Bidding on Bad VIMS Designs

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IEA 2025 Conference

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Background / Objectives

- This presentation is focused on new construction radon/VIMS design
- What makes a radon/VIMS design "**GOOD**"
- What makes a radon/ VIMS design "**BAD**"
- What different costs can be incurred from a "**BAD**" design
- Communication with client about a **"BAD"** design
- What to put in a proposal to protect yourself from liability

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When is a Passive Design "**GOOD**"?

- It is really designed to be ACTIVE with the hope that it works passively
- Meets the requirements of CC-1000
- Provisions for pressure field extension (PFE) testing
- Identifies PFE test point locations, future monitor, future electric locations

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Why "BAD" Designs Happen?

- Nobody intends a bad design (at least most of the time)
- Lack of understanding of how systems work
- We have always done it this way
- Designer has never installed a system in the field
- Lack of PFE testing to verify a system will work
- Over-engineering
- Under-engineering

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Why "**BAD**" Designs Happen?

- Not familiar with CC-1000
- Anyone who takes the three-day course is a radon professional
- The status quo is that the designer can put just about anything they want down on paper and it is considered a "**GOOD**" design
- The industry accepts the concept of "**PASSIVE**" mitigation which can be a bad concept

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Why Passive Designs are "**BAD**"?

- Passive provides an assumption that the system will work without a fan (blower)
- System performance can differ across the seasons
- System will only work as well as the quality of installation
- If a second smoke test right before the slab pour is not performed and any leaks sealed, you have no certainty of a "significantly airtight seal"

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How to Identify a "BAD" Design

- Does not conform to CC-1000
- Conforms to outdated/withdrawn standards
- Risers in exterior walls
- Wrong size/number pipe risers for size of plenum served
- Design creates restrictions in venting system reducing effectiveness (both as a Passive or an Active system)
- Areas of a building are not included in the plan
- Does not specify PFE testing requirements or locations
- Does not specify locations for future monitors
- Looks pretty on paper, difficult to install in the field
- Scale is incorrect on the design drawings

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Impact of "BAD" Design on Client

- Higher cost up front (over engineered)
- Higher cost if testing finds elevated radon levels and system does not work (under engineered)
- If it is a HUD job, HUD may not sign off on draw if non-compliant design
- Liability?

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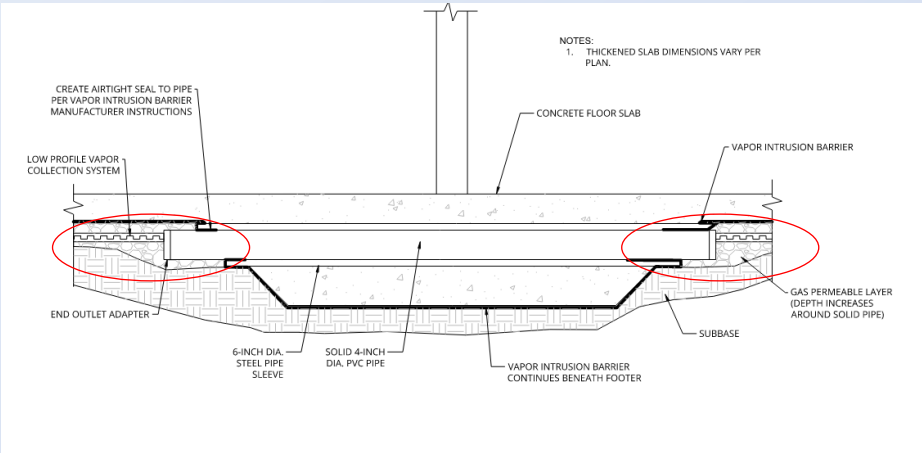
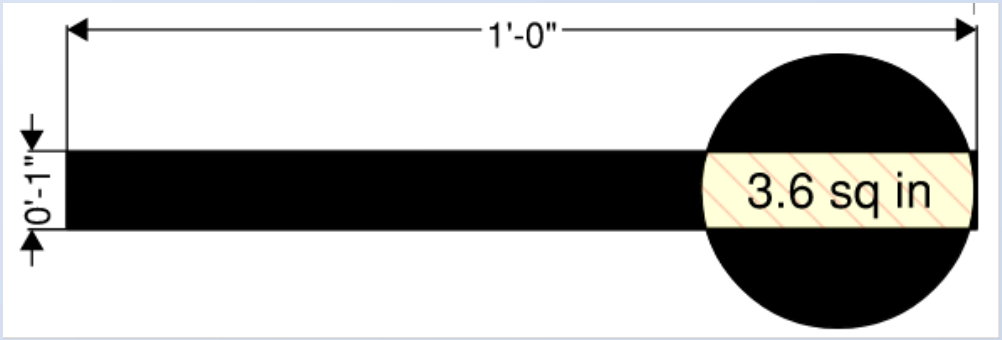
Bad Materials Specified

- What is the cross-sectional area of different sizes of pipe?
- Using vapor mat – What is the cross-sectional area?
- End-out fittings – What is the cross-sectional area?



Pipe Inner Diameter (ID)	Cross Sectional Area (sq. ft.)	% Reduction in Area with End Out
2-inch	3.1	+ 19%
3-inch	7.1	- 49%
4-inch	12.6	- 71%
Vapor Mat	7.0	- 48%



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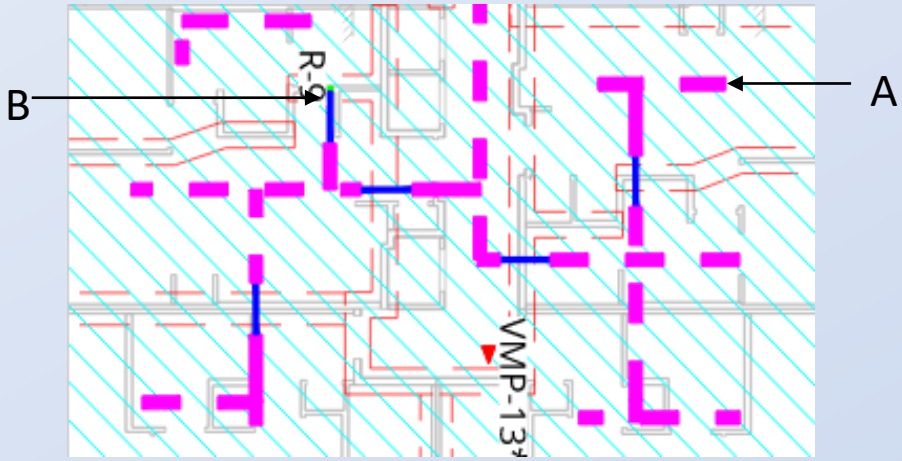
BAD Choices

- What is an orifice and what does it do to airflow?
  - End-outs reduce size of inlet ducting

5.6.4 *Duct size changes*
The size of *exhaust vent piping* between the connection to *inlets* or *inlet* ducting below the top of the plenum and the point of discharge or termination at the roof shall not be reduced in the direction of airflow toward the exhaust location.

