



Green Modifications

Suburban Wellness Center
Germantown, Maryland

Cory J. Abramowicz



PENNS^TATE





Building Background Information

Existing Systems Summary

Design Criteria

Mechanical Depth

Optimize Building Performance

Green Roof

Indoor Environmental Quality

Lighting Breadth

Daylighting Analysis

Cost Analysis

Conclusions and Recommendations



Building Background Information

Owner:

Suburban Hospital

Building Occupants:

Suburban Hospital & Healthtrax

Gross Area:

64,800 ft²

Project Cost:

\$7.6 Million

Construction:

December 2001 - November 2002





Building Background Information

- Gymnasium
- Racquetball Courts
- Swimming Pool
- Aerobic Rooms
- Imagery Lab
- Locker Rooms
- Weight & Cardiovascular Rooms





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Existing System Summary

Air-Side System

- 2- 90 ton Rooftop Units w/ VAV
- Dehumidification Unit for Natatorium

Water-Side System

- 2- 800 MBH gas-fired hot water heaters
- 1- 400 MBH & 2- 250 MBH gas-fired pool heaters



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Design Criteria

Sustainability is Important for Fitness Centers

Green Modifications' goals:

- Improve Sustainability of the Building
- Provide Cleaner Air to Patrons
- Reduce Energy Consumption



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EA Credit 1 Optimize Building Performance

9 Building Energy Simulation Scenarios

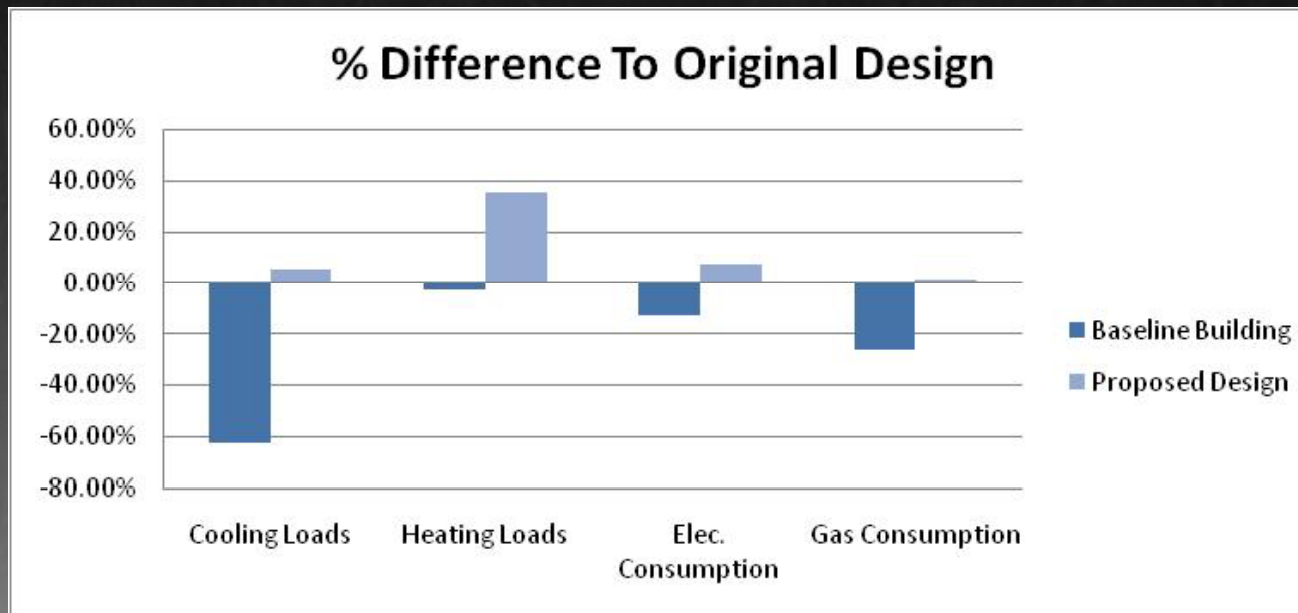
- Original Building
- Original Building + Daylighting
- Original Building + Daylighting + Green Roof
- Original Building + Daylighting + 30% Increased Ventilation
- Original Building + Daylighting + 30% Increased Ventilation + Green Roof + Heat Exchanger
- Baseline Building (Rotated +0°, +90°, +180°, +270°)



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EA Credit 1 Optimize Building Performance

| | Cooling Loads | | Heating Loads | | Elec. Consumption | | Gas Consumption | |
|---------------------|---------------|---------|---------------|---------|-------------------|---------|-----------------|---------|
| | Mbtu | % Diff. | Mbtu | % Diff. | MWh | % Diff. | Mbtu | % Diff. |
| OB | 9088 | 0.00% | 1886 | 0.00% | 2,260.60 | 0.00% | 2,882.70 | 0.00% |
| BB | 3379 | -62.82% | 1825 | -3.23% | 1,966.30 | -13.02% | 2,126.50 | -26.23% |
| OB+DL+30V +GR+HX | 9560 | 5.19% | 2554 | 35.42% | 2,423.00 | 7.18% | 2,916.00 | 1.16% |

