PROPOSAL OUTLINE

STEVE KIJAK, MICHAEL GILROY, JASON BROGNANO, DAVID MASER

KGB Maser
Management. Engineering. Consulting.

Presentation Overview:

Façade Redesign

Energy Performance

Additional Value Engineering

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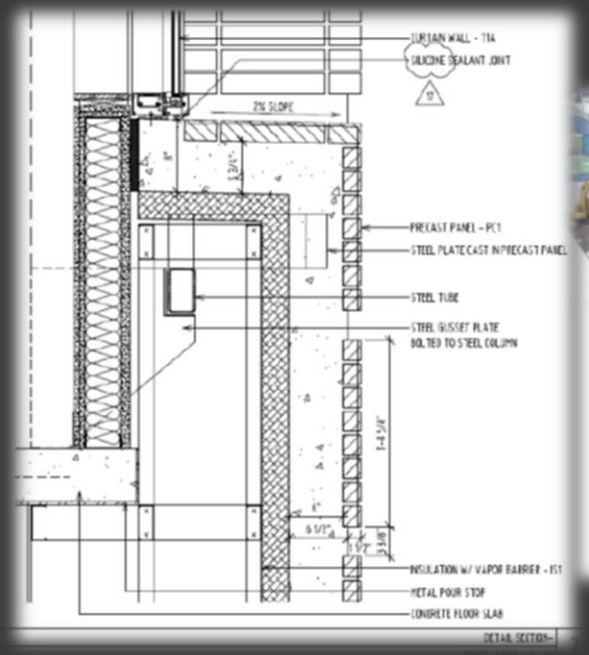
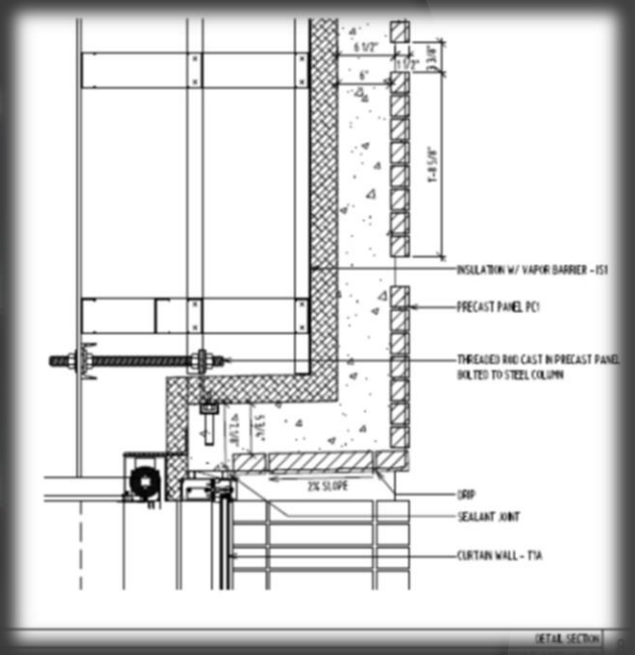
Façade Redesign

Energy Performance

Additional Value Engineering

Façade Existing Conditions





Façade Existing Conditions

- Current Design
  - The use of 5000 psi concrete.
  - Split face brick with 6” backing of concrete.
  - Total panel depth = 1’-5”
  - Nominal panel = 12’X22’
    - Weight = 23,000 lbs

Current Design

Façade Redesign

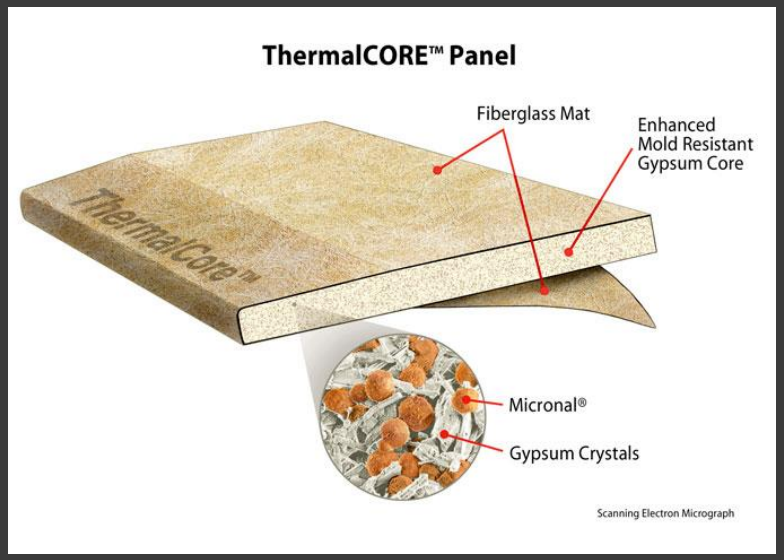
- Proposal Design
  - A foam core will be located in the center of the precast panel.
  - Lighten the load of the panel.
  - Increase R value of the panels.
  - Decreased size of crane.
  - Cost valued design.

Proposal Design

Façade Redesign

- Other options to consider:
  - The use of lightweight concrete.
  - The use of other façade materials.
  - Increase the size of the nominal panel.

Phase Change Drywall

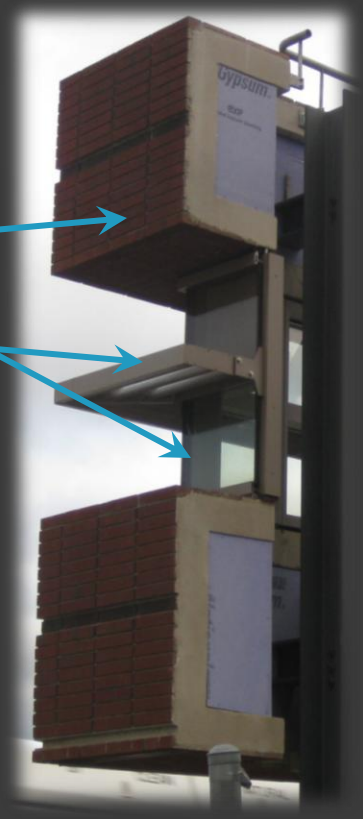


Thermal CORE Panel from National Gypsum

- Changes phase at 73º F
- 22 BTU per square foot latent heat capacity
- Reduces temperature swings and peak loads in spaces

Existing Daylighting

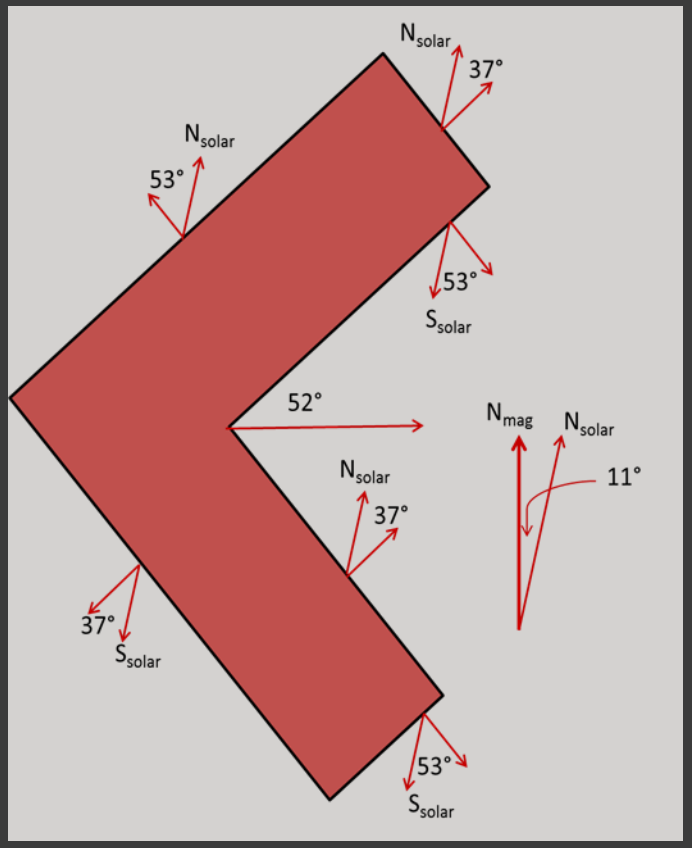
- Fritted Glazing
  - 70% transmittance
  - 60% open Ceramic fritting
- Overhangs
- Dimmable Lighting



Current Design

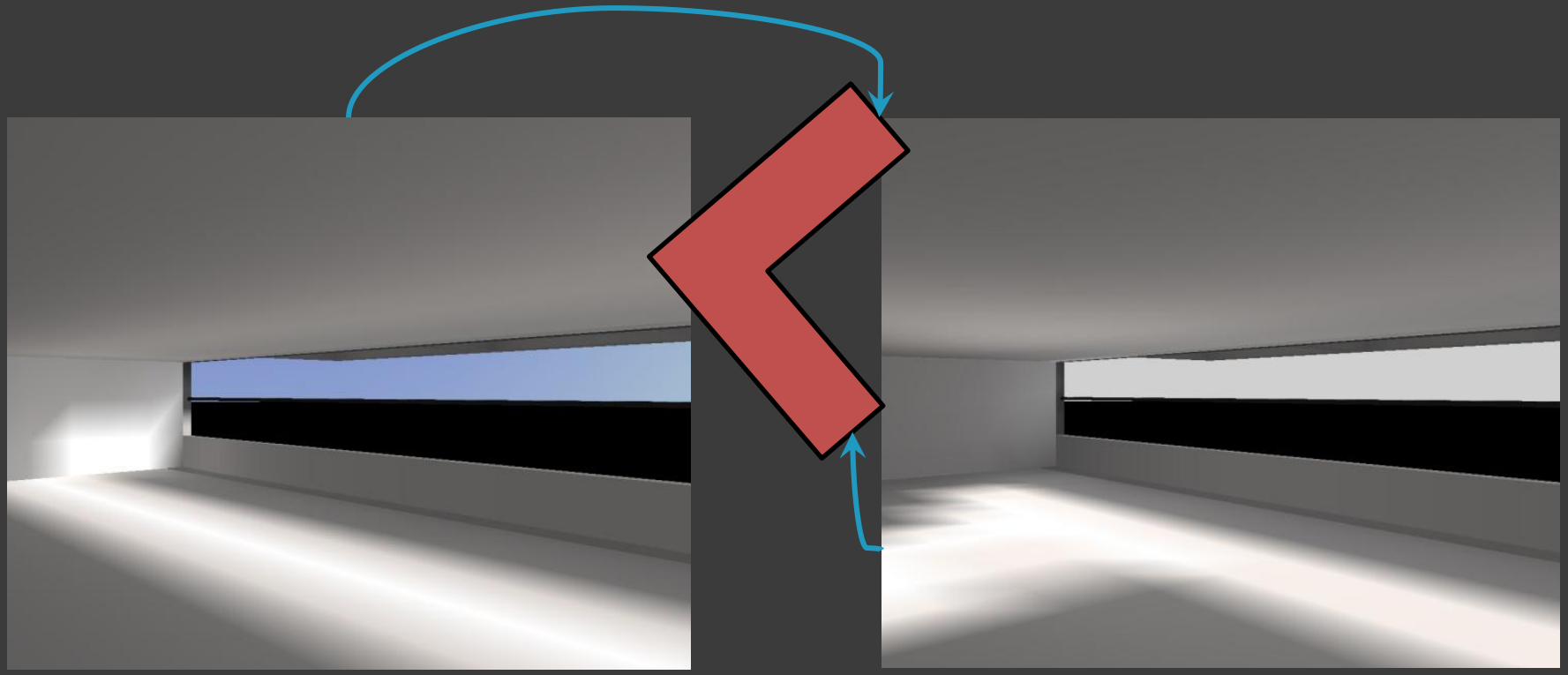
Existing Daylighting

- Direct Gain Concerns:
  - Morning on NE façades
  - Afternoon on SE façades
  - Evening on SW façade
  - Reflection on NW façade



