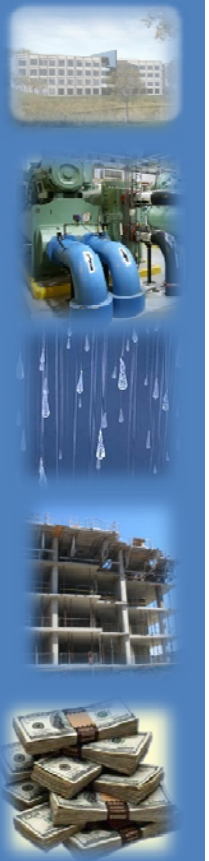
HITT Contracting Headquarters

Falls Church, VA



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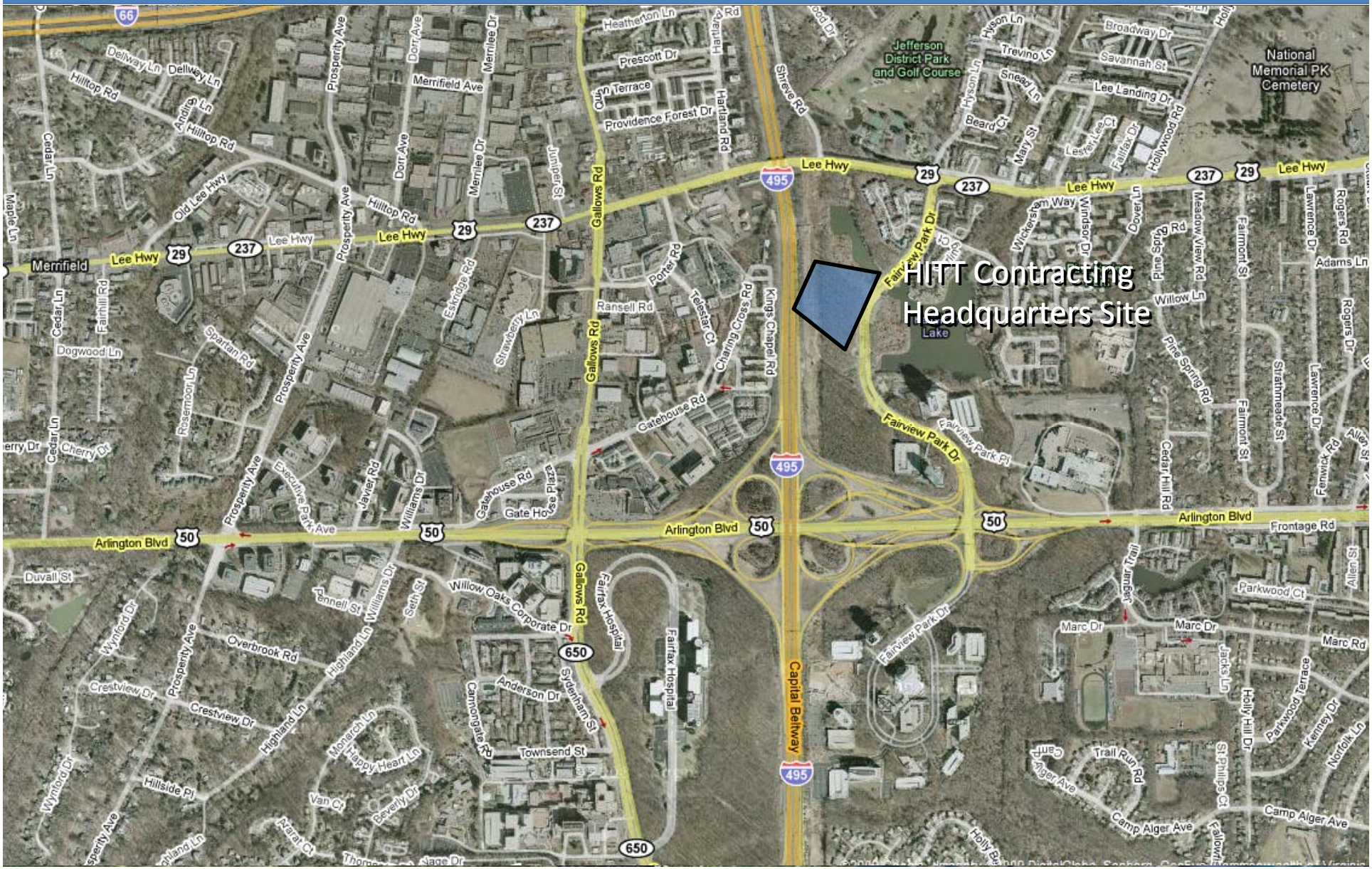
Falls Church, VA



HITT Contracting Headquarters

Falls Church, VA

Existing Conditions





Project Team

Owner – HITT General Contracting
Architect – Noritake Associates
MEP – KTA Group

Construction Information

- $30 Million
- LEED Silver
- May 2008 – September 2009

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Falls Church, VA

Existing Conditions





General

- 135,000 SF Office Building
- 4 floors (including basement level)

Structural

- Concrete – 10” 2 way reinforced slab
- Precast Concrete wall panels

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HITT Contracting Headquarters

Falls Church, VA

Existing Conditions





Mechanical Systems

7 VAV Rooftop Units

- Electric Resistance Heating
- DX Cooling
- Power Exhaust
- Total Enthalpy Wheel

3 Supplemental Split Systems

All meet ASHRAE 62.1 and LEED Credit EQ 2 –
Increased Ventilation as designed

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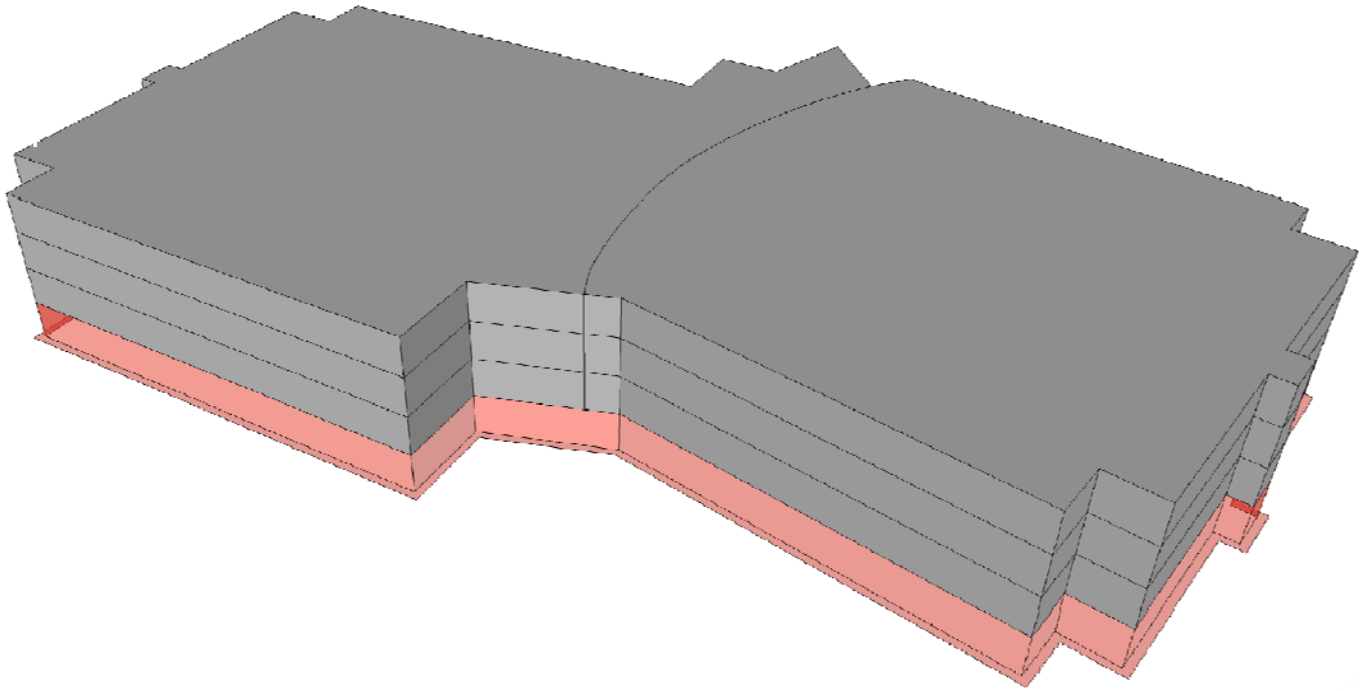
Falls Church, VA

Existing Conditions





Building Mechanical Zones



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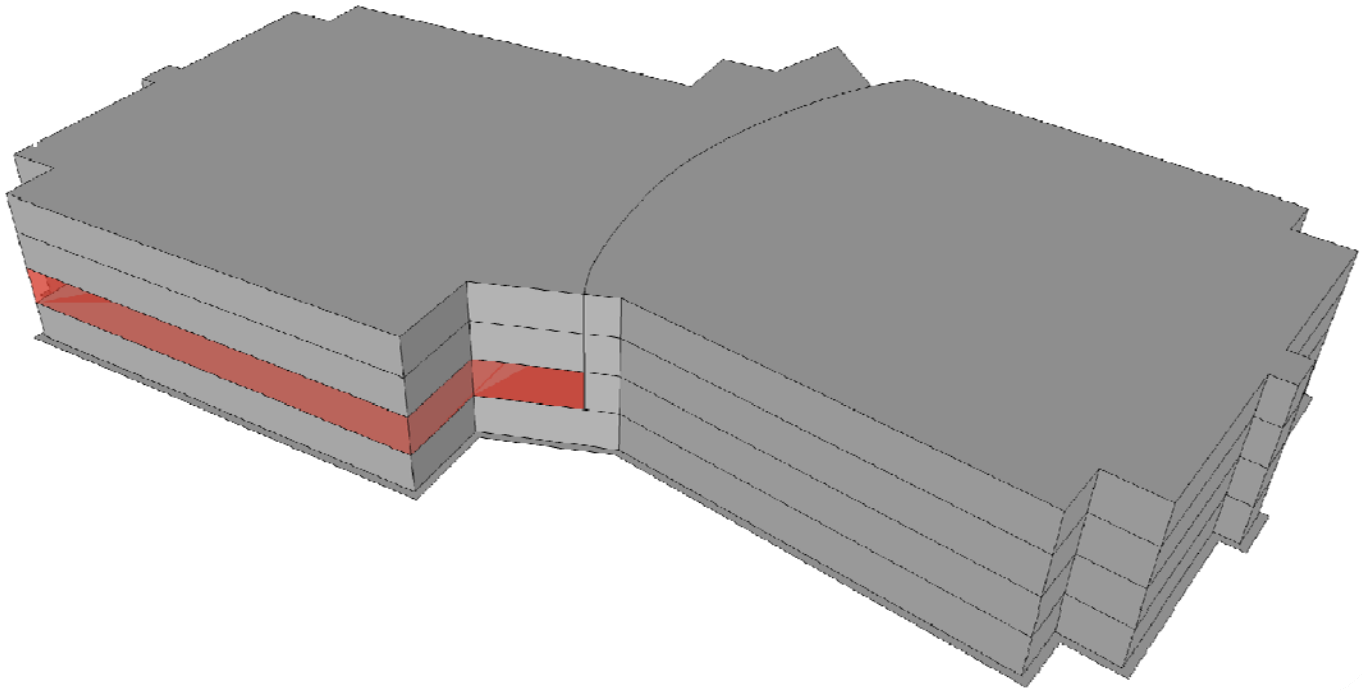
Falls Church, VA