- What changes to duct size from point A to B

3 – 2-3-2 – 3 – 2-3-2 – 3 – 2-3-2 – 3 – 2-3 – Riser



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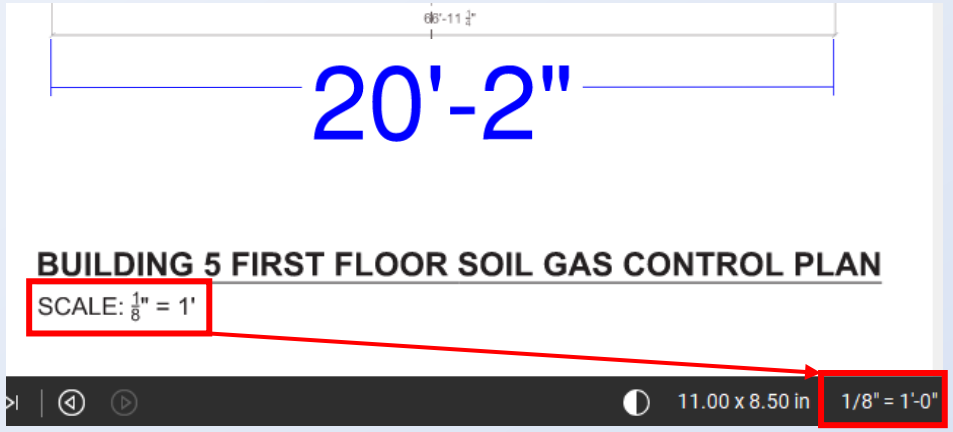
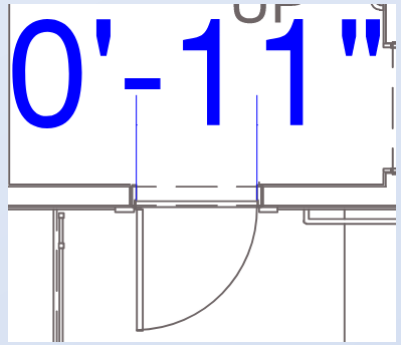
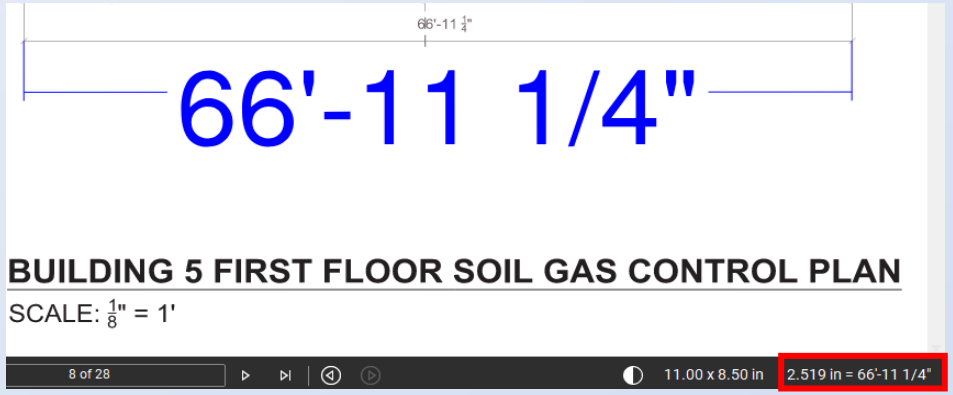
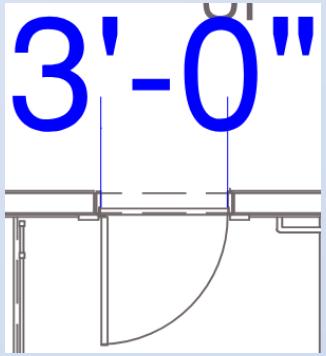
How to Identify a “BAD” Design - Scale Set Incorrectly









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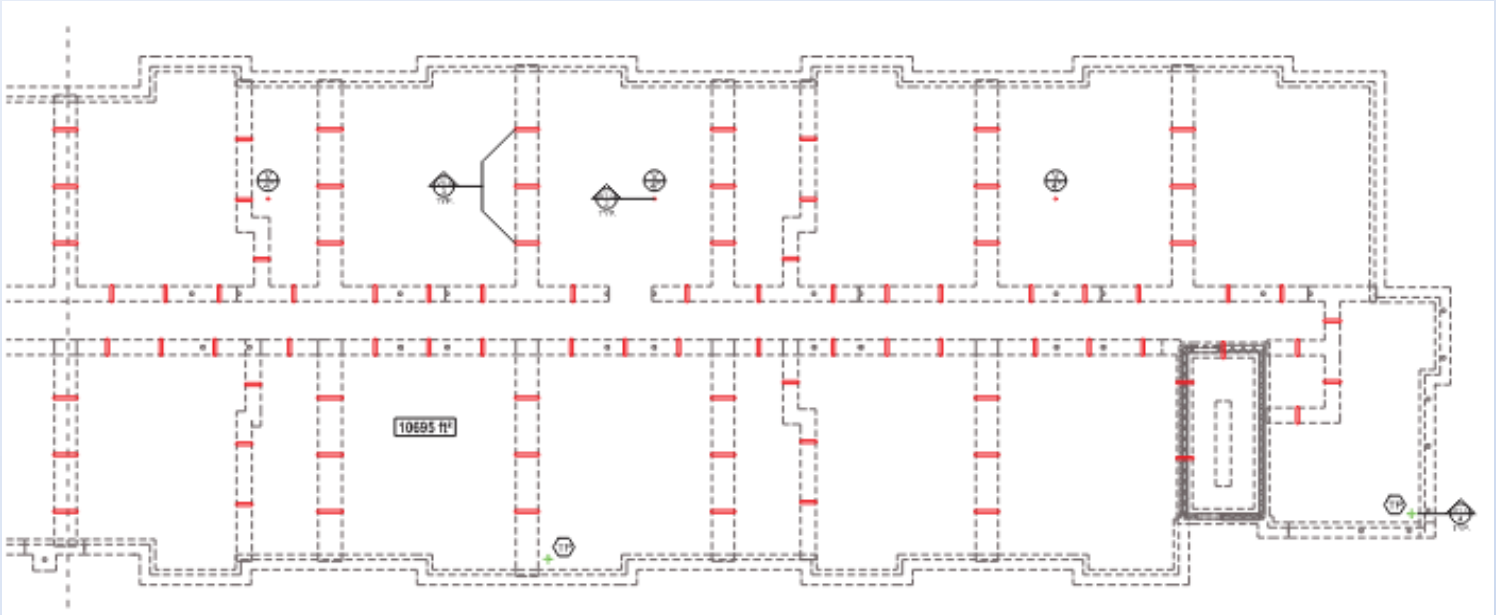
How to Identify a “BAD” Design - Design Basis Incorrect

What is wrong here?

This stipulated that the design and specifications meet the requirements of CC-1000.
It also identified that the “Radon Professional” designer is NRPP certified.