Orientation

Existing Daylighting

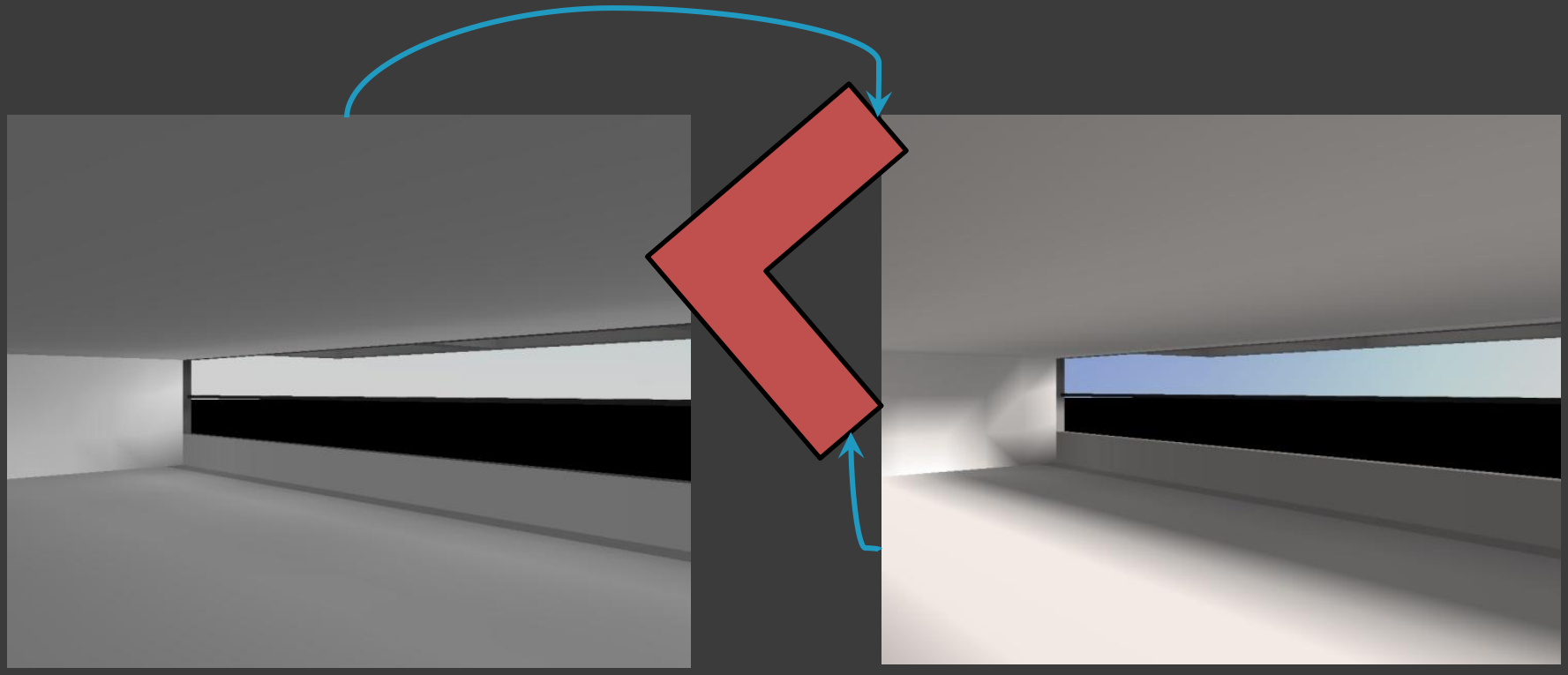


Material Science

Life Science

6/21, 6:00am

Existing Daylighting

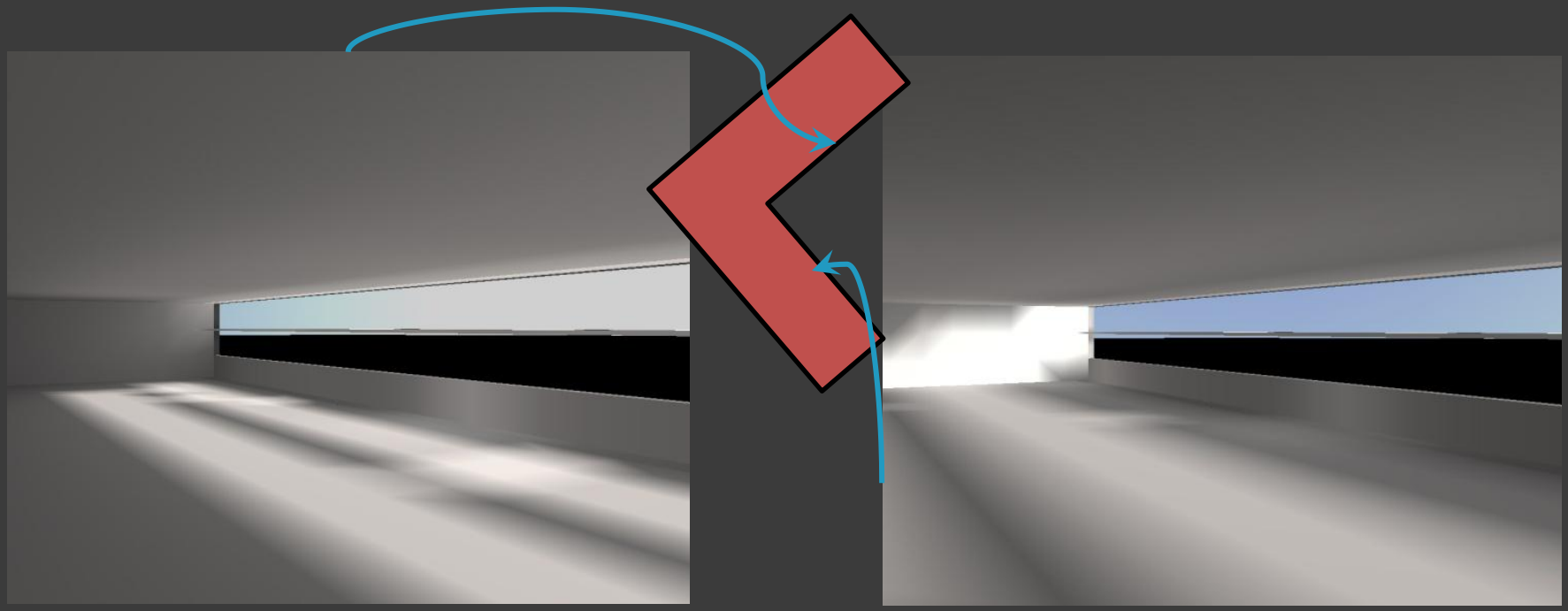


Material Science

Life Science

12/22, 9:00-10:00am

Existing Daylighting

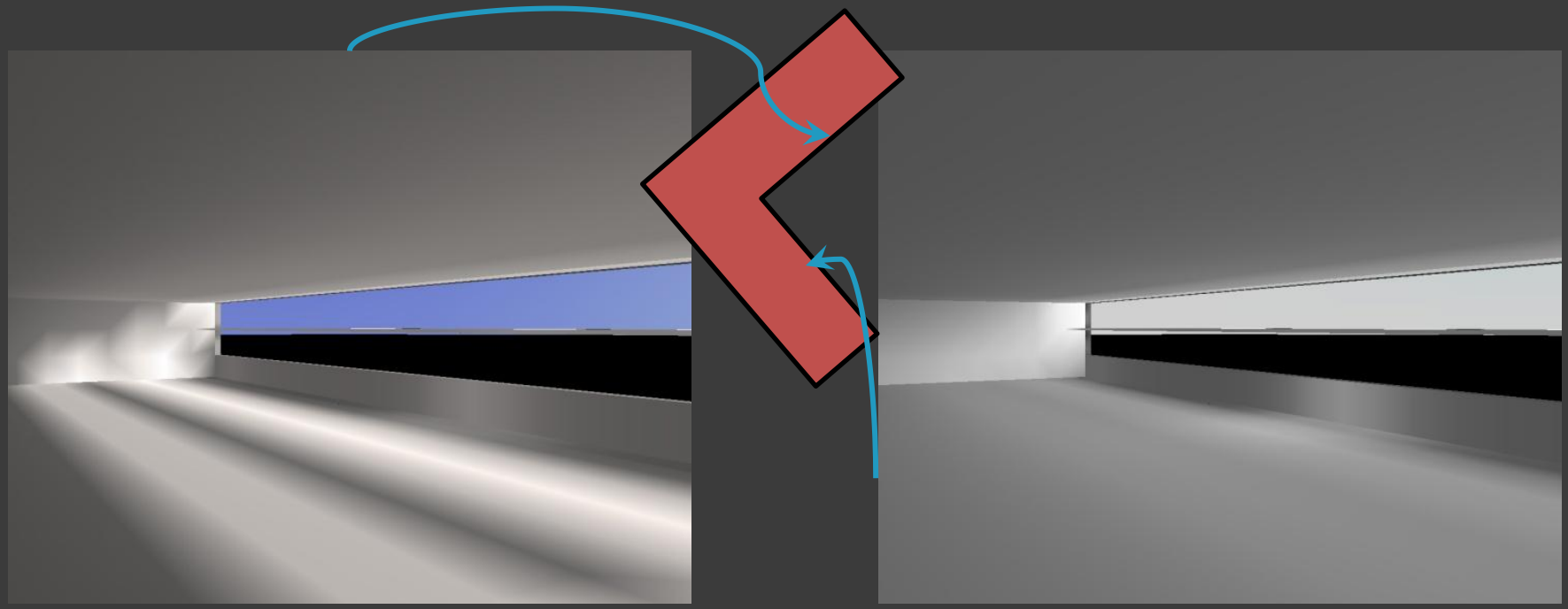


Material Science

Life Science

6/21, 7:00 and 6:00am

Existing Daylighting

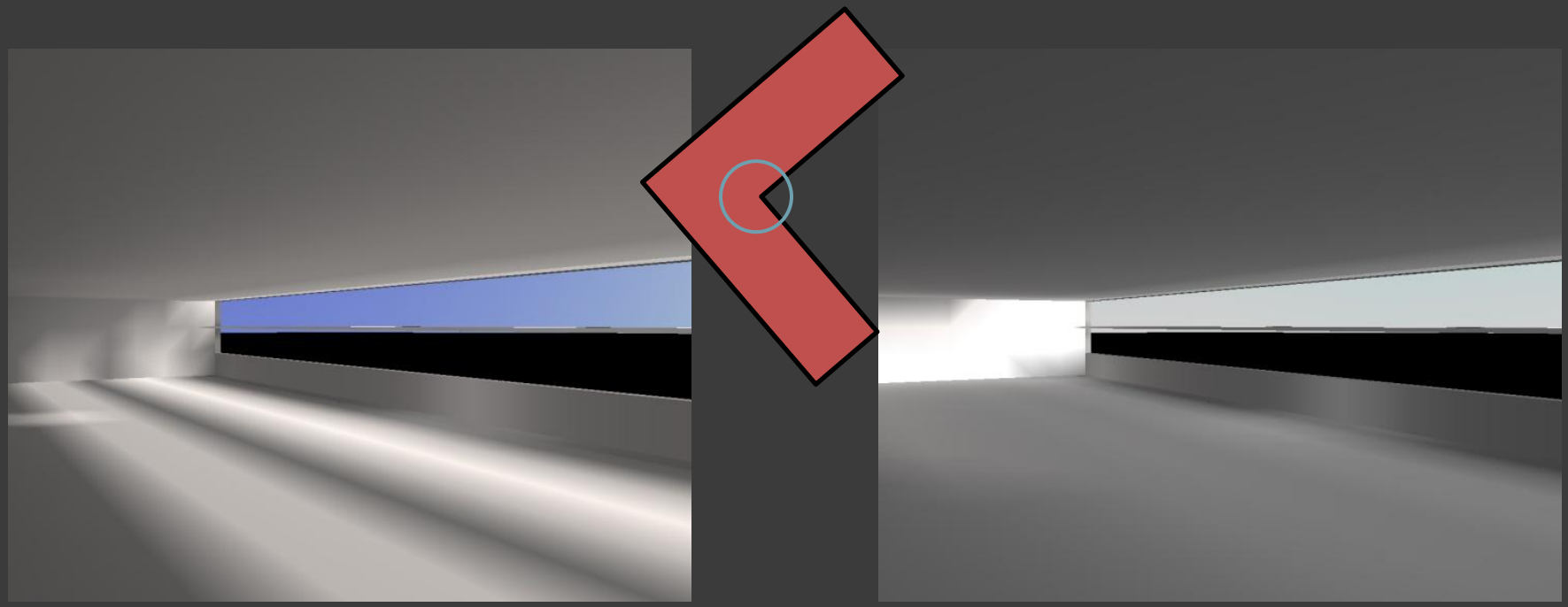


Material Science

Life Science

12/22, 11:00 and 9:00am

Existing Daylighting

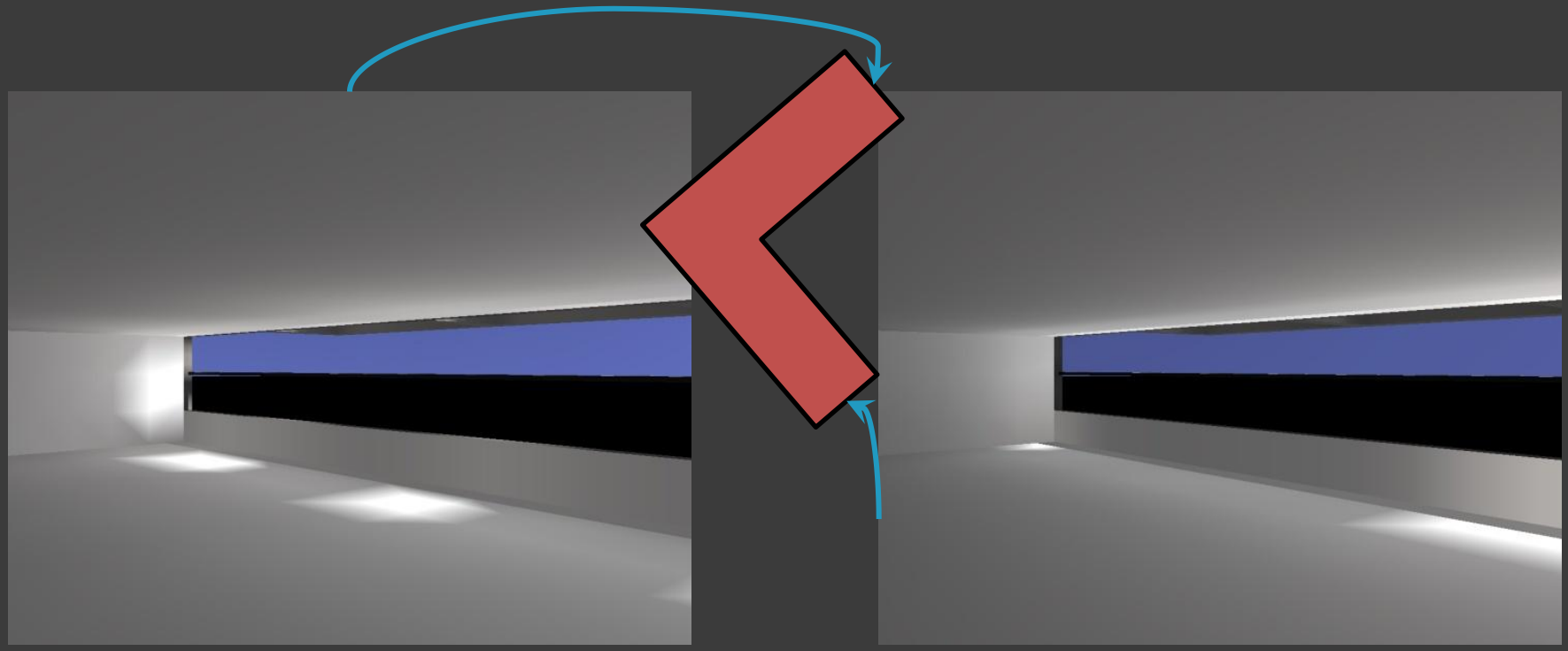


Café / Lounge

6/21, 7:00am

12/22, 9:00am

Existing Daylighting

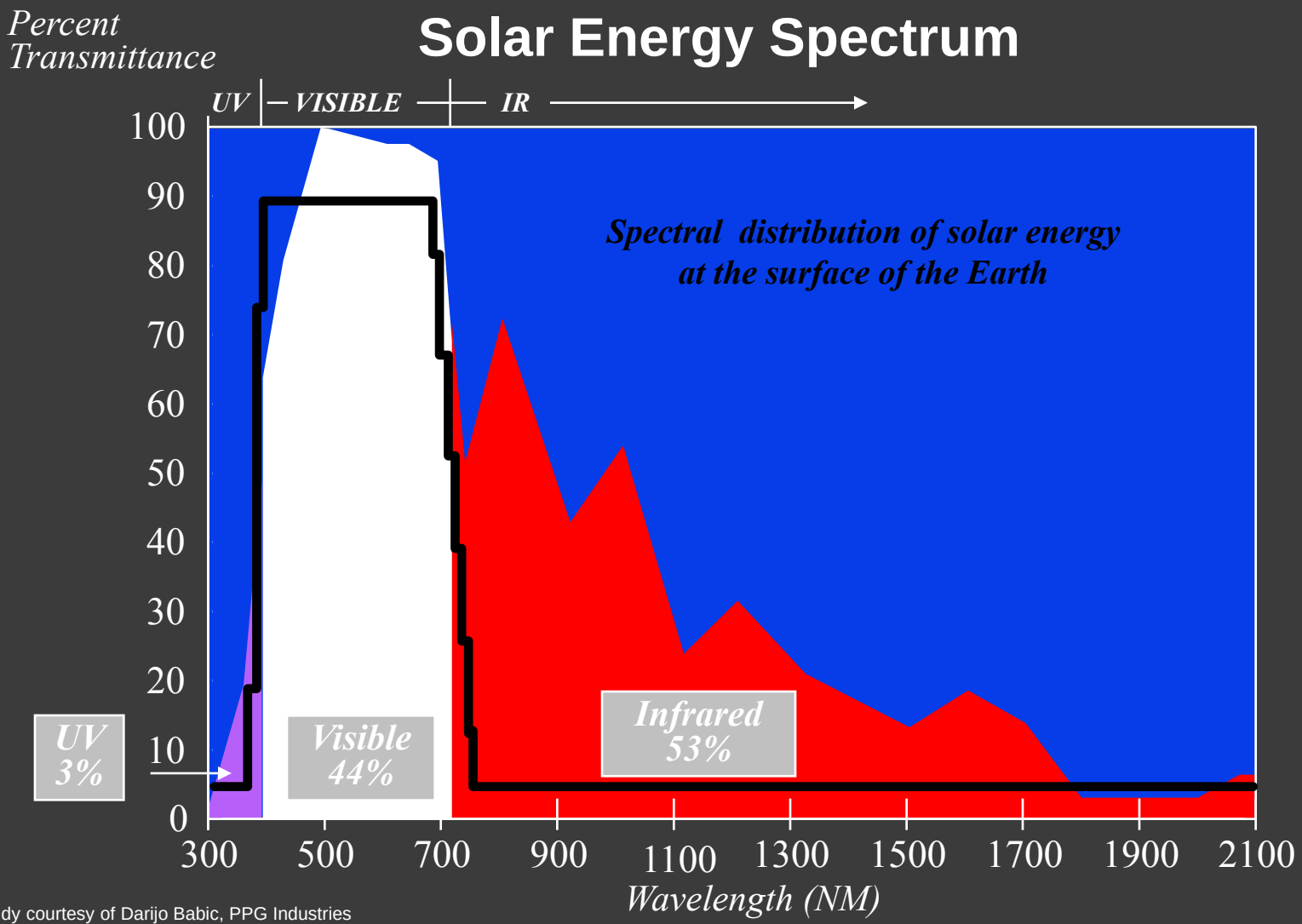


Material Science

Life Science

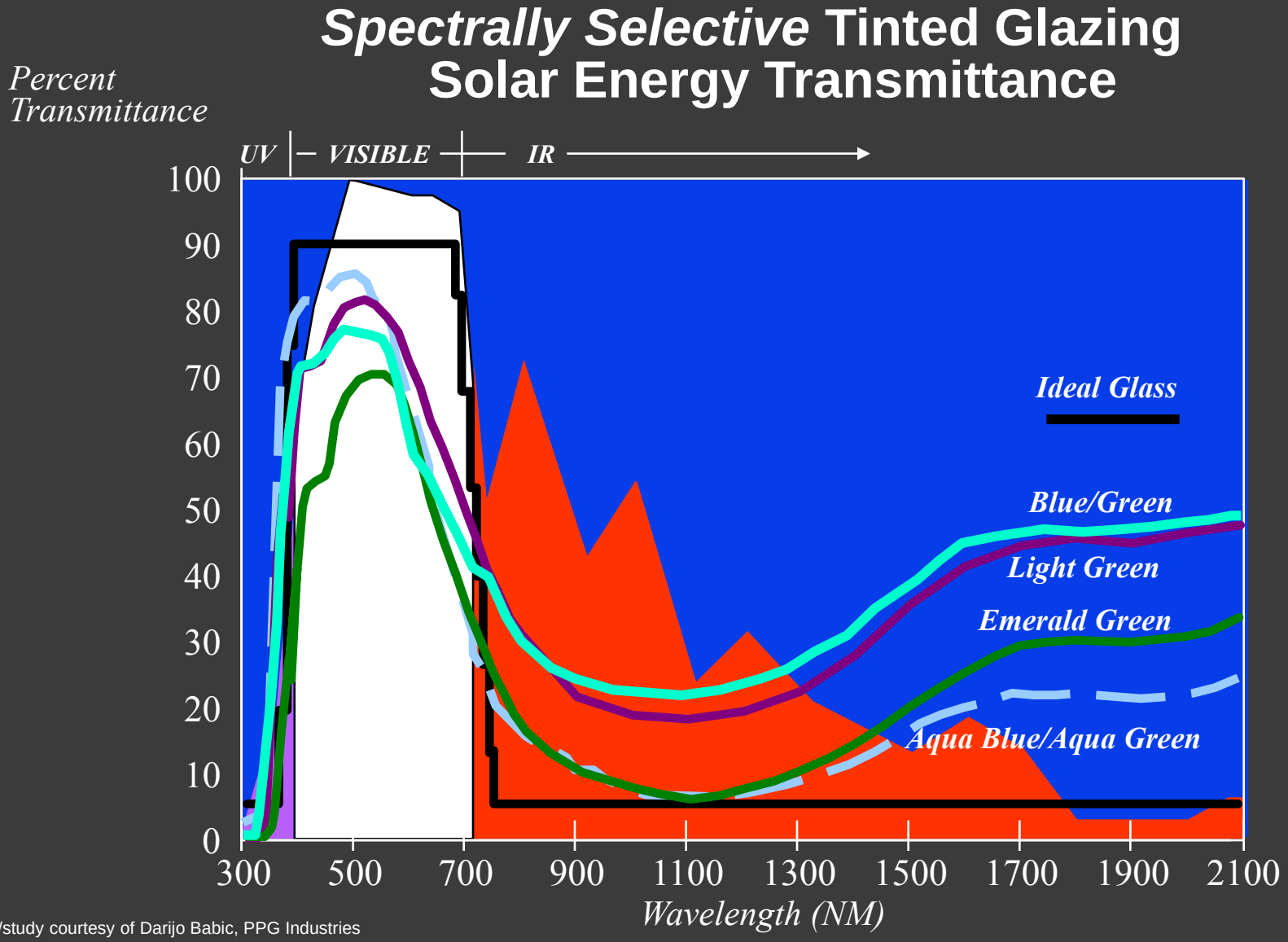
Trellised Overhang High Angle Blockage

Spectrally Selective Glazing



Images/study courtesy of Darijo Babic, PPG Industries

