GEORGETOWN DAY SCHOOL
LOWER/MIDDLE SCHOOL

AEI TEAM 5 – 2021
INTEGRATION
STRUCTURAL
MECHANICAL
ELECTRICAL

TEAM MEMBERS

ELECTRICAL
MATTHEW HUNTWORK
AARON ADAMS
ALLIE HUFFMAN
ANDREW MARTINEZ
GAGE GIBNEY
PROJECT MANAGER

MECHANICAL
MITCHEL SIEH
ASHLEY EVERITT
JENNIFER MACK

STRUCTURAL
JAMES ANDRUS
RAYAN AL HASHMI

PROJECT MANAGER
Georgetown Day School Lower/Middle School
Location: Washington, DC
Grades Served: Pre-K to 8th
Building: 155,000 SF
Parking Garage: 36,000 SF
Budget: $64 Million

Building Site
- Playing Field
- Playground
- Basketball Court
- Exterior Seating
- Terrace Green Roof
CLIENT PROFILE

GDS
GEORGETOWN DAY SCHOOL

WHERE STUDENTS LOVE & CHANGE
TO LEARN
THE WORLD

INTRODUCTION
INTEGRATION
DISCIPLINE
SUMMARY
PROJECT
CHALLENGES

CORE THEMES
Gratitude
Peace and Goodwill
Equality
Freedom
Self-Determination

PROJECT GOALS & DESIGN PRINCIPLES

DESIGN PRINCIPLES
SOCIALLY RESPONSIBLE
CLIENT ORIENTED
CHALLENGE DRIVEN

PROJECT GOALS
SUSTAINABILITY
WELLNESS
BIOPHILIA
UNITY
EXPRESSION

Georgetown Day School
Founded 1945
Grades Served Pre-K - 12
School Type Independent
History/Relocated 8 times
INTEGRATION ACTIVITY

CODES & STANDARDS

2015 International Plumbing Code
2015 International Mechanical Code
2015 International Fuel Gas Code
2015 International Building Code
2015 International Fire Code
DESIGN CHALLENGES

DESIGN CHALLENGES OVERVIEW

Building Performance Enhancement
Pandemic Resiliency
Water Retention, Harvesting, and Re-utilization
### Envelope Thermal Performance

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Percent Improvement from ASHRAE 90.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>N/A</td>
</tr>
<tr>
<td>Double-pane</td>
<td>24%</td>
</tr>
<tr>
<td>Double-pane, Exterior Shading</td>
<td>38%</td>
</tr>
<tr>
<td>Triple-pane, Exterior Shading</td>
<td>52%</td>
</tr>
</tbody>
</table>

### Exterior Wall Properties

- **OITC**: 31
- **STC**: 39

### West Elevation

- Typical Window Sizes:
  - Clerestory window: 2’ x 5’
  - Panels: 6’ x 5’
- Operable window meets requirements
- Operable window does not meet requirements
- Window Panel (Low E - Triple Pane with Tint)
- Spandrel panel
BUILDING PERFORMANCE ENHANCEMENT

Operable Window

Daylighting – Sefaira Results

Weather Station

TO BAS AND LINE VOLTAGE
WINDOW SCREEN

TO BAS AND LINE VOLTAGE
INTERNAL LIGHT SHELF

Daylighting – Sefaira Results

<table>
<thead>
<tr>
<th>Design Option</th>
<th>SDA (300,50%)</th>
<th>ASE (1000,250)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original Design</td>
<td>71%</td>
<td>41%</td>
</tr>
<tr>
<td>44% VLT no exterior shades</td>
<td>88%</td>
<td>48%</td>
</tr>
<tr>
<td>Increased Window Area 44% VLT no exterior shades</td>
<td>82%</td>
<td>44%</td>
</tr>
</tbody>
</table>