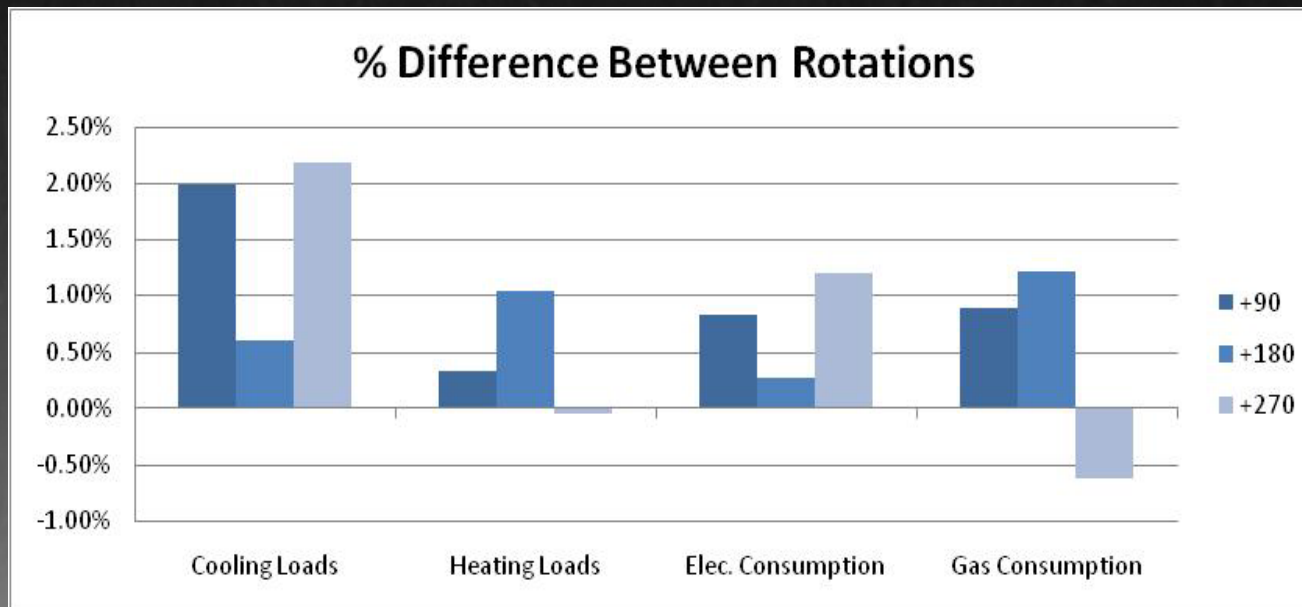




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EA Credit 1 Optimize Building Performance Baseline Building

| | Cooling Loads | | Heating Loads | | Elec. Consumption | | Gas Consumption | |
|----------|---------------|---------|---------------|---------|-------------------|---------|-----------------|---------|
| | Mbtu | % Diff. | Mbtu | % Diff. | MWh | % Diff. | Mbtu | % Diff. |
| Baseline | 3379 | | 1825 | | 1,966.30 | | 2,126.50 | |
| +90 | 3312 | 1.98% | 1819 | 0.33% | 1,950.20 | 0.82% | 2,107.80 | 0.88% |
| +180 | 3359 | 0.59% | 1806 | 1.04% | 1,960.90 | 0.27% | 2,100.70 | 1.21% |
| +270 | 3305 | 2.19% | 1826 | -0.05% | 1,942.80 | 1.20% | 2,139.70 | -0.62% |





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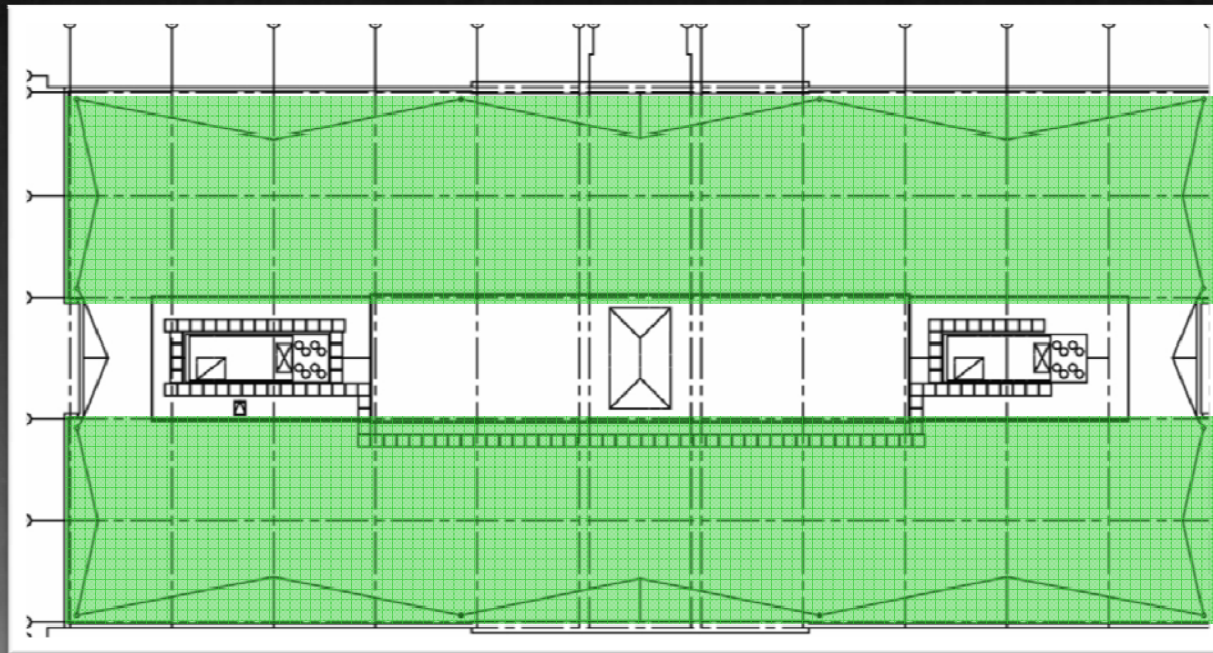


