

Roofs and Pressures - Learning From Mistakes to Prevent in the Future

Summer Camp - 2023



Speaker:

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Topics

- Concrete Roof Decks and Moisture – Surprise Still Wet...
 - Still having problems and Solutions
- Vapor Retarders...Stick the Landing
- Dry a Wet Roof???...Yes
- Cold Roof Decks and Moisture – Just get a Lawyer
- Prefabricated Metal Buildings – Feel the Pressure
- Cold Storage Roofs - Don't get it backwards
- Low Rise Adhesive Foam - Mixology

Concrete Roof Decks and Moisture

- Problems have been on the Technical “radar” for over a decade now
- Lots of research and product development have been done
- Presented Summer Camp 2017
- There still is no magic bullet
- Concrete roof decks are poured with moisture...but
 - Problem is dew, frost, snow, rain and other sources of exterior moisture
 - Leaky roofs have also been identified as issues in rewetting old concrete roof decks
- Light weight structural is still of more concern than regular weight structural

Concrete Roof Decks and Moisture

- When possible, always use coated glass facers over paper faced polyisocyanurate
 - ASTM C1289 – Type II, Class 2
 - Honey Badger Don't Give a _____ (coated glass can take moisture)
- Never use water based anything when concrete is involved
- Vapor retarders are your friends over concrete
 - 2-ply BUR still very good choice [fast][cold weather adaptable]
 - Cold adhesives can be ridiculously strong!
- Venting is possible
 - Manufacturer specific
 - “suck down” systems are typically used

Concrete Roof Decks and Moisture

- Light weight insulating concrete has been used successfully
 - It is an option, but it needs to be vented
- No approved or accepted test for concrete moisture outdoors
 - Hand held meters are great for acceptance of the concrete surface being dry
- Surface profile should be specified and accepted based on ICRI profiles
 - <https://store.icri.org/tag/surface-profile-chips>
- Lots of legal potholes and traps...good contracts and proposal provisions are key

Concrete Roof Decks and Moisture

- Many articles available
- National Roofing Contractors Association (NRCA) is a hub of articles and warnings on this
- Each manufacturer has recommendations and systems they prefer to use over concrete...ask

Vapor Retarders for Concrete Roofs

Vapor Retarders for Concrete Roofs

- Research showed that a strong vapor retarder was the most expedient and cost-effective option.
- Questions and issues were raised with vapor retarder adhesion and long-term vapor pressure exposure.
 - Real, mobilized and measurable force on the “wet” side.
- 2018 testing at SRI showed that an ASTM D41 Primed concrete deck with a torch applied SBS modified bitumen peeled “like a post-it note” after 1 year
 - YIKES!
 - This was assumed to be the gold standard of bonding to concrete