Existing Conditions





Building Mechanical Zones



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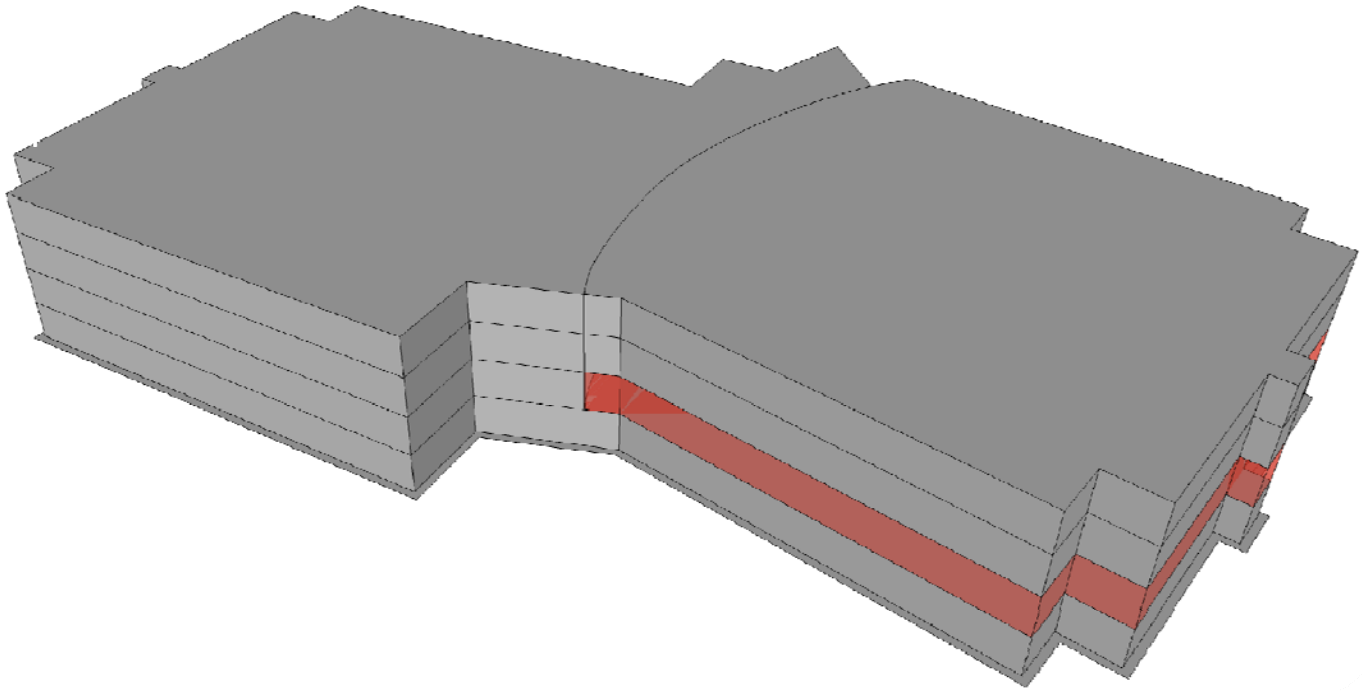
Falls Church, VA

Existing Conditions





Building Mechanical Zones



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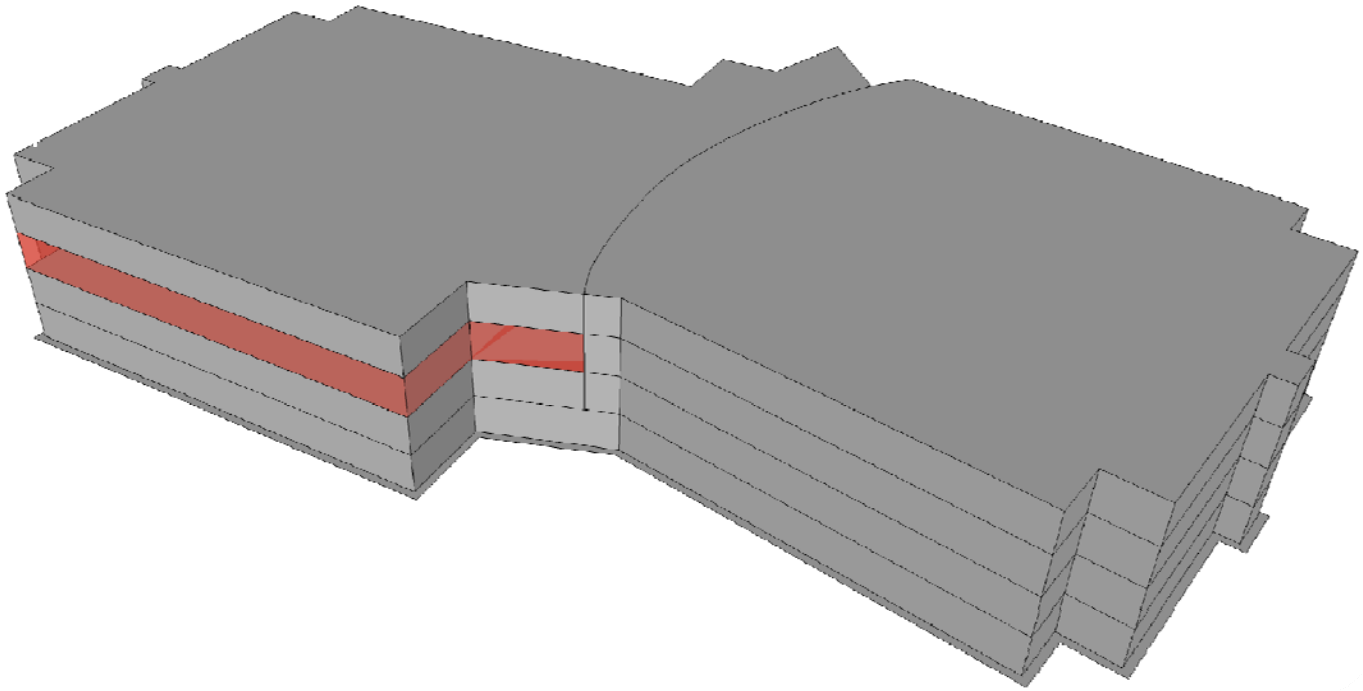
Falls Church, VA

Existing Conditions





Building Mechanical Zones



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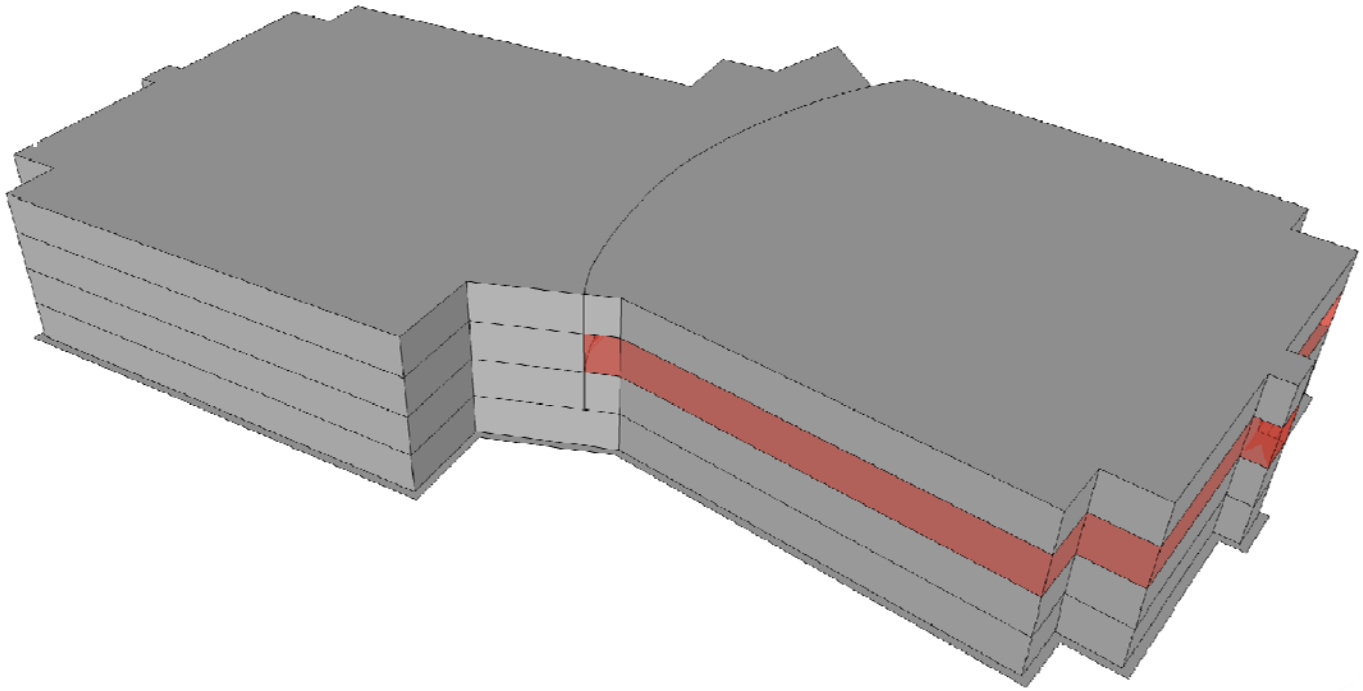
Falls Church, VA