PANDEMIC RESILIENCY

Before

Raised Floors

After
INTRODUCTION

INTEGRATION

DISCIPLINE

SUMMARY

PROJECT

CHALLENGES

PANDEMIC RESILIENCY

INTRODUCTION

INTEGRATION

DISCIPLINE

SUMMARY

PROJECT

CHALLENGES

21

WATER HARVESTING

Rainwater | Gallons per Year
--- | ---
Collected from roof and field | 1.8 Million
Total reused | 1.1 Million
-Used to flush water closets and urinals | 403,000
-Used for irrigation | 713,000

GDS saves $7,200 per year on water bill

CISTERN ROOM

60,000 gallon storage tank

INTRODUCTION

INTEGRATION

DISCIPLINE

SUMMARY

PROJECT

CHALLENGES

22
LEED & WELL CERTIFICATIONS

Water: 7 of 10
Air: 15 of 18
Light: 13 of 13
Sound: 9 of 16
Thermal Comfort: 8 of 16
Movement: 9 of 20

INTEGRATION
INTRODUCTION
INTEGRATION
DISCIPLINE
SUMMARY
PROJECT
CHALLENGES
SITE ANALYSIS

Cistern Overflow (Storm)
1-Hour Fire Rated
Ground Ring
Window Well
Fuel Cell
Natural Gas
Transformer

SITE ANALYSIS

Rainwater Collection
SOCcer Field

Fiber Optic Link to High School
Georgetown Day High School
GEOTHERMAL & GEOTECHNICAL

- Allowable soil bearing pressure: 5000 psf (spread footings on compacted aggregate piers)
- Allowable soil bearing pressure: 4000 psf (spread footing)
- Fluid pressure = 50'H psf for below grade walls