Green Roof

- 24,000 SF ~ 66% coverage
- Sedum plant species

Three Building Effects

- Higher roof reflectance
- Increased R-value
- Evapotranspiration





Green Roof

GreenGrid Modular Green Roof System

- \$13-15/SF Total Cost
- Installation 5-8 days
- Easy Transportation to Roof
- 15 psf weight

Disadvantages

- Cannot be applied to sloped roof (maximum slope tolerance 3:12)





Green Roof

Traditional Green Roof System

- \$22-25/SF Total Cost
- Installation 14-30 days
- Easy Transportation to Roof
- 28-30 psf weight

Disadvantages

- Expensive
- Long Installation Time
- Heavy per SF
- Extensive repair for leakage



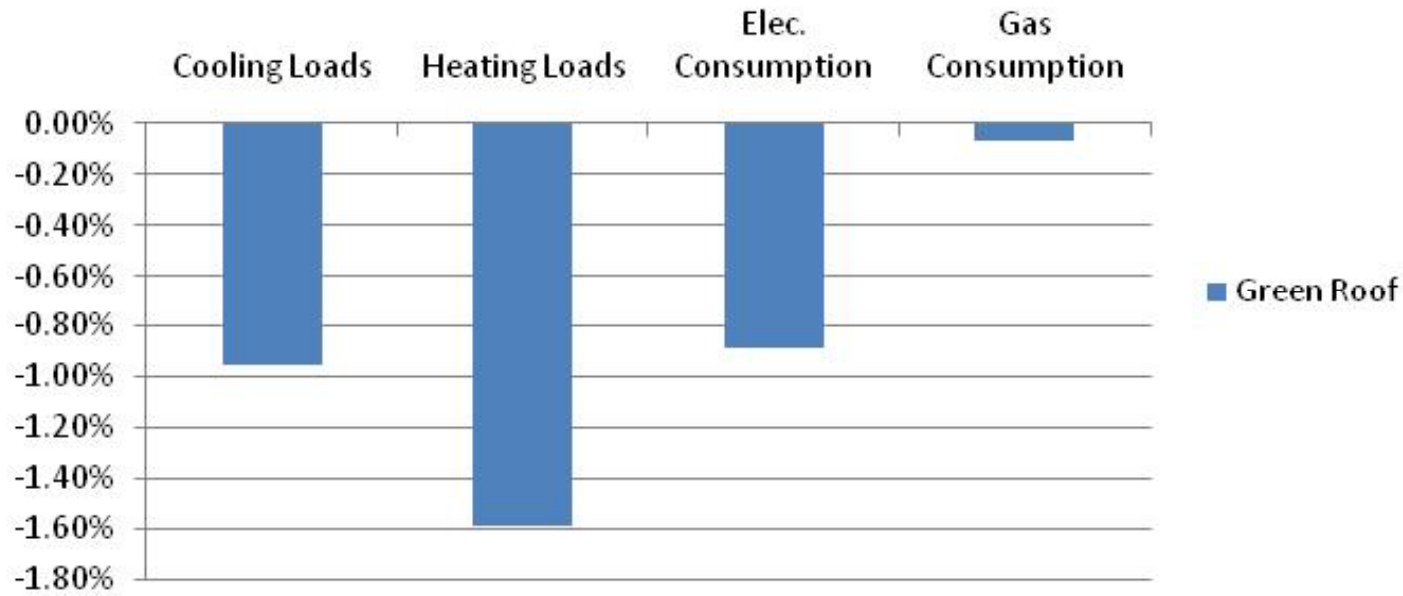


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Green Roof

| | Cooling Loads | | Heating Loads | | Elec. Consumption | | Gas Consumption | |
|----------|---------------|---------|---------------|---------|-------------------|---------|-----------------|---------|
| | Mbtu | % Diff. | Mbtu | % Diff. | MWh | % Diff. | Mbtu | % Diff. |
| OB+DL | 9093 | | 1889 | | 2,262.00 | | 2,883.00 | |
| OB+DL+GR | 9006 | -0.96% | 1859 | -1.59% | 2,242.00 | -0.88% | 2,881.00 | -0.07% |

% Difference To Original Design





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Green Roof

| Yes | ? | No | | |
|-----|---|----|--|------------------|
| | | | Sustainable Sites | 14 Points |
| 1 | | | Credit 6.1 Stormwater Design, Quantity Control | 1 |
| 1 | | | Credit 6.2 Stormwater Design, Quality Control | 1 |
| 1 | | | Credit 7.2 Heat Island Effect, Roof | 1 |
| | | | Energy & Atmosphere | 17 Points |
| 10 | | | Credit 1 Optimize Energy Performance | 1 to 10 |
| | | | Materials & Resources | 13 Points |
| 1 | | | Credit 4.1 Recycled Content, 10% (post-consumer + 1/2 pre-consumer) | 1 |
| 1 | | | Credit 5.1 Regional Materials, 10% Extracted, Processed & Manufactured Regionally | 1 |



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Indoor Environmental Quality