Existing Conditions





Building Mechanical Zones



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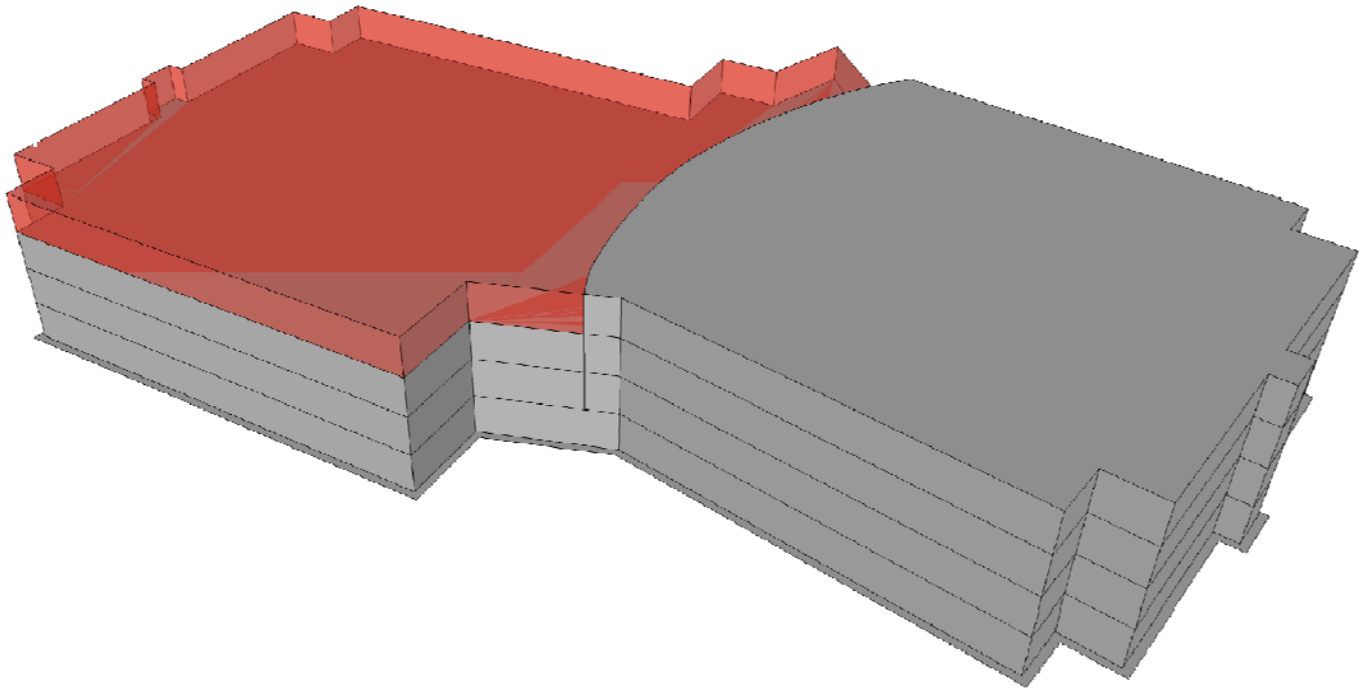
Falls Church, VA

Existing Conditions





Building Mechanical Zones



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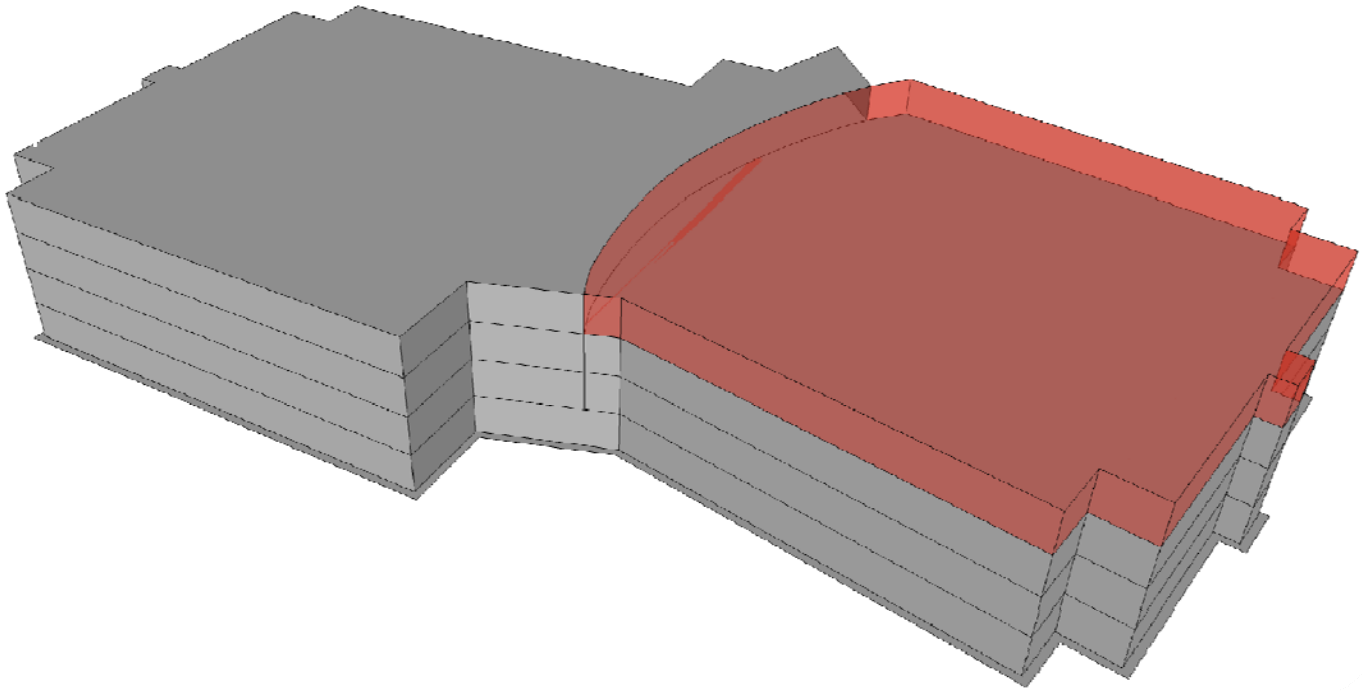
Existing Conditions





Building Mechanical Zones



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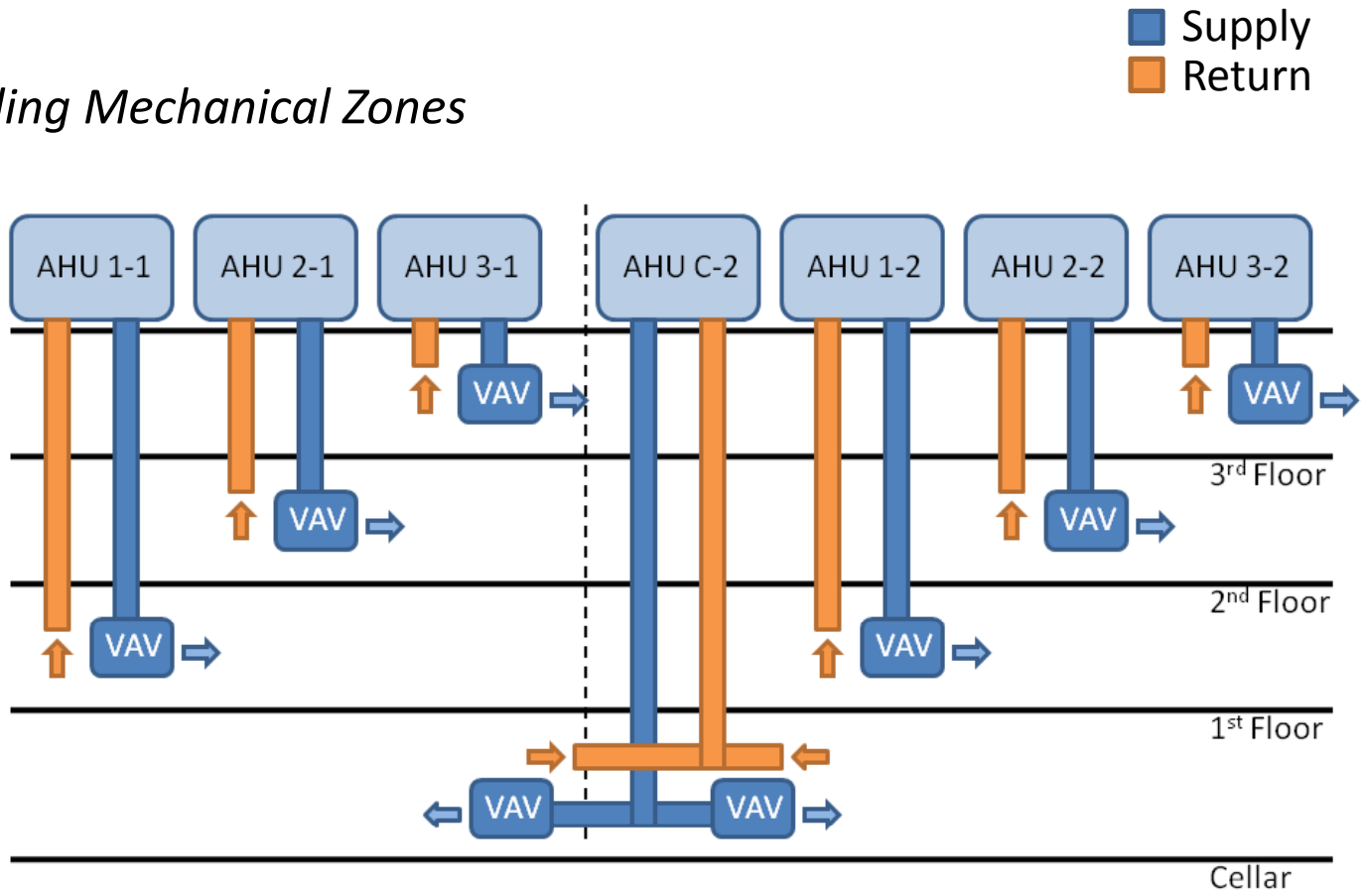
Falls Church, VA

