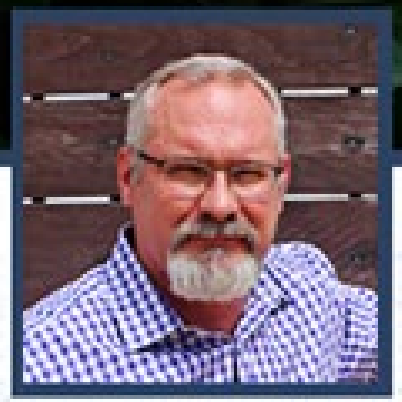


Revolutionizing Building Envelopes

The Evolving Impacts of Willis Carrier's Invention

David Leslie, RWC

President / Building Science at National United Facilities Asset Management

Learning Objectives:

1. Explore how air conditioning changed where we live, work, and how we construct buildings.

2. Develop a better understanding of the building enclosure and the importance of keeping the outside out and the inside in.

3. Delve into the concept of the Three Ps of Continuity.

4. Illustrate how to apply the Three Ps of Continuity to the building enclosure and how it relates, to maximize the benefits of air conditioning and minimize the damage.

Willis Haviland Carrier

July 17, 1902, Carrier developed a system, in response to an air quality problem experienced at the Sackett-Wilhelms Lithographing & Publishing Company in Brooklyn, New York.

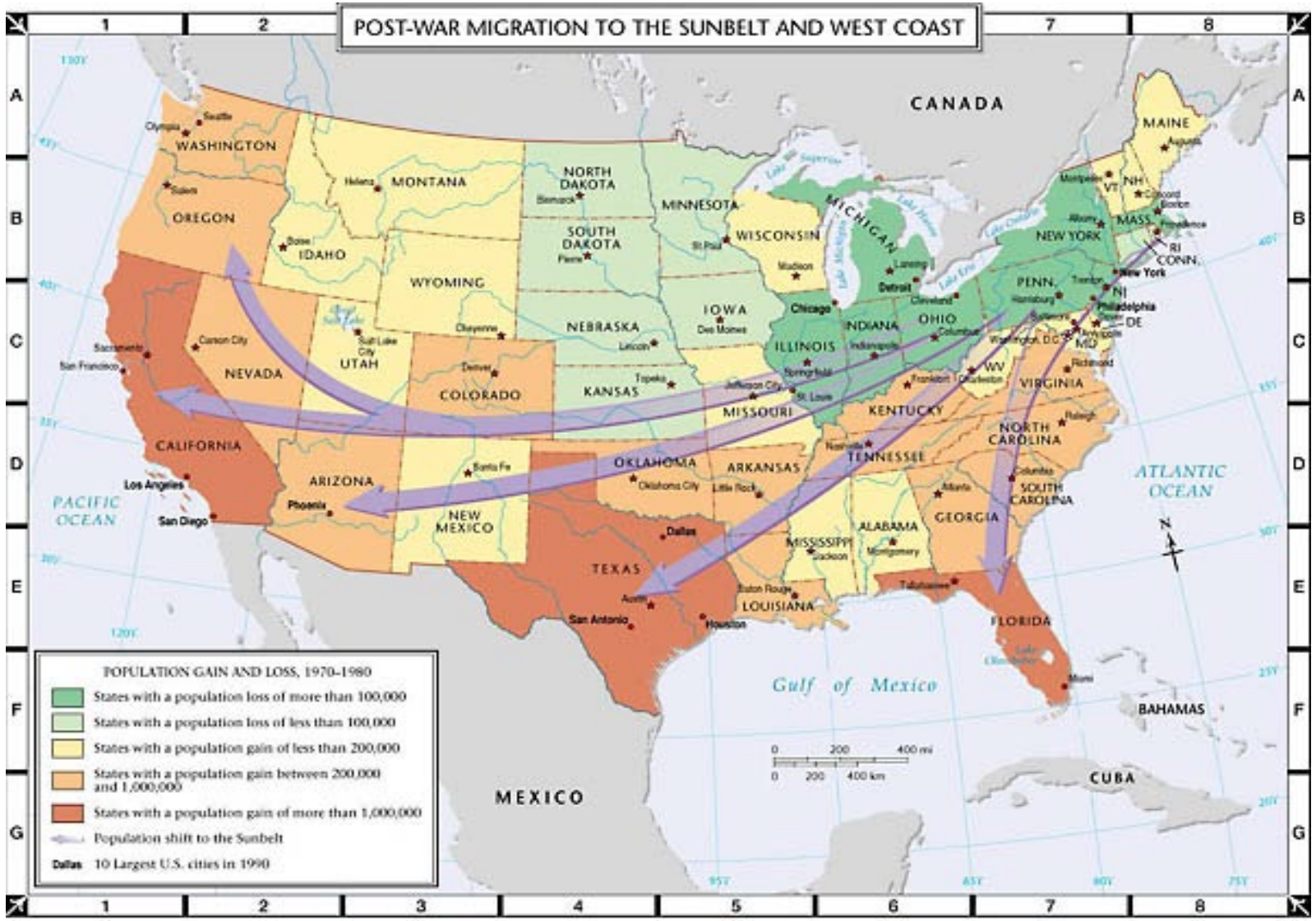
January 2, 1906, Carrier was granted U.S. Patent 808,897

What is Air Conditioning?

