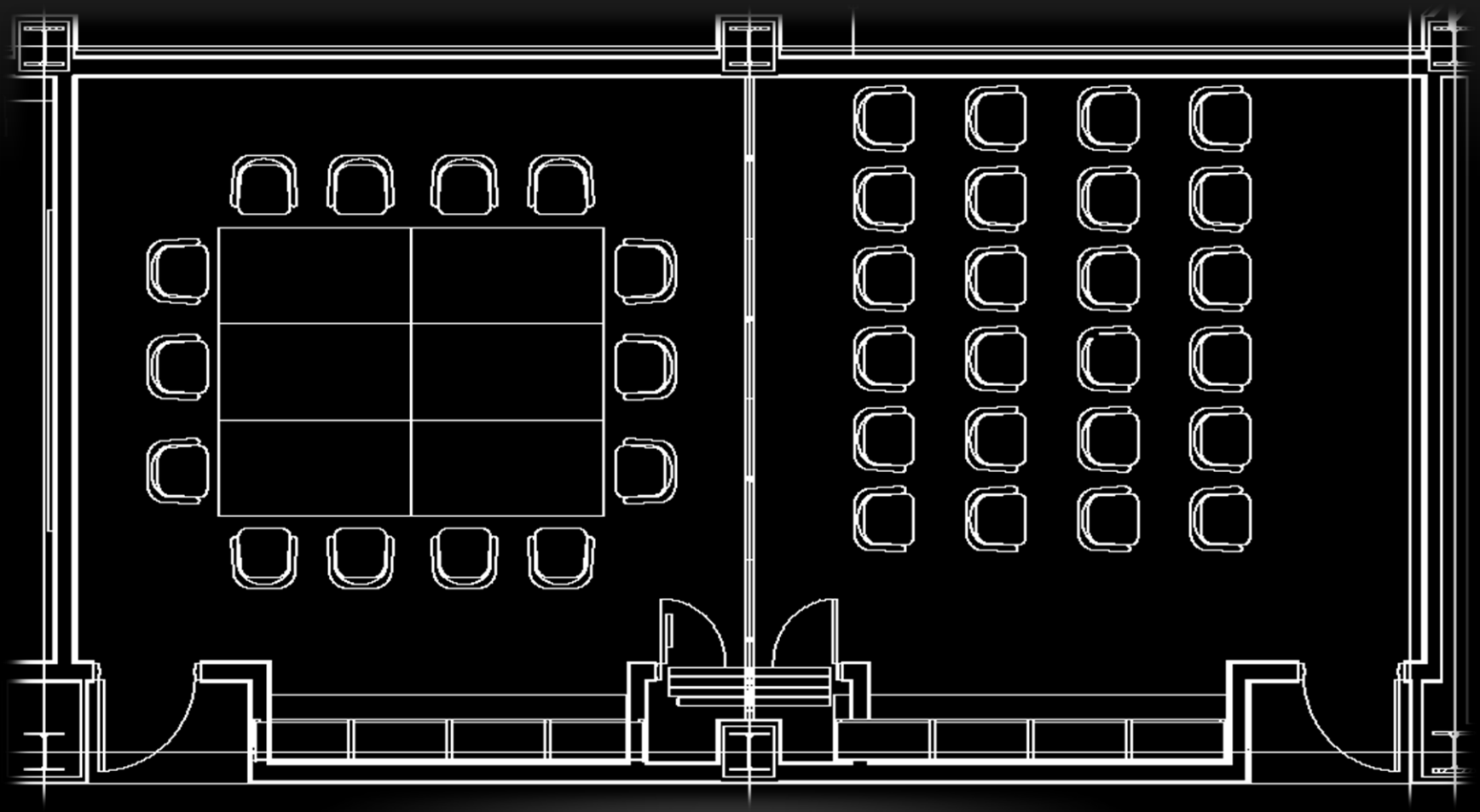
CONFERENCE ROOM: OVERVIEW



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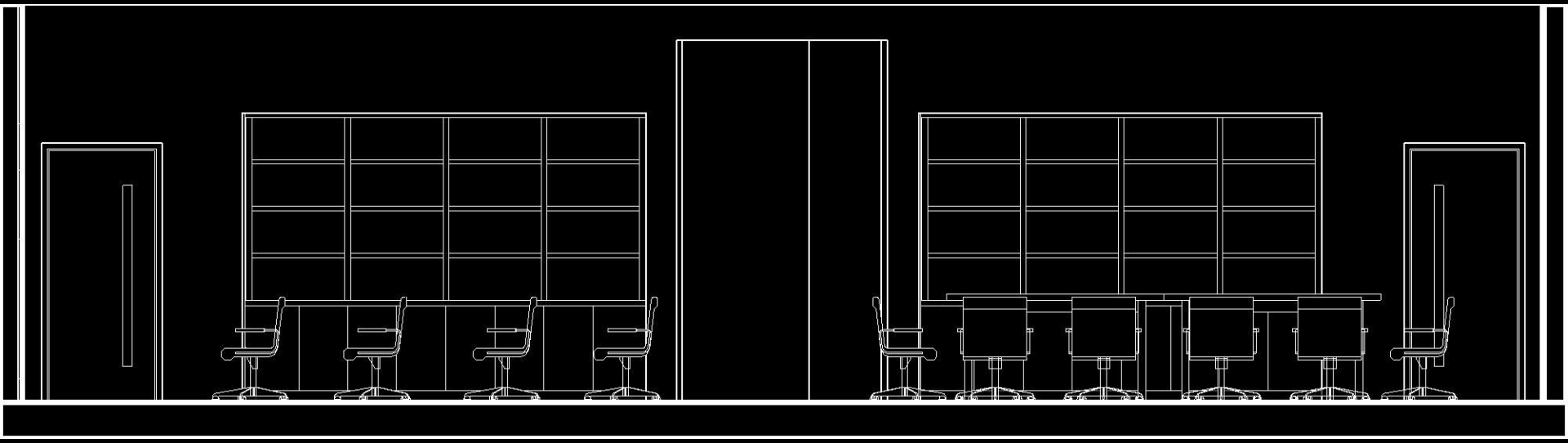
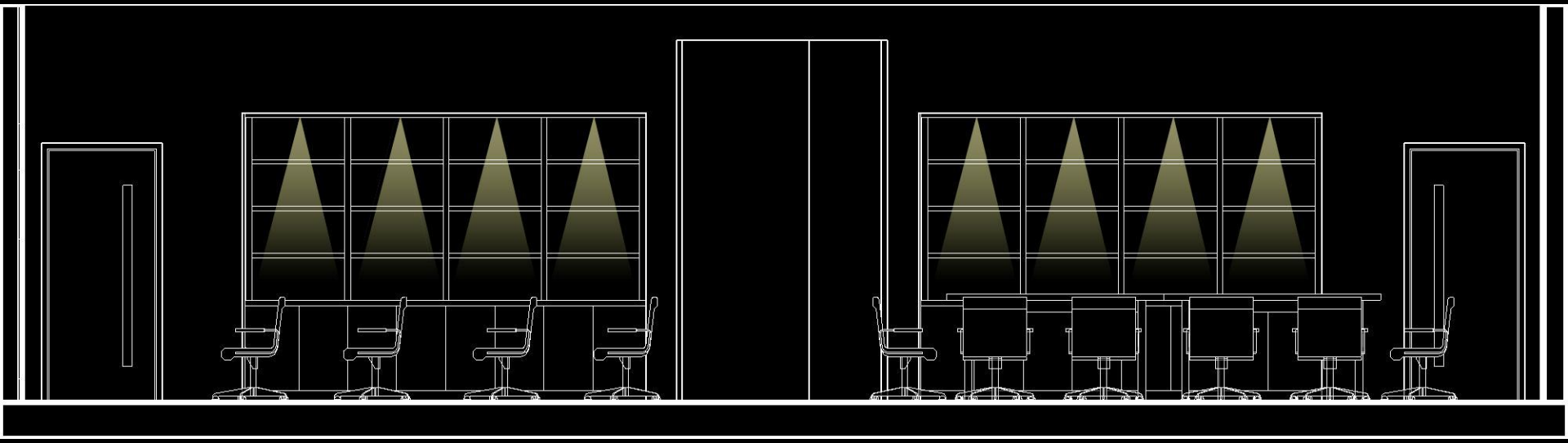
CONFERENCE ROOM: SECTION

- **IESNA Design Criteria**
  - **Meeting Tasks:**
    - 30fc Horizontal
    - 5fc Vertical
  - **Video Conferencing:**
    - 50fc Horizontal
    - 30fc Vertical