Existing Conditions





Building Mechanical Zones



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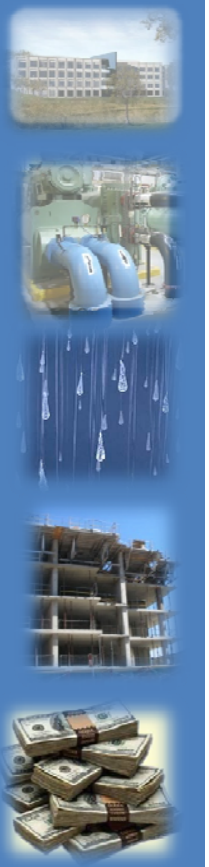
Existing Condition



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Falls Church, VA

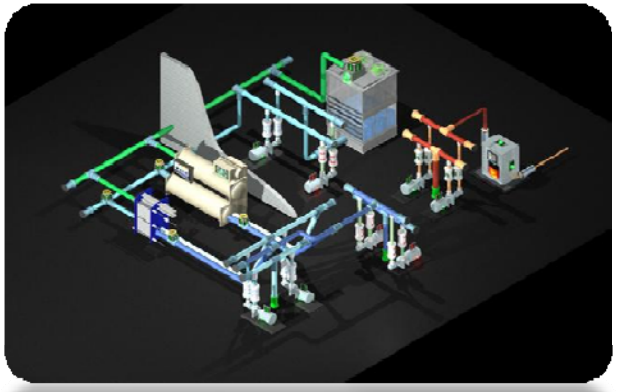
Mechanical Depth





Objectives of Centralized Plant Design

- Reduction in energy consumption over existing system
- Simple Payback within 20 years
- Educational interest in absorption chillers & centralized plant design



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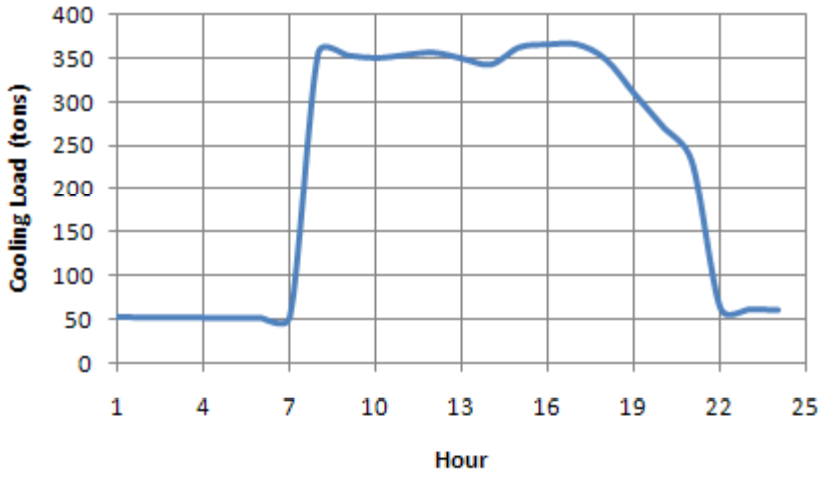
Mechanical Depth





Chiller-Heater Design

- Simultaneous heating and cooling
- Direct-fired natural gas
- Peak Cooling load – 367 tons



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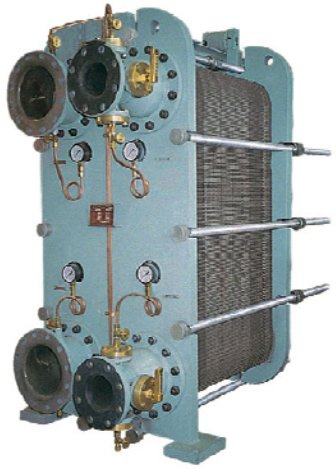
Mechanical Depth





Waterside Free Cooling Design

- Provides energy savings by bypassing chiller
- LMTD 39°F and U=219.5 btuh/ft^2



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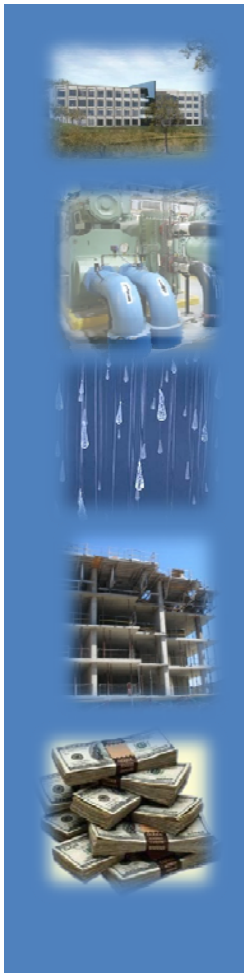
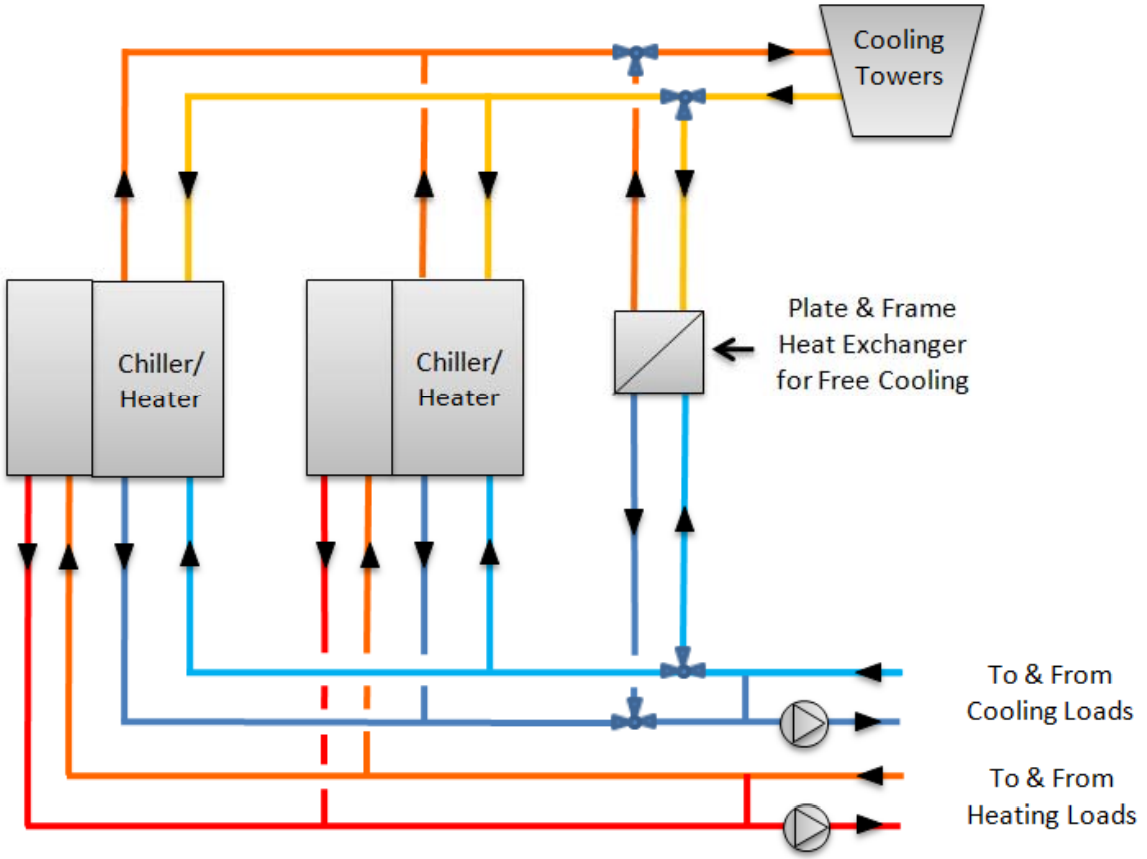
Mechanical Depth





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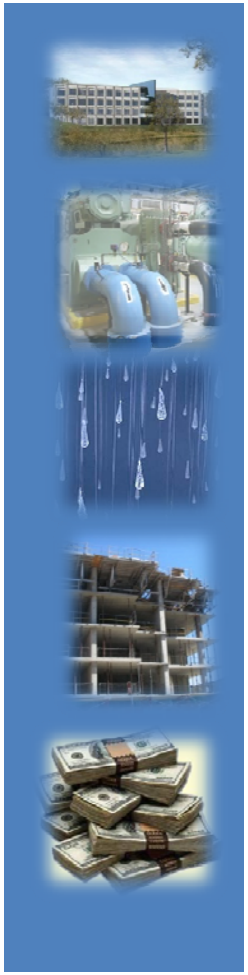
Mechanical Depth