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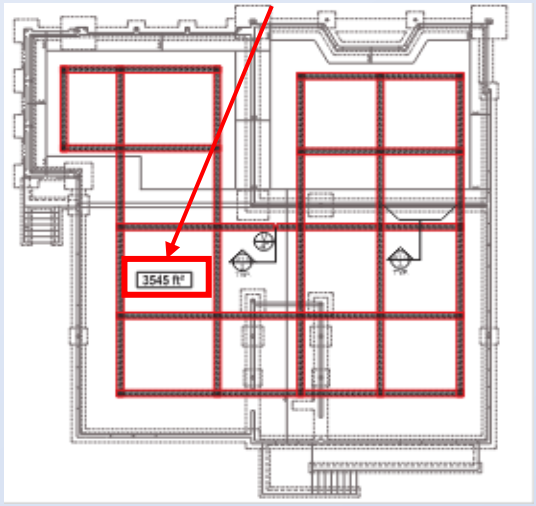
How to Identify a “BAD” Design - Plenum/Riser Sizing Incorrect

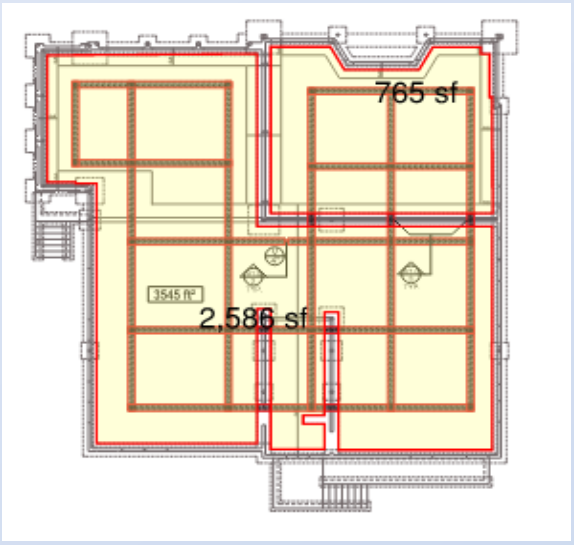
Plenum size not taken from inside edge of footers

Table 4.3	Plenum Size Restrictions	
Nominal inside pipe diameter	Maximum size of Soil Gas Collection Plenum(s) per duct size	
	Where compliant plenum installation is verified by inspection per Section 5.10.2	Size allowed where gas-tight plenum closure, per Section 6.3.2, is also provided
3 inch (7.6 cm)	3,500 square feet (325 m^2)	4,000 square feet (372 m^2)
4 inch (10.2 cm)	6,200 square feet (575 m^2)	7,100 square feet (660 m^2)

Listed – 3,545 ft^2



Actual – 3,353 ft^2



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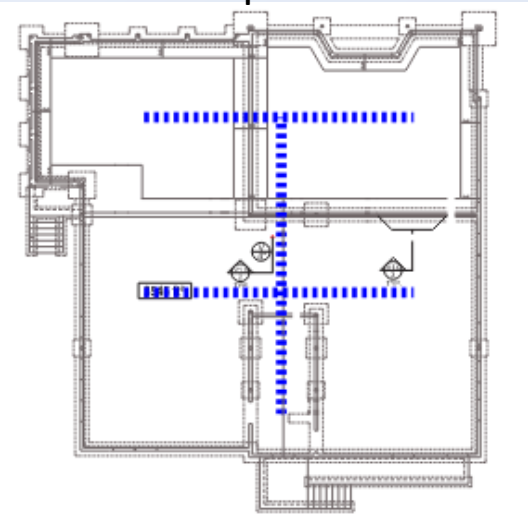
How to Identify a “BAD” Design - Design Basis Incorrect

- Design is for a building with sand
- Building has 4-inches of #57 stone
- 3-inch pipe is correct for plenum size
- Design calls for 4-inch pipe located in 2x6 wall
- This design is a good candidate for a VE option

125’ vapor mat



495’ vapor mat

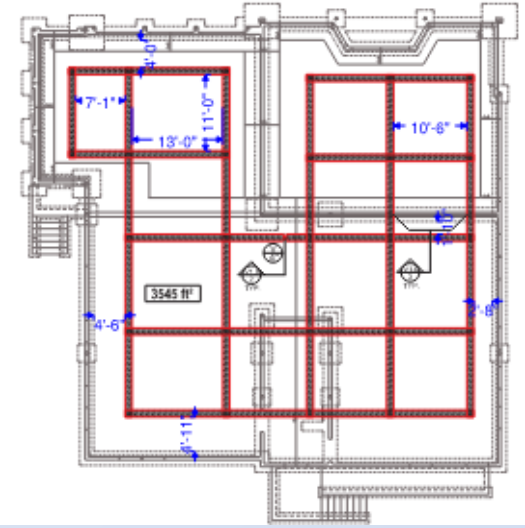
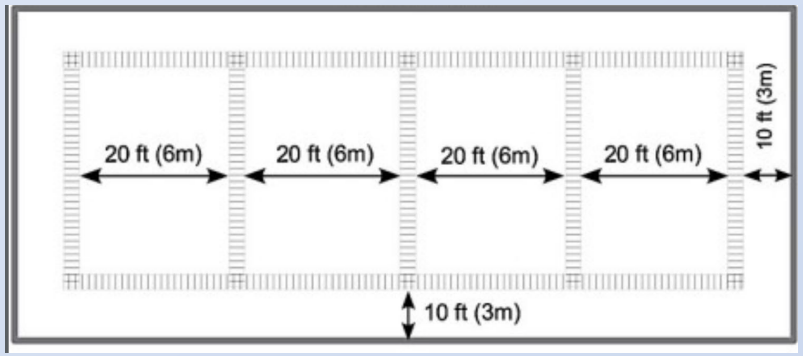


