

Pressure Field Evaluation of Strong Sleeves™ Grade Beam Sleeve Installed During Construction



Location: Affinity Apartment Building, Durango, CO

Elevation: 6,512 feet

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Introduction

The installation of soil gas mitigation systems, such as soil gas collection mats, beneath concrete slabs is a widely accepted method for preventing the infiltration of hazardous soil gases. These gases include radon and volatile organic compounds (VOCs), which can pose significant health risks if allowed to enter buildings. The sub-slab preparation and vertical stacks throughout the building enable easy activation of the system with inline fans if radon or other soil gases are detected.

Grade beams, which are integral structural elements in many foundation systems, create significant barriers to effective sub-slab pressure field extension, significantly reducing the efficiency of soil gas collection systems.

This study evaluates the pressure field dynamics of a soil gas collection system when Strong Sleeves™ are installed in grade beams during construction. The objective is to determine their impact on sub-slab pressure field communication across grade beams, which is critical for the design and effectiveness of radon and VOC mitigation systems.

The mitigation system was installed in accordance with ANSI/AARST CC-1000-2018-0523 standards. The system included:

- Slab square footage: 7,562 Sf.
- Number of grade beams utilizing Strong Sleeves™: 12
- Slab assembly: 4" thick with 6X6 W2.1XW2.1 welded wire fabric.
- Grade beam: 3'- 6" min, Thickness 8", uniform layer of gravel or crushed stone not less than 4 inches in depth the meets ASTM numbers 5, 56, 57, or 6.
- PDS Radon Supply Soil Gas Collector Mat™: 1" thick, 1' wide for sub-slab soil gas transport.
- Strong Sleeves™: 1'-1" wide, 1 ½" thick to facilitate cross footer/grade beam airflow.
- StegoWrap™: 10-mil Class A vapor retarder, mechanically sealed at all foundation penetrations.
- Vent pipe size: 3" PVC vent pipes (qty. 2).
- A temporary adapter was used for testing from 3" PVC to 4" x 6" rubber fan coupler.

Measurement Methodology¹

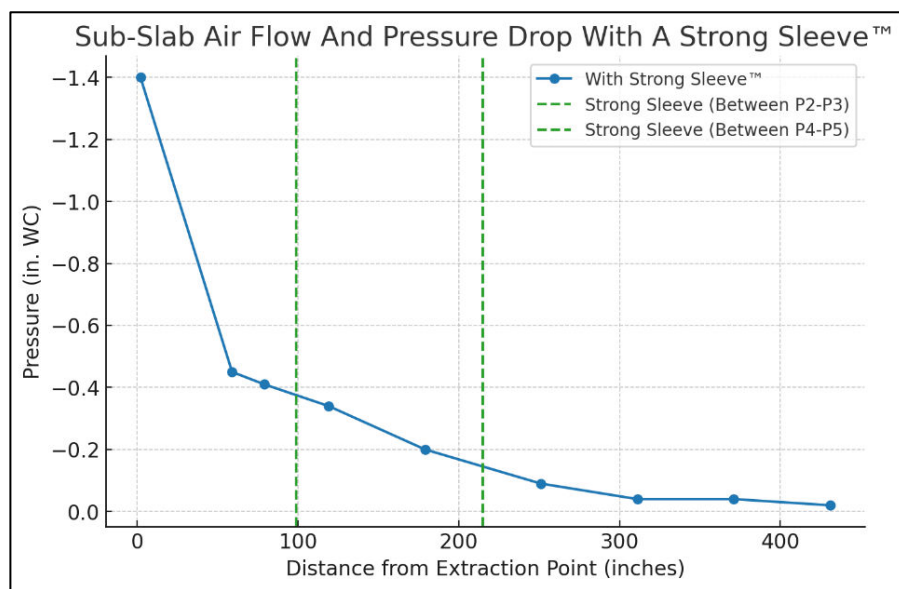
Sub-slab suction was measured using a digital micromanometer at nine designated locations within the perimeter foundation. Each measurement point was carefully selected to provide a thorough assessment of the pressure extension.

The following steps were completed to prepare for the test:

- A small-diameter test hole (5/8") was drilled through the slab in each location.
- Vapor Pins® were temporarily installed in each of the test locations.
- Suction was applied to the 3" PVC vent pipe utilizing a Fantech® Pressure Field Evaluation Diagnostic Kit (PFEDK). Adjustable fan speed was set to a consistent level of 7.0.
- A digital micromanometer was used to measure vacuum pressure at each test port.
- Measurements were analyzed to determine pressure field extension and overall system performance.
- Distances are measured and noted as either direct line of sight, or via Soil Gas Collector Mat™.

Measurement Locations and Results

A total of nine measurement locations were identified based on factors such as the distance to the suction location and proximity to grade beams. The fan produced 207 CFM² (cubic feet per minute) and 4,217 ft/s with a 3" PVC pipe during the testing.



This graph highlights how the Strong Sleeves™ helps maintain air pressure over an extended distance, making it effective for sub-slab ventilation systems.

¹ Performance standards: ANSI/AARST CC-1000-2018-0523, Soil Gas Control Systems in New Construction of Multifamily, School, Commercial and Mixed-Use Buildings – Rev. 5/23

² The equivalent CFM at sea level would be approximately 263 CFM, assuming the same mass flow rate and adjusting for atmospheric pressure differences. The difference is ~27% higher at sea level.

Measurement Observations:

- Sharp initial pressure drop from 2 inches (-1.40 in. WC) to 59 inches (-0.45 in. WC), showing significant suction near the extraction point.
- Moderate decline: between 59 inches and 119 inches, the pressure gradually decreases from -0.45 to -0.34 in. WC.
- Pressure stabilization: beyond 311 inches, the pressure levels off between -0.04 and -0.02 in. WC, indicating minimal loss over longer distances.

Key Findings of Report

1. Uniform Pressure Distribution in the Soil Gas Collection System

- a. Readings from test locations on opposite sides of the grade beam showed no notable change in pressure field propagation, indicating consistent air flow through grade beams when Strong Sleeves™ were used.
- b. The pressure differential across test points demonstrates effective sub-slab gas movement.

2. Unrestricted Pressure Communication Across Grade Beams

- a. Measurements confirmed that the presence of Strong Sleeves™ within the grade beams did not impede pressure field extension across the slab.
- b. Pressure readings on both sides of the grade beam remained consistent³, suggesting no significant pressure drop.

3. Strong Sleeves™ Design Effectiveness

- a. The Strong Sleeves™ allowed for uninterrupted airflow, contributing to an effective radon mitigation gas pathway.

Conclusion

This study demonstrates that using PDS Radon's Soil Gas Collector Mat™ and Strong Sleeves™ effectively created a pressure field extending more than 35 feet from the extraction point. By following ANSI AARST guidelines and incorporating these materials, we achieved a 100% success rate in pressure field extension (PFE) across grade beams, eliminating concerns about airflow obstruction. These results offer architects and builders a proven, cost-effective solution for designing efficient soil gas mitigation systems with reduced complexity.

End of Report

³ 0.01 inWC pressure drop is attributed to natural decrease based on the increased distance from the extraction point.