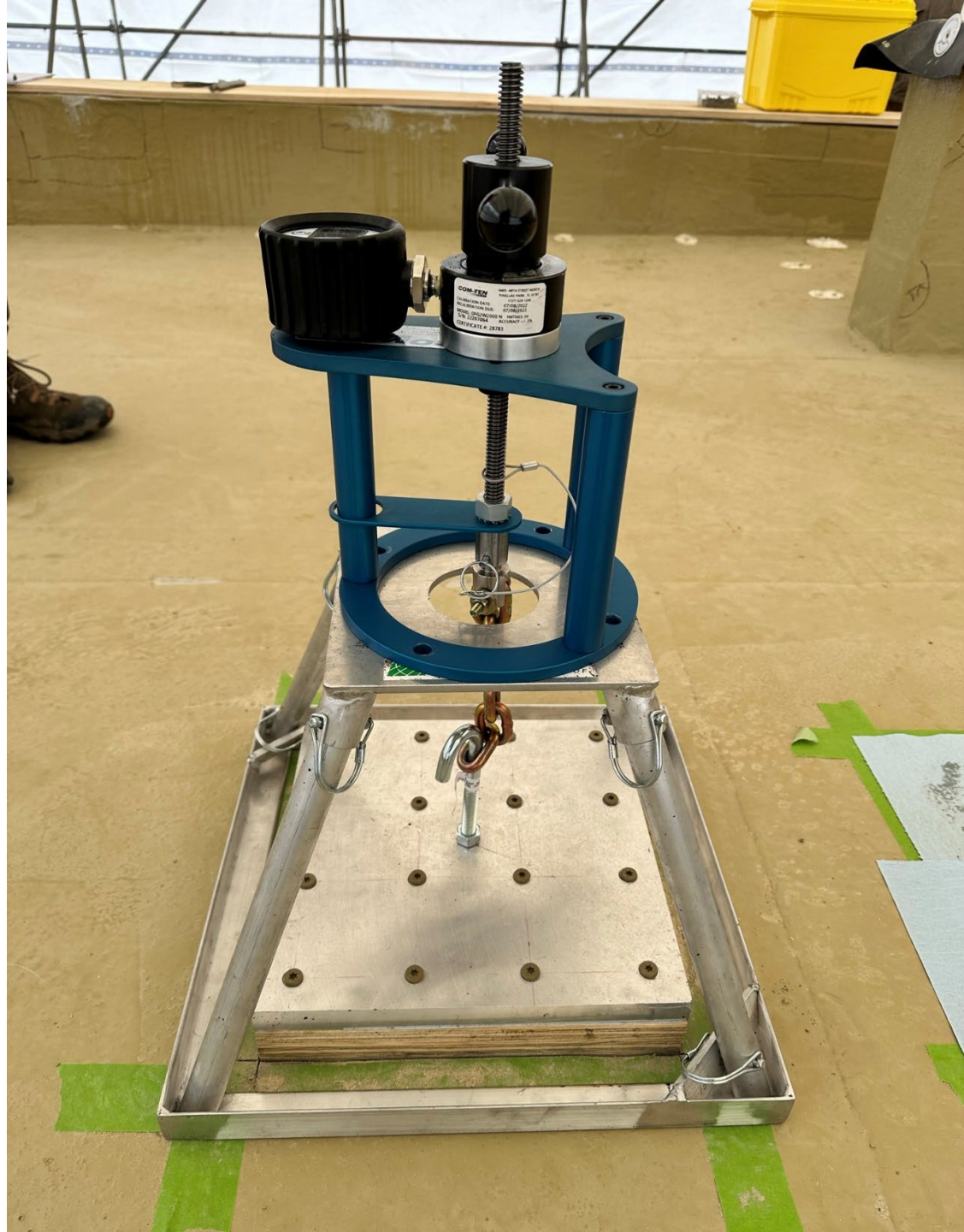


Vapor Retarders for Concrete Roofs

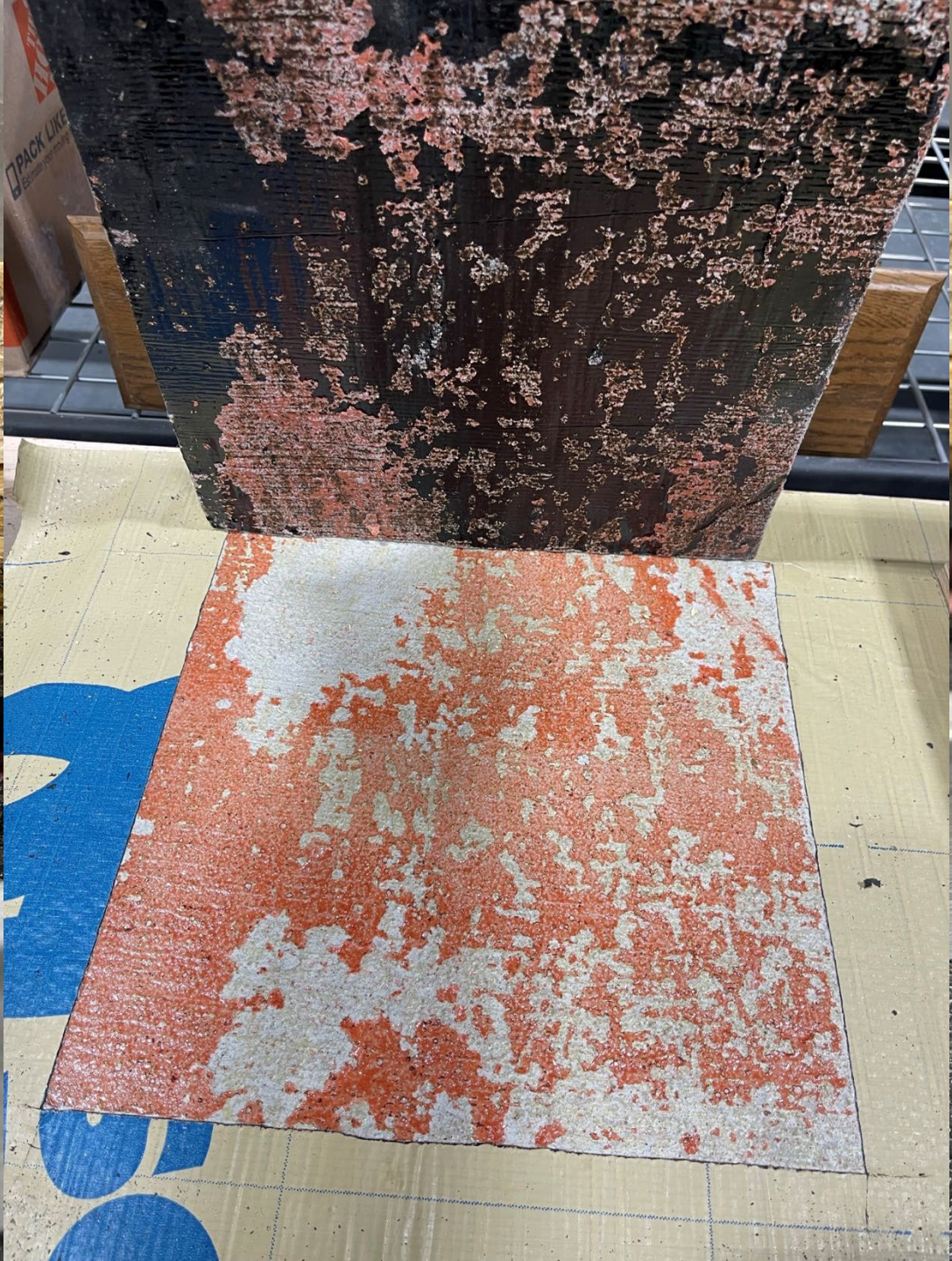
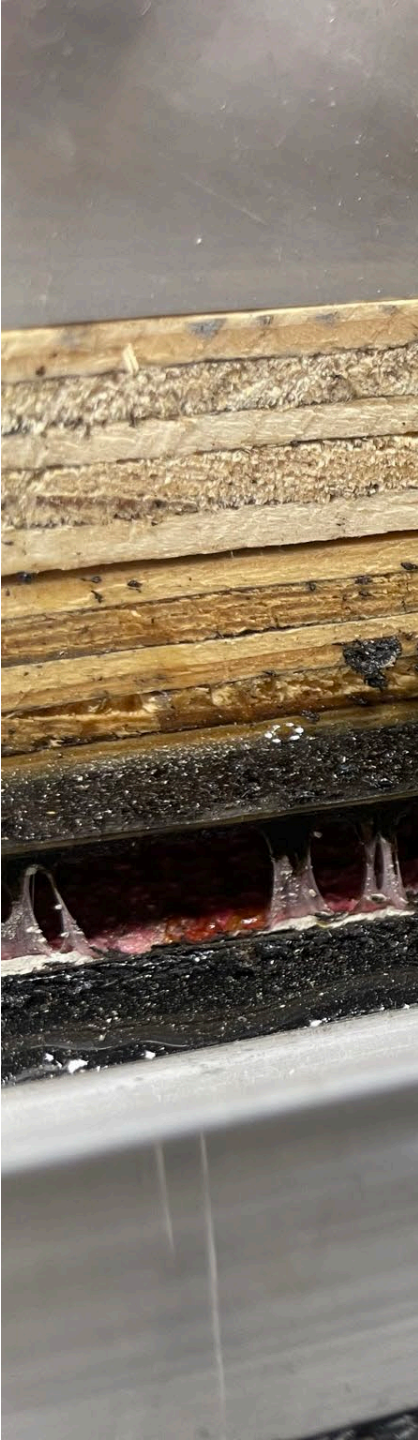
- 2022 NRCA Requests Testing of Vapor Retarders
 - Regular weight Structural
 - Light weight Structural
 - 28 Day cure on concrete
 - 60-day dwell in lab conditions
 - One set at Lab temp (70°F)
 - One set with vapor drive across vapor retarder
 - Encapsulate and heat from below 100°F
 - 4 - Self Adhesive (SA) products from market
 - 1 - 2-ply BUR with Type III mopping asphalt











Vapor Retarder Uplift Testing 2022 [28 day cure/60 dwell]