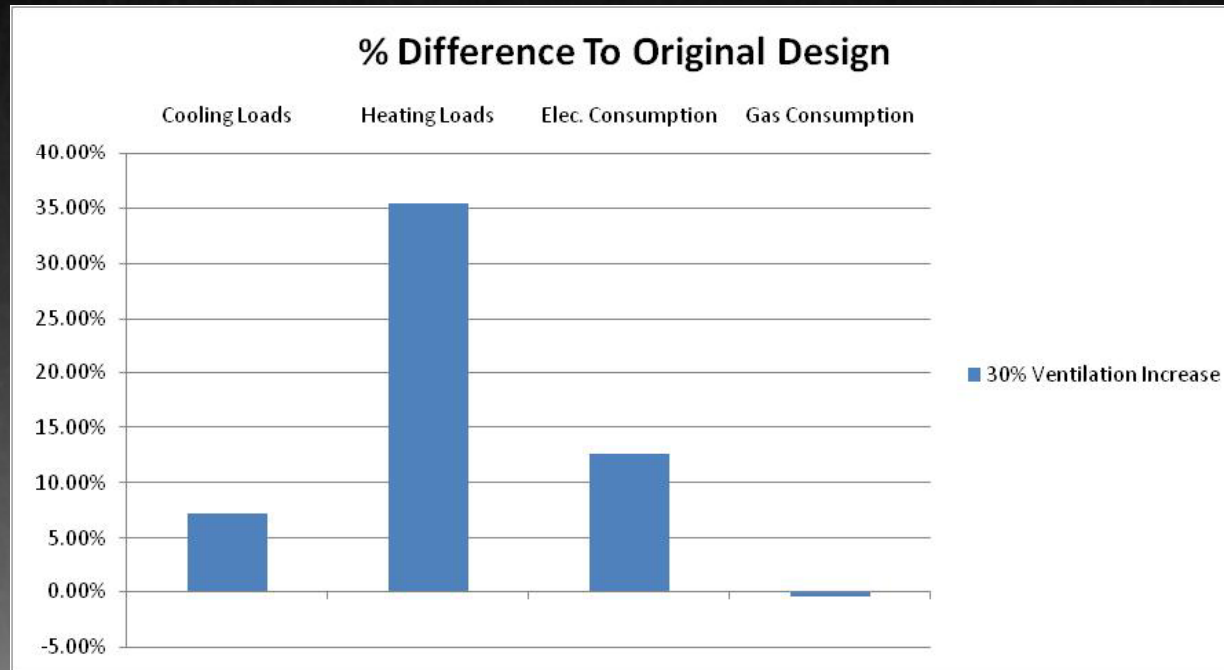
| 15 | 0 | | Indoor Environmental Quality | 15 Points |
|----|---|--|---|-----------|
| Y | | | Prereq 1 Minimum IAQ Performance | Required |
| Y | | | Prereq 2 Environmental Tobacco Smoke (ETS) Control | Required |
| 1 | | | Credit 1 Outdoor Air Delivery Monitoring | 1 |
| 1 | | | Credit 2 Increased Ventilation | 1 |
| 1 | | | Credit 3.1 Construction IAQ Management Plan, During Construction | 1 |
| 1 | | | Credit 3.2 Construction IAQ Management Plan, Before Occupancy | 1 |
| 1 | | | Credit 4.1 Low-Emitting Materials, Adhesives & Sealants | 1 |
| 1 | | | Credit 4.2 Low-Emitting Materials, Paints & Coatings | 1 |
| 1 | | | Credit 4.3 Low-Emitting Materials, Carpet Systems | 1 |
| 1 | | | Credit 4.4 Low-Emitting Materials, Composite Wood & Agrifiber Products | 1 |
| 1 | | | Credit 5 Indoor Chemical & Pollutant Source Control | 1 |
| 1 | | | Credit 6.1 Controllability of Systems, Lighting | 1 |
| 1 | | | Credit 6.2 Controllability of Systems, Thermal Comfort | 1 |
| 1 | | | Credit 7.1 Thermal Comfort, Design | 1 |
| 1 | | | Credit 7.2 Thermal Comfort, Verification | 1 |
| 1 | | | Credit 8.1 Daylight & Views, Daylight 75% of Spaces | 1 |
| 1 | | | Credit 8.2 Daylight & Views, Views for 90% of Spaces | 1 |



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Indoor Environmental Quality EQ Credit 2 Increased Ventilation

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|-----------|---------------|---------|---------------|---------|-------------------|---------|-----------------|---------|
| | Mbtu | % Diff. | Mbtu | % Diff. | MWh | % Diff. | MBtu | % Diff. |
| OB+DL | 9093 | | 1889 | | 2,262.00 | | 2,883.00 | |
| OB+DL+30V | 9748 | 7.20% | 2556 | 35.31% | 2,547.10 | 12.60% | 2,869.70 | -0.46% |





Indoor Environmental Quality

EQ Credit 3.2 – Construction IAQ Management Plan, Before Occupancy – Option 1

| Flush-Out (No Occupancy) | | | | |
|--------------------------|--------------|-----------|-----------|-------------|
| OA rate | 14000 CF/SF | | | |
| Building Area | 64800 SF | | | |
| Flush-out volume | 907200000 CF | | | |
| OA Supply | 91431 CFM | | | |
| System On | 165.4 Hours | | | |
| | 6.9 Days | | | |
| Date | 1/1 - 1/7 | 4/1 - 4/7 | 7/1 - 7/7 | 10/1 - 10/7 |
| Energy (MWh) | 34.28 | 33.31 | 30.64 | 27.47 |