FUEL CELL

Fuel Cell

Heat Exchanger

Water Heater
RAISED FLOOR

INTRODUCTION
INTEGRATION
DISCIPLINE
SUMMARY
PROJECT
CHALLENGES

Floor Diffuser
Underfloor Air Distribution System

FLOOR SLAB
STRUCTURAL SYSTEM
HVAC SYSTEM
FILL AREA

Floor Boxes
MECH/ELEC COORDINATION

3D Coordination View

2D Coordination View

EXTERIOR ACOUSTICS

Traffic Noise

Airports and Flight Paths

Acoustic Screen
ACOUSTICS

INTRODUCTION
INTEGRATION
DISCIPLINE
SUMMARY
PROJECT

BUILDING AUTOMATION

INTRODUCTION
PROJECT
CHALLENGES
INTEGRATION
DISCIPLINE
SUMMARY

COLOR LEGEND
- INPUT DEVICE
- SERIAL COMMUNICATION LINK
- CONTROLLER
- ACTUATION DEVICE
- BACNET BUSBAR

Room Under Occupancy
Room Over Occupancy
CONSTRUCTABILITY

- Raised Floor Construction
- Skid-Mounted
- Just-In-Time Delivery

INTRODUCTION
PROJECT
CHALLENGES
INTEGRATION
DISCIPLINE
SUMMARY

STRUCTURAL DESIGN
### Gravity Loading

<table>
<thead>
<tr>
<th></th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dead Loads</strong></td>
<td></td>
</tr>
<tr>
<td>Floor (Hybrid)</td>
<td>50 PSF</td>
</tr>
<tr>
<td>Floor (Steel)</td>
<td>87 PSF</td>
</tr>
<tr>
<td>Roof</td>
<td>52.5 PSF</td>
</tr>
<tr>
<td>Green Roof</td>
<td>122.5 PSF</td>
</tr>
<tr>
<td>Parking Garage Roof</td>
<td>45 PSF</td>
</tr>
<tr>
<td><strong>Snow Load</strong></td>
<td></td>
</tr>
<tr>
<td>Ground</td>
<td>25 PSF</td>
</tr>
<tr>
<td>Roof</td>
<td>20 PSF</td>
</tr>
<tr>
<td>Canopy &amp; Terrace Drift</td>
<td>91 PSF</td>
</tr>
<tr>
<td>Green Roof Drift</td>
<td>52 PSF</td>
</tr>
<tr>
<td>Roof Drift</td>
<td>54 PSF</td>
</tr>
<tr>
<td><strong>Live Load</strong></td>
<td></td>
</tr>
<tr>
<td>Gym/Assembly Area</td>
<td>100 PSF</td>
</tr>
<tr>
<td>Storage</td>
<td>125 PSF</td>
</tr>
<tr>
<td>Corridors</td>
<td>100 PSF</td>
</tr>
<tr>
<td>Stairs</td>
<td>100 PSF</td>
</tr>
<tr>
<td>Mechanical</td>
<td>100 PSF</td>
</tr>
<tr>
<td>Stacked Rooms</td>
<td>150 PSF</td>
</tr>
<tr>
<td>Garages</td>
<td>40 PSF</td>
</tr>
<tr>
<td>Dining Rooms</td>
<td>100 PSF</td>
</tr>
<tr>
<td>Stage Floor</td>
<td>150 PSF</td>
</tr>
<tr>
<td><strong>Rain Loads</strong></td>
<td></td>
</tr>
<tr>
<td>Rainfall Rate</td>
<td>3.25 IN/HR</td>
</tr>
<tr>
<td>Rain Load</td>
<td>27.3 PSF</td>
</tr>
</tbody>
</table>

### Floor System

**Hybrid Floor System**
Floor: "175 V" CLT Panel

**Composite Floor System**
Floor: 5 ½" Concrete Slab

**Precast Floor System**
Floor: 10DT32
**CLT VS CONCRETE**

Environmental Impact of Wood, Steel and Concrete

- **Timber is Strong**
- **Surprisingly Durable**
- **Easy To Work With**
- **Visually Appealing**
- **A Natural Insulator**
- **100% Sustainable**

**COLUMN SUMMARY**

Gravity Column – W14X43
Frame Column – W14X74
PRATT TRUSS & STEEL JOISTS

INTRODUCTION

INTEGRATION

DISCIPLINE

SUMMARY

PROJECT

CHALLENGES

- **6' PRATT TRUSS**
  - Web members: W8X15
  - Bottom chord: W14x61, W14x120
  - Top chord: W14x26

- **5' PRATT TRUSS**
  - Web members: W8X24
  - Bottom chord: W14x53, W14x109
  - Top chord: W14x53

LATERAL LOADING

Components & Cladding

<table>
<thead>
<tr>
<th>Design Area(ft^2)</th>
<th>Zone 1</th>
<th>Zone 3</th>
<th>Zone 4</th>
<th>Zone 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>75</td>
<td>29.1</td>
<td>40.7</td>
<td>30</td>
<td>34</td>
</tr>
<tr>
<td>50</td>
<td>29.5</td>
<td>47.6</td>
<td>30.7</td>
<td>35.5</td>
</tr>
<tr>
<td>35</td>
<td>30</td>
<td>56.6</td>
<td>31.6</td>
<td>37.3</td>
</tr>
<tr>
<td>10</td>
<td>31.3</td>
<td>79.1</td>
<td>34</td>
<td>42</td>
</tr>
</tbody>
</table>
LATERAL LOADING

SEISMIC LOAD

<table>
<thead>
<tr>
<th>SEISMIC DESIGN CATEGORY</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEISMIC RESPONSE COEFFICIENT</td>
<td>0.0489</td>
</tr>
<tr>
<td>RESPONSE MODIFICATION FACTOR</td>
<td>3.00</td>
</tr>
<tr>
<td>BASE SHEAR</td>
<td>765 Kip</td>
</tr>
<tr>
<td>BASE MOMENT</td>
<td>54,466 Kip-Ft</td>
</tr>
</tbody>
</table>

LATERAL FRAMES & SHEAR WALLS

Shear Wall Locations at Parking Garage

Braced Frame and Moment Frame Location
TYPICAL BRACED FRAMING SIZES

INTRODUCTION
INTEGRATION
DISCIPLINE
SUMMARY

RETAINING WALL

Retaining Wall Location
Retaining Wall Footing Detail
Retaining Wall at Floor Slab
FOOTING DESIGN

Typical Sizes:
- Parking garage: 10’x10’
- Basement level: 12’x12’
- Ground level: 7’x7’

Footing Thickness:
- 18-30”

Footing Depth:
- 8” below top of slab on grade

EXPANSION JOINTS

An expansion joint will be placed in between the below grade structure and the parking garage.