The 1902 installation marked the birth of air conditioning because of the addition of humidity control, which led to the recognition by authorities in the field that A/C must perform four basic functions:

1. Control Temperature
2. Control Humidity
3. Control Air Circulation and Ventilation
4. Cleanse the Air

The Sunbelt Migration



Shelter Human Activity…

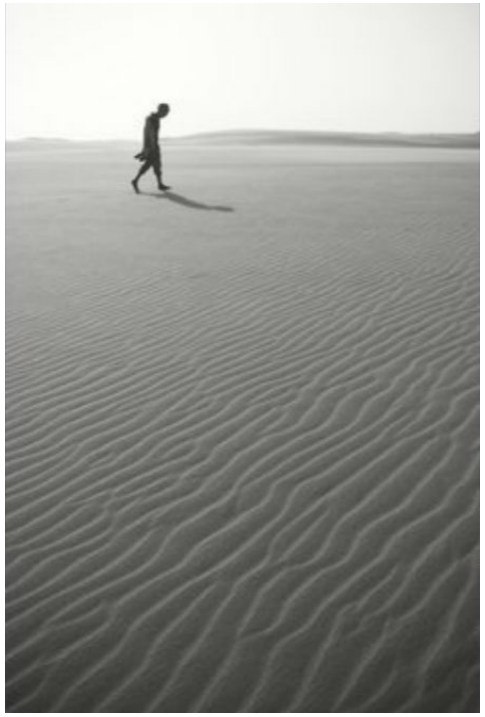
Building:

Keeping the Outside Out!

And the Inside In!

Radiation

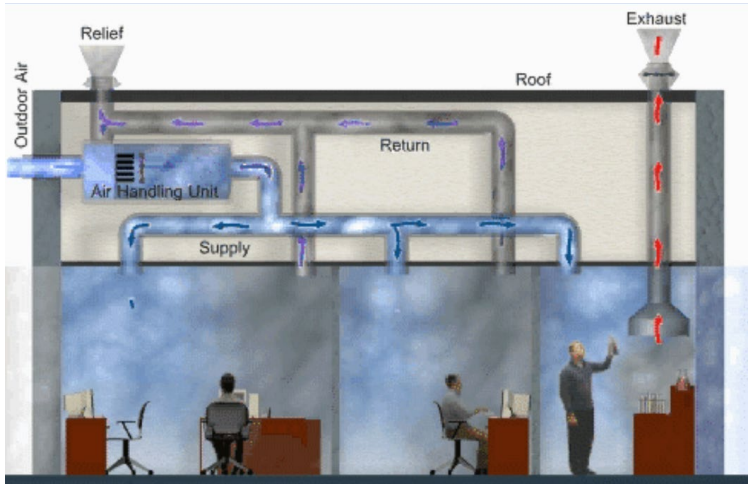
Water



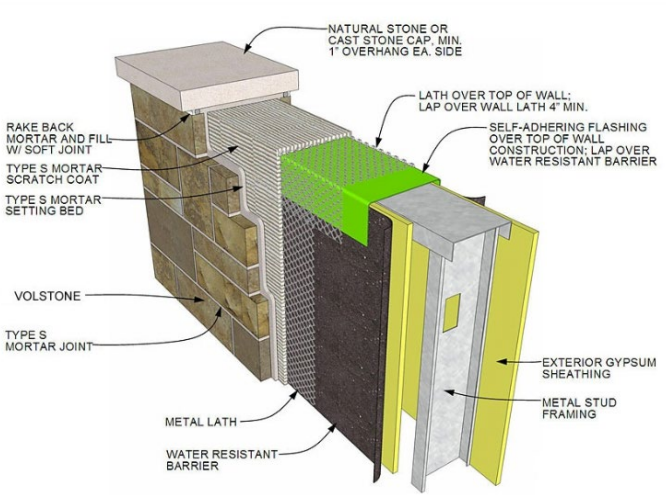
Air

Demand

Expectation



Technology




Continuity

Shocking Truth:

80% of new construction litigation involves water intrusion!

Michael T. Kubal – Construction Waterproofing Handbook

THE MOST IMPORTANT WATERPROOFING PRINCIPLE

Each separate envelope trade contractor's work, regardless of its being thought of as a waterproofing system or not (e.g., exterior mechanical apparatus), must become part of a totally watertight building envelope. Equally important, all individual envelope systems must be adequately transitioned into other components or provided with watertight terminations. Often the tradesworkers completing this work are not aware of, trained in, or supervised in enveloping a building properly. And this is the number one cause of water infiltration in all types of structures.

The resulting improper attention to details is responsible for countless problems in construction. Properly detailing a building's envelope presents an enormous task. From inception to installation, numerous obstacles occur. Highlighting this interrelationship of

The 90%/1% principle: 90 percent of all water intrusion problems occur within 1 percent of the total building or structure exterior surface area.

detailing, as discussed previously with Fig. 1.9. This 1 percent area all too frequently leads