CONFERENCE ROOM: CABINET LIGHTING



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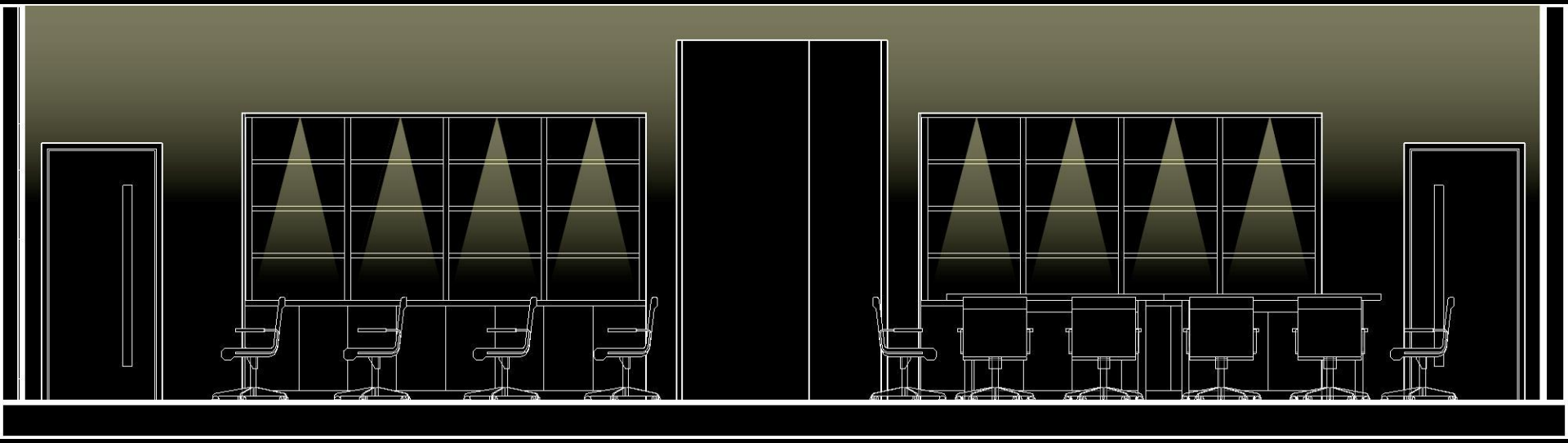
CONFERENCE ROOM: CABINET & WALL-WASHING



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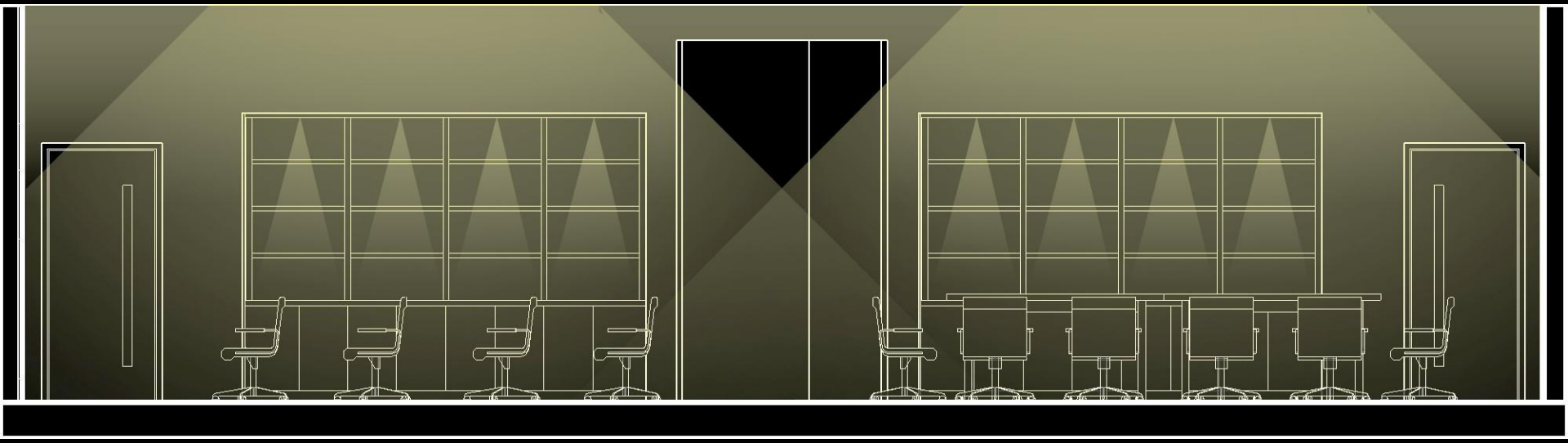
CONFERENCE ROOM: ADDING RECESSED DOWNLIGHTS