Building Expansion Joints

<table>
<thead>
<tr>
<th>Material</th>
<th>Joint Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Masonry &amp; Other Materials</td>
<td>245' &lt; 300'</td>
</tr>
<tr>
<td>Concrete</td>
<td>485' &gt; 300'</td>
</tr>
<tr>
<td>Steel</td>
<td>505' &gt; 300'</td>
</tr>
<tr>
<td>Wood</td>
<td>Infinite &gt; 300'</td>
</tr>
</tbody>
</table>

Location of Expansion Joint
ROOF SLOPES & ROOF CONDITIONS

**Roof Slope**
- 1/4" Per Foot
- Minimum slope for water run off for flat roofs
- Drains and diaphragm openings are coordinated with the mechanical team.

**Floor Depression**
- Located in Gymnasium and Blackbox Theater.
- Sunken slabs are coordinated with the mechanical team.
- Raised Floor will negate all floor depression for floors above or at grade.

<table>
<thead>
<tr>
<th>Building Element</th>
<th>Fire Rating for Type IIIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Structural Frame</td>
<td>1 Hour</td>
</tr>
<tr>
<td>Interior Bearing Walls</td>
<td>1 Hour</td>
</tr>
<tr>
<td>Exterior Bearing Walls</td>
<td>2 Hour</td>
</tr>
<tr>
<td>Interior Non-Bearing Walls</td>
<td>0 Hour</td>
</tr>
<tr>
<td>Exterior Non-Bearing Walls</td>
<td>0 Hour</td>
</tr>
<tr>
<td>Floor Construction</td>
<td>1 Hour</td>
</tr>
<tr>
<td>Roof Construction</td>
<td>1 Hour</td>
</tr>
<tr>
<td>Secondary Members</td>
<td>1 Hour</td>
</tr>
<tr>
<td>Primary Occupancy</td>
<td>E (Educational)</td>
</tr>
</tbody>
</table>

FIRE RATINGS

[Images showing different fireproofing methods like Charred, Gypsum Board Wrapping, and Spray Foam Fire Proofing Methods]
MECHANICAL DESIGN

LOAD CALCULATIONS

Building Breakdown

- Level 4: 47 tons
- Level 3: 49 tons
- Level 2: 62 tons
- Level 1: 41 tons
- Basement 2: 36 tons
- Basement 1: 27 tons
- Specialty Spaces: 11 tons
- Gym: 56 tons
- Kitchen: 28 tons

G4 Classroom - 2 tons
- Misc: 10%
- People: 44%
- Glazing: 15%
- Wall Condition: 1%
- Lights: 12%

Black Box - 17 tons
- Misc: 60%
- People: 20%
- Glazing: 0%
- Wall Condition: 0%
- Lights: 5%

Library - 6.5 tons
- Misc: 11%
- Glazing: 21%
- Wall Condition: 2%
- Lights: 16%
**INTRODUCTION**

**INTEGRATION**

**DISCIPLINE**

**SUMMARY**

**PROJECT**

**CHALLENGES**

---

### PRIMARY HVAC EQUIPMENT

**120 Ton Evaporative Fluid Cooler**

- **Loopfield Bypass Valve**
- **Loopfield Manifold**
- **300 GPM 4.37 HP Pump**
- **Drain Valve**