Transitions

Penetrations

Terminations


Polyguard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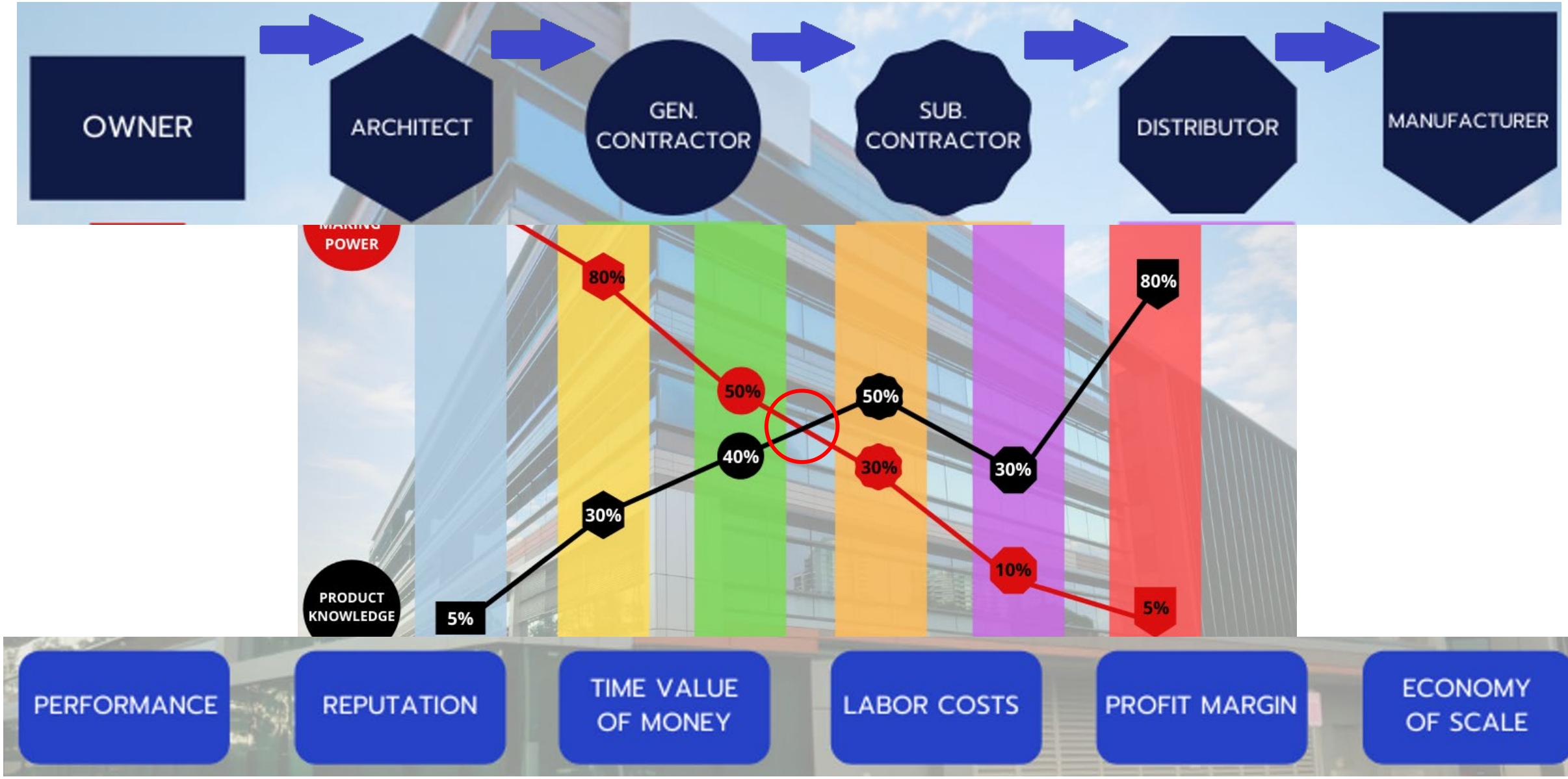
Power vs. Knowledge – New Buildings



Three Ps of Continuity:

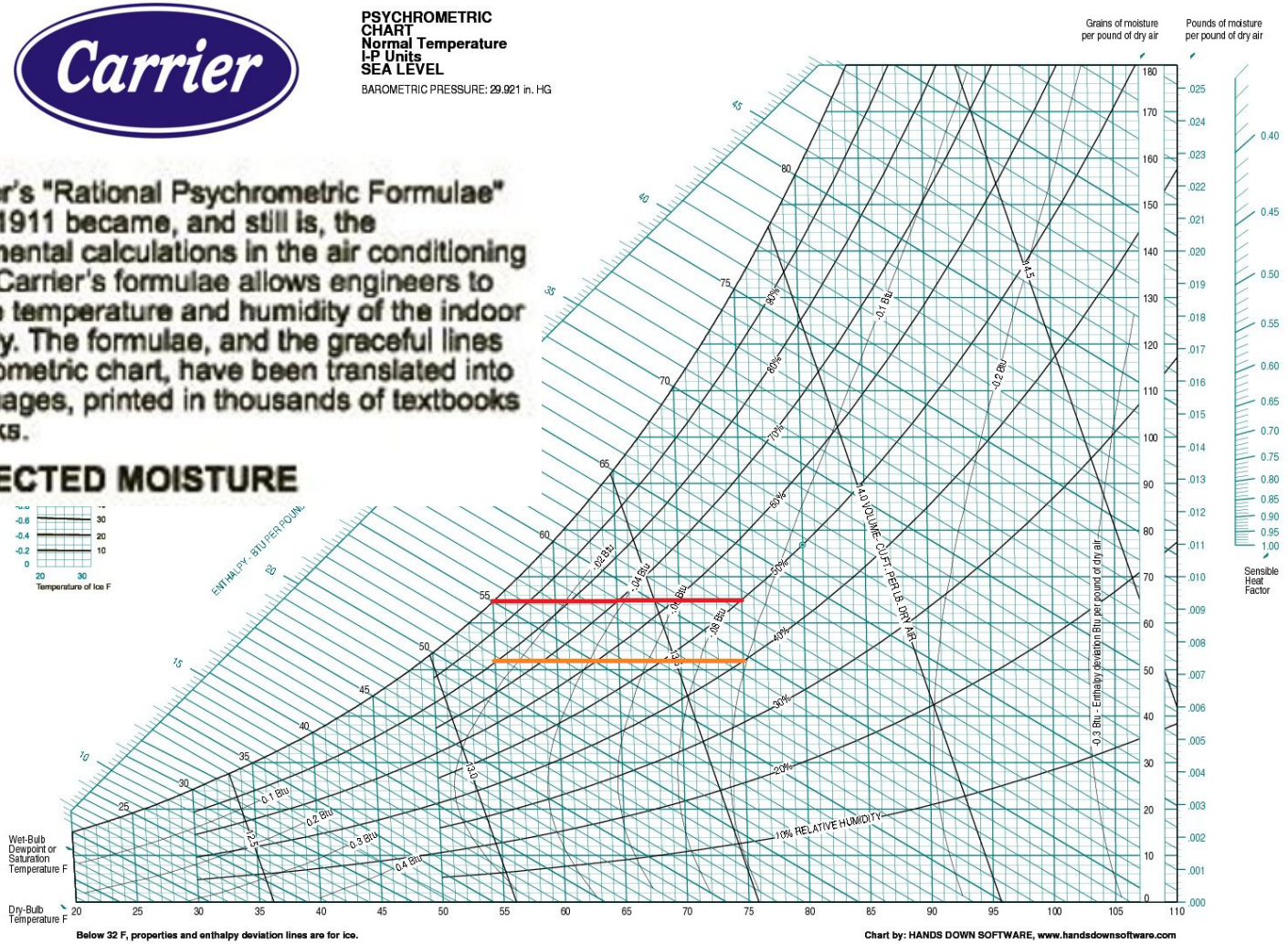
Principle:

The set of truths that apply to the subject being managed.