Indoor Environmental Quality

EQ Credit 3.2 – Construction IAQ Management Plan, Before Occupancy – Option 2

| Flush-Out (Occupancy) | | | | |
|-----------------------|--------------|-----------|-----------|-------------|
| OA rate | 3500 CF/SF | | | |
| Building Area | 64800 SF | | | |
| Flush-out volume | 226800000 CF | | | |
| | | | | |
| OA Supply | 91431 CFM | | | |
| System On | 41.3 Hours | | | |
| | 1.7 Days | | | |
| | | | | |
| Date | 1/1 - 1/2 | 4/1 - 4/2 | 7/1 - 7/2 | 10/1 - 10/2 |
| Energy (MWh) | 10.04 | 11.03 | 11.62 | 10.01 |



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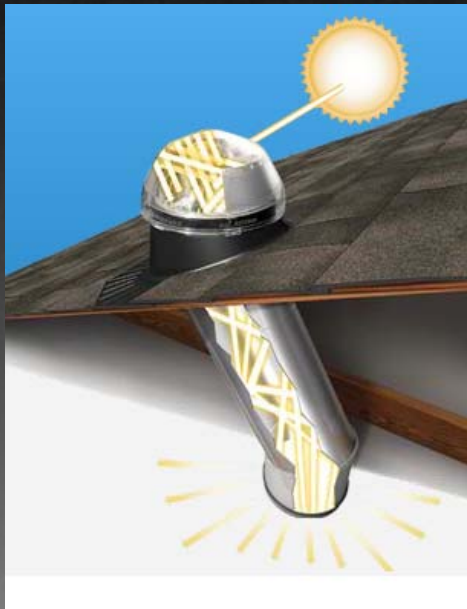
Conclusions and Recommendations



Daylighting Analysis

EQ Credit 8.1 Daylight and Views, Daylight 75% of Spaces

- 25 fc @ 30" for 75% spaces under clear sky conditions at noon on the equinox





Daylighting Analysis

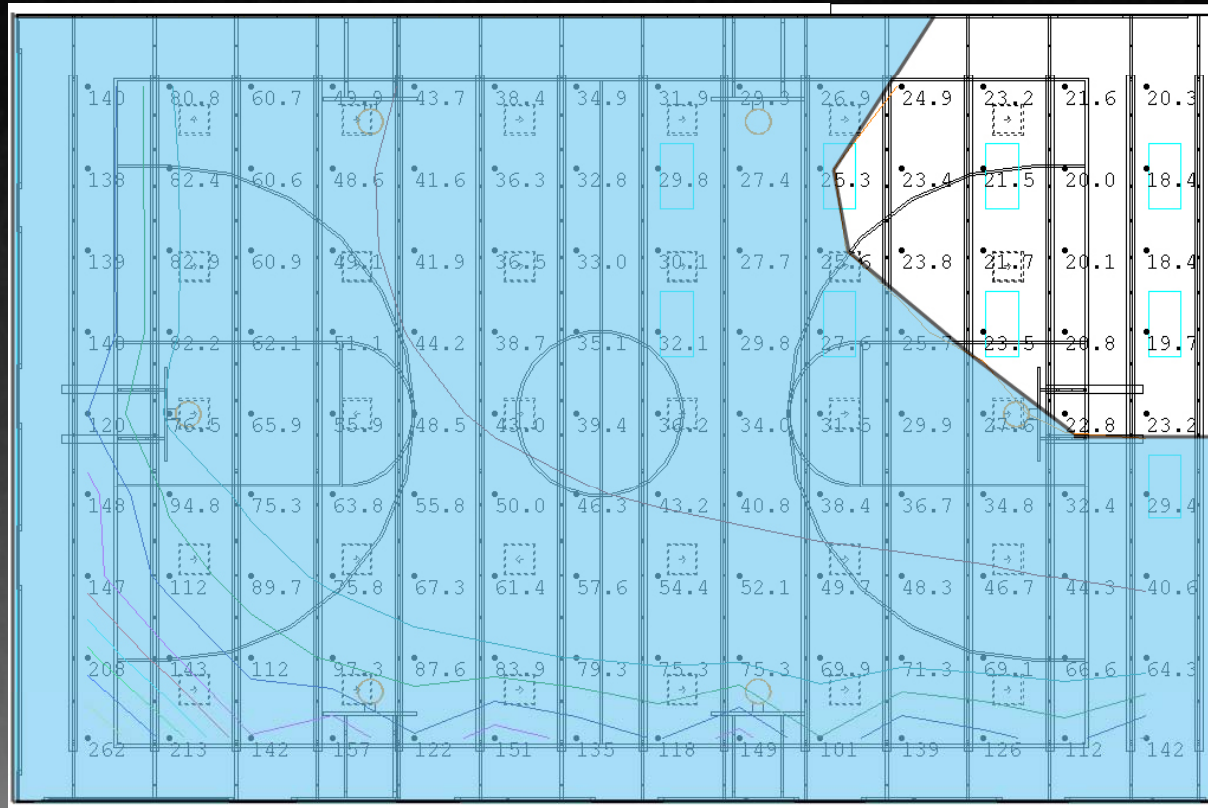
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Daylighting Analysis