**Heat Recovery Chiller**

- **400 GPM 56 FT HD (2 TYP)**
- **60°F Ent**
- **94°F LWT**
- **130°F LWT**

**230 Ton Geothermal Loop Field**

---

### SECONDARY SYSTEM ABOVE GRADE

**Outdoor Air**

**Dedicated Outdoor Air System**

- **25,000 GPM OA**

**To Below Grade**

**Return Grille**

**Relief Air**

**Outdoor Air**

**Raised Floor**

**4-Pipe Fan Coil**

---

**INTRODUCTION**

**PROJECT**

**CHALLENGES**

**INTEGRATION**

**DISCIPLINE**

**SUMMARY**
SECONDARY SYSTEM BELOW GRADE

TO 25,000 CFM DEDICATED OUTDOOR AIR SYSTEM

OUTDOOR AIR

RELIEF AIR

SUPPLY AIR 6,780 CFM OA

RETURN AIR

ECON SUPPLY

GYM AHU 3,790 CFM OA

ECON RELIEF

B1 & B2

6,780 CFM OA

SUPPLY AIR 2,385 CFM OA

RETURN AIR

ECON SUPPLY

KITCHEN & DINING 4,860 CFM OA

SUPPLY AIR 2,500 CFM OA

RETURN AIR

ECON SUPPLY

INTRODUCTION INTEGRATION DISCIPLINE SUMMARY

PROJECT CHALLENGES

55

SPECIALTY SYSTEMS

<table>
<thead>
<tr>
<th>Specialty System</th>
<th>Room</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ductless Split System</td>
<td>Telecom Rooms</td>
</tr>
<tr>
<td>Ductless Split System</td>
<td>Elevator Shaft</td>
</tr>
<tr>
<td>Fan Coils</td>
<td>Stairwells</td>
</tr>
<tr>
<td>Fan Coils</td>
<td>Vestibules</td>
</tr>
<tr>
<td>Units Heaters</td>
<td>Exit Doors</td>
</tr>
<tr>
<td>Units Heaters</td>
<td>Heat Only Rooms</td>
</tr>
</tbody>
</table>

Ductless Split System

Fin Tube Radiator

Fan Coil

SPLIT SYSTEM OUTDOOR UNIT (ELEVATOR / TELECOM ROOMS)

REFRIGERANT LINES

SPLIT SYSTEM INDOOR UNIT
ENERGY PERFORMANCE

Energy Use Intensity
EUI = 30.5 kBTU/sqft-year

26.3% Reduction Over Baseline Model (per ASHRAE 90.1)

LIFE CYCLE COST

Year 14.5
### PLUMBING

**Domestic Riser**

- Water Heaters: 150 USG (4)
  - Fuel Cell Reject Heat (Electric)

- Booster Pump: 10 HP
  - Domestic Water

- Sewage Ejector: 1 HP
  - Duplex Pump

- Grease Interceptor: 100 GPM
  - GB-500

- Collection Tank: 60,000 Gallons
  - Rainwater Harvesting

**Waste & Vent Riser**

**DOMESTIC HOT WATER**

- Fuel Cell
- Heat Exchanger
- Electric Water Heaters 150 Gallon Each (4)

- Hot Water To Fixtures
- Hot Water To Kitchen
MECHANICAL NOISE

Vibration Isolators

Flexible Connection

Duct Silencer

ROOM ACOUSTICS

Sound Transmission Class (STC)