Table 5.5.3
Requirements For Alternative Gas Permeable Layers



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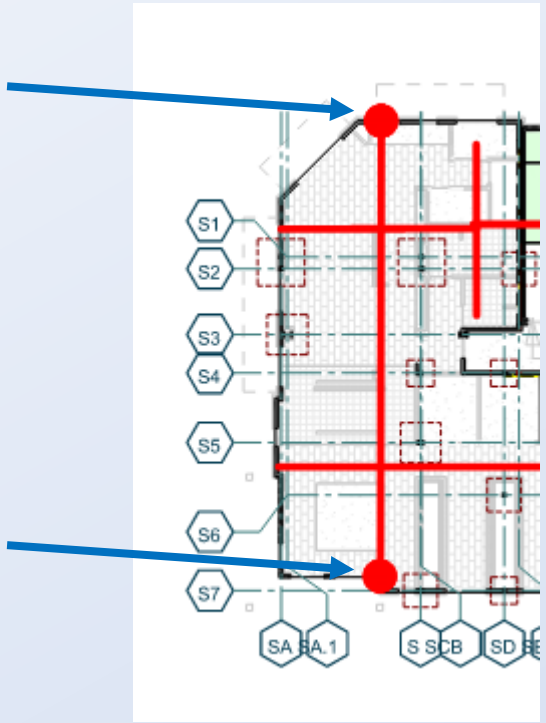
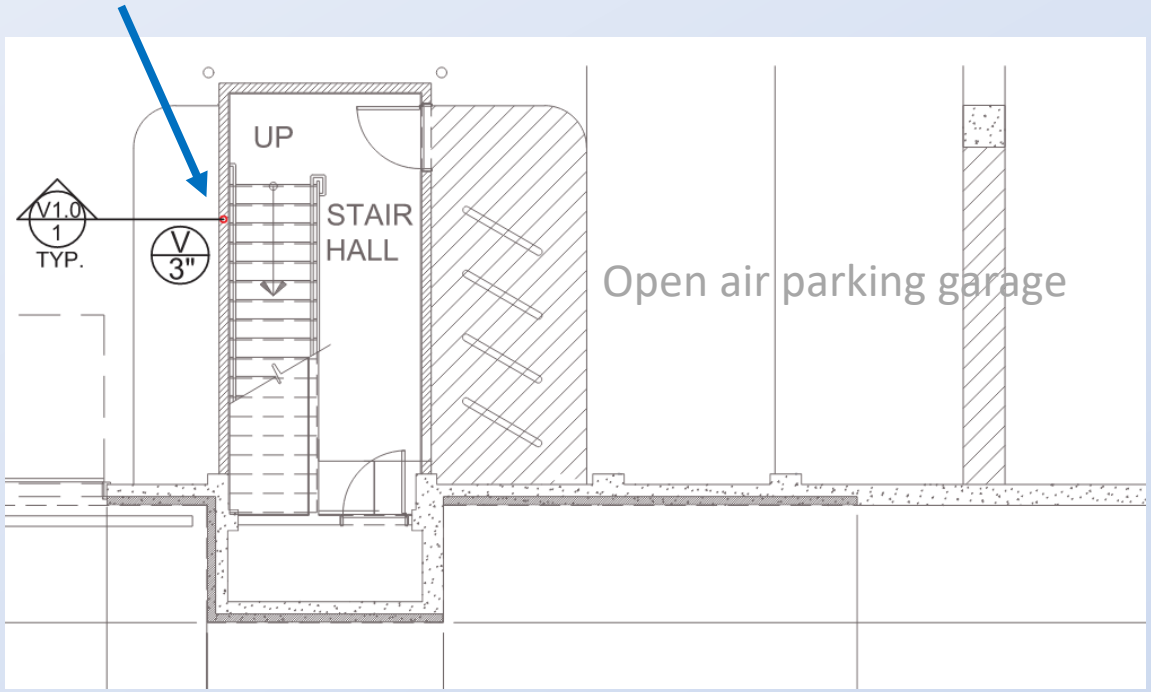
How to Identify a “BAD” Design - Design Basis Incorrect

Risers in exterior wall – plans do not call for active system from time of installation





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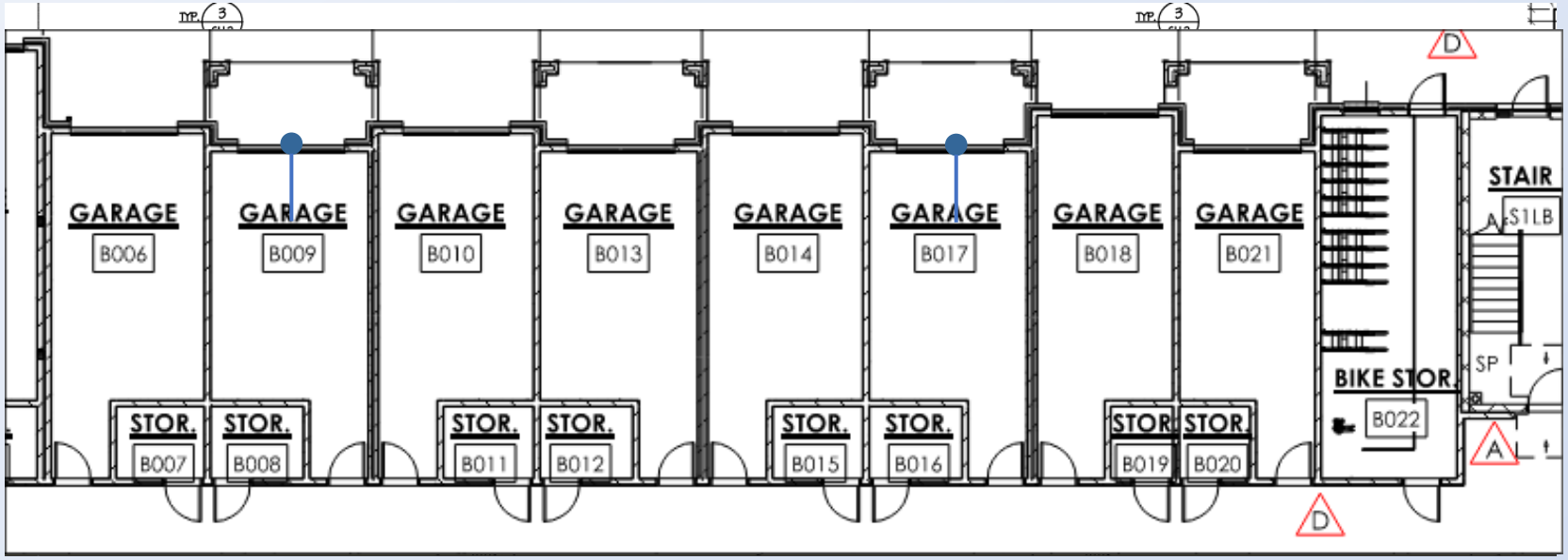
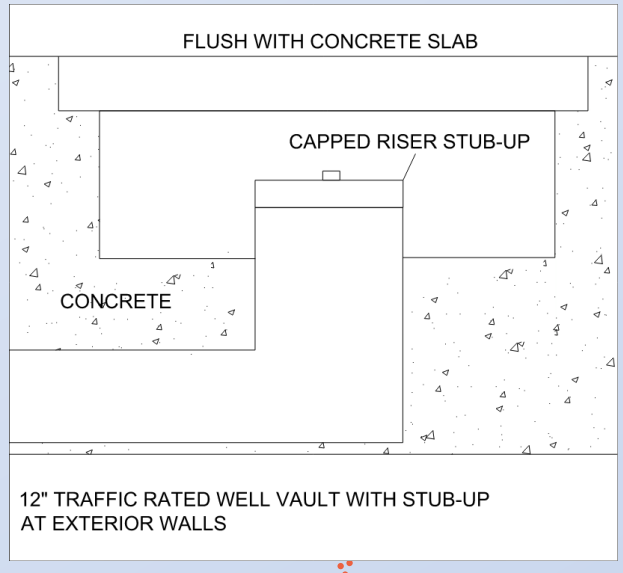
How to Identify a “BAD” Design - Design Basis Incorrect

- HUD project – should be CC-1000 compliant
- What is wrong here? How many different things can you identify?