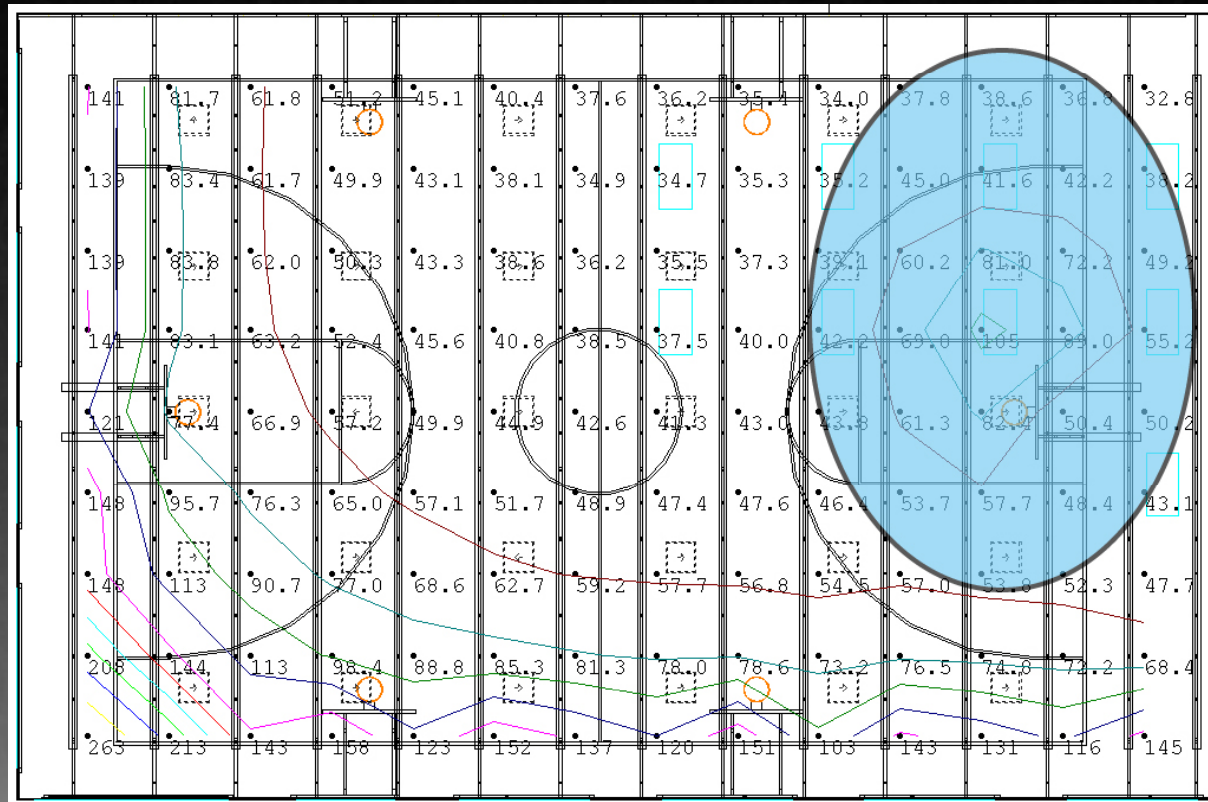
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Daylighting Analysis

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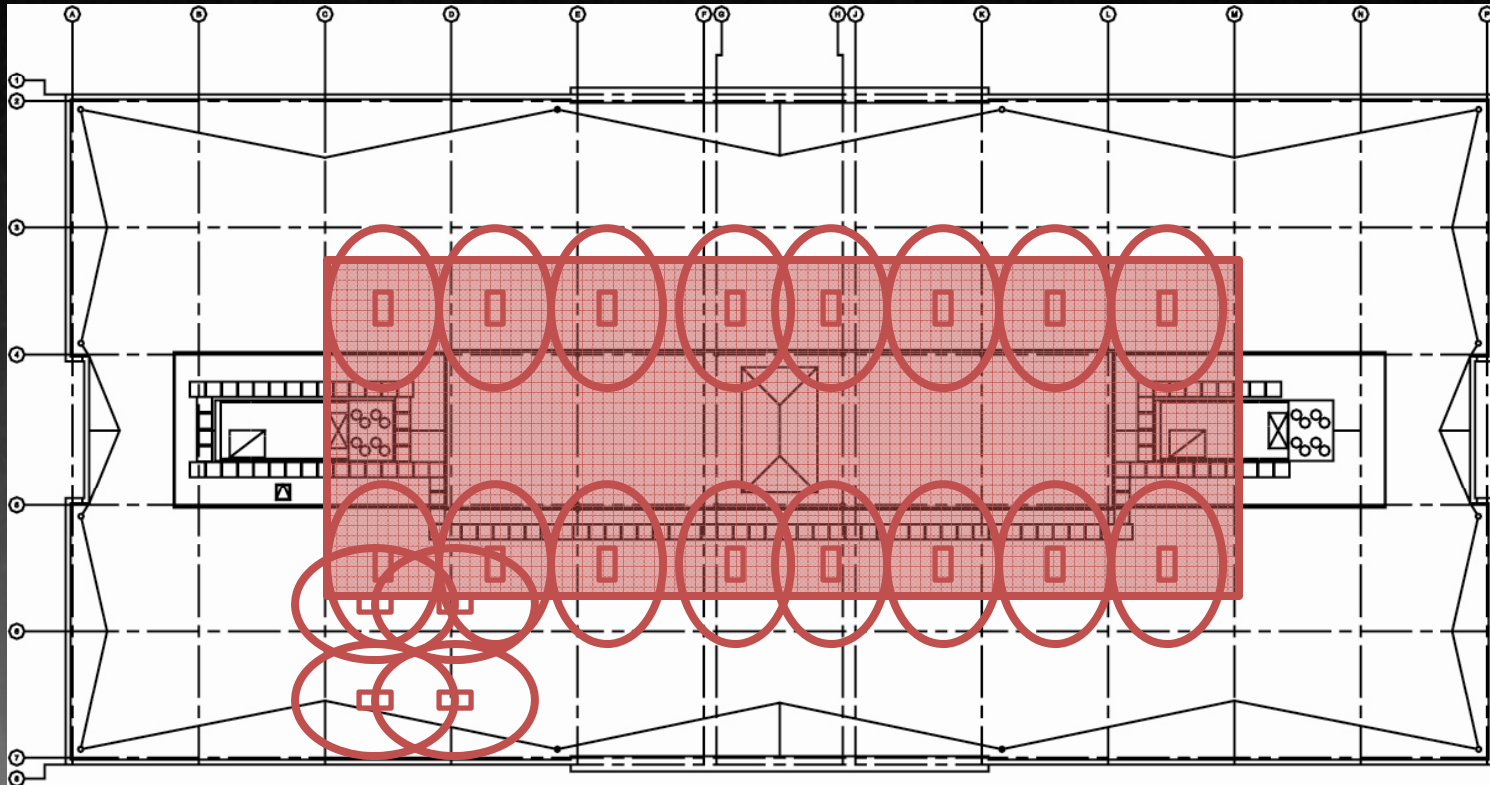