Psychrometric Scale:

Dr. Willis Haviland Carrier's "Rational Psychrometric Formulae" presented December 3, 1911 became, and still is, the cornerstone of all fundamental calculations in the air conditioning industry. Understanding Carrier's formulae allows engineers to precisely control both the temperature and humidity of the indoor air that surrounds us daily. The formulae, and the graceful lines they trace on the psychrometric chart, have been translated into most of the world's languages, printed in thousands of textbooks and engineers' handbooks.

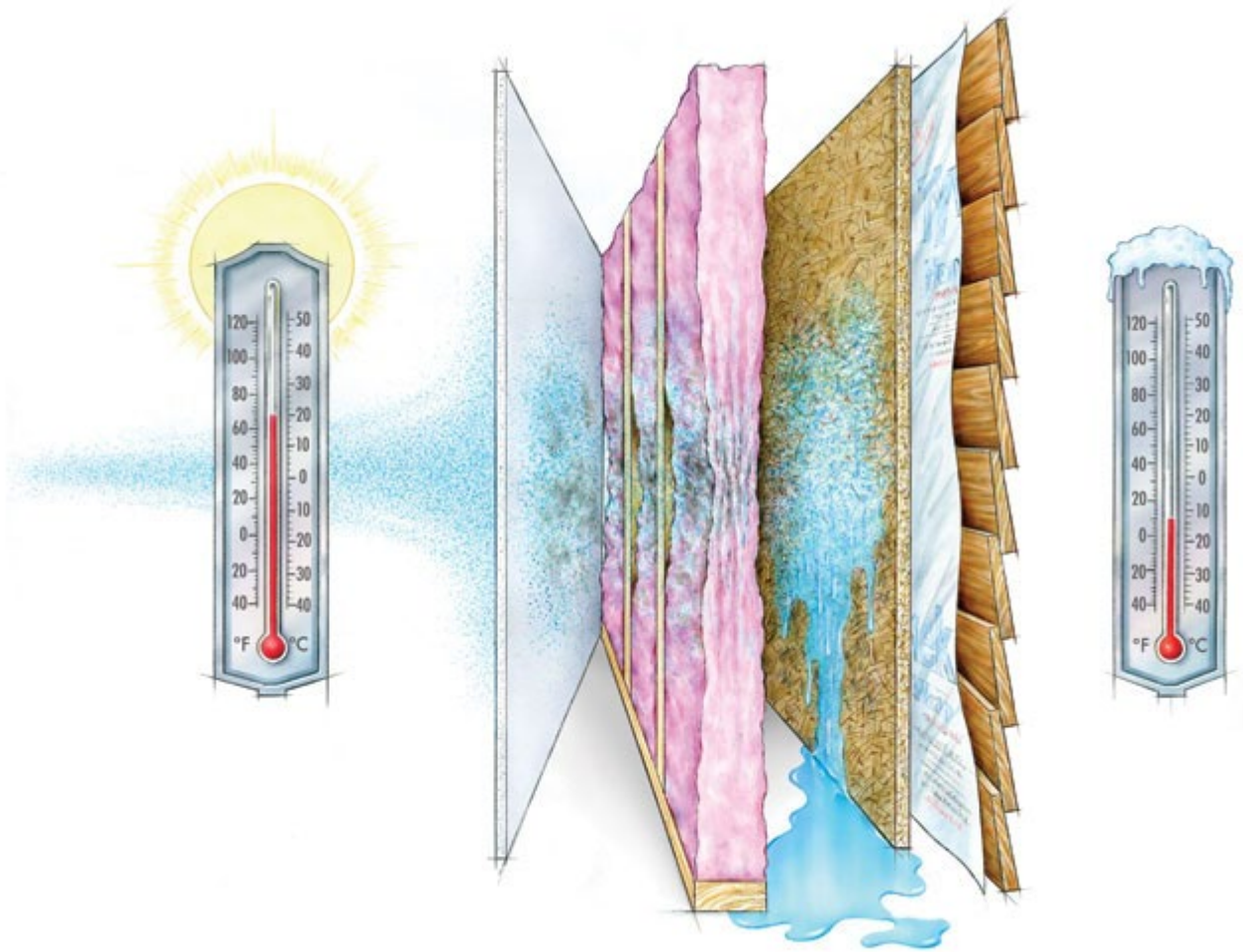
ENTHALPY OF ADDED OR REJECTED MOISTURE



Simple Dew Point:

	Ambient Air Temperature - Fahrenheit										
Relative Humidity %	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**110**	**120**
90	18	28	37	47	57	67	77	87	97	107	117
85	17	26	36	45	55	65	75	84	95	104	113
80	16	25	34	44	54	63	73	82	93	102	110
75	15	24	33	42	52	62	71	80	91	100	108
70	13	22	31	40	50	60	68	78	88	96	105
65	12	20	29	38	47	57	66	76	85	93	103
60	11	19	27	36	45	55	64	73	83	92	101
55	9	17	25	34	43	53	61	70	80	89	98
50	6	15	23	31	40	50	59	67	77	86	94
45	4	13	21	29	37	47	56	64	73	82	91
40	1	11	18	26	35	43	52	61	69	78	87
35	-2	8	16	23	31	40	48	57	65	74	83
30	-6	4	13	20	28	36	44	52	61	69	77