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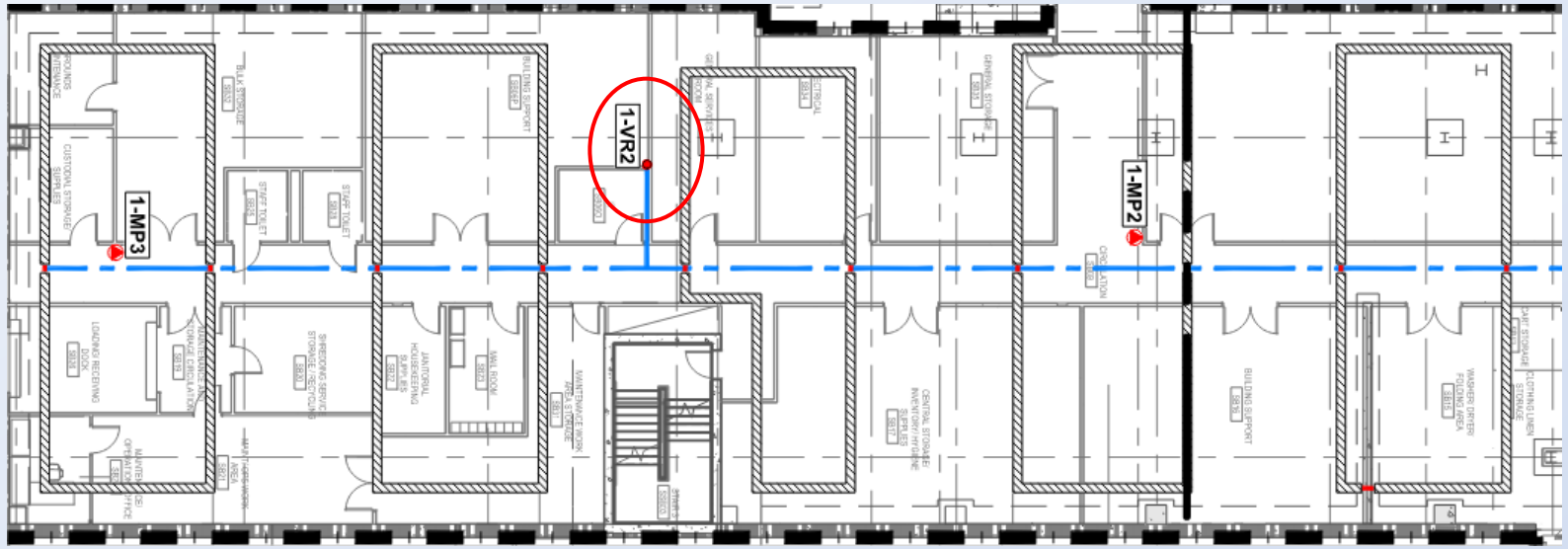
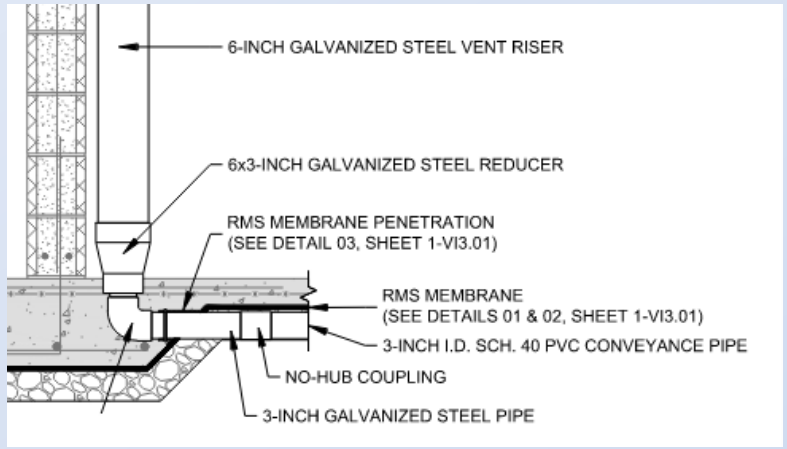
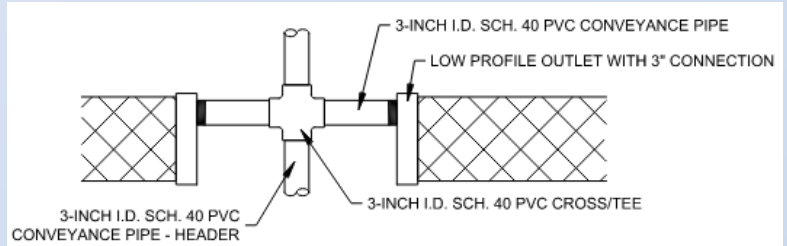
Just What the Heck

This isn't rocket science, but…

it is fluid dynamics (or not)







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How to Identify a “BAD” Design - Under-Engineered

- 66,900 SF slab
- 4 zones, 2 x 2-inch risers per zone, 1 inlet, 1 extraction
- CoC – TCE and PCE (Not Methane)
- Initial post-construction radon testing
  - June: no elevated radon levels
- 3 years later
  - Radon testing in winter – elevated radon levels in 14 units
  - Marker of system failure
- NO pre-installed test ports
- Pilot study done to verify PFE and size fan

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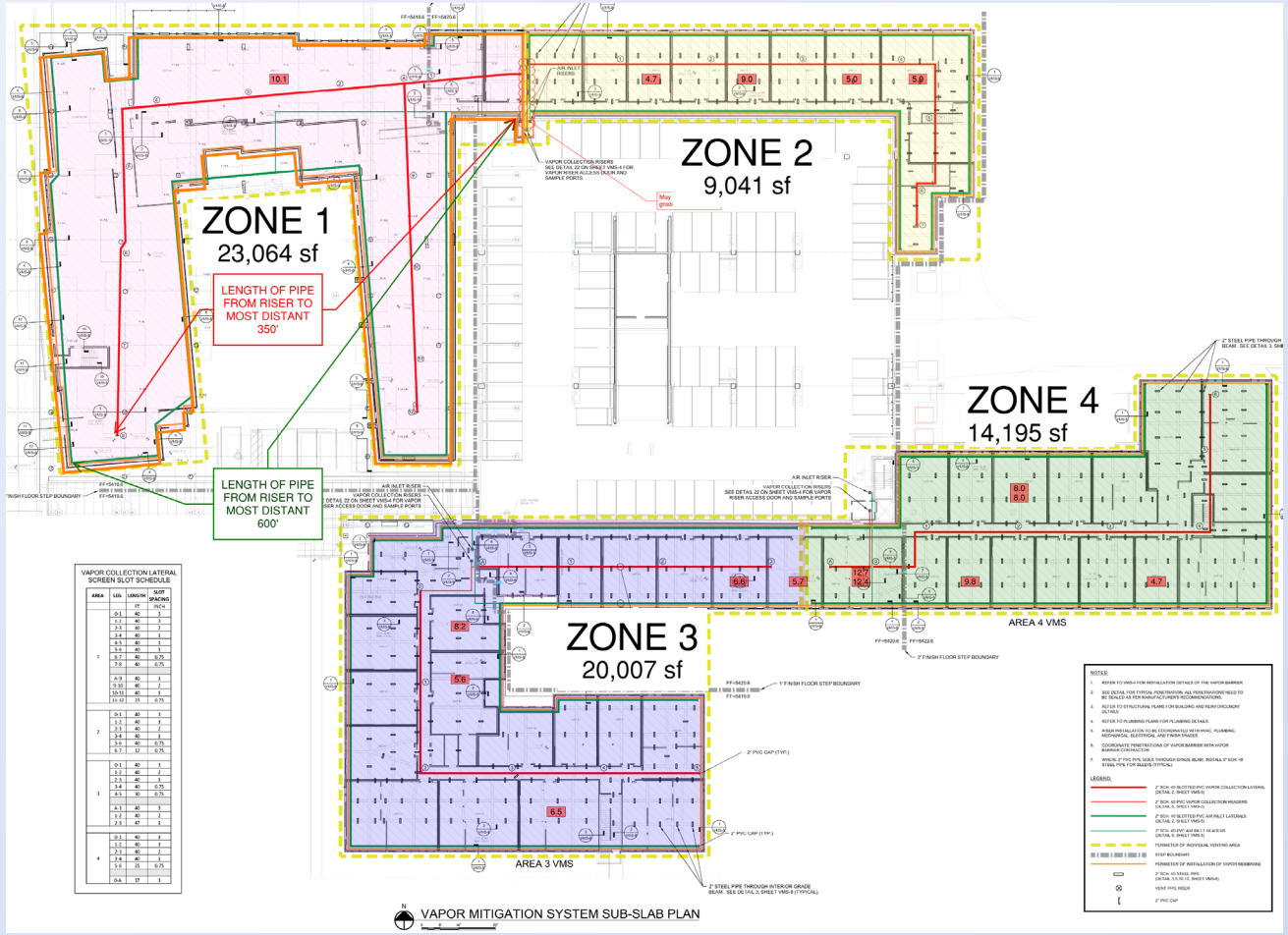
How to Identify a “BAD” Design - Under-Engineered