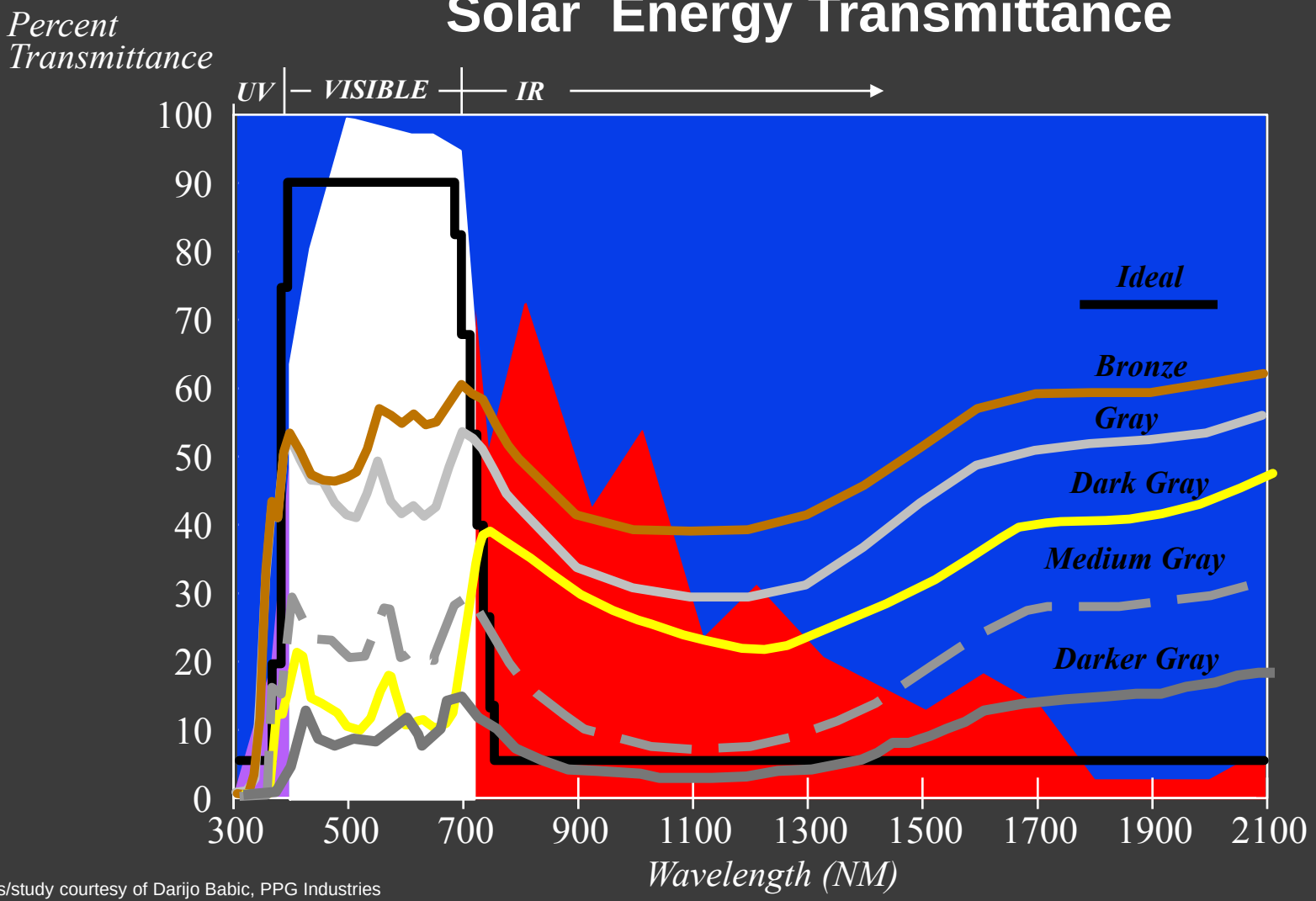
Spectrally Selective Glazing



Images/study courtesy of Darijo Babic, PPG Industries

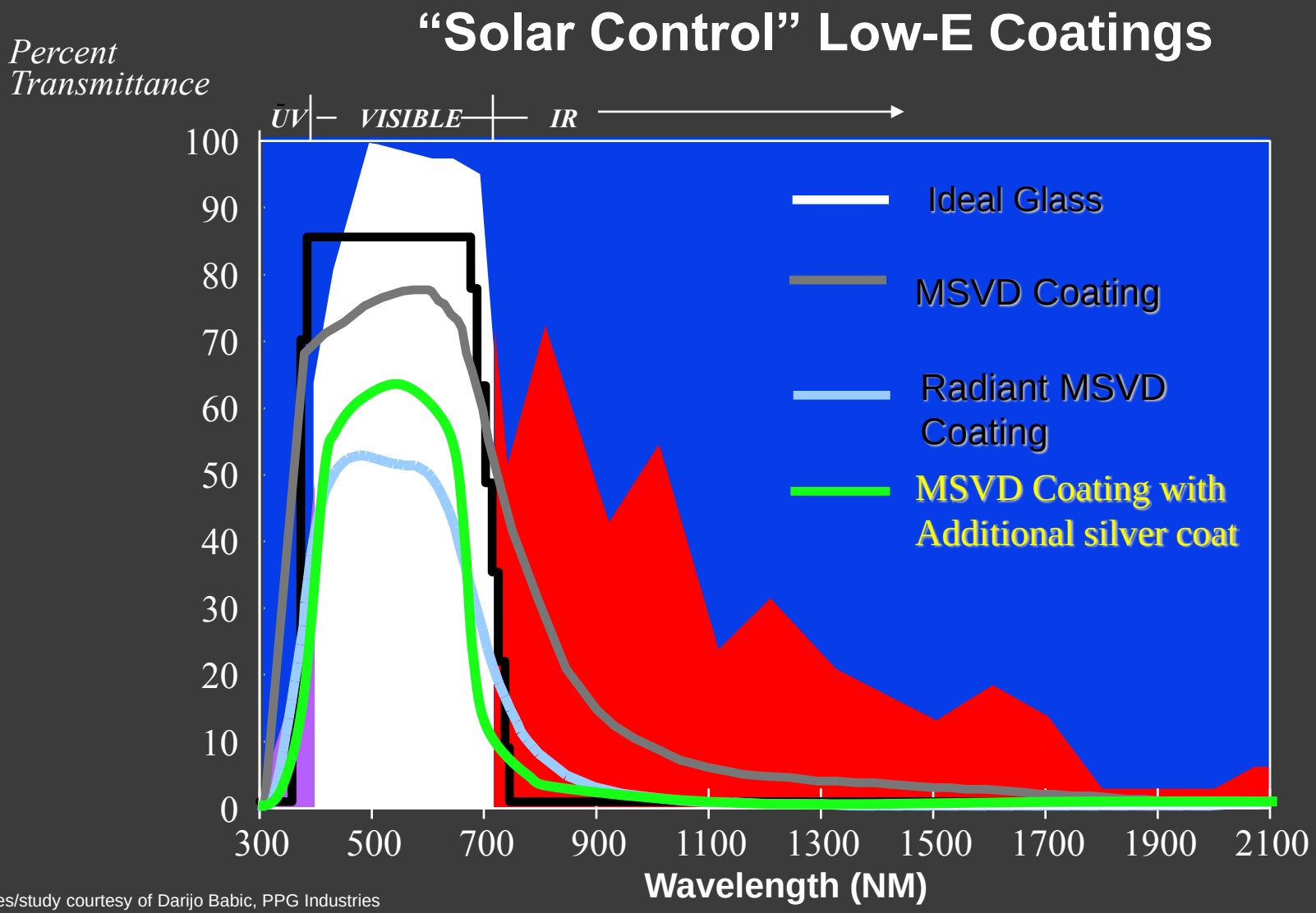
Spectrally Selective Glazing

"Moderate" Bronze/Gray Glazing
Solar Energy Transmittance



Images/study courtesy of Darijo Babic, PPG Industries

Spectrally Selective Glazing



Images/study courtesy of Darijo Babic, PPG Industries

Spectrally Selective Glazing

Glass Type	Winter U-Value	VLT	SHGC	LSG
Uncoated Glasses				
Clear Glass	0.47	79%	0.70	1.13
Ultra-Clear Glass (Low-iron glass)	0.47	84%	0.82	1.02
Blue/Green (Spectrally Selective) Tinted Glass	0.47	69%	0.49	1.41
Coated Glasses				
Pyrolytic Low-E (Passive Low-E) Glass	0.35	74%	0.62	1.19
Triple Silver Solar Control Low-E	0.28	64%	0.27	2.37
Tinted Solar Control Low-E	0.29	51%	0.31	1.64
Subtly Reflective Tinted	0.47	47%	0.34	1.39
Blue/Green Reflective Tinted	0.48	27%	0.31	0.87

Images/study courtesy of Darijo Babic, PPG Industries

Spectrally Selective Glazing

City	Annual HVAC Operating Expenses		Annual Savings	Total HVAC Equipment Costs		Immediate Equipment Savings	1st Year Savings
	Dual-Pane Tinted	Triple Silver		Dual-Pane Tinted	Triple Silver		
Atlanta	$680,456	$597,772	$82,684	$2,115,464	$1,697,686	$417,597	$500,281
Boston	$853,450	$756,001	$97,539	$2,326,967	$1,928,086	$398,881	$496,420

City	Electricity (KwH Savings)	Gas (Therm Savings)	Annual CO_2 Reductions (Tons)	40-Year CO_2 Reductions (Tons)
Atlanta	455,841	18,829	417	16,699
Boston	432,301	26,618	354	14,163
Chicago	434,777	29,644	502	20,087
Houston	473,971	14,199	422	16,889
Phoenix	469,246	6,170	411	16,451
Seattle	328,567	29,588	250	10,018