Pounds per Square Foot

Manufacturer	Description	Room Temperature	Heated 30°F	Δ	%
		Average	Average		
1	2-ply BUR (Type III)	1421.3	833.1	-588.2	-41
2	Smooth Surface SBS SA	767.9	644.8	-123.0	-16
3	Sanded Surface SBS SA	330.5	318.2	-12.3	-3
4	Unwoven APP SA	1138.4	1311.1	172.3	15
5	Woven Applique SBS SA	1415.2	706.8	-708.6	-50

Vapor Retarders for Concrete Roofs

- Article
 - Professional Roofing, March 2023 (Mark Graham) “Better Understanding of adhesion”
 - Pure Accident
 - Made a 6th set...”My Bad”
 - Tested Soprema COLPLY EF cold adhesive with SBS base sheet
 - WOW!
 - Honey Badger strikes again
 - Had to stop testing as loads reached capacity of test frame 2,000 pounds per square foot
 - With and without heat.
 - SRI Design standard when it can't fail...and cost is a second or third consideration

Dry a Wet Roof

Dry a Wet Roof

- 1980's ORNL and others studied the self drying roof concept
 - Older generation BUR roofs, typically with compressed fiberglass insulation would wet in the winter and dry during the summer
 - Original "O. G." Honey Badger roof?
 - This is not that
 - Technology from Europe
 - Allegedly this is somewhat common in Europe
 - Using desiccation and forced air movement, a wet roof is dried out.

Dry a Wet Roof

- Ports are cut for intake of warm desiccated air
- Ports are cut for exhaust fans and hygrometers
- Not an overnight process
- Monitor incoming and outgoing air moisture levels (grains)
- Some roofs are better candidates than others
- Novel process in North America and being developed as a process and business model







Dry a Wet Roof

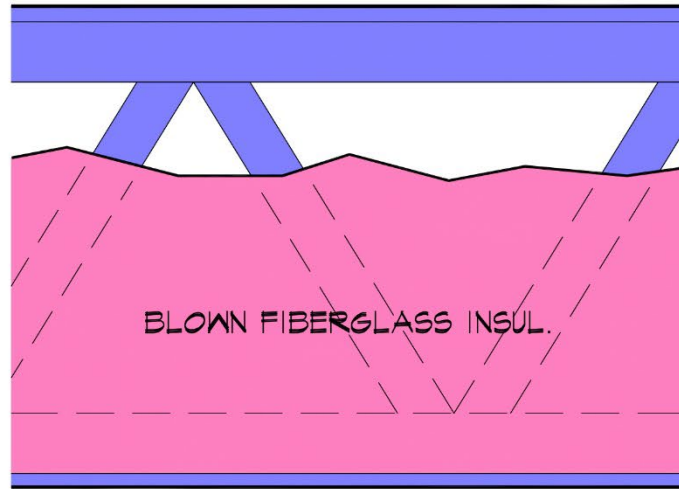
- Interesting work in progress
- Could be very useful in certain reroof and renovations
- More Info
 - Polygon US
 - 6240 Arctic Drive
Beaverton OR 97005 United States
Telephone: +1-800-422-6379

Cold Roof Decks and Moisture

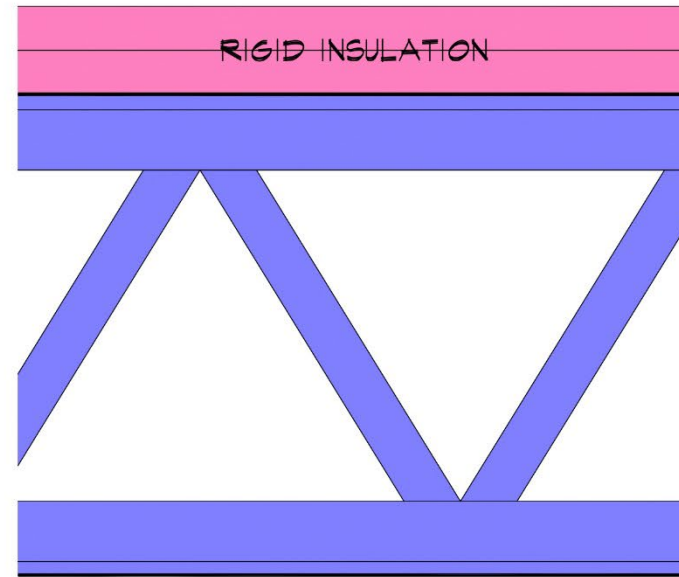
Cold Roof Decks and Moisture

- About a decade ago designers started a trend where they built apartments and mixed use (retail / apartments) with cold roof decks
- Cold roof decks have no insulation above them
- All insulation is below the deck, typically blown cellulose or fiberglass
- Platform construction with parallel cord trusses -> fire code required sprinklers above the top floor drywall ceiling
 - Exception is if it was blown solid with insulation
 - R-50 or so insulation and no sprinkler = win+win right?