MINIMUM SOUND TRANSMISSION CLASS WALL RATING

- STC 45
- STC 50
- STC 55
- STC 60
# ELECTRICAL DESIGN

## INTRODUCTION

INTEGRATION

SUMMARY

PROJECT

CHALLENGES

## BUILDING ELECTRIC SYSTEM

### Building Electrical Service Estimation

<table>
<thead>
<tr>
<th>Space Type</th>
<th>Area (sq ft)</th>
<th>Lighting</th>
<th>Devices</th>
<th>HVAC</th>
<th>Misc</th>
<th>Total</th>
<th>Est. Load (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom</td>
<td>12544</td>
<td>0.87</td>
<td>1.9</td>
<td>5.3</td>
<td>1.8</td>
<td>9.87</td>
<td>1238</td>
</tr>
<tr>
<td>Food Service</td>
<td>6687</td>
<td>0.67</td>
<td>20</td>
<td>30</td>
<td>7</td>
<td>57.87</td>
<td>387</td>
</tr>
<tr>
<td>Parking Garage</td>
<td>35042</td>
<td>0.2</td>
<td>0.5</td>
<td>1.2</td>
<td>0.8</td>
<td>2.7</td>
<td>65</td>
</tr>
<tr>
<td>Fire Pump</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>43</td>
</tr>
<tr>
<td>Electric Water Heat</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>390</td>
</tr>
<tr>
<td>Primary Voltage</td>
<td>480</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>208</td>
</tr>
<tr>
<td>Spare Capacity</td>
<td>20%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20%</td>
</tr>
<tr>
<td>Total Service (Amps)</td>
<td>3109</td>
<td>7106</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2153</td>
</tr>
</tbody>
</table>

### Electric Vehicle Service Estimation

<table>
<thead>
<tr>
<th>EN Charging Stations</th>
<th>Num. of Spots</th>
<th>Voltage (V)</th>
<th>Phase</th>
<th>Indiv. Load (W)</th>
<th>Est. Load (kW)</th>
<th>Est. Load (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10</td>
<td>208</td>
<td>1</td>
<td>6600</td>
<td>66</td>
<td>317.31</td>
</tr>
</tbody>
</table>

### Utility Transformer Sizing

<table>
<thead>
<tr>
<th>Service</th>
<th>Secondary Ampacity</th>
<th>Secondary Voltage</th>
<th>Secondary Load (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>3106</td>
<td>480</td>
<td>2561</td>
</tr>
<tr>
<td>B</td>
<td>79</td>
<td>480</td>
<td>66</td>
</tr>
<tr>
<td>Transformer Size (kVA)</td>
<td></td>
<td>2847</td>
<td></td>
</tr>
</tbody>
</table>
**BUILDING ELECTRIC SYSTEM**

### Building Electrical Service Estimation

<table>
<thead>
<tr>
<th>Space Type</th>
<th>Area (sq ft)</th>
<th>Lighting</th>
<th>Devices</th>
<th>HVAC</th>
<th>Misc</th>
<th>Total</th>
<th>Est. Load (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom</td>
<td>35544</td>
<td>0.87</td>
<td>1.9</td>
<td>5.3</td>
<td>1.8</td>
<td>9.87</td>
<td>387</td>
</tr>
<tr>
<td>Food Service</td>
<td>6887</td>
<td>0.87</td>
<td>20</td>
<td>30</td>
<td>7</td>
<td>57.87</td>
<td>387</td>
</tr>
<tr>
<td>Parking Garage</td>
<td>35042</td>
<td>0.2</td>
<td>0.5</td>
<td>1.2</td>
<td>0.8</td>
<td>2.7</td>
<td>95</td>
</tr>
<tr>
<td>Fire Lift</td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>43</td>
</tr>
<tr>
<td>Electric Water Heat</td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8</td>
<td>380</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2153</strong></td>
<td><strong>480</strong></td>
<td><strong>308</strong></td>
<td><strong>57.87</strong></td>
<td><strong>2.7</strong></td>
<td><strong>1238</strong></td>
<td><strong>387</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lighting</th>
<th>Devices</th>
<th>HVAC</th>
<th>Misc</th>
<th>Total</th>
<th>Est. Load (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.87</td>
<td>1.9</td>
<td>5.3</td>
<td>1.8</td>
<td>9.87</td>
<td>1238</td>
</tr>
<tr>
<td>0.87</td>
<td>20</td>
<td>30</td>
<td>7</td>
<td>57.87</td>
<td>387</td>
</tr>
<tr>
<td>0.2</td>
<td>0.5</td>
<td>1.2</td>
<td>0.8</td>
<td>2.7</td>
<td>95</td>
</tr>
</tbody>
</table>