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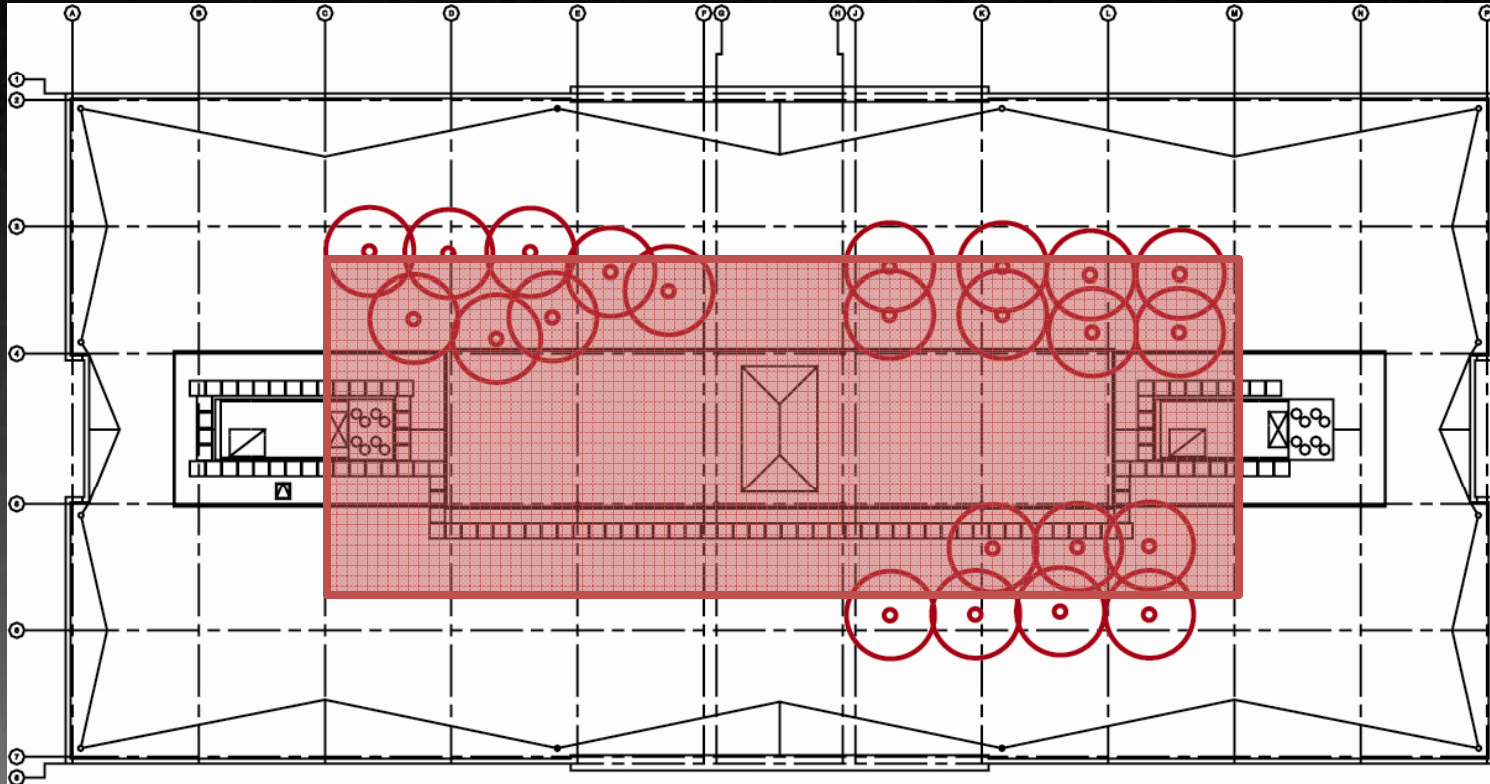