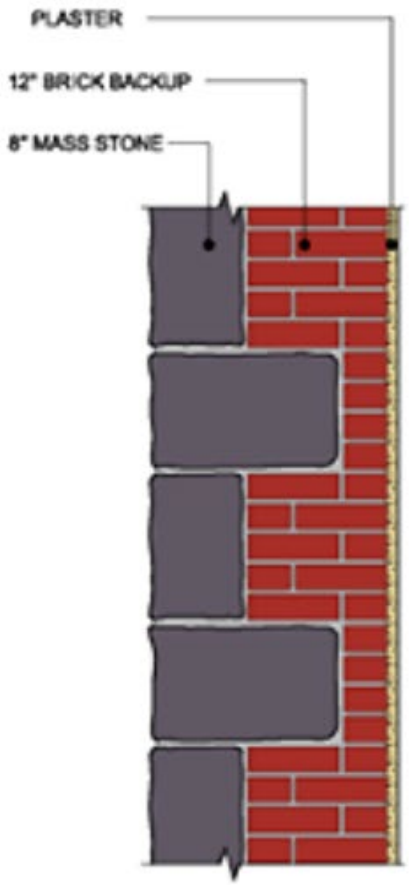
Direction that moisture travels:



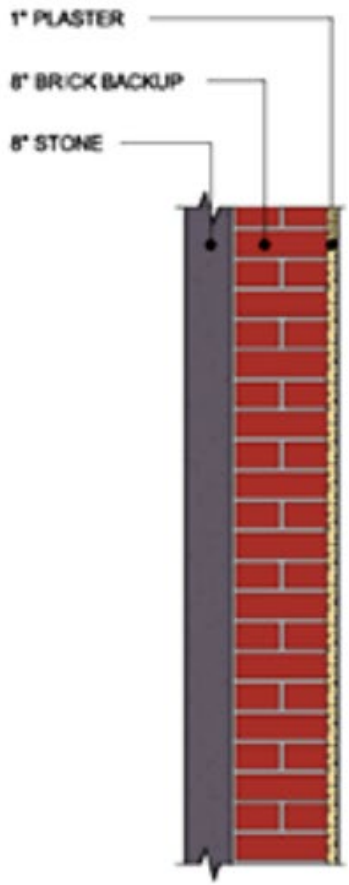
Not aligned with the Principle:

Process:

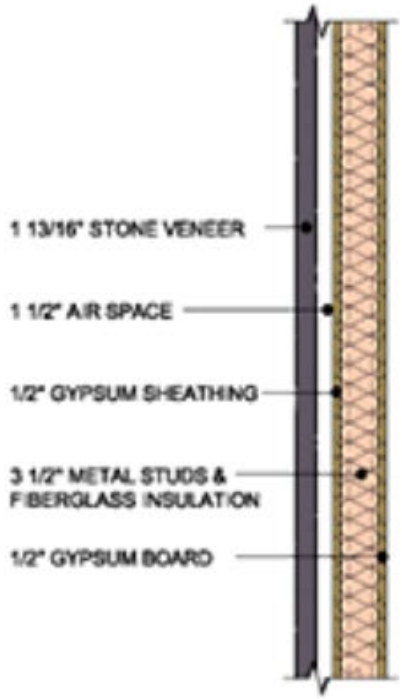
The set of activities that apply to the subject being managed.