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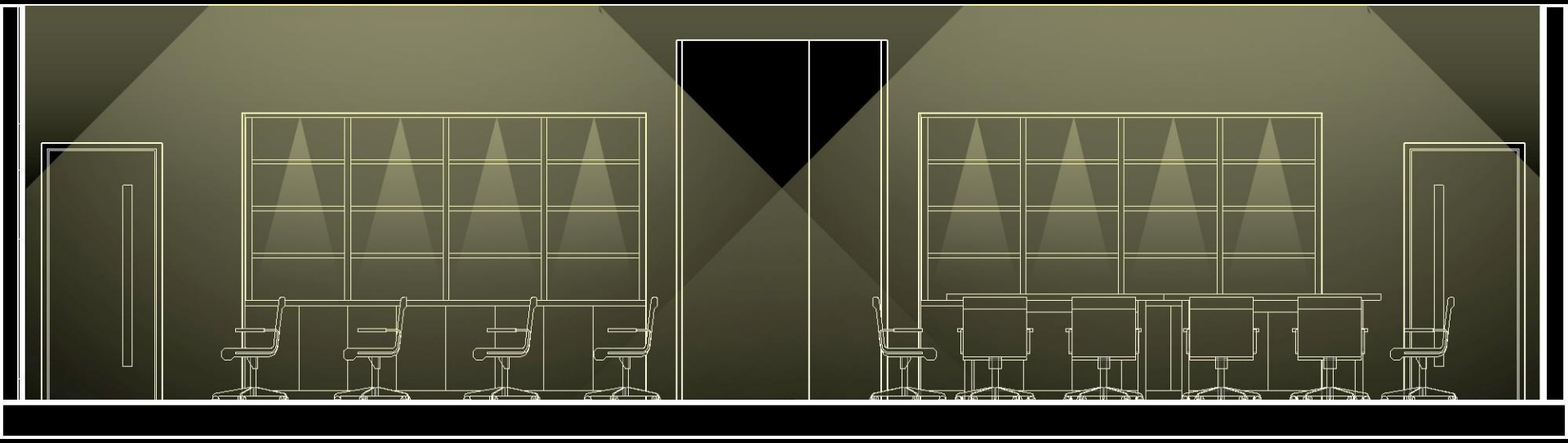
CONFERENCE ROOM: SCENES

CONFERENCING & MEETINGS



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CONFERENCE ROOM: ADDING RECESSED DOWNLIGHTS

VIDEO CONFERENCING

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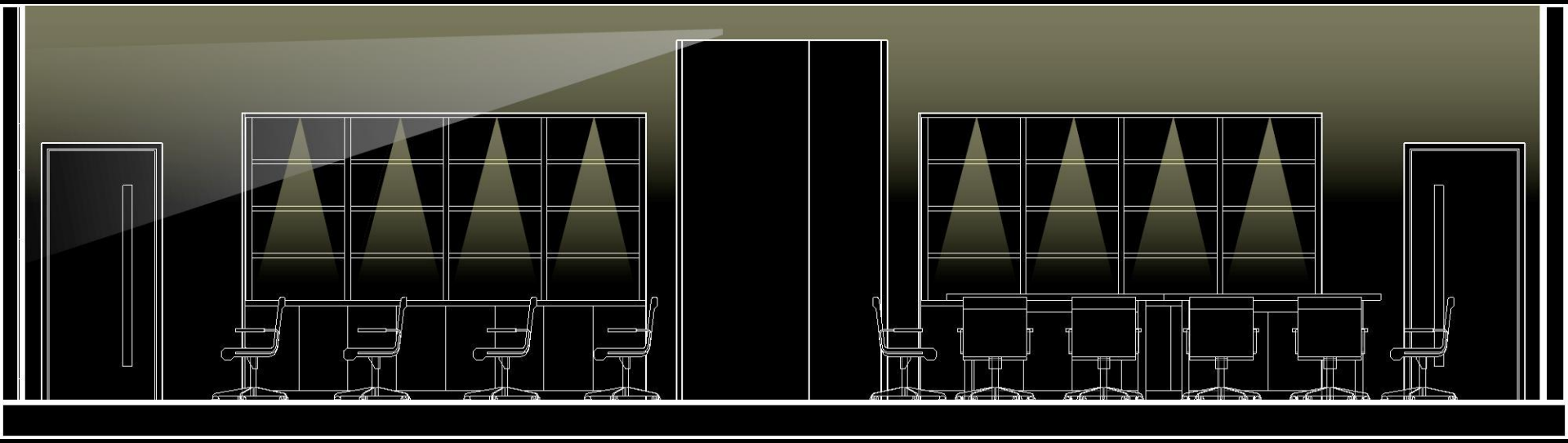
CONFERENCE ROOM: SCENES

PRESENTATION



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HOW I PLAN TO ACHIEVE THIS DESIGN

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THANK YOU

QUESTIONS/COMMENTS