Cold Roof Decks and Moisture



COLD ROOF

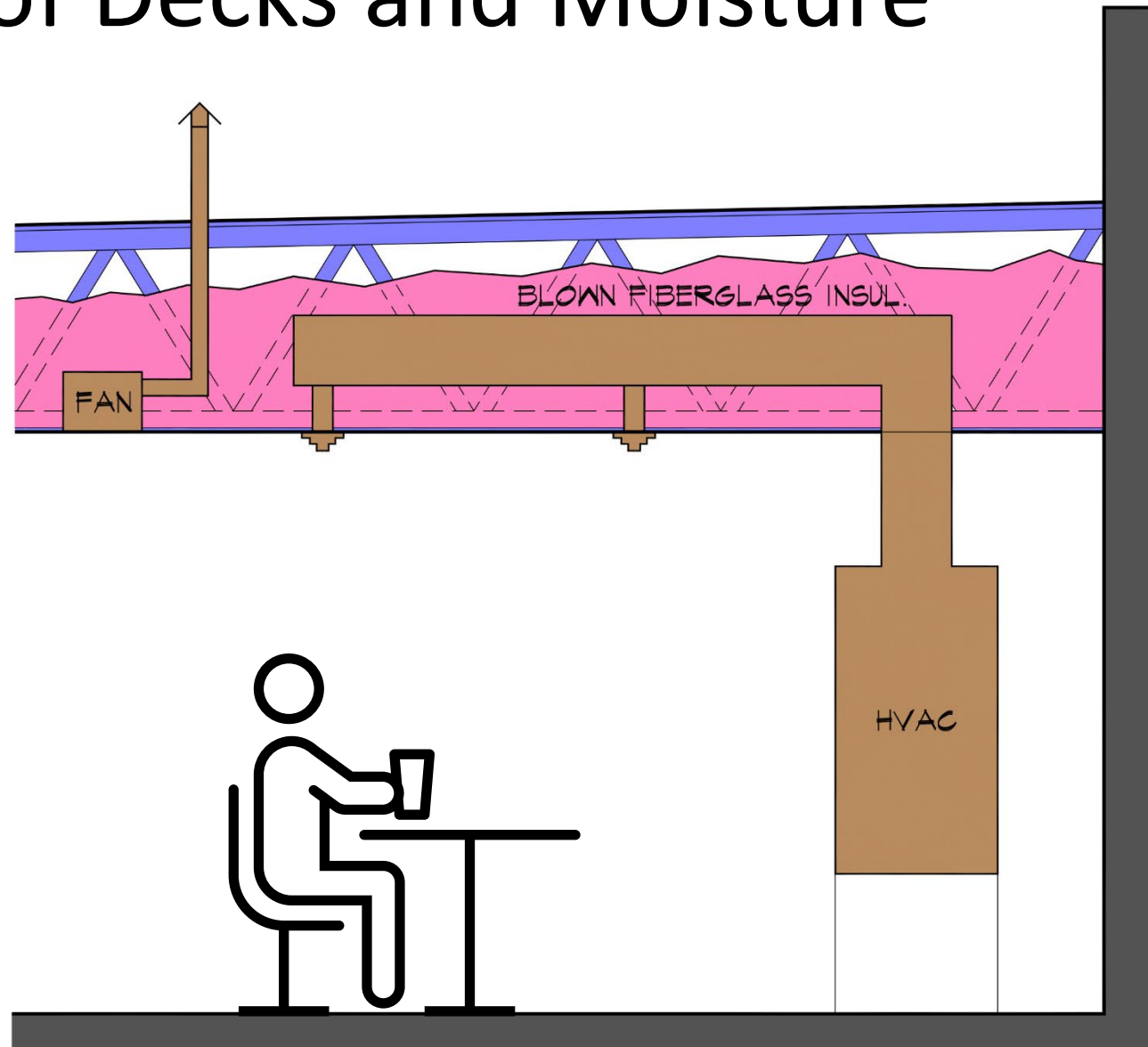


WARM ROOF

Cold Roof Decks and Moisture

- Here was the catch, the designers / contractors put all the HVAC, electrical, venting (dryer/bath/stove), security and more in the ceiling assembly (aka roof deck)