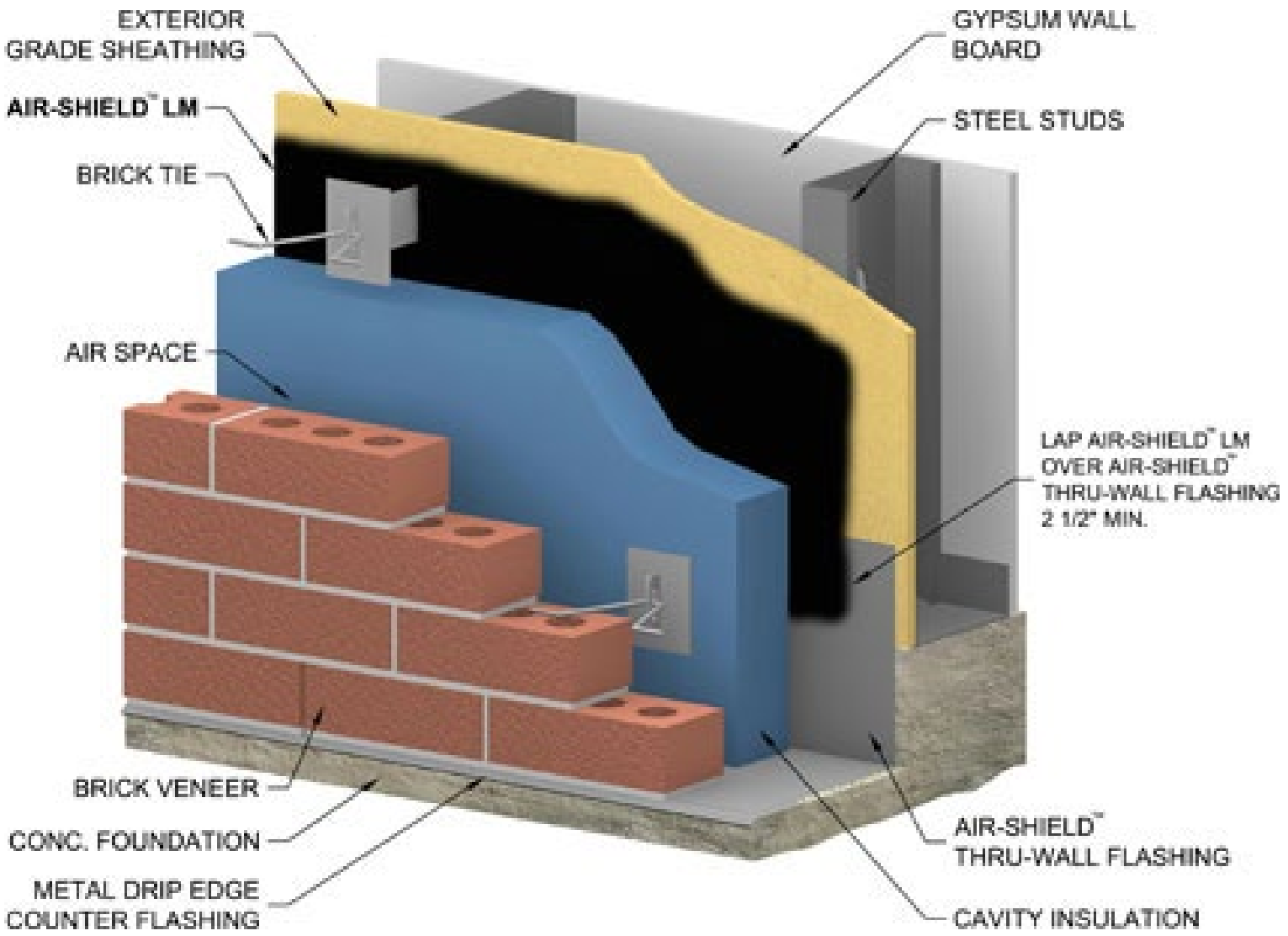
STONE BEARING WALL 1800



STONE CURTAIN WALL 1932

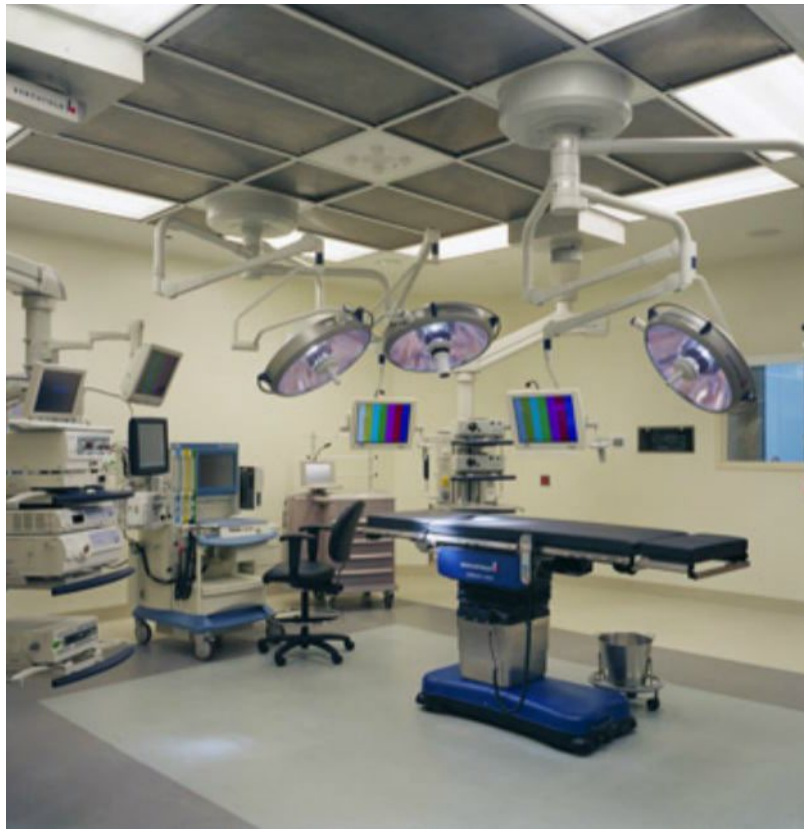


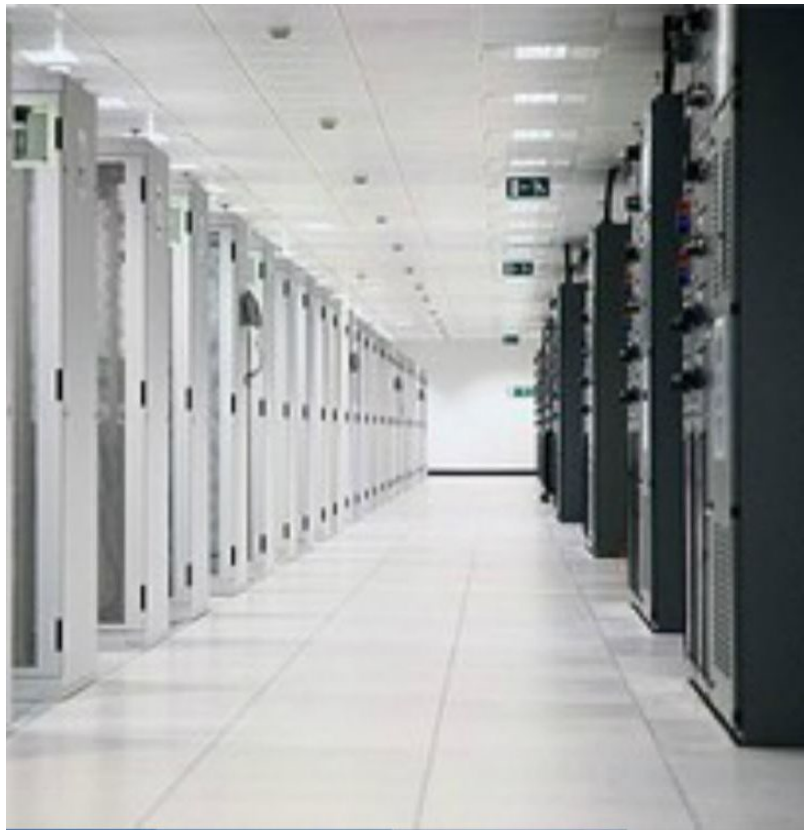
STONE VENEER CURTAIN WALL 200

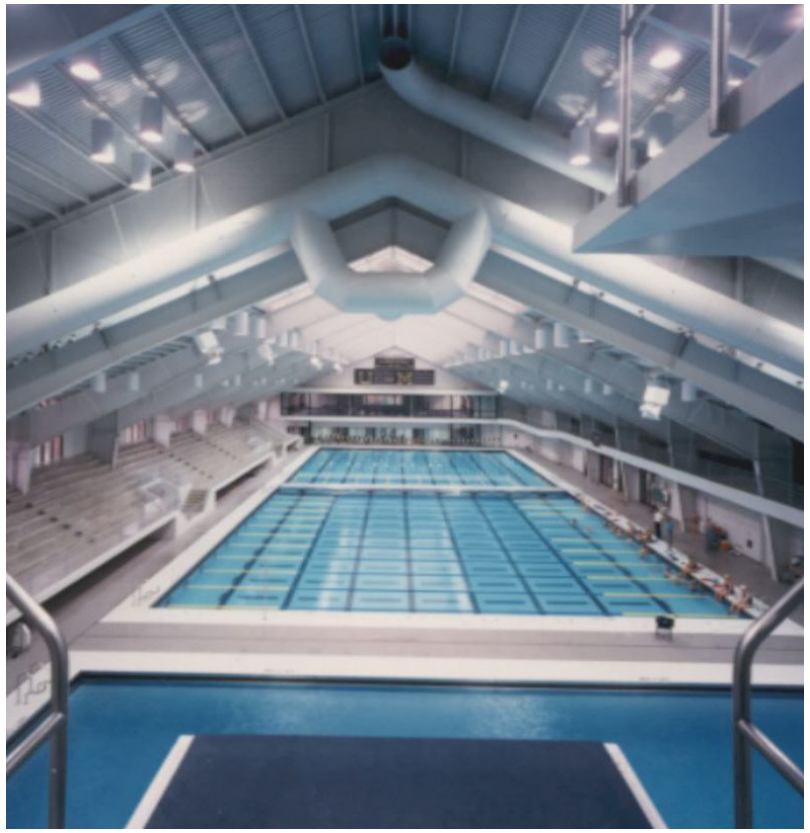

EXTERIOR
GRADE SHEATHING
AIR-SHIELD™ LM
BRICK TIE
AIR SPACE
BRICK VENEER
CONC. FOUNDATION
METAL DRIP EDGE
COUNTER FLASHING
GYPSUM WALL
BOARD
STEEL STUDS
LAP AIR-SHIELD™ LM
OVER AIR-SHIELD™
THRU-WALL FLASHING
2 1/2" MIN.
AIR-SHIELD™
THRU-WALL FLASHING
CAVITY INSULATION

Property:

The set of elements that apply to the subject being managed.





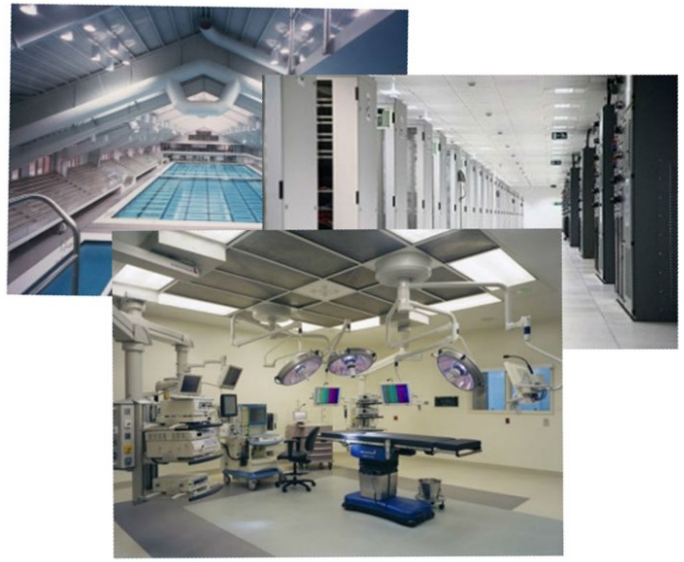


Where and How it is Usage

Composition

Lifecycle

Usage



Composition

Lifecycle

Sustainability

What does this mean for Existing Building?

Ownership

The building's purpose is shelter, but we build them for financial gain. If it loses its purpose, it loses its value both today and into the future.

Asset Manager

Managing a portfolio is about ROI, but timing is critical. If funds are not directed timely and appropriately, revenue is lost today, with equity being lost into the future.

Property Manager

A property is a mirror, but help is needed for a clear reflection. If the appropriate resources are not available now and for the long term, a property loses its luster.

Facility Engineer

The building is a calling, but the right tools make any job easier. If the job can’t be done efficiently, it typically can’t be done correctly.

What does this mean for Existing Building?

Board of Trustees

The building's purpose is shelter, but we build them for financial gain. If it loses its purpose, it loses its value both today and into the future.

Vice Chancellor of Facilities

Managing a campus is about ROI, but timing is critical. If funds are not directed timely and appropriately, revenue is lost today, with equity being lost into the future.