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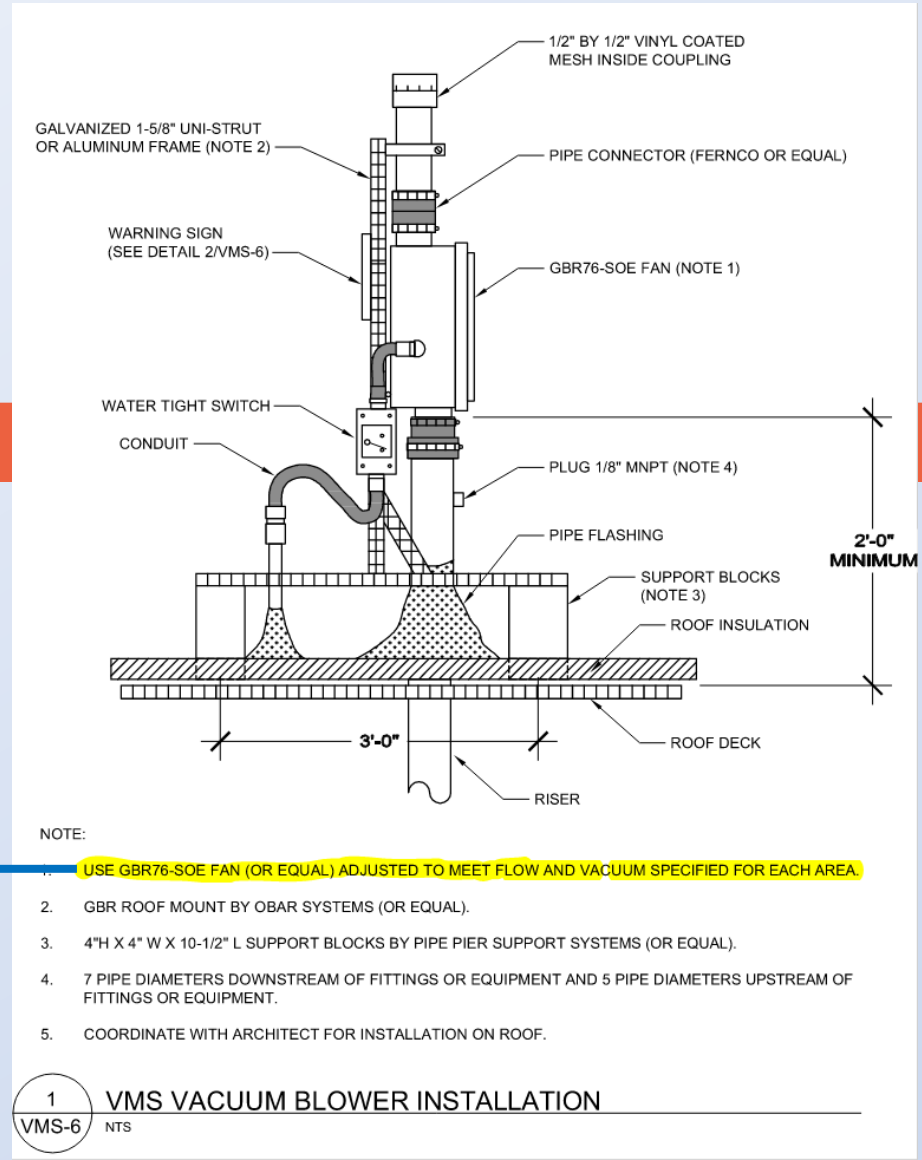
Under-Engineered

- VIMS plan calls for Obar GBR76-SOE
- One fan on extraction line
- Where did the flow and pressure numbers come from?

VAPOR MITIGATION SYSTEM VACUUM BLOWER/FAN SCHEDULE

AREA	DESIGN BLOWER FLOW RATE (CFM)	DESIGN BLOWER INLET VACUUM (" WATER)	BLOWER MANUFACTURER	MODEL #	VOLTAGE	PHASE	POWER (WATTS)
1	53	10	OBAR SYSTEMS	GBR76 SOE-12	120 VAC	1	160 TO 200
2	24	4	OBAR SYSTEMS	GBR76 SOE-08	120 VAC	1	80 TO 120
3	53	8	OBAR SYSTEMS	GBR76 SOE-12	120 VAC	1	160 TO 200
4	28	4	OBAR SYSTEMS	GBR76 SOE-08	120 VAC	1	80 TO 120



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Under-Engineered

Can we get PFE?

2	24	4

n Device	SP#	Power	Full	Medium
☐		Static Vac " WC		3
☐		Air Flow FPM		1815
☐	2A	Air Flow CFM	160	158
☐		Vane Anemometer CFM Calculation:		FPM

Distance In Feet	Suction Device Off	Radon Level Differential	Full	Med
1				
5				
132	+0.0300	350	-0.0268	
140	+0.0260	450	-0.0816	
142	+0.0330	700	-0.0334	
142	+0.0310	30	-0.0250	-0.0110
136	+0.0300	518	-0.1420	

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Building Pressure Dynamics

How much pressure does a mechanical closet that is operating as a return plenum apply to the slab?