Cold Roof Decks and Moisture





Cold Roof Decks and Moisture

- Well established that all of these ducts and vents leak air
- What happens when we leak warm moisture laden air above a vapor retarder in the ceiling and a cold single ply roof membrane?
 - Lots of condensation
 - Biological growth
 - Decay of OSB / plywood
- In legal cases designers over and over have tried to claim defective construction due to leaky ducts
 - “my client believes they had a right to assume that the assembled ducts and vents would not leak air” –lawyer for the architect

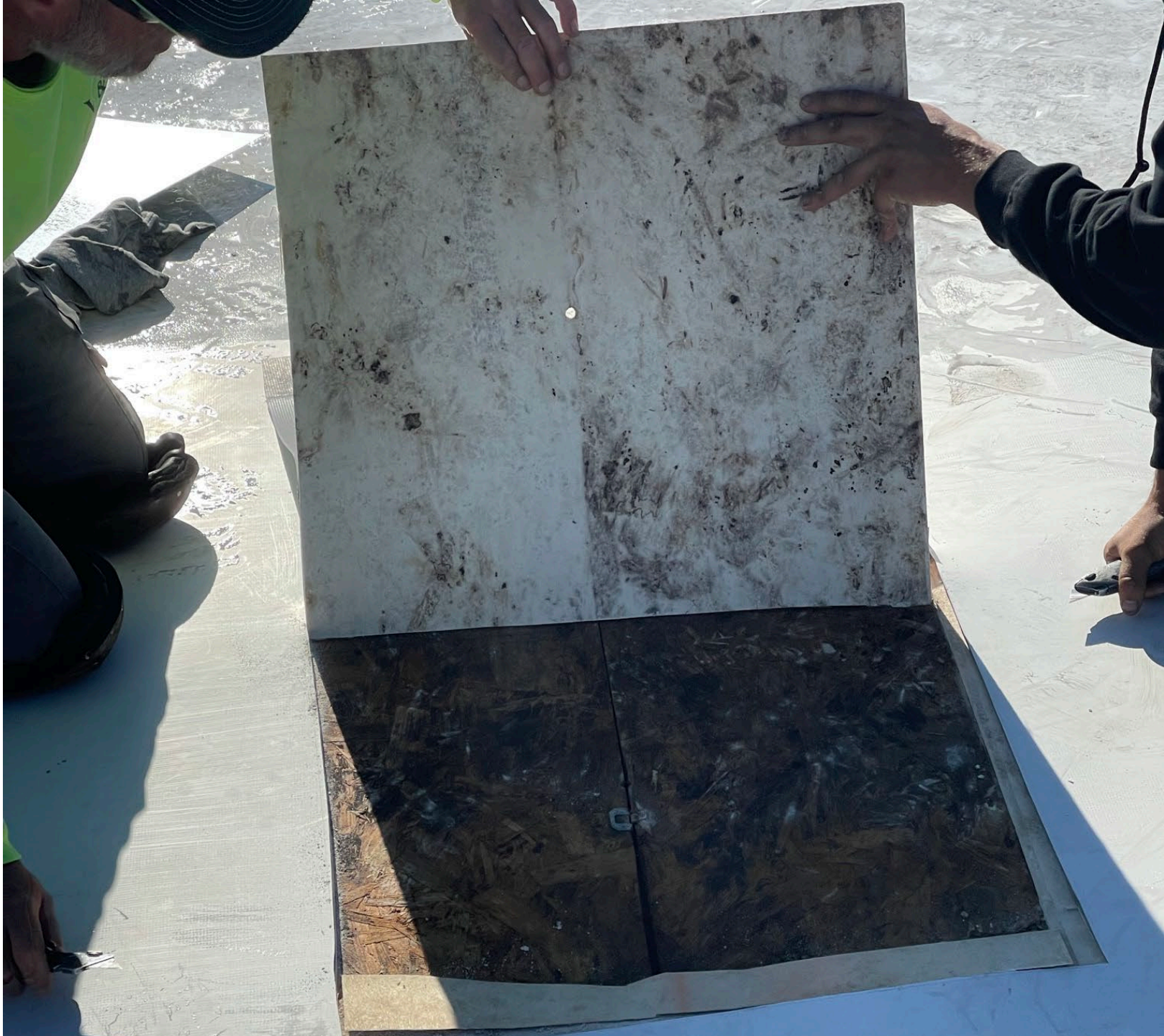






Cold Roof Decks and Moisture

- Even when everyone agreed what went wrong, roofer was drug along in legal proceedings
- There have been variations of this scenario
- 99.99% blamed on Designer of Record
- Fix?
 - Repair moisture damage
 - Place insulation above roof deck