Images/study courtesy of Darijo Babic, PPG Industries

Diffuse Glazing and PCM

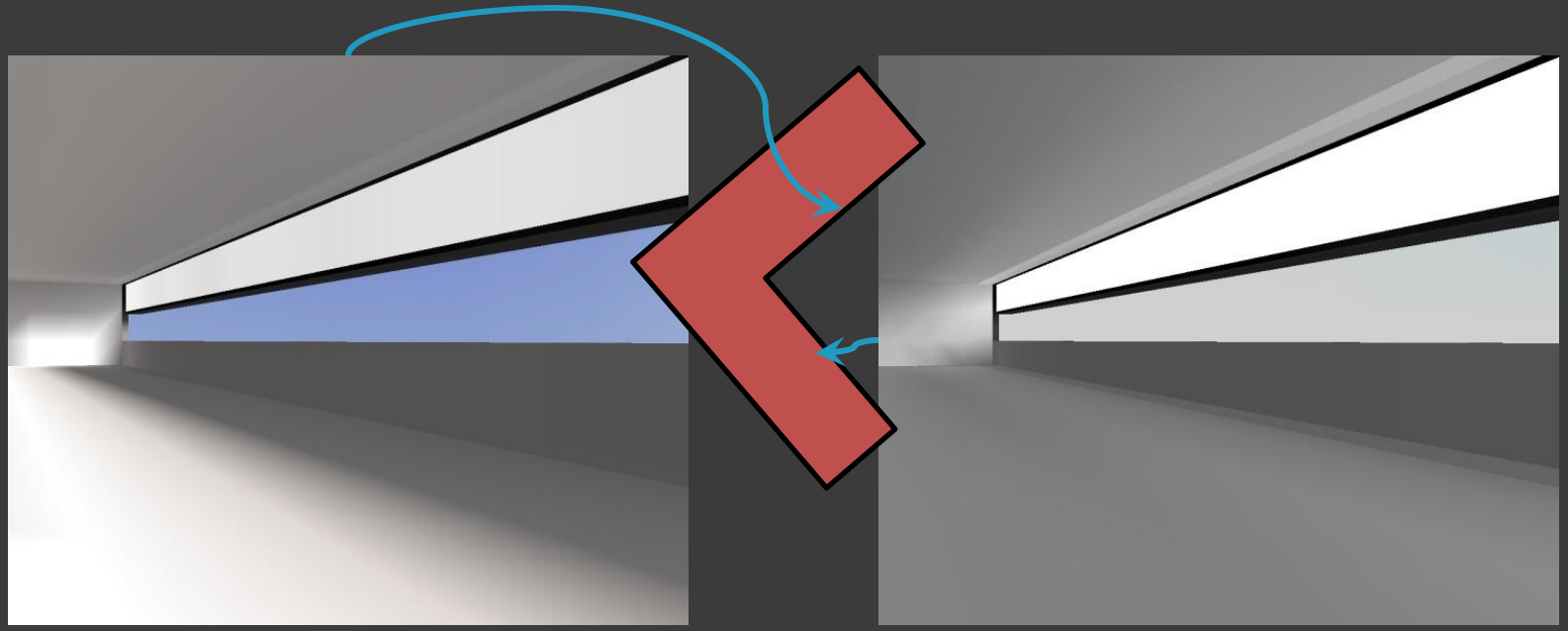
Phase Change Material

Diffuse Distribution

DELTA® - COOL 28

Images from www.cosella-dorken.com

Diffuse Glazing and PCM

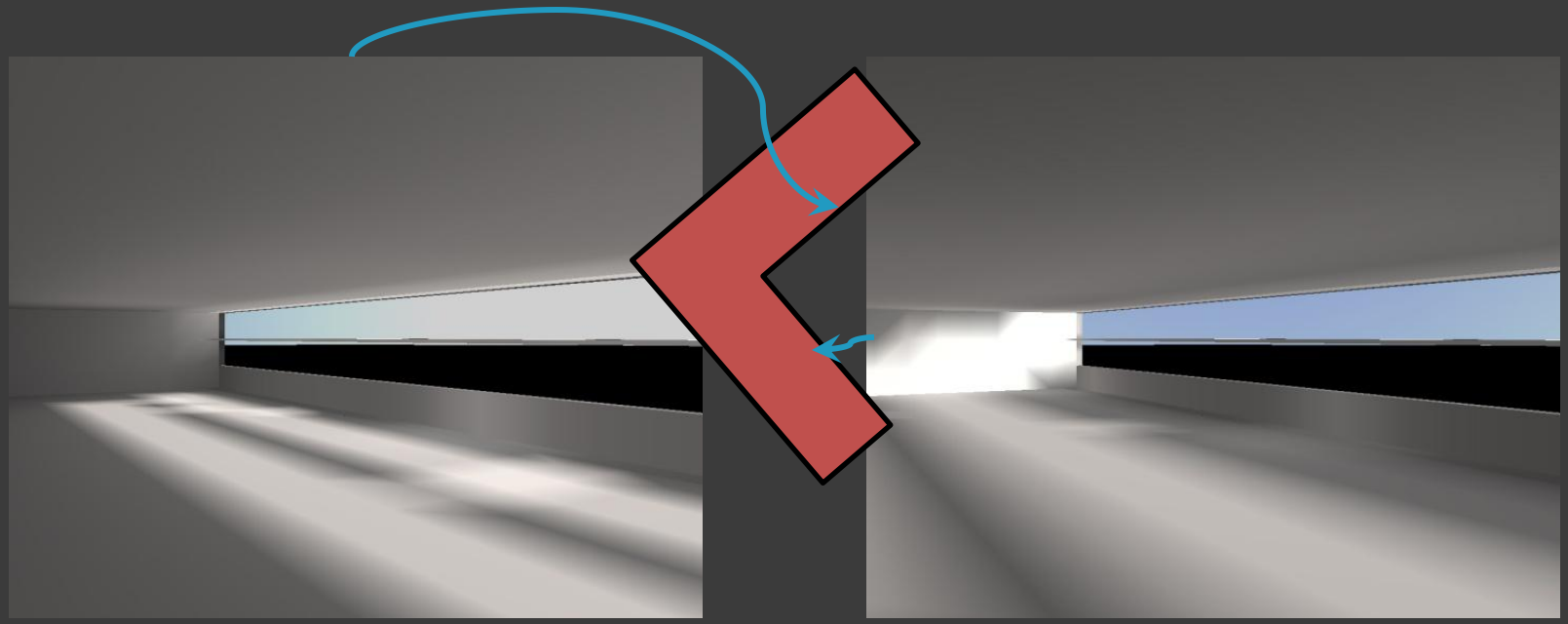


Material Science

Life Science

Low Summer Angle Blockage

Light Shelves

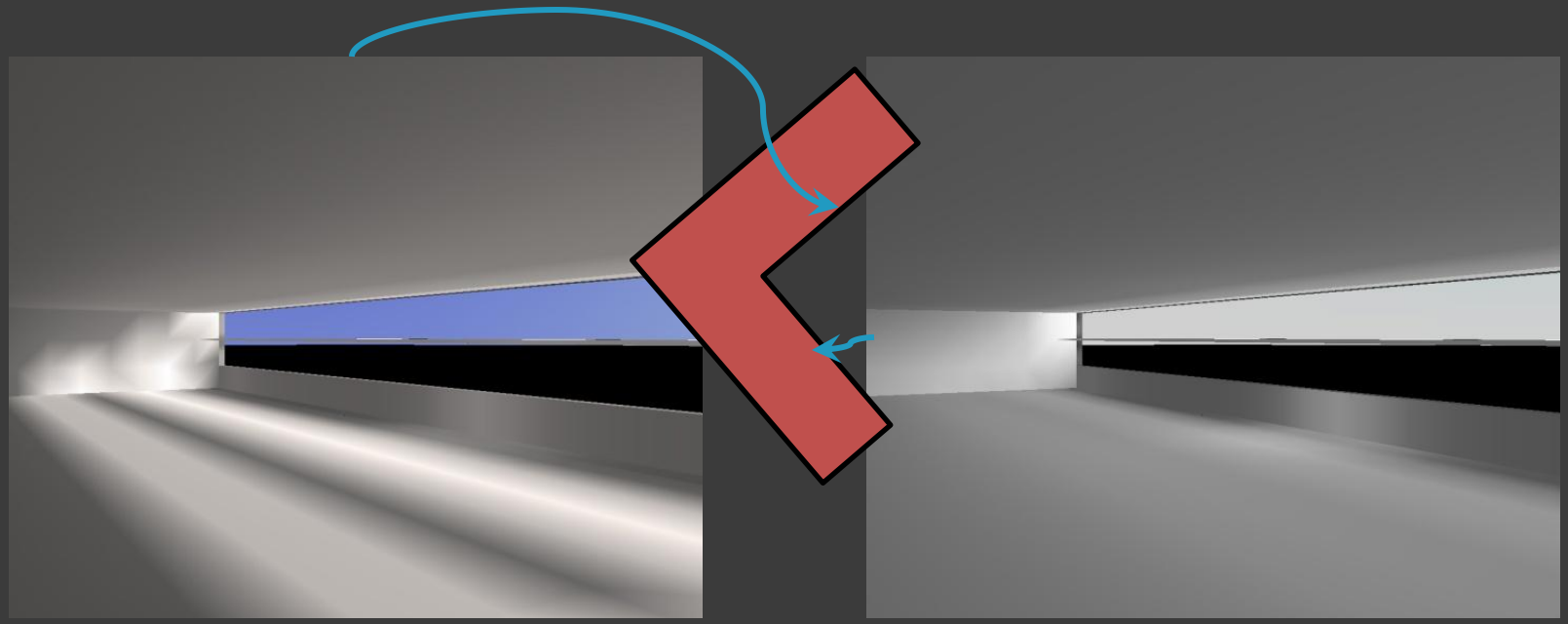


Material Science Corridor

Life Science Corridor

Low Summer Angle Blockage

Light Shelves



Material Science Corridor

Life Science Corridor

Low Winter Angle Blockage

Presentation Overview:

Façade Redesign

Energy Performance

Additional Value Engineering

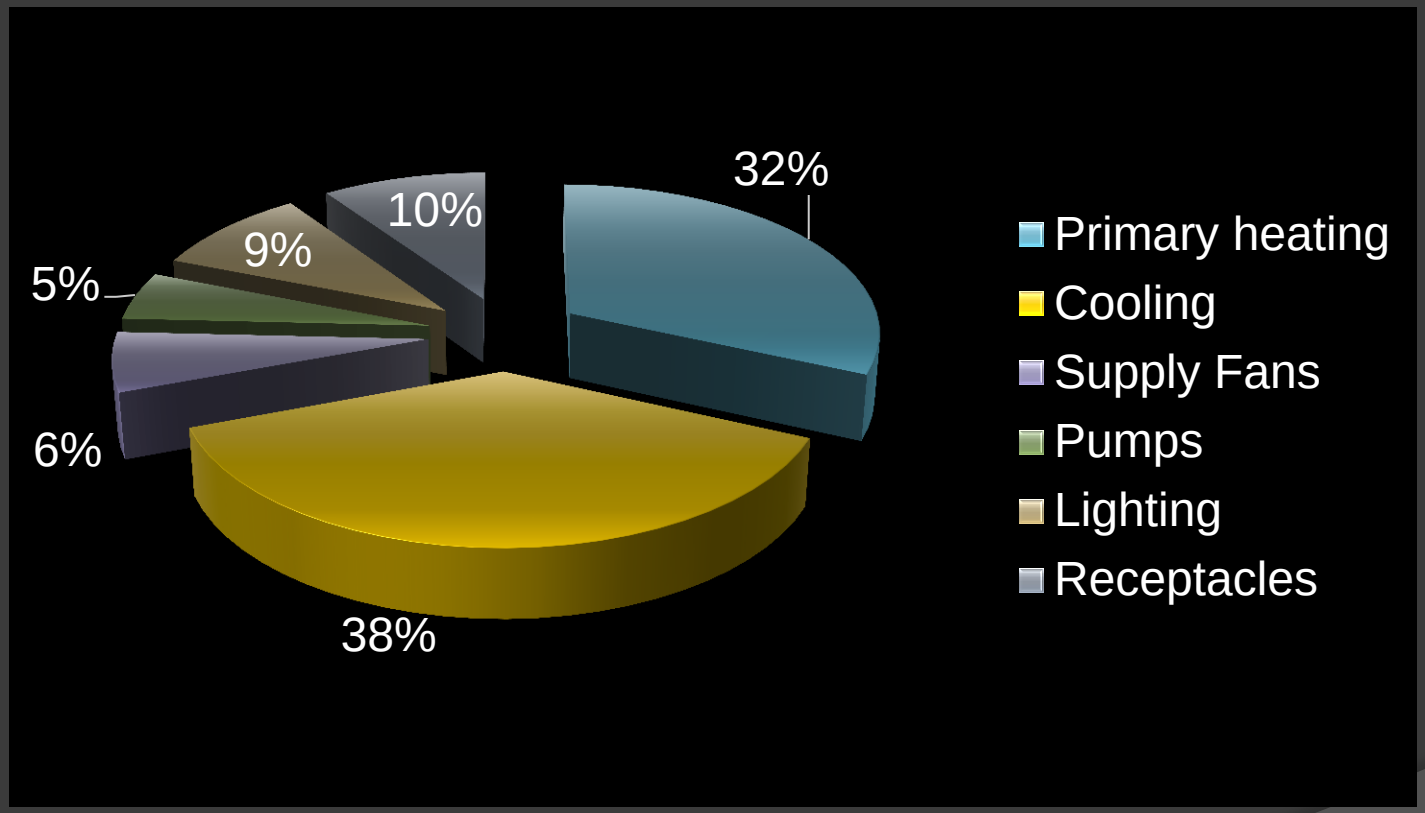
Existing Mechanical System

- (5) 50,000 CFM 100% Outdoor Air AHUs serve laboratory spaces
- (3) 40,000 CFM AHUs serve office and supporting areas
- VAV Air distribution throughout the building
- Use of campus steam and chilled water

Existing Energy Consumption

3rd Floor Energy Data	Existing Design
Electricity (kWh/yr)	684,280
Purchased Chilled Water (therms/yr)	28,705
Purchased Steam (therms/yr)	24,119
Energy Intensity (kBTU/ft^{2-} yr)	172.2
Operating Annual Cost	$123,754