**Utility Transformer Sizing**

<table>
<thead>
<tr>
<th>Service A</th>
<th>Secondary Amperage</th>
<th>Secondary Voltage</th>
<th>Secondary Load (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service A</td>
<td>3106</td>
<td>480</td>
<td>2561</td>
</tr>
<tr>
<td>Service B</td>
<td>79</td>
<td>480</td>
<td>66</td>
</tr>
<tr>
<td>Transformer Size (kVA)</td>
<td>2647</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**BUILDING ELECTRIC SYSTEM**

### MECHANICAL EQUIPMENT LIST

Additional Special Loads

- Fire Pump
- Elevator
- EV Charging
### BUILDING ELECTRIC SYSTEM

#### Building Electrical Service Estimation

<table>
<thead>
<tr>
<th>Service</th>
<th>Secondary Ampacity</th>
<th>Secondary Voltage</th>
<th>Secondary Load (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service A</td>
<td>3106</td>
<td>480</td>
<td>2581</td>
</tr>
<tr>
<td>Service B</td>
<td>79</td>
<td>480</td>
<td>66</td>
</tr>
</tbody>
</table>

#### Transformer Size (kVA)
- 2647

#### Electric Vehicle Service Estimation

<table>
<thead>
<tr>
<th>EV Charging Stations</th>
<th>Num. of Spots</th>
<th>Voltage (V)</th>
<th>Phase</th>
<th>Ind. Load (kW)</th>
<th>Est. Load (kW)</th>
<th>Est. Load (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10</td>
<td>208</td>
<td>1</td>
<td>6600</td>
<td>66</td>
<td>317.31</td>
</tr>
</tbody>
</table>

#### Utility Transformer Sizing

<table>
<thead>
<tr>
<th>Service</th>
<th>Secondary Ampacity</th>
<th>Secondary Voltage</th>
<th>Secondary Load (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service A</td>
<td>3106</td>
<td>480</td>
<td>2581</td>
</tr>
<tr>
<td>Service B</td>
<td>79</td>
<td>480</td>
<td>66</td>
</tr>
</tbody>
</table>

### NORMAL POWER DISTRIBUTION

[Diagram of normal power distribution]

---

69

---

70

---

35
“Allowing the school to be a place where students feel connected among their differences while promoting individuality and expression through learning”

Typical Classroom
TYPICAL COMMONS

Flat Panel
Active Shooter Detection

Commons Lighting Control Zones

<table>
<thead>
<tr>
<th>Fixture</th>
<th>C3A</th>
<th>C3B</th>
<th>D1PL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scene A - Full On</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Scene B - Full Off</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Scene C - Lounge Mode</td>
<td>50%</td>
<td>50%</td>
<td>100%</td>
</tr>
<tr>
<td>Scene D - TV Mode</td>
<td>0%</td>
<td>10%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Commons Illuminance Levels

<table>
<thead>
<tr>
<th>Type</th>
<th>Average</th>
<th>Minimum</th>
<th>Maximum</th>
<th>1% Rec.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal (lux @ 3 ft)</td>
<td>33.5 lx</td>
<td>50.5 lx</td>
<td>21.8 ft</td>
<td>≤ 5 %</td>
</tr>
</tbody>
</table>