 - Keep the roof deck warm and not a condensing surface
 - As little as R-5 to R-10 has been anecdotally shown to prevent the decay
 - Experience shows that code required insulation will protect the roof deck even without sealing and ducts or penetrations
- See Professional Roofing – March 2022 for article















Prefabricated Metal Buildings – Feel the Pressure

Prefabricated Metal Buildings – Feel the Pressure

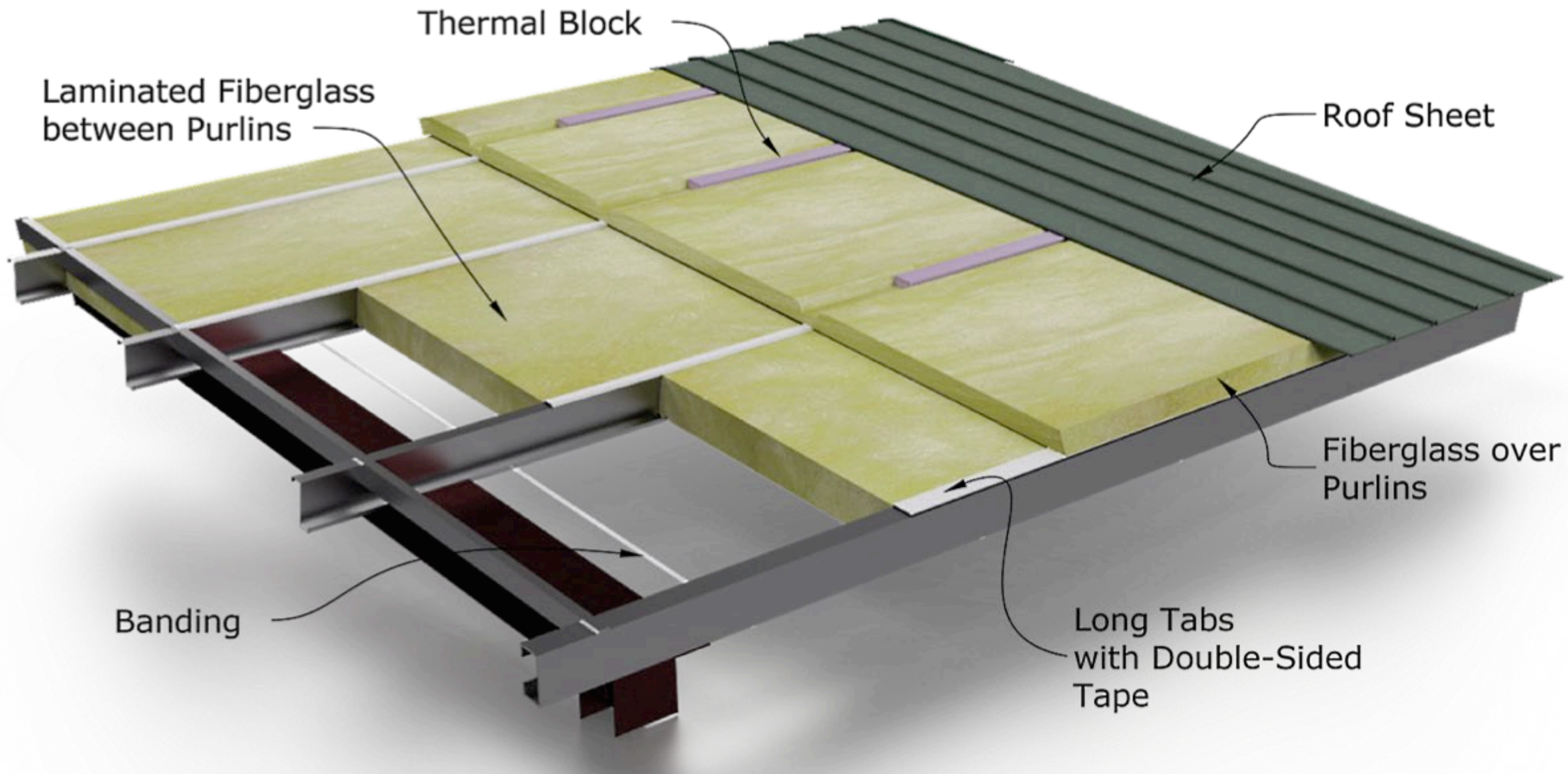
- Prefabricated metal buildings are typically a value proposition
 - Square footage per dollar
- Historically used for industrial, agricultural and storage
 - Can be very “rugged” buildings that can take abuse
- Prefab metal building manufacturers have expanded to capture more market in past decades.
 - Mixed use (Office + ?)
 - Vehicle storage
 - Vehicle Maintenance
 - Office
 - Light industrial
 - Warehouse
 - More