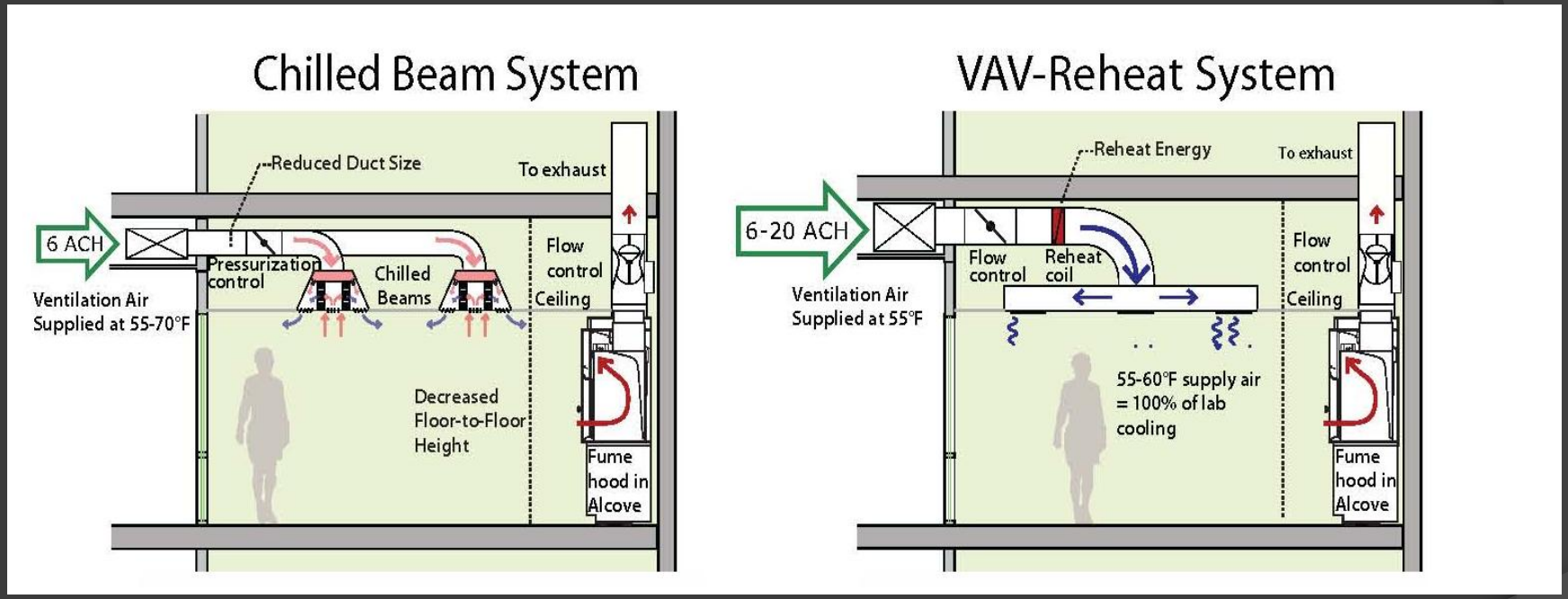
Existing Energy Breakdown



Mechanical System Redesign

- Chilled Beam + DOAS + Radiant Floor Heating
- Chilled Beam and Radiant Floor
  - Sensible Loads
- DOAS
  - Ventilation requirements and latent loads
- Proposed for the office spaces and lab spaces with 2 or less fume hoods

Mechanical System Redesign

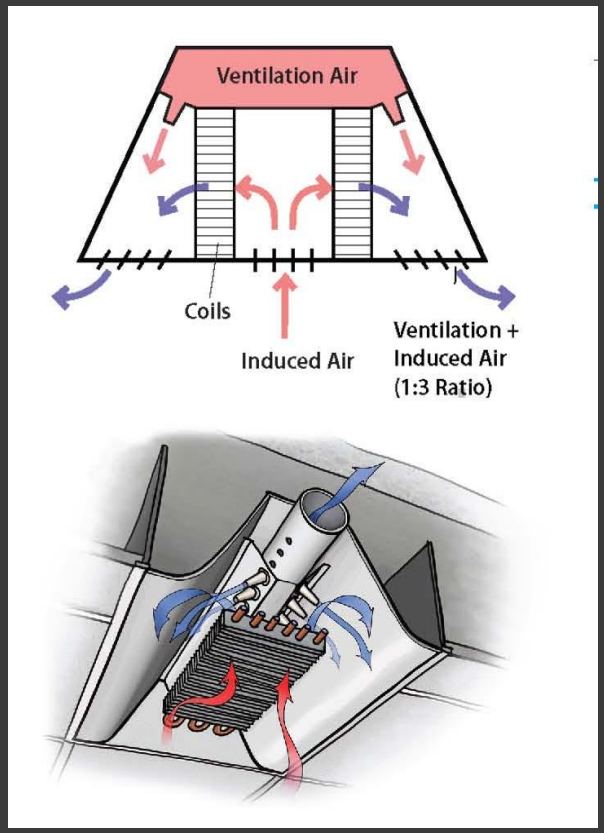


Chilled Beam vs. VAV system. From Labs 21: Chilled Beams in Laboratories

Dedicated Outdoor Air System

- Assures proper ventilation to spaces
  - Little or no IAQ concerns
  - More productive occupants
- Air need for ventilation or latent loads only
  - Smaller duct distribution system
  - Smaller AHUs
- Need for Enthalpy Wheels

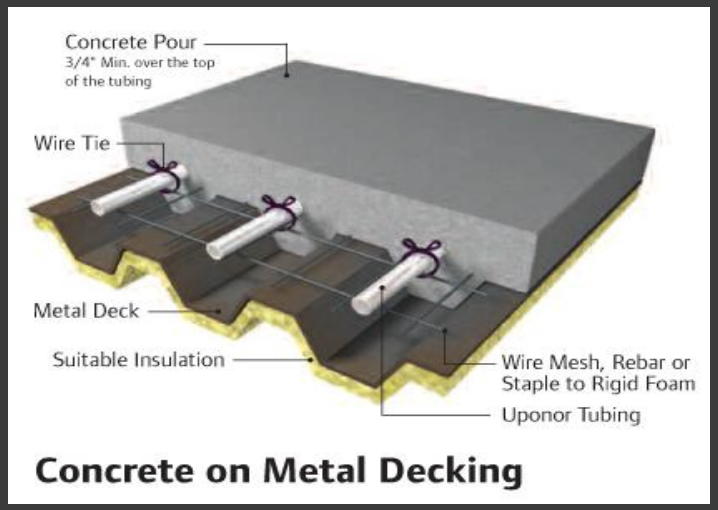
Chilled Beams



Active Chilled Beam. From Labs 21: Chilled Beams in Laboratories

- Active chilled beams
  - Induce room air
  - Mix with ventilation air
  - Air cooled by coils
  - Delivered back into space at desired temperature
- Heat capacity of water greater than air
- Coordination with lighting

Radiant Floor Heating



- Again, water has higher heat capacity than air
  - Energy Savings
  - Smaller equipment
- Heats occupants at occupant level
- Quieter than VAV system
- Structural & Construction coordination

Possible Radiant Floor Section. From uponor-usa.com

Exploratory Mechanical Ideas

- The following ideas may be analyzed, but owner concerns could limit implementation
  - Fume Hood Face Velocity Control
  - FanWall AHUs
  - Expansion of Snow Melt System
  - Ductless Fume Hoods

Fume Hood Face Velocity

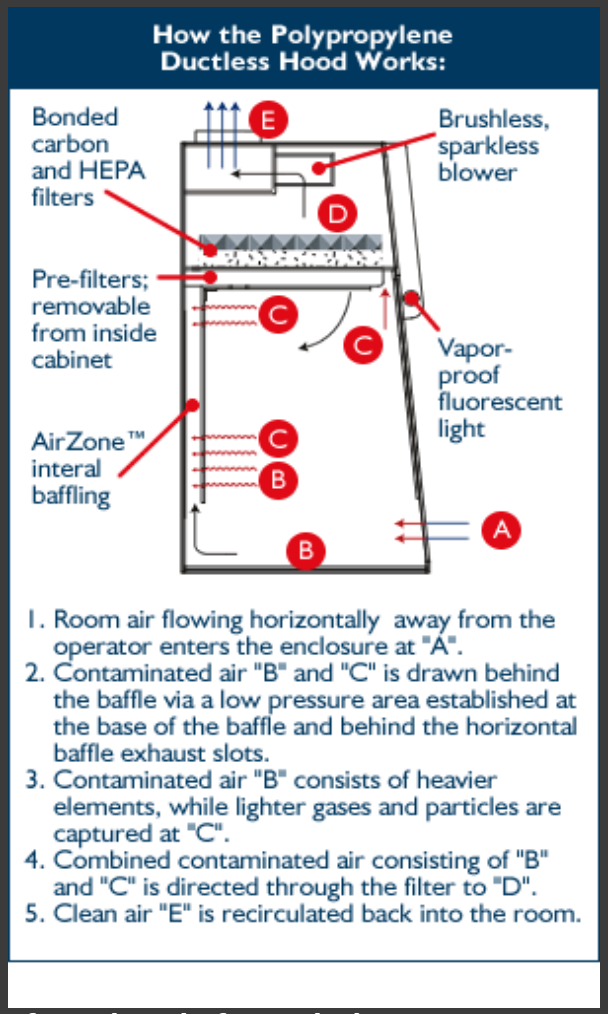
- Reduction of standard face velocity of 100 fpm to 60 fpm
- OSHA Guideline: 60-150 fpm
  - Most systems are designed for 100 fpm
- Research has shown 60 fpm keeps operators safe
- Reductions in air conditioning loads, energy consumption

FanWall AHUs

FanWall AHU

- Smaller footprint
  - Could help coordination issues in 4th floor
- Reduce energy usage
  - Average of 6-10% energy savings
- Less vibration
- Stated owner concerns by engineer

Ductless Fume Hoods



Ductless fume hoods from aircleansystem.com

- Exhaust system operating cost savings
- Exhaust requirements would not drive cooling load
- Concerns regarding filter efficiency and application
- Currently not recommended for use by NIH in research facilities

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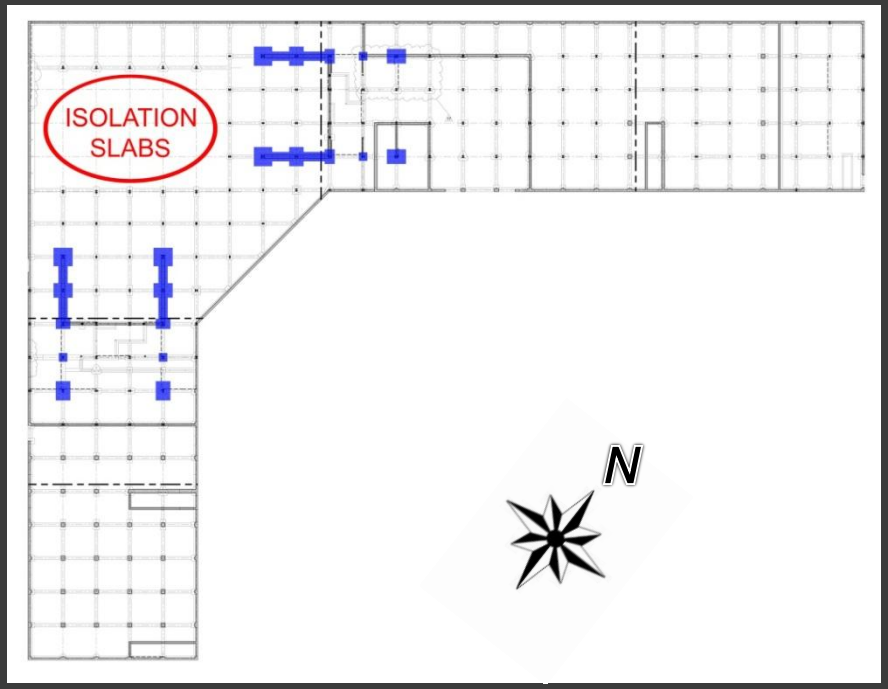
Structural Existing Conditions