LOBBY

T1
P2
L5

WHERE STUDENTS LOVE & CHANGE THE WORLD
LEARN TO LOVE & CHANGE THE WORLD
DISCIPLINE BUDGETS

<table>
<thead>
<tr>
<th>DISCIPLINE</th>
<th>$ PER SQUARE FOOT</th>
<th>% OF TOTAL BUDGET</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEEL FRAMING</td>
<td>$ 29</td>
<td>9%</td>
</tr>
<tr>
<td>CONCRETE</td>
<td>$ 20</td>
<td>6%</td>
</tr>
<tr>
<td>EQUIPMENT</td>
<td>$ 3</td>
<td>1%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$ 78</td>
<td>24%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DISCIPLINE</th>
<th>$ PER SQUARE FOOT</th>
<th>% OF TOTAL BUDGET</th>
</tr>
</thead>
<tbody>
<tr>
<td>HVAC</td>
<td>$ 46</td>
<td>11%</td>
</tr>
<tr>
<td>PLUMBING</td>
<td>$ 21</td>
<td>5%</td>
</tr>
<tr>
<td>FIRE PROTECTION</td>
<td>$ 5</td>
<td>1%</td>
</tr>
<tr>
<td>ACoustics</td>
<td>$ 12</td>
<td>3%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$ 84</td>
<td>20%</td>
</tr>
</tbody>
</table>

PROJECT BUDGET

<table>
<thead>
<tr>
<th>DISCIPLINE</th>
<th>COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARCHITECTURAL</td>
<td>$ 25,600,000</td>
</tr>
<tr>
<td>STRUCTURAL</td>
<td>$ 14,728,753</td>
</tr>
<tr>
<td>MECHANICAL</td>
<td>$ 12,486,877</td>
</tr>
<tr>
<td>ELECTRICAL</td>
<td>$ 7,362,207</td>
</tr>
<tr>
<td>ACOUSTICS</td>
<td>$ 2,062,632</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$ 62,240,469</td>
</tr>
<tr>
<td>ADD ALTERNATE</td>
<td>$ 436,172</td>
</tr>
</tbody>
</table>
CONCLUSION

On-Site Generation

Power Distribution

Lighting Design

INTRODUCTION

INTEGRATION

DISCIPLINE

SUMMARY

AEI TEAM 5 – 2021

CLIENT ORIENTED

SOCALLY RESPONSIBLE

CHALLENGE DRIVEN
INTEGRATION REFERENCES

https://www.researchgate.net - Daylight shading
https://hoppereffect.gds.org/ - GDS logo s.11
https://www.linuxjournal.com/article/2538 - Weather Station s.19
https://www.revereelectric.com/ASSETS/DOCUMENTS/ITEMS/EN/Wiring_Device_Kellems_AFB3013AAAZBK_Catalog.pdf - Hubbell floor box s.29
https://en.wikipedia.org/wiki/Underfloor_air_distribution - underfloor s.29
https://www.priceindustries.com/underfloor/products/mfd-dp-modular-floor-diffuser-displacement-pattern - floor diffuser s.29

STRUCTURAL REFERENCES

https://www.woodworks.org/design-and-tools/building-types/#tabs-1-2
https://www.structurlam.com/
https://civilread.com/different-types-footings/
MECHANICAL REFERENCES

www.baltimoreaircoil.com - Evaporative Fluid Cooler
https://usacoil.com/common-problems-with-fan-coil-units/ - Fan coil units
https://www.priceindustries.com/noisecontrol/products/erm-absorptive-elbow - Duct silencer
http://www.durodyne.com/connector.php - Duct flexible connection
https://kineticsnoise.com/hvac/spring_isolators.html - Vibration isolators
https://www.heddenbroswelldrilling.com/geothermal.html - Geothermal

ELECTRICAL REFERENCES

https://turf.design/ceiling-baffles/ - Turf slab ceiling baffles s.31
https://arktura.com/product/soundbar/ - Arktura soundbar s.31
https://arktura.com/product/atmosphera-standard-swell/ - Arktura swell atmosphera s.31
https://arktura.com/product/softscreen-stack/ - Arktura stack softscreen s.31
https://www.shutterstock.com/search/unity+network?safe=true&coupon_code=vecportal15 - face s.72
https://tiemposlegados.blogspot.com/2015/05/juntos-por-christian.html - hand s. 72
https://www.youtube.com/watch?v=l_S6lWV1FyY - prism s.72