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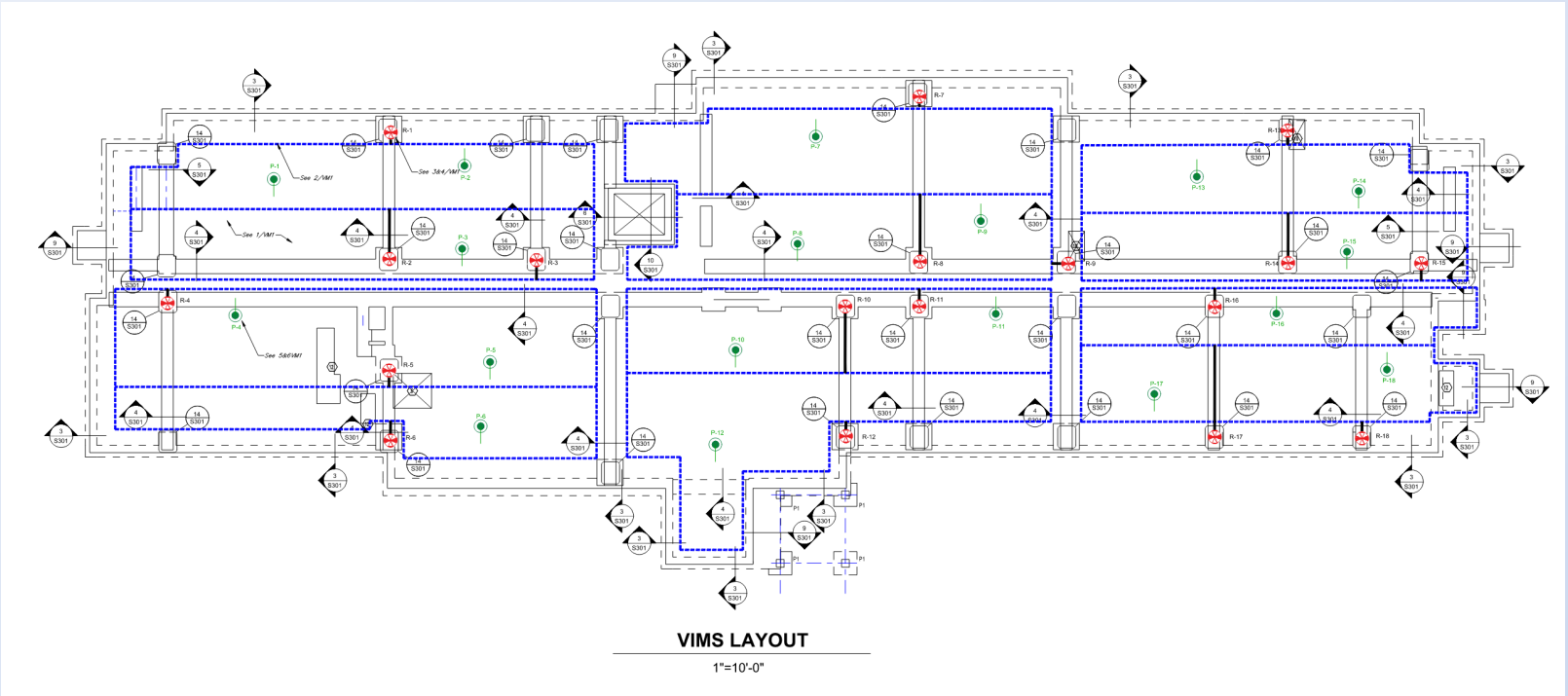
Over-Engineered

- 15,000 sf slab on grade
- 18 – 4” risers, 1,700' pipe sub-slab



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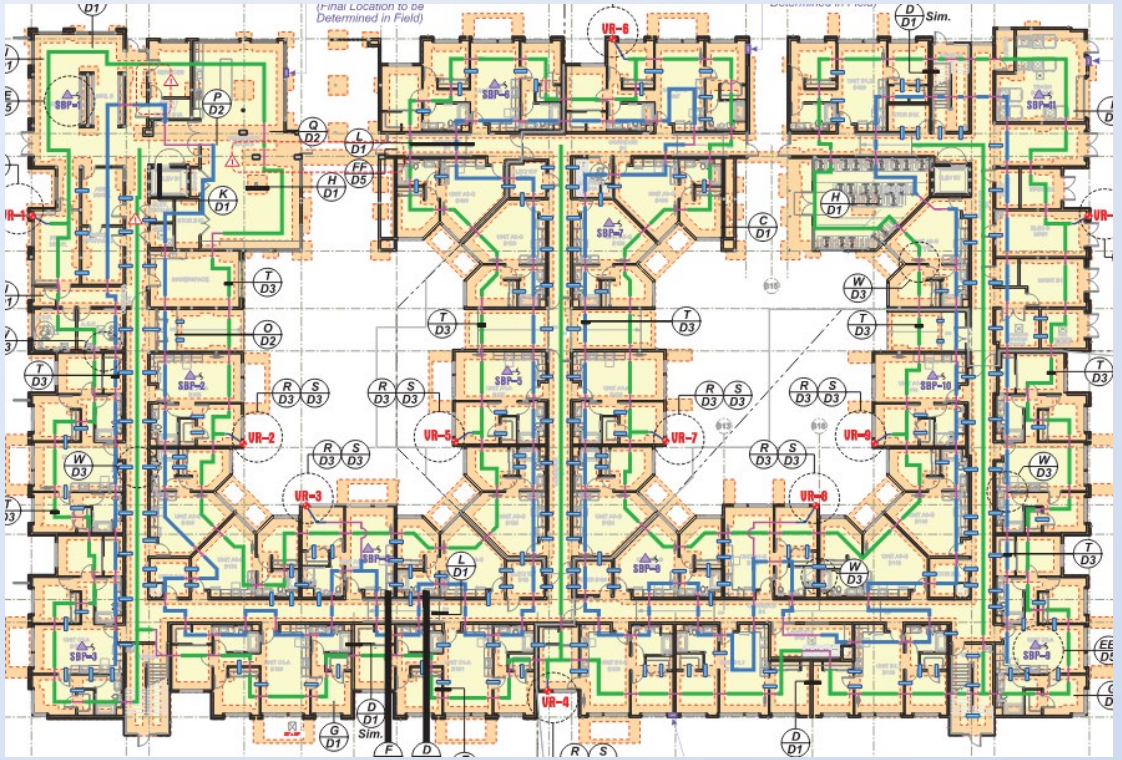
A Complicated Design

Is this a circuit breaker or a VIMS plan?

Does this design conform to CC-1000?