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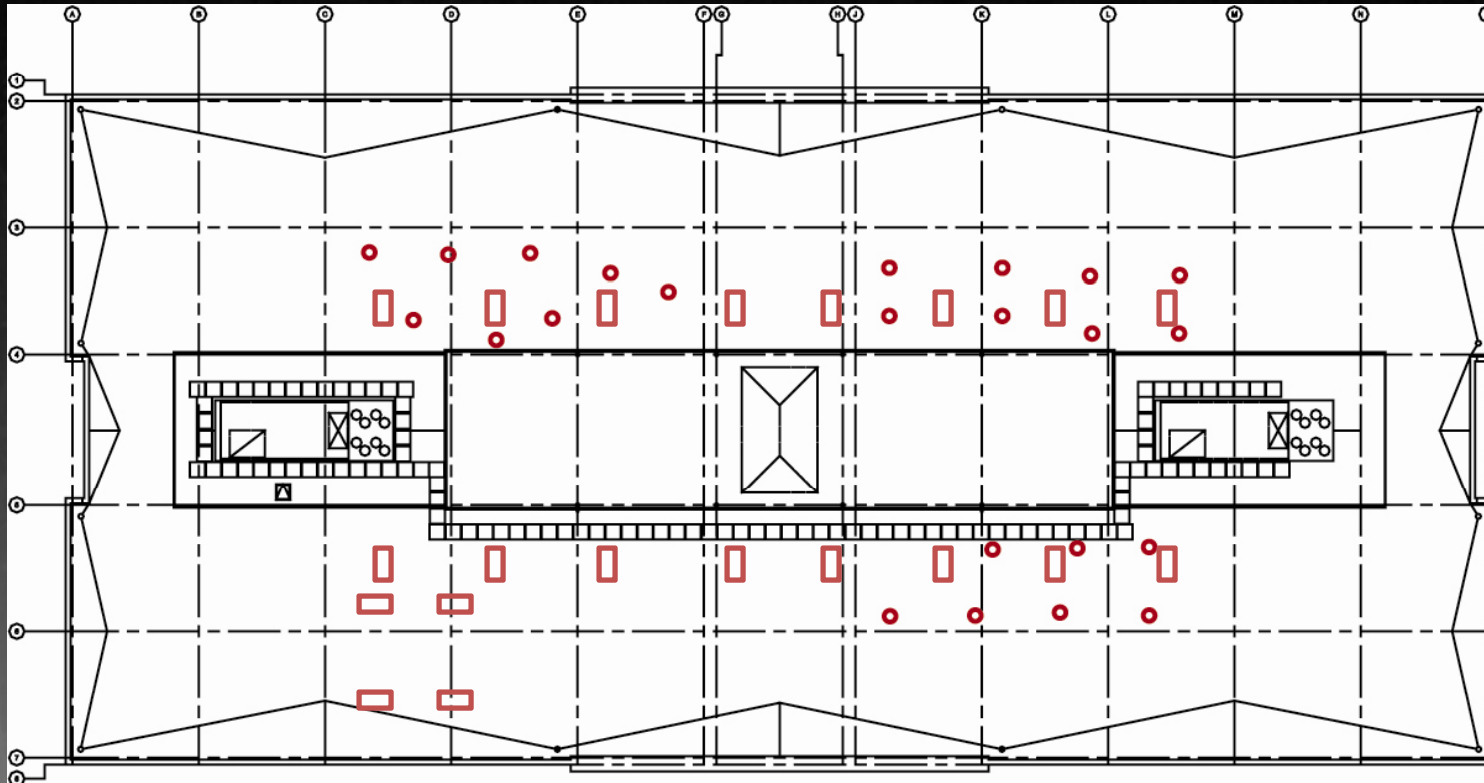




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Daylighting Analysis

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EQ Credit 4.2 Low-Emitting Materials, Paints & Coatings

VOC vs. Zero-VOC

| Sherwin-Williams (per 1 gal. container) | | | | | |
|---|-------------------|-------|------------------|-------|---------------|
| Finish | Classic 99 w/ VOC | | Harmony Zero-VOC | | \$ Difference |
| Flat | \$ | 32.99 | \$ | 35.49 | \$ 2.50 |
| Semi-gloss | \$ | 34.99 | \$ | 39.99 | \$ 5.00 |



Cost Analysis

Proposed Design vs. Original Design

| Proposed Design | | | Original Design | | |
|-----------------|--|---------------|-----------------|-----------------------------|---------------|
| Qty. | Item | Expense | Qty. | Item | Expense |
| 2 | 120 Ton Rooftop Units | \$ 469,956.20 | 2 | 90 Ton Rooftop Units | \$ 367,320.00 |
| 1 | Dehumidifier; 120-155 lb/hr | \$ 65,971.17 | 1 | Dehumidifier; 120-155 lb/hr | \$ 65,971.17 |
| 2 | 300 gal. Gas Water Heaters | \$ 12,649.16 | 2 | 300 gal. Gas Water Heaters | \$ 12,649.16 |
| | Commissioning for Mechanical Equipment | \$ 4,018.00 | | | |
| 14 | 2x4 Skylights | \$ 4,060.00 | | | |
| 200 | 1 Gal. Zero-VOC Paint | \$ 9,406.00 | | | |
| | Green Roof System | \$ 360,000.00 | | | |
| Total | | \$ 926,060.53 | Total | | \$ 445,940.33 |



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Conclusions and Recommendations

Green Modifications' goals:

- ❑ Improve Sustainability of the Building
- ❑ Provide Cleaner Air to Patrons
- ❑ Reduce Energy Consumption



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Green Modifications' goals:

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Acknowledgments

My Family
AE Faculty
AE Colleagues



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Questions?