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Mechanical Depth

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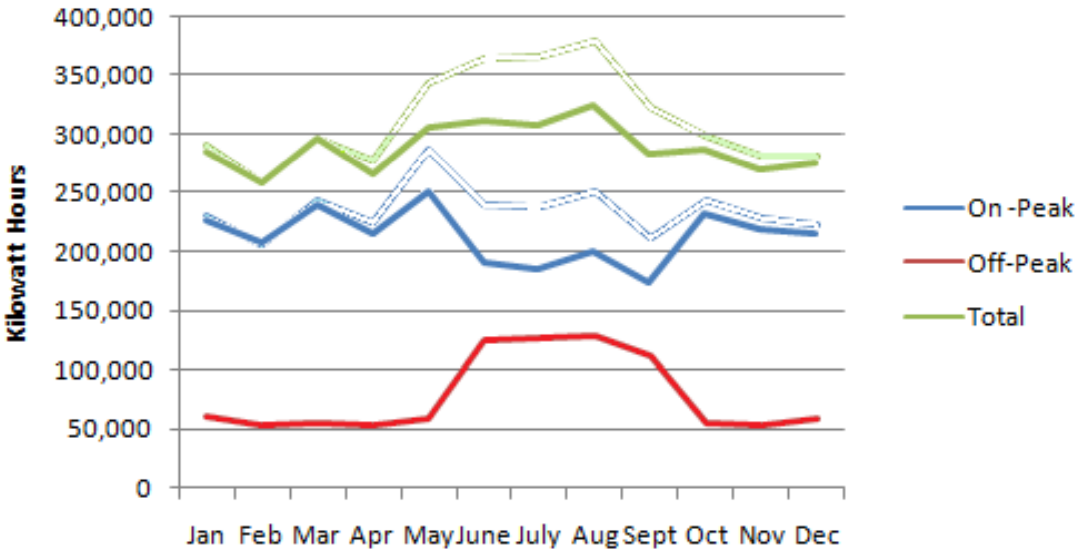
Mechanical Depth





Energy Analysis



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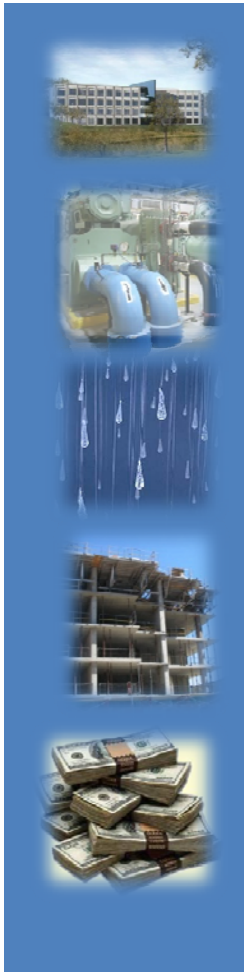
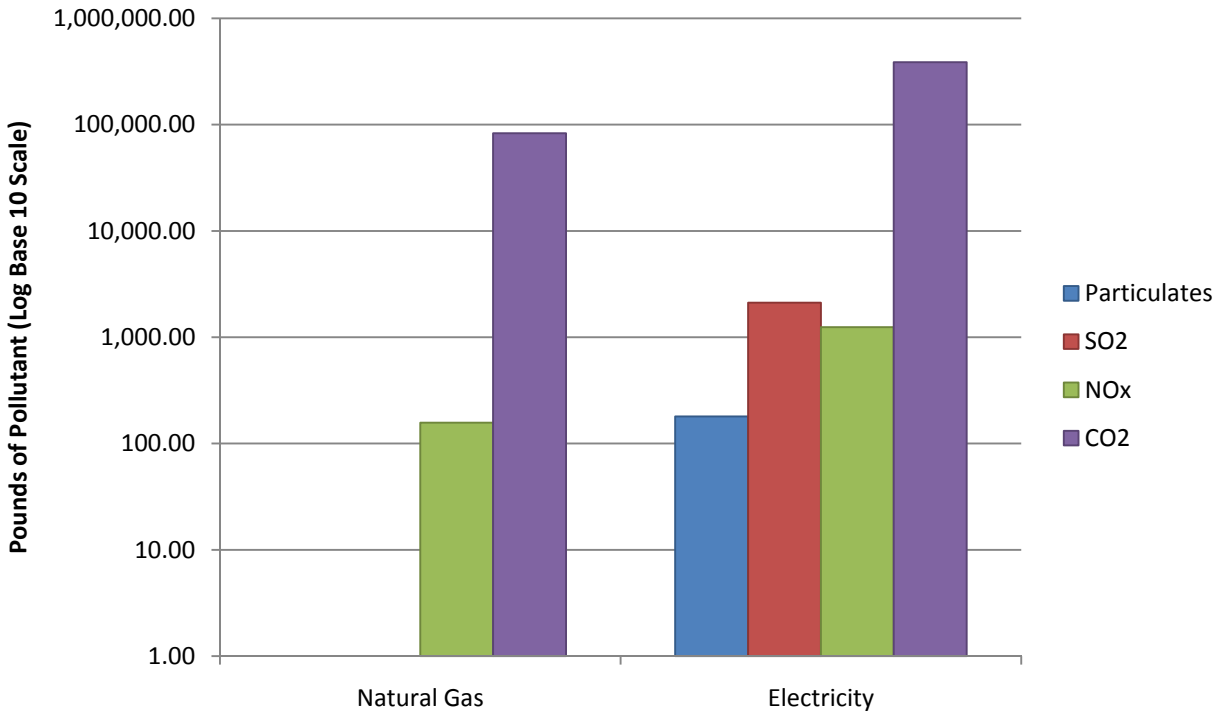
Mechanical Depth



Emissions Reduction



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Mechanical Depth





Economic Analysis

Existing System First Cost

$516,280

$3.82 per Square Foot

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Mechanical Depth





Economic Analysis

Existing $516,280

New Mechanical System First Cost

$702,810

$5.20 per Square Foot

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Mechanical Depth





Economic Analysis

Existing $516,280
New $702,810

First Cost Increase

$186,530

$1.38 per Square Foot

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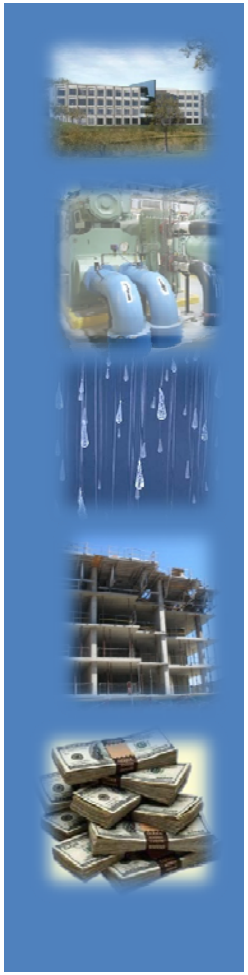
Mechanical Depth



Economic Analysis

Existing $516,280
New $702,810
Increase $186,530

Annual Energy Cost Decrease

$18,192

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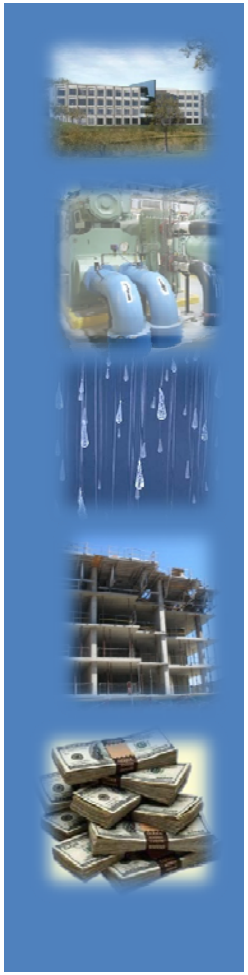
Mechanical Depth



Economic Analysis

Existing $516,280
New $702,810
Increase $186,530
Energy Decrease $18,192

Simple Payback

$186,530 ÷ $18,192

11 Years

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Mechanical Depth





Objectives of Centralized Plant Design

- Reduction in energy consumption over existing system
- Simple Payback within 20 years
- Educational interest in absorption chillers & centralized plant design

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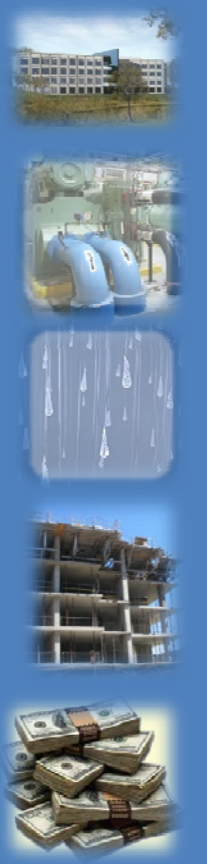
Sustainability Breadth

Sustainability Depth



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Sustainability Breadth





Objectives of Sustainability Breadth

- Recycle rainwater which would normally be discharged into the storm water system from the 42,000 square foot roof
- Replace current Polyvinyl Chloride roofing
- LEED Credit WE 2 – 50% reduction in potable water usage

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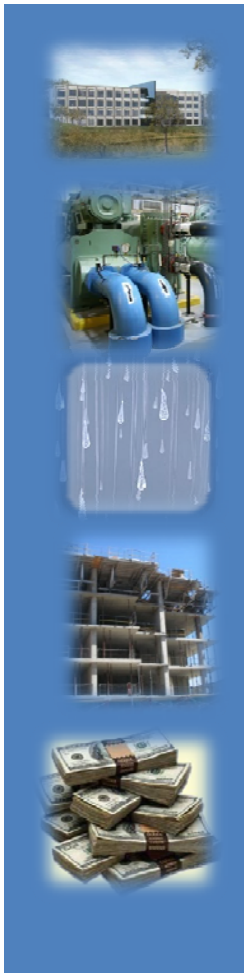
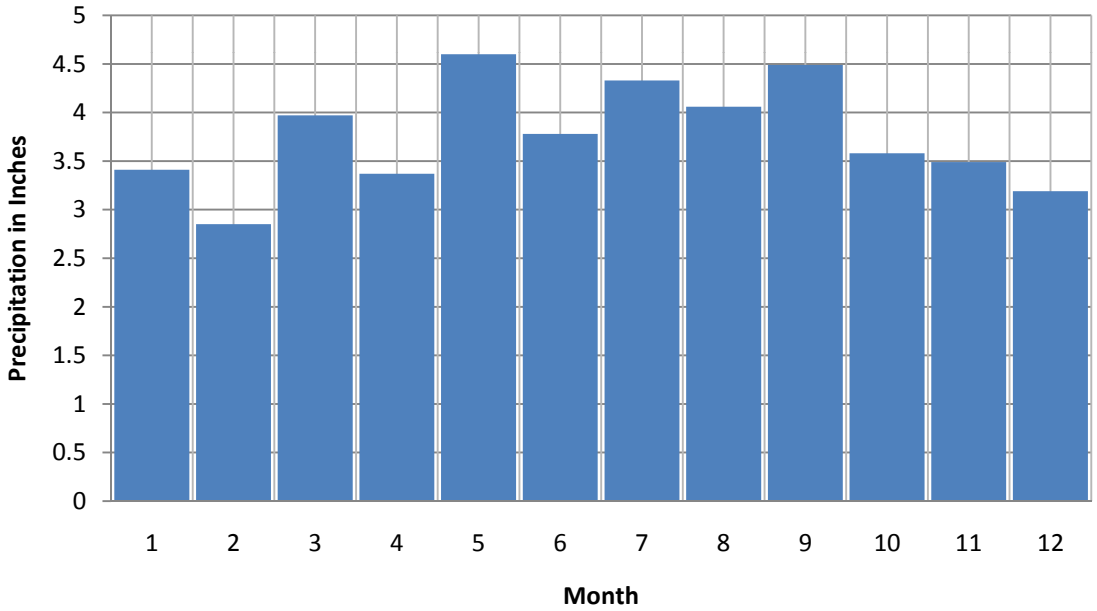
Sustainability Breadth