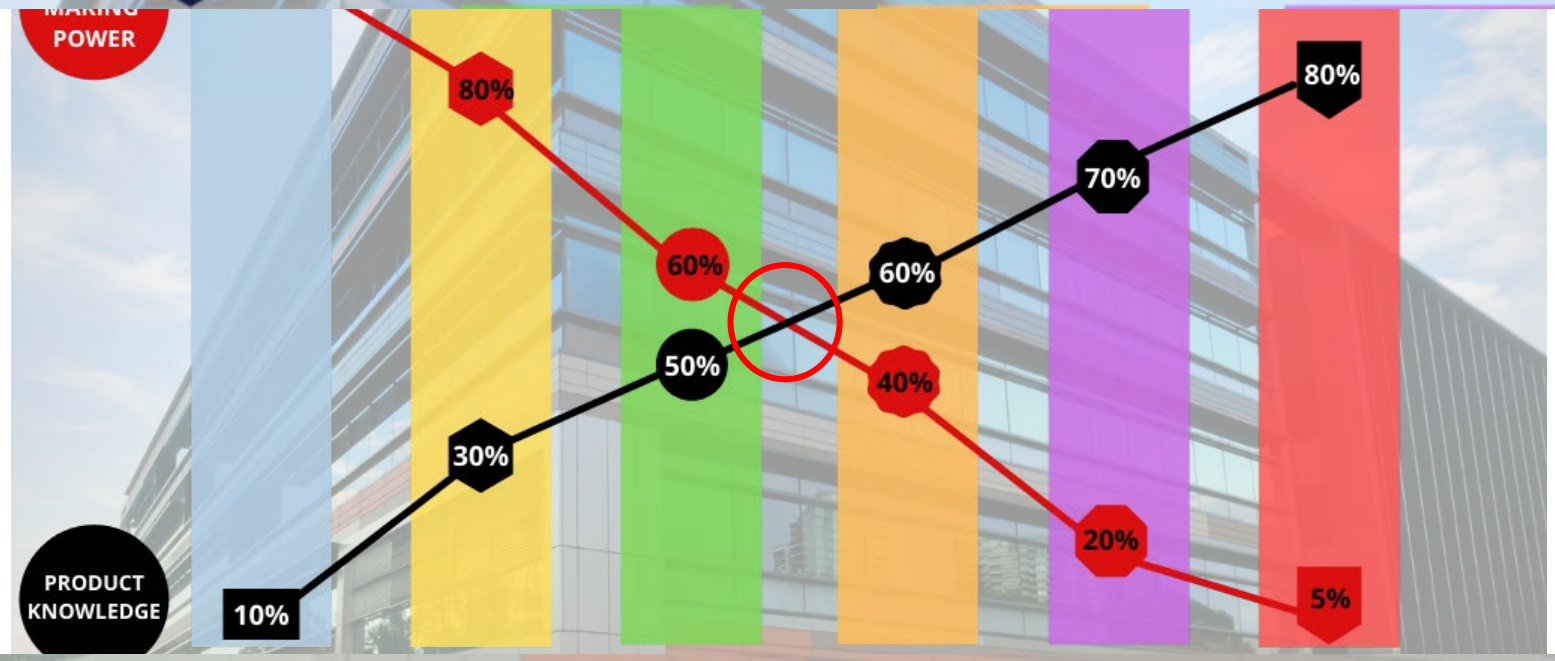
Physical Plant

The facilities are a mirror, but help is needed for a clear reflection. If the appropriate resources are not available now and for the long term, a things stop working.

Facility Engineer

The building is a calling, but the right tools make any job easier. If the job can’t be done efficiently, it typically can’t be done correctly.

Power vs. Knowledge – Existing Buildings



Vast majority of Intrusion…

is not puddles on the floor!

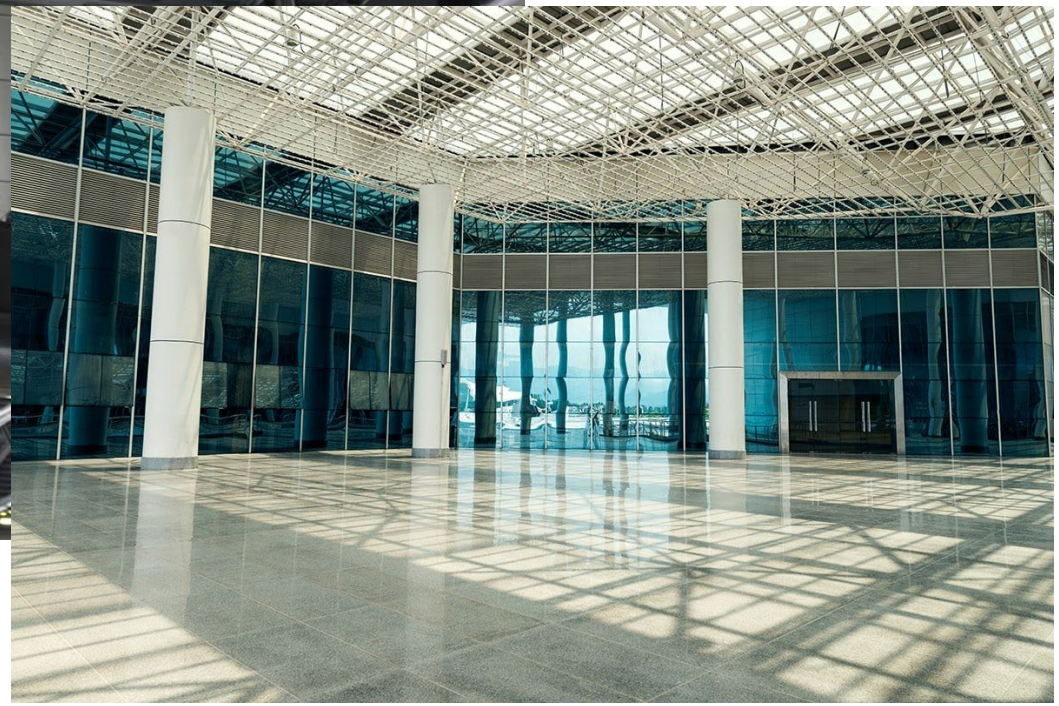
Yesterdays Building Envelope…

is not Today's Building Envelope!

Tomorrow's Building Envelope…

is the whole building!

Building Enclosure leaks…



have hidden costs!

The Fatal Funnel:

- *Non-revenue generating space*
- *Reduction in Maintenance Funds*
- *Inefficient building and systems*
- *Mold and sick building syndrome*
- *Expensive emergency repairs*
- *Devaluation of the property*

This is…

preventable.

David Leslie, RWC
President

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dl@nu-fam.com

469-449-3393

air barrier
abaa
association of
america