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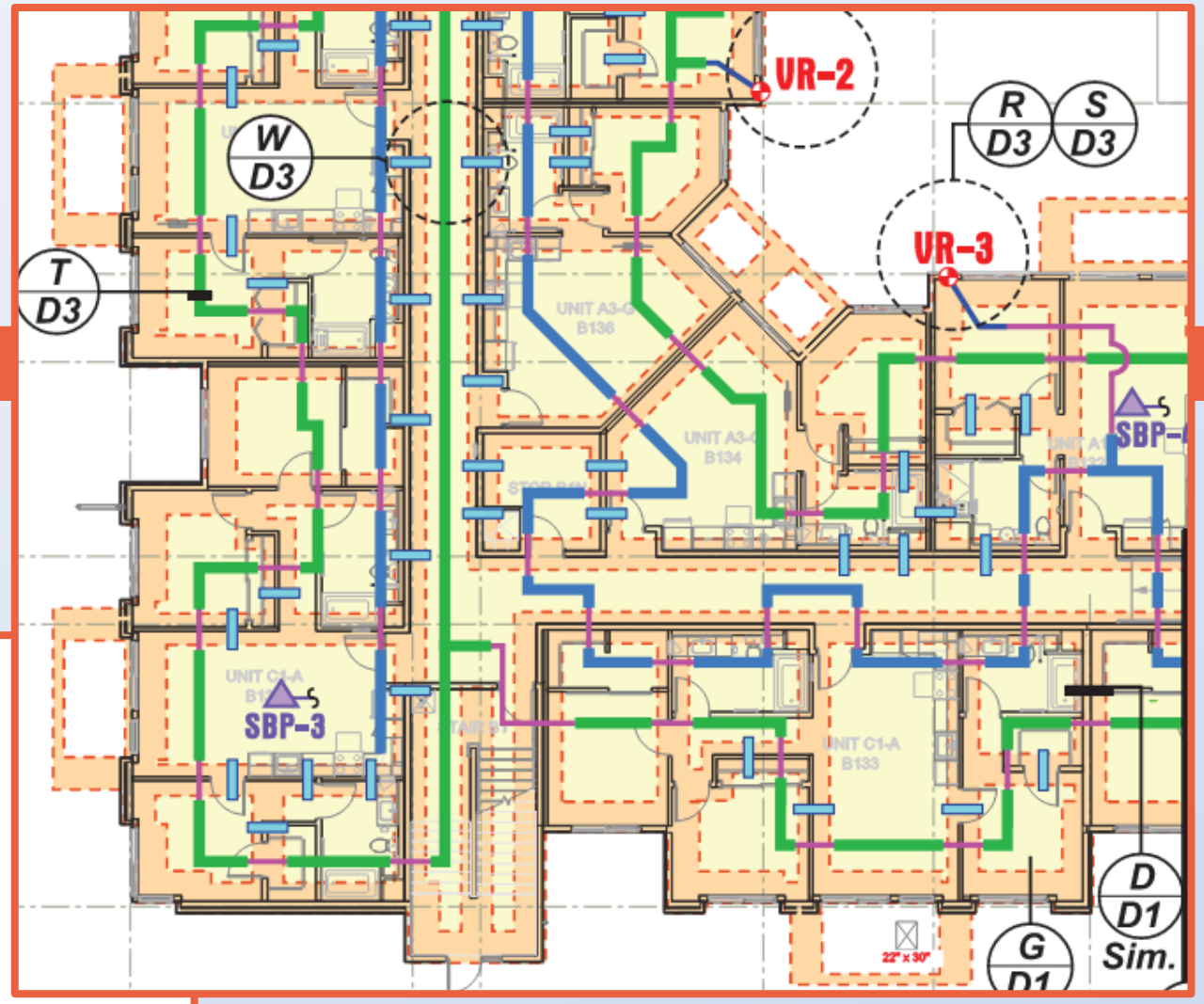
A Complicated Design



Limits of Soil VOC Vapor Barrier

Limits of Foundation / Isolated Footing

12" Wide Low Profile Vapor Sub-Slab Vent Piping
(*Fresh Air Re-Charge - Future)*

12" Wide Low Profile Vapor Sub-Slab Vent Piping
(*Extraction - Future)*

3" Dia. Solid ABS Sub-Slab Transition/Sleeve Vent Piping

3" Dia. Solid ABS Sub-Slab Vent Sleeve Pipe

VR-1 Vent Riser With Designation Extending Up to Roof Level with Transition Piping

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Considerations When Speaking With Client About Bad Design

- Was the design given to the GC by the owner?
- They have already paid for the design, they won't want to pay again
- The person who did the design is "licensed/certified/engineer" therefore the design must be correct
- If VI and design has gone through regulatory approval, a redesign can take a long time ($$)
- They have always done it this way and never had a problem
- They don't really care/think it is needed

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Considerations When Speaking With Client About Bad Design

- You can offer a VE option saving time and money
- The system may not work as intended
- You are protecting them from liability

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Considerations When Speaking With Client About Non-Compliant Design

- Clearly state that design does not meet CC-1000 guidelines and give specific information and references to the section in the standard
- If design follows a withdrawn standard (EPA or ASTM E1465) identify that
- You are a licensed/certified radon professional and will provide a design that meets the requirements of CC-1000 and take accountability for the performance of the system

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Any project – Identifies as CC-1000 design but is non-CC-1000 compliant

- Send RFI listing specific omissions and/or errors. Identify section of CC-1000 that addresses that condition and ask for clarification from designer.

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Design does not meet any previous or current standard

- The provided design does not meet any previously or currently accepted radon/VIMS design standard. If (Company Name) is contracted to install according to the provided design, we can provide a materials and workmanship warranty only. Any warranty on the performance of the system is the responsibility of the system designer.

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CYA

HUD project – Non-CC-1000 compliant design

- HUD MAP Guidelines Section 9.6.3.2-H requires a certificate of completion after installation and post construction radon testing has been completed. The certificate of completion must certify that the radon work meets the requirements listed in 9.6.3.2-F. The provided design does not meet CC-1000 requirements, and no certificate of completion can be provided if the provided radon plan is followed.

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CYA

Vent riser installation in plumbers' scope of work

- Inspections of vent pipe risers are required to provide final system documentation. If (Company Name) installs the soil gas exhaust vents we will perform inspections of that phase of work. If the plumbing contractor installs the soil gas exhaust vents and (Company Name) is not hired to inspect the them, then no warranty for the installed radon/VIMS systems can be provided.

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CYA

Vent riser installation in plumbers' scope of work (2)

- Inspections of the slab prior to installation of sheetrock are required to provide final system documentation. If (Company Name) installs the soil gas exhaust vents we will perform inspections of that phase of work. If the plumbing contractor installs the soil gas exhaust vents and (Company Name) is not hired to inspect the slab, no warranty for the installed radon/VIMS systems can be provided unless (Company Name) is contracted to inspect the slab prior to the installation of sheetrock.

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CYA

Design does not reflect actual Architectural and/or Structural drawings

- This proposal is based on the provided design. Some errors/omissions in the design were identified. Any change of scope during construction will incur additional charges.

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Lessons Learned

- Always check the scale when doing take-offs for pricing
- Just because you can offer a VE option, the client may not accept it
- A provided design, even from a certified/licensed professional or engineer may be incorrect
- Be familiar with CC-1000 and know how to look at a design to compare with the standard
- If you do not provide exclusions/exceptions in your proposal, you are accepting ownership of system performance
- Bad designs can cost you and/or your client a lot of $

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Call to Action

- Be familiar with the CC-1000 standards of practice
- Review plans with installation in mind
- Install with system performance in mind
- If you don’t know your PFE, you don’t know Jack

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Any Questions?

To discuss these findings, please contact Matt Koch, at mkoch@cleanvapor.com

Thank you!

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