NOAA Average Monthly Rainfall Data



Average Annual Rainfall of 45.12 inches

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Sustainability Breadth





Rainfall Capturing Calculation

Variables:

- Runoff Coefficient – 95%
- First Flush – 0.1 inches
- Monthly Rainfall Average – 3.76 inches

Assumptions:

- 440 Gallons/Day of Water use

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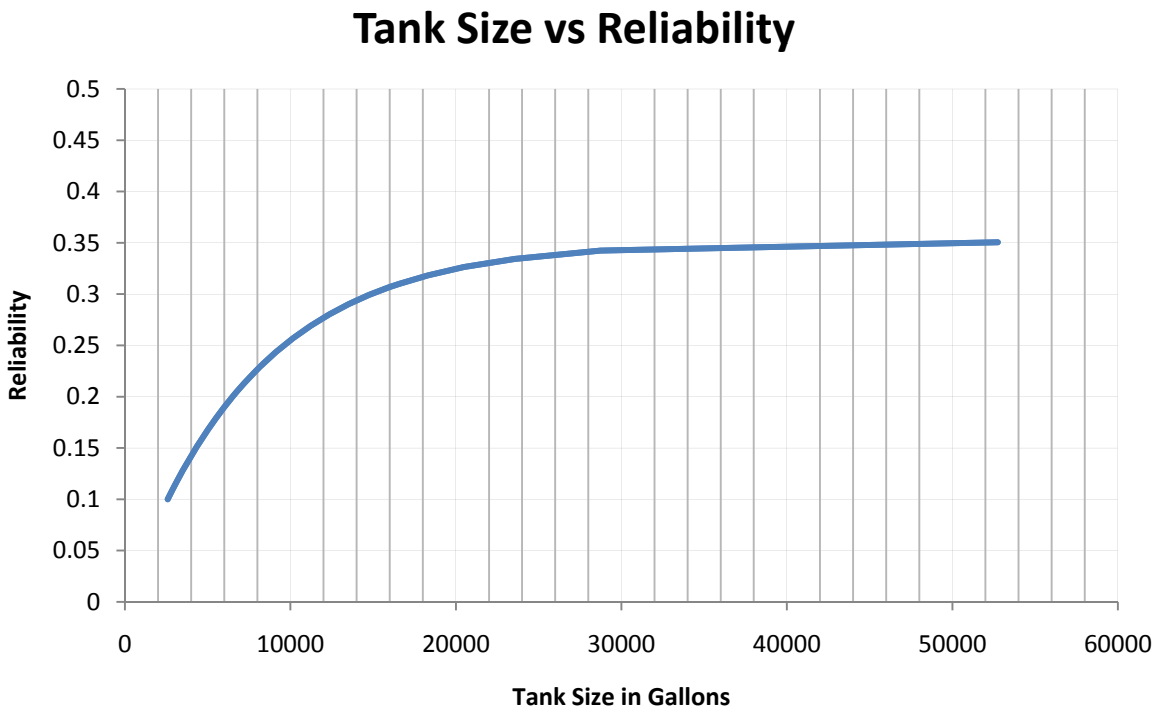
Sustainability Breadth





Rainfall Capturing Calculation



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Sustainability Breadth





Rainfall Capturing Calculation

Results:

- **1,033,530 Gallons Collected Annually**
- 25% Reliability of Tank Providing Full Volume/Day
- 40,170 Gallons Estimated Annual Spill Volume

Required Tank Size 10,700 Gallons

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Sustainability Breadth





Rainfall Capturing Equipment

8 Fine Vortex Filters – 6” pipe outlet

Filter mesh size 0.28 mm

10,700 gallon storage tank

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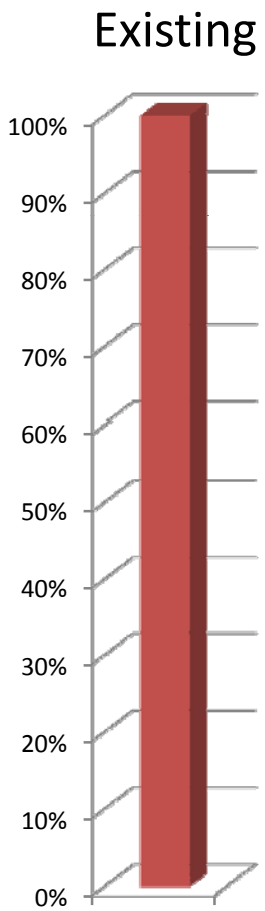
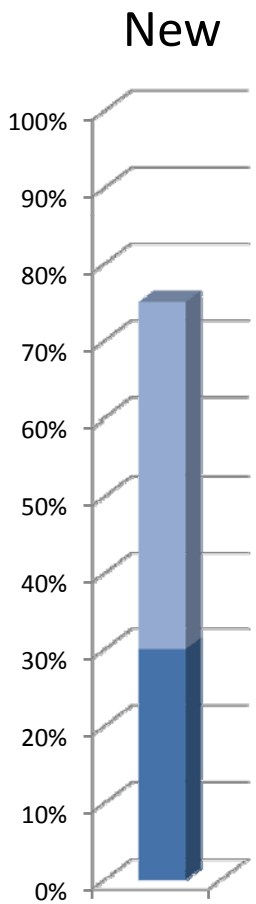
Sustainability Breadth





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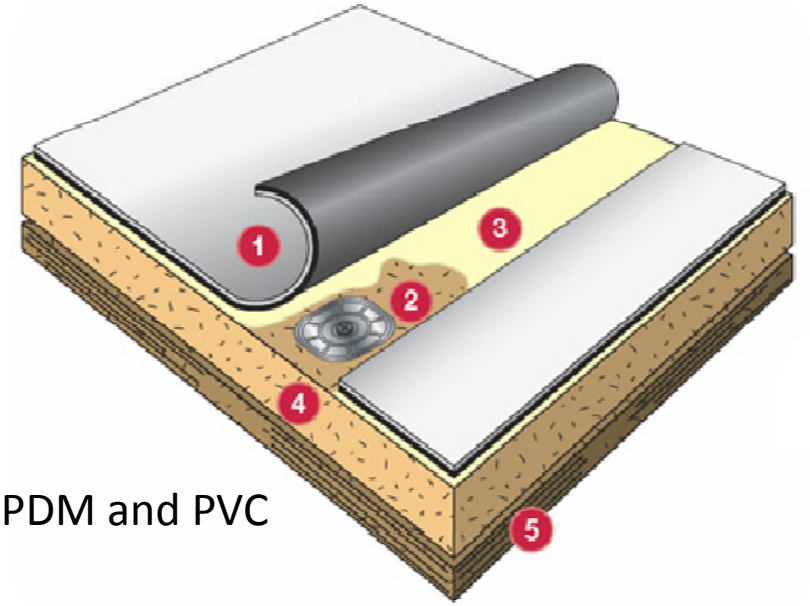
Sustainability Breadth

New Roofing Material



TPO – Thermoplastic Olefin

Combines advantages of EPDM and PVC

Lower Lifecycle Cost

High Reflectivity

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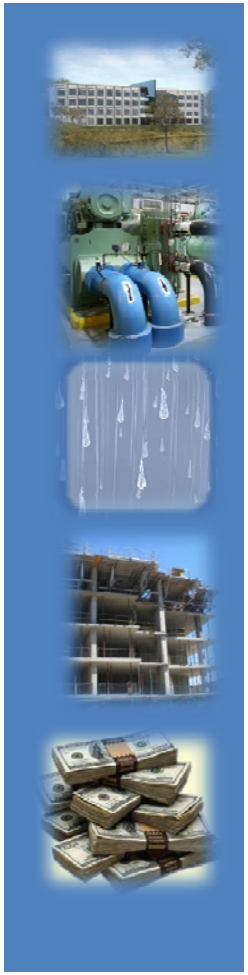
Sustainability Breadth



Economic Analysis

Existing System First Cost

$98,154

73 Cents per Square Foot

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Sustainability Breadth





Economic Analysis

Existing $98,154

New Rainwater System First Cost

$104,893

77 Cents per Square Foot

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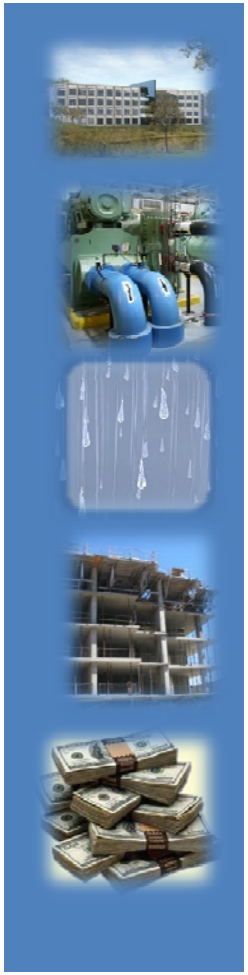
Sustainability Breadth