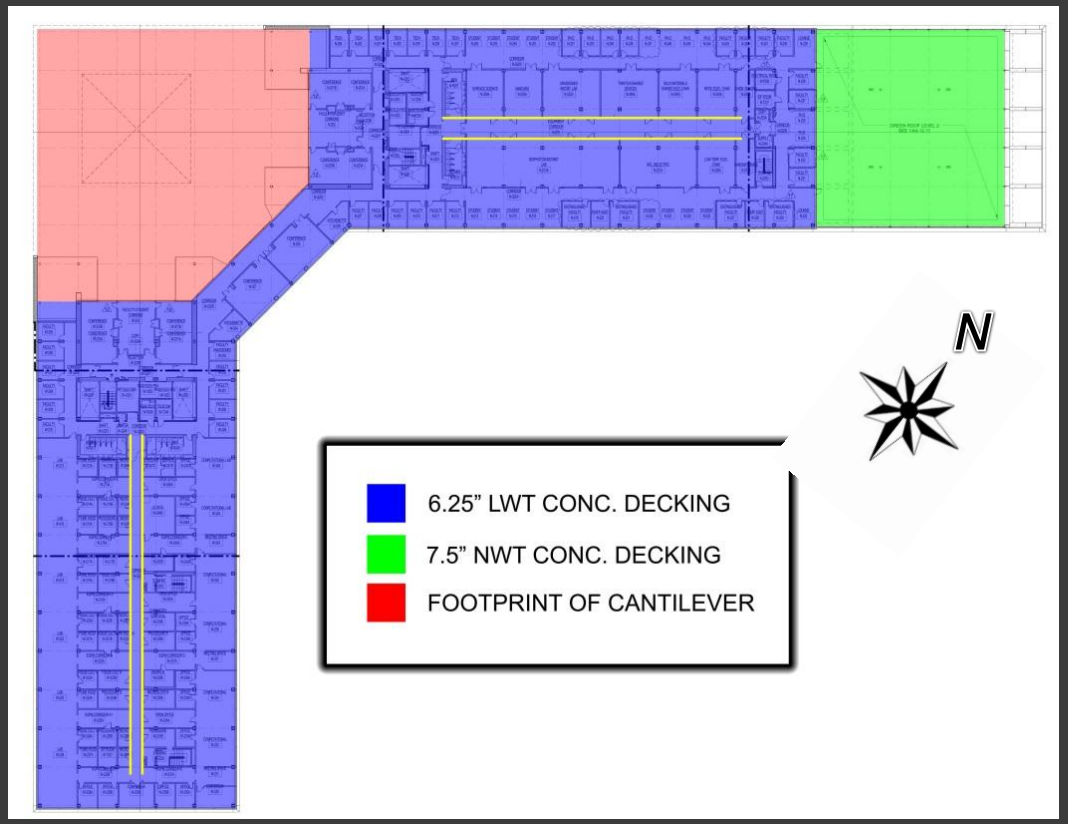
Picture taken by Ryan Solnoski

Structural Existing Conditions



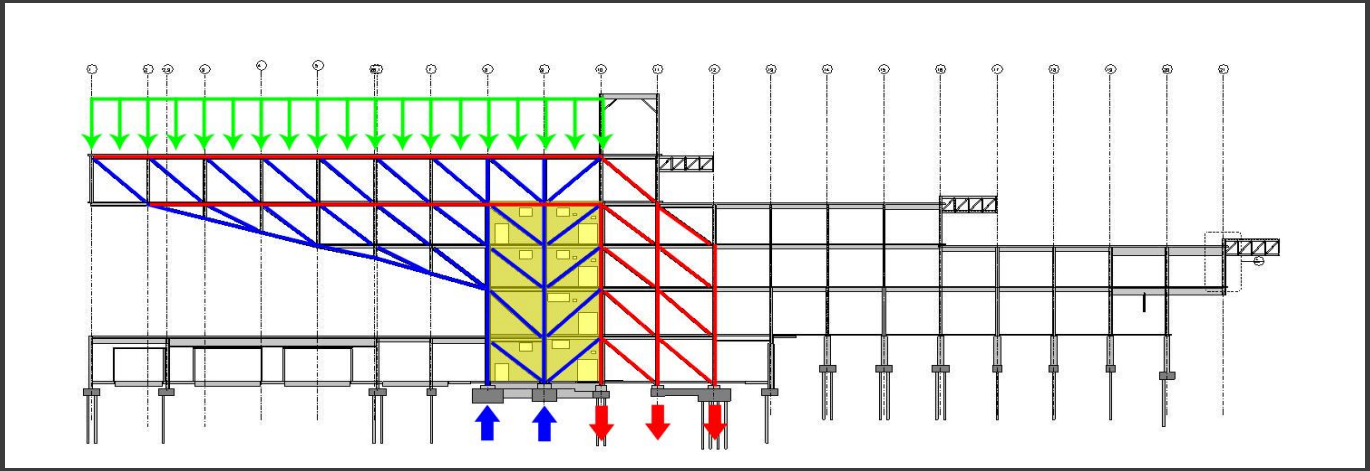
- Three Isolation Labs in Basement
- C-shaped shear walls at the base of cantilever
  - Steel trusses feed into shear walls
- Columns at regularly spaced grid lines
- Enlarged pile caps beyond shear wall

Structural Existing Conditions



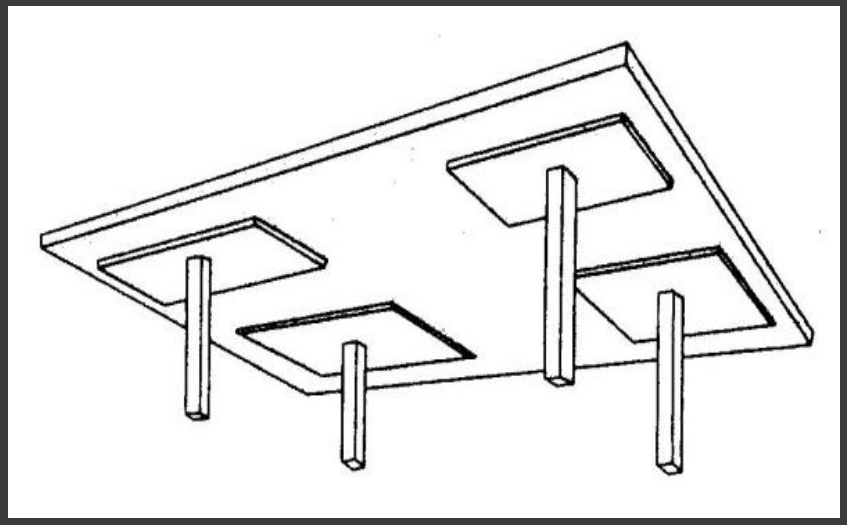
- Typical Floor Layout
  - Concrete on metal decking
  - W21 beams and W24 Girder
  - W14 columns
- Areas of different gravity loads
  - Laboratories and offices
  - Green roof
  - Mechanical Penthouse and entrance below cantilever
- Efficient design

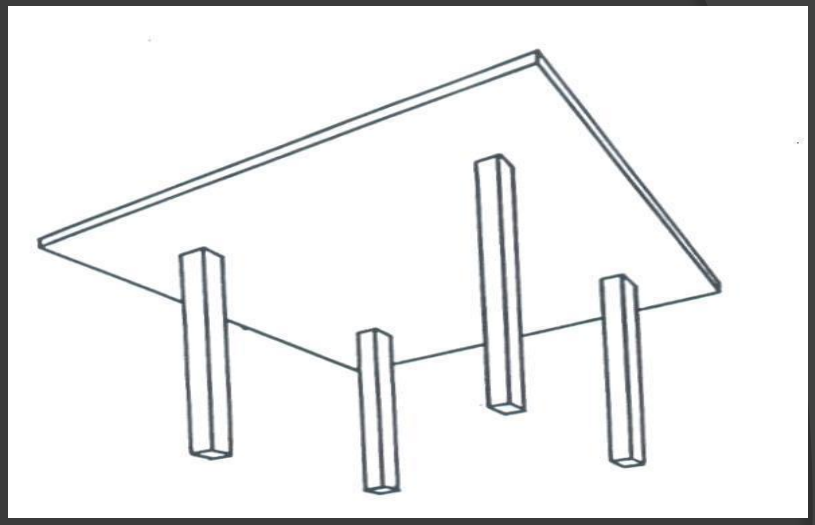
Structural Existing Conditions

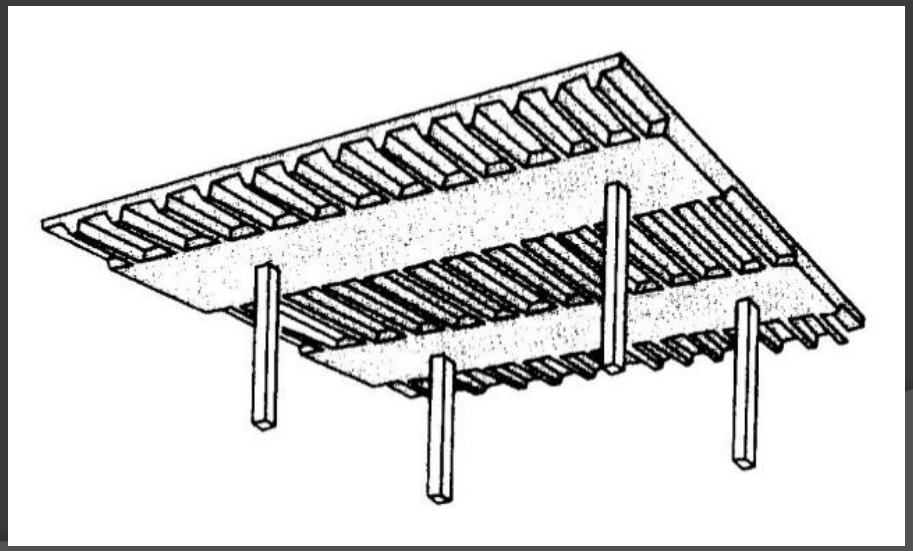


- Steel trusses
  - 4 trusses in total
  - Feed into shear wall
- Overturning moment
  - Trusses extend to grid line 12
  - Enlarged pile caps at base