Prefabricated Metal Buildings – Feel the Pressure

- The roof system is almost always structural standing seam metal roof
- Before roof goes down a poly / mylar / woven fiber “liner” is run across the purlins making the ceiling.
- From the top side fiberglass batt insulation is laid between and across the purlins
- Then standing seam metal roof is installed











STEERING WHEELER
SHELTER AREA



Prefabricated Metal Buildings – Feel the Pressure

- Attempt to Correct
- BSC connected SRI to The Energy Conservancy (TEC)
- Brought in high sensitivity manometers
 - Instrumented building
 - Above and below the liner in multiple locations

Prefabricated Metal Buildings – Feel the Pressure

- TEC probably needs to present data, but...basic summary
- Two HVAC units, two thermostats
 - Fighting between units created over pressure
- Clear communication between air space above and below liner
 - But one side of the building did not produce pressure change above on the other side of the building.
 - But locally pressure increase below would influence pressure above
 - It was “sealed” but all the holes and fasteners just added up
 - Discussion in ASHRAE Fundamentals of this issue...lots of small holes add up.





ETEC

DG1000-3007077 (Remote Control)

TIME AVG

T Subsecond

FAN SPEED

CURSE

Pressure (Pa)

-9.9

Pressure (Pa)

-26.8

SET BASELINE

30 Pa

▶

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Prefabricated Metal Buildings – Feel the Pressure

- Dozens of these as problems or already in litigation
- What has become clear is that it is NOT the external envelope letting moisture in
- Internal sourced moisture is deadly and difficult to correct
- It appears careful HVAC design and balancing is paramount to long term performance of any prefabricated and heated metal building in a cold climate.
- Vapor retarder (liner) is working as intended keeping diffusion in check
- Air intrusion / Air leakage through any gap or thousands of fastener holes appears to be culprit to air space between “liner” on the interior and standing seam metal roof.

Cold Storage Roofs

Cold Storage Roofs

- Cold storage roofs work in reverse of normal roofs
- Moisture flow is from exterior to interior
- NO VAPOR RETARDER ON THE DECK!!!!
- Air seals are of the utmost importance
 - Perimeter
 - Penetrations
 - Temperature changes
- Consider loading dock at 55°F and cold warehouse at -10°F
 - Need to keep air from loading dock entering warehouse

Cold Storage Roofs

- Worse than normal situation HVAC contractor is the Roofers mortal enemy
 - Is this possible?
- Ammonia pipes are placed on stands that are typically welded in place. Hundreds or more of these get welded after the roof is on.
 - Inspect before and after
 - Document
 - Even the most careful welder will put holes in membrane
- Remember it is reversed
 - Regular leaks are problems
 - Air leaks are problems
- Professional Roofing – November 2019 article w/ details









FROZEN COOKED CRAWFISH TAILMEAT

PEA SOURCE
CUSTOMER CLAIM

INTERMEX I











Beware the cheapest roof you can install

Beware the cheapest roof you can install

- About once or twice a year SRI gets a call to inspect / defend a roof that was put down on the cheap.
- Code compliance is out the window
 - Wind
 - Edge metal
 - Energy code
 - What the???
- Be very, very careful if you are going to pull one of these.
 - Owner
 - Roofer
 - Manufacturer
 - Designer???
- On the hook for tear off and replacement of your roof and possibly going back with a code compliant roof
 - Get the owner to accept it in writing?



Closing Comments

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- Dry a Wet Roof???...Yes
- Cold Roof Decks and Moisture – Just get a Lawyer
- Prefabricated Metal Buildings – Feel the Pressure
- Cold Storage Roofs - Don't get it backwards
- Beware the Cheapest Roof

Questions?

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