Economic Analysis

Existing $98,154
New $104,893

First Cost Increase

$6,739

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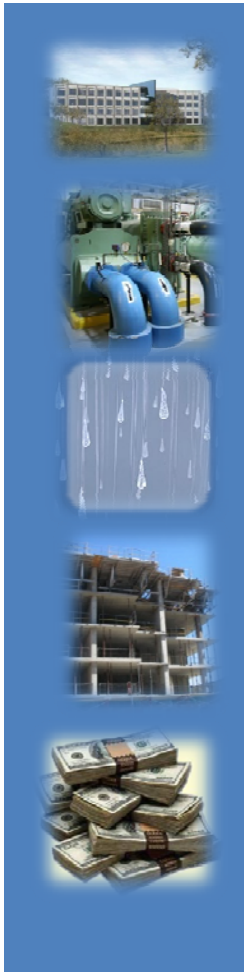
Sustainability Breadth



Economic Analysis

Existing $98,154
New $104,893
Increase $6,739

Annual Water Cost Decrease

$645

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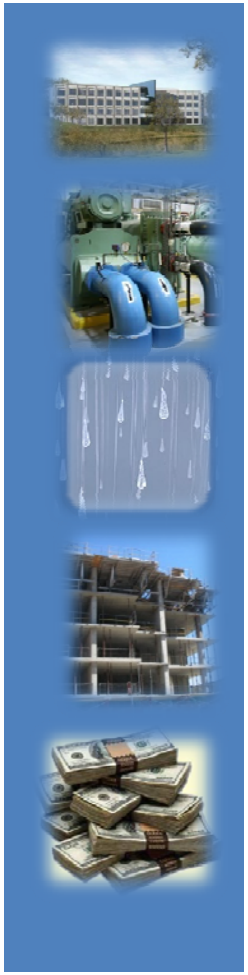
Sustainability Breadth



Economic Analysis

Existing $98,154
New $104,893
Increase $6,739
Water Decrease $645

Simple Payback

$6,739 ÷ $645

11 Years

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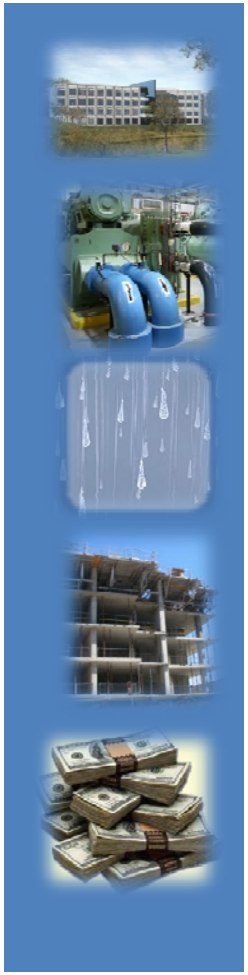
Sustainability Breadth



Economic Analysis

Existing $98,154
New $104,893
Increase $6,739
Water Decrease $645

20-Year Life Cycle Cost Savings

$6,215

20-Year Life Cycle Potable Water Saved

20,670,600 Gallons

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Sustainability Breadth

Objectives of Sustainability Breadth

- Recycle rainwater which would normally be discharged into the storm water system from the 42,000 square foot roof
- Replace current Polyvinyl Chloride roofing
- LEED Credit WE 2 – 50% reduction in potable water usage

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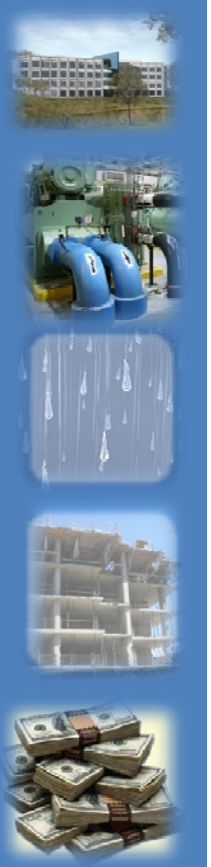
Structural Breadth

Sustainability



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Structural Impacts





Objectives of Structural Impact Study

- Calculate the new structural design of the roof taking into account the loads of the new equipment

- Calculate cost difference of the new and existing systems

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Structural Impacts



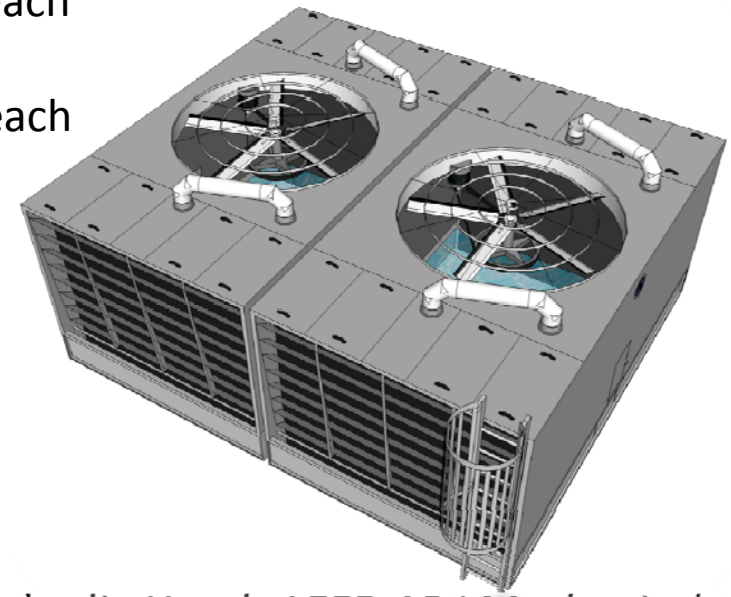


Structural Calculation

Existing Rooftop units: 10,000 lbs/each

New Air Handling units: 8,200 lbs/each

New Cooling Towers: 8,500 lbs/each



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Structural Impacts





Structural Calculation

PCA Slab inputs

Two-way Slab Analysis

- Typical Existing vs. New AHU Span
- Typical Existing vs. New Cooling Tower Span

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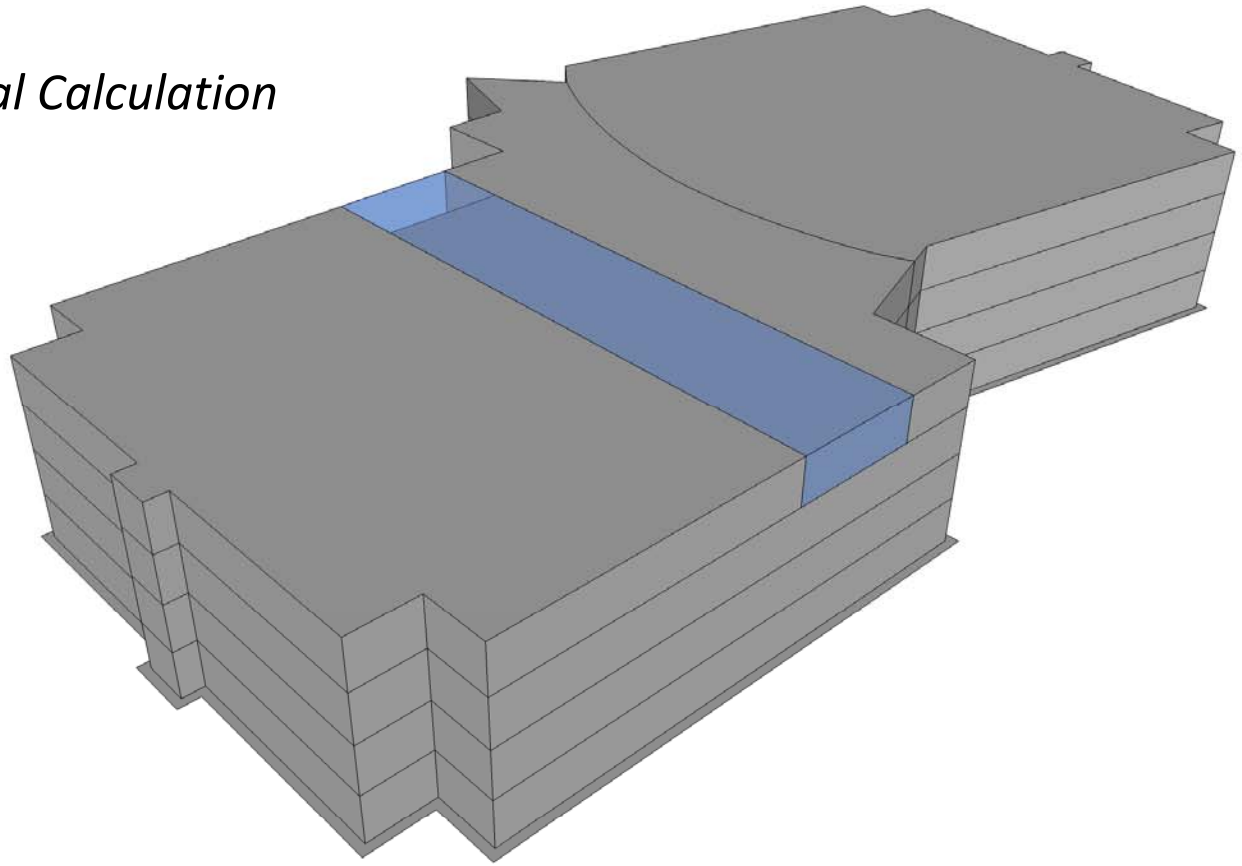
Structural Impacts