Reduce Cost: Structural Research

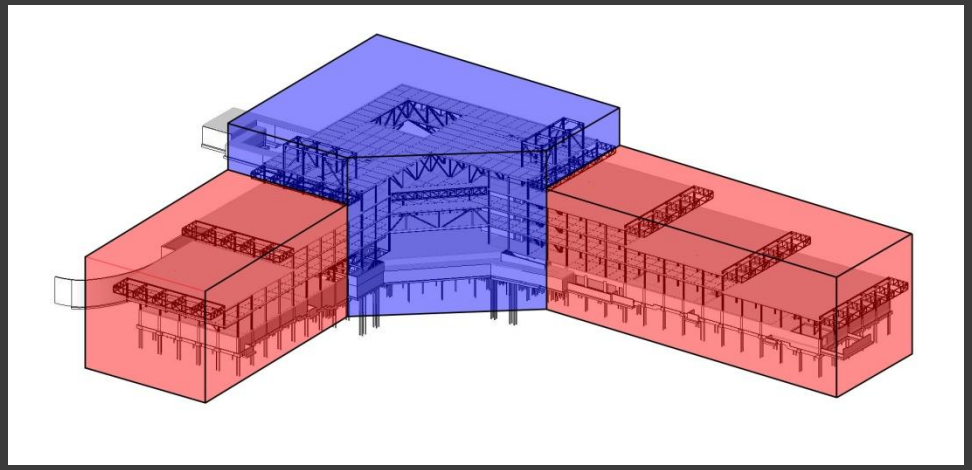




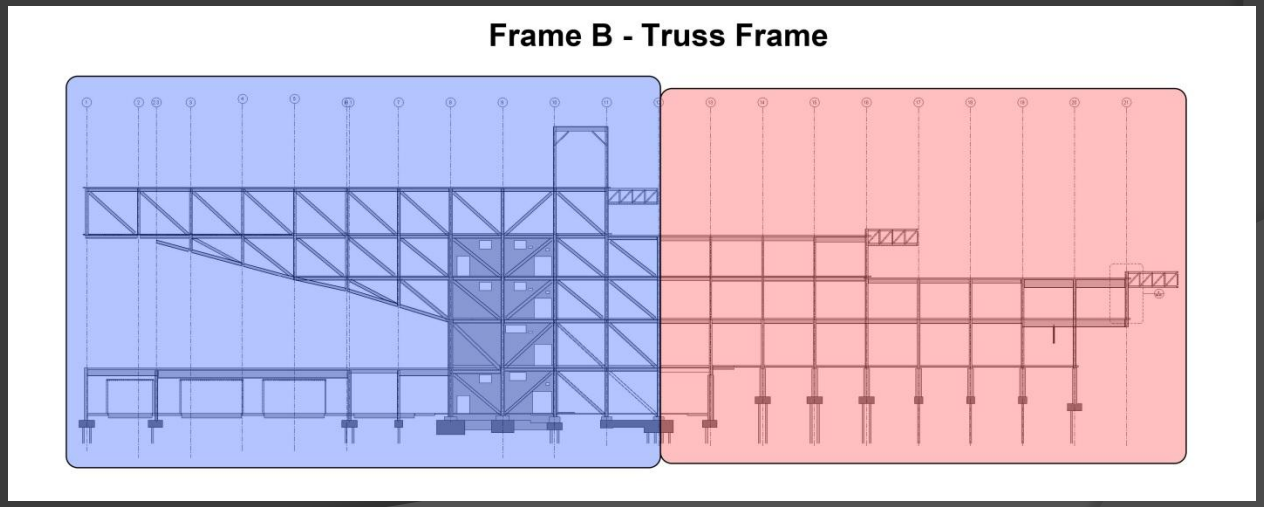


Reduce Cost: Structural Research

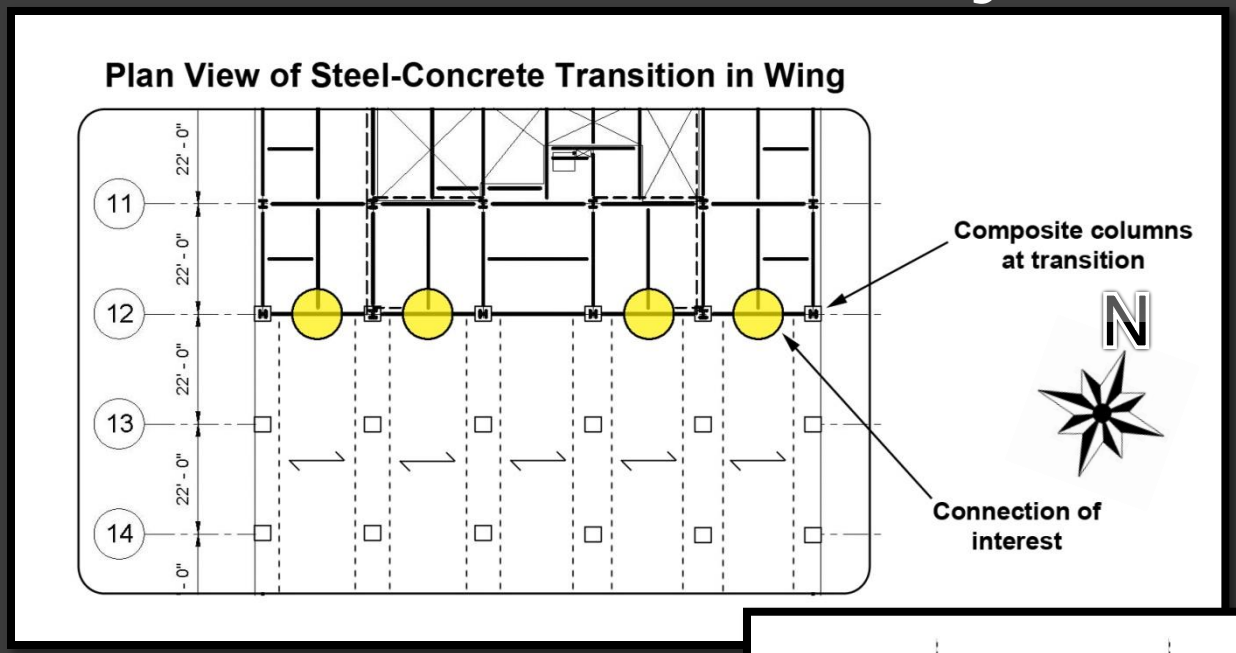
Reduce Cost: The Hybrid



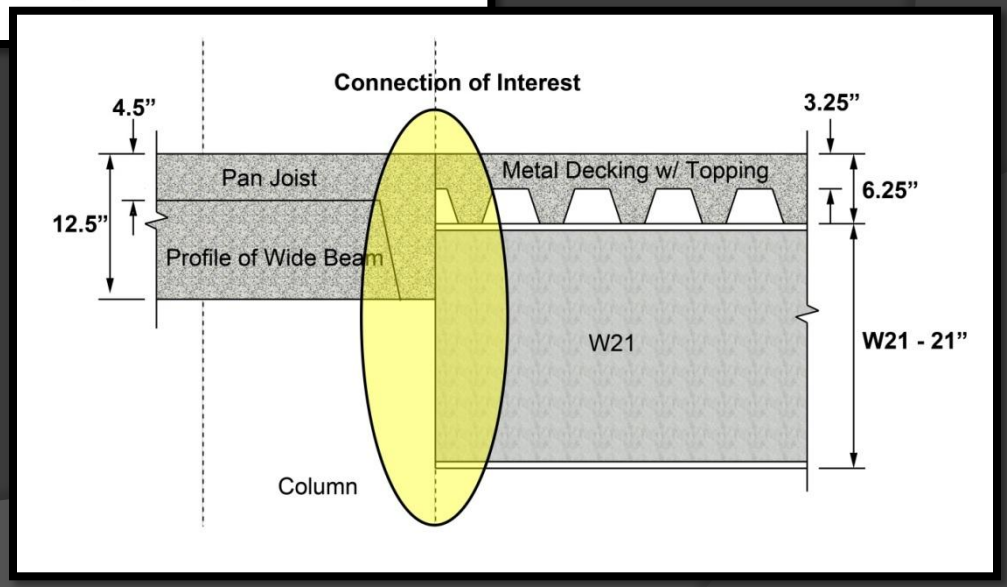
- Division between typical gravity system and special systems



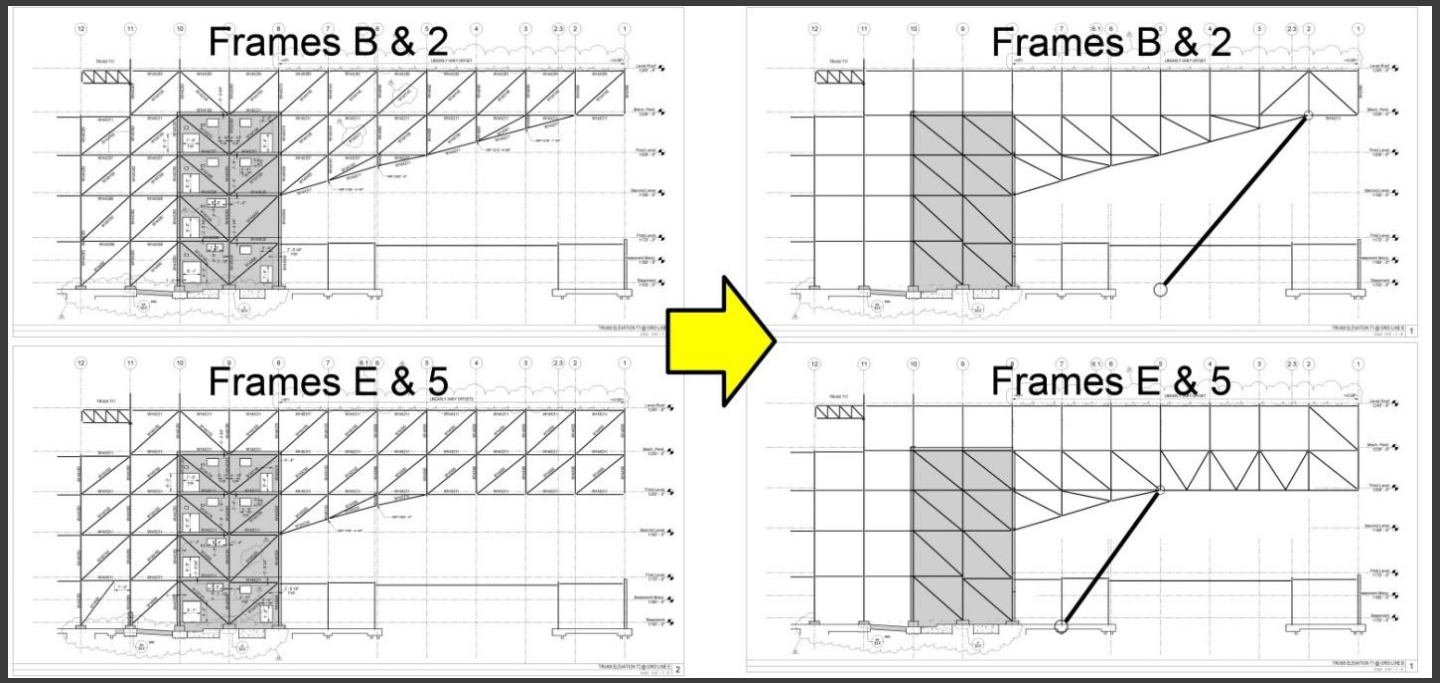
Reduce Cost: The Hybrid



- Continuous floor system
  - Integrate pan joists with steel and composite decking
- Connection issues at transition

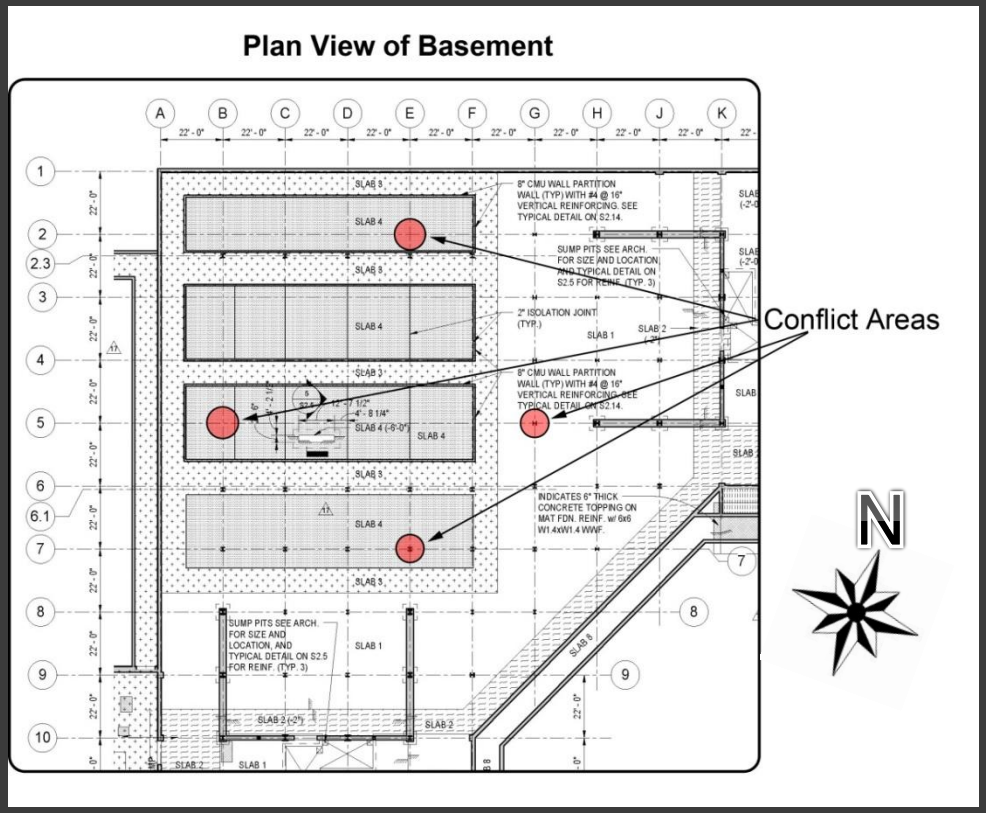


Reduce Cost: The Column



- 1 column at each truss frame
- Induced tension in chords
- Concentration of stresses in 2nd and 3rd floors
- Freeing of space in 4th floor

Reduce Cost: The Column



- Columns enter basement at grid lines
  - Conflict of spaces
  - Isolation labs moved or shrunk
  - Interference of existing beams and columns
- Large connection at foundation
- Potential need for braces

QUESTIONS?