Structural Calculation



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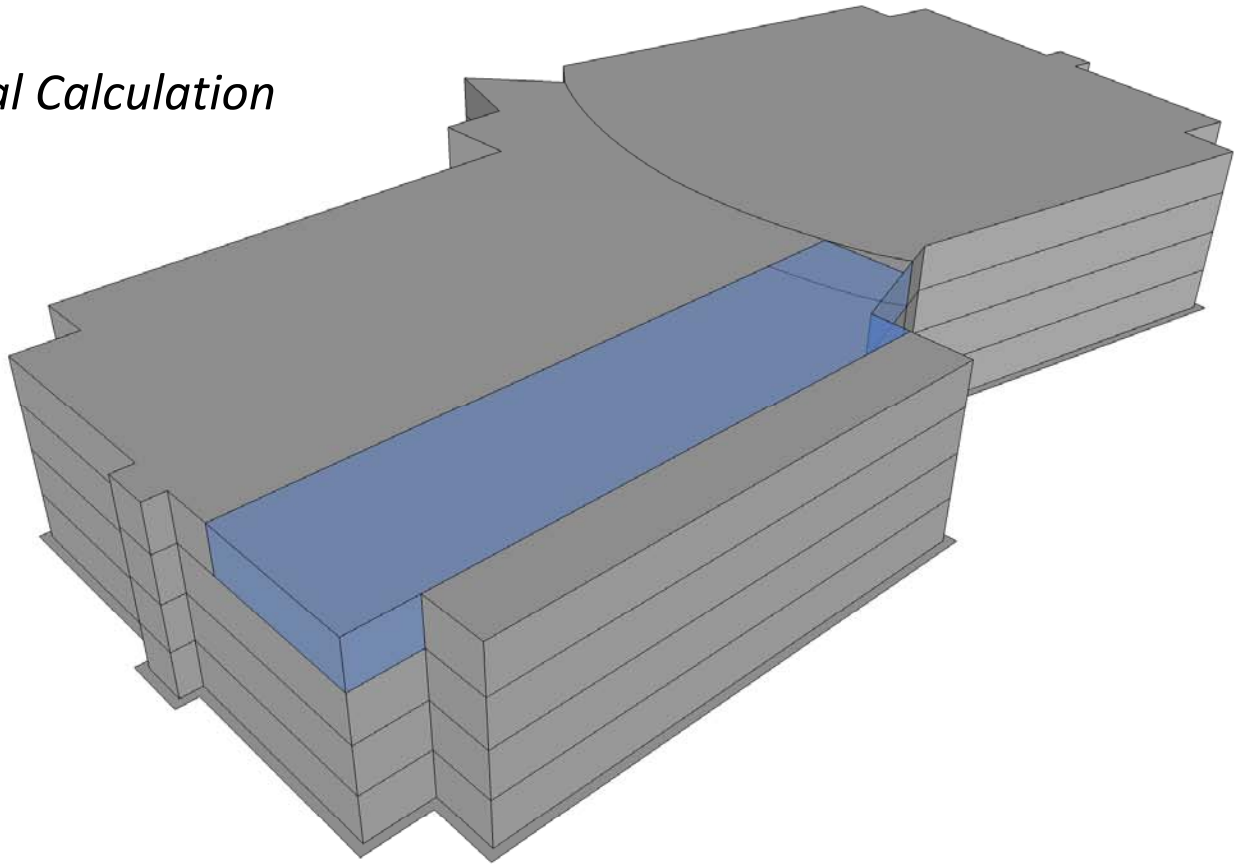
Structural Impacts





Structural Calculation



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Structural Impacts





Structural Calculation

PCA Slab Results

- Total Existing vs. New AHU Spans

Decrease of 1650 lbs of reinforcing steel

- Total Existing vs. New Cooling Tower Spans

Increase of 408 lbs of reinforcing steel

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Structural Impacts





Structural Calculation

PCA Slab Results

Net Reduction = 1232 lbs

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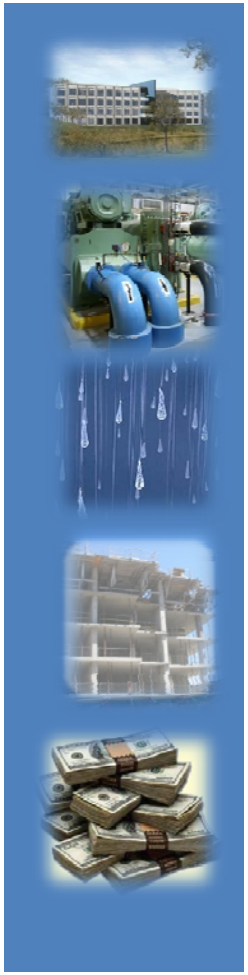
Structural Impacts



Economic Analysis

First Cost per pound of reinforcing steel

$0.50 x 1232 lbs

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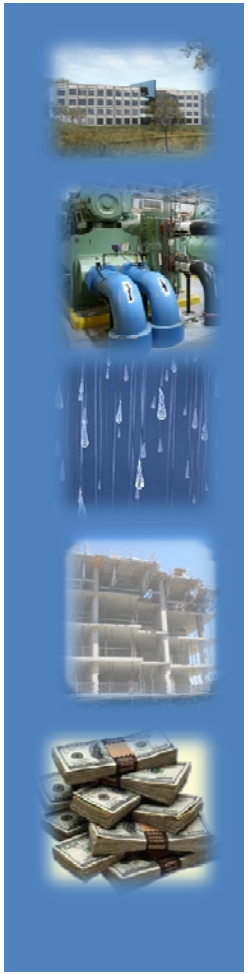
Structural Impacts



Economic Analysis

First Cost $0.50 x 1232 lbs

First Cost Savings

$614

0.50 Cents per Square Foot Saved

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HITT Contracting Headquarters

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Structural Impacts





Objectives of Structural Impact Study

- Calculate the new structural design of the roof taking into account the loads of the new equipment
- Calculate cost difference of the new and existing systems

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Structural Impacts

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Conclusions





- *Centralized Plant Redesign*
  - Improvements to energy efficiency of the system through the design of a centralized plant
  - 11 year payback period
- *Sustainability Study*
  - Potable water conservation and LEED
  - Roof Reflectivity and Design
  - 11 year payback period
- *Structural Impacts*
  - Calculate the new structural design of the roof taking into account the loads of the new equipment
  - Cost savings of $614

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David Noland at KTA Group

All the AE Faculty

Friends and Family

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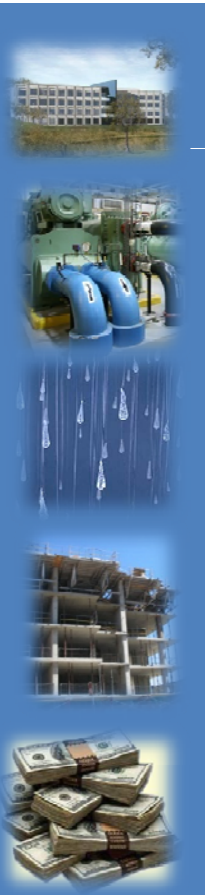

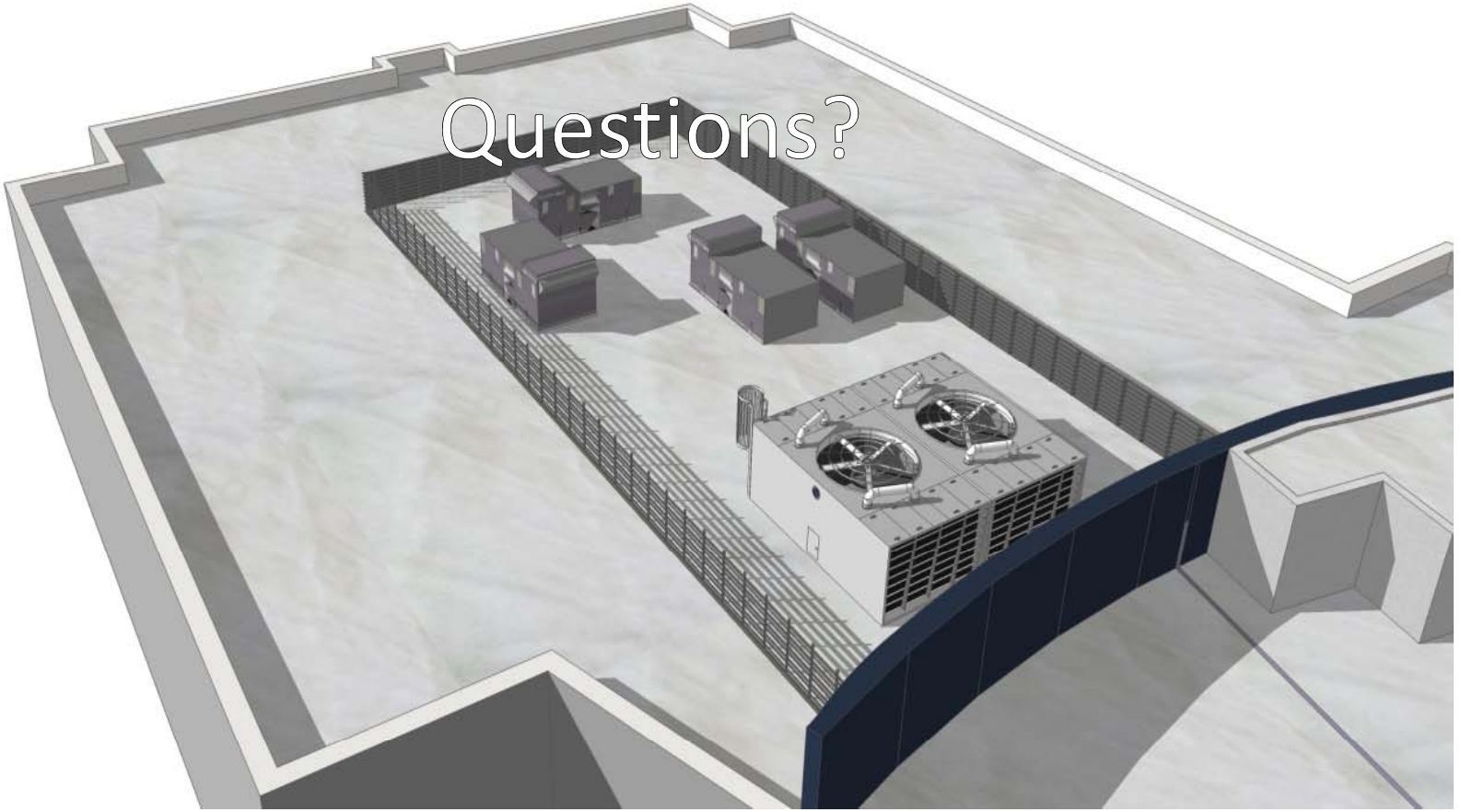

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