

NIBS AIR BARRIERS

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Update on Standards

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ASHRAE 1478 RP

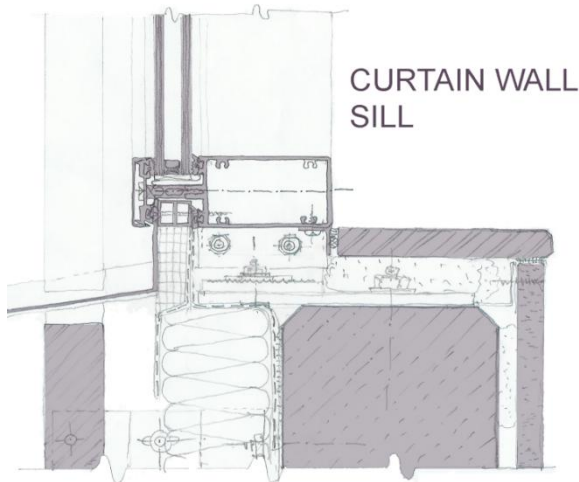
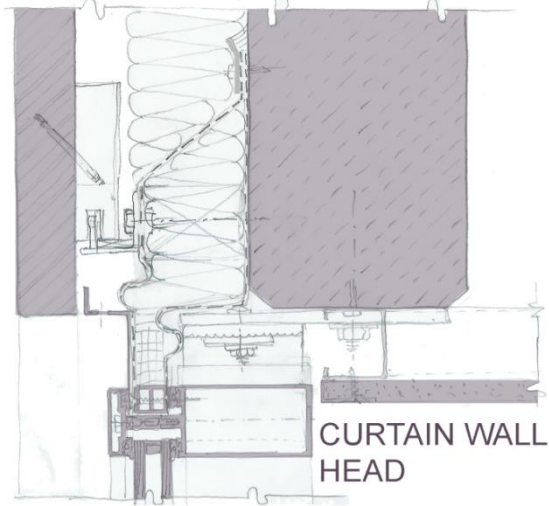
LEED PLATINUM
0.8 cfm/ft² @ 75 Pa



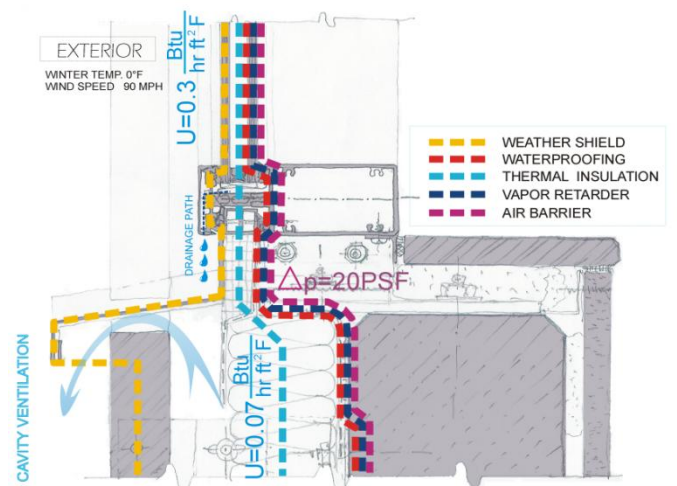
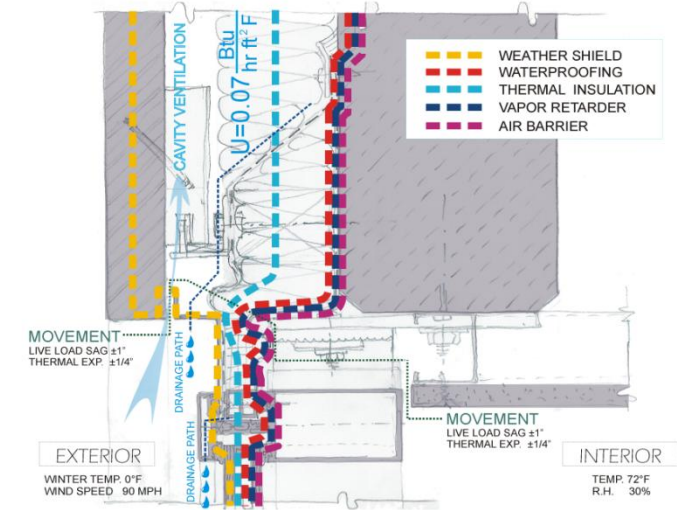
PEN TEST

Continuity of barriers

DETAILS TO BE ANALYZED



ANALYSIS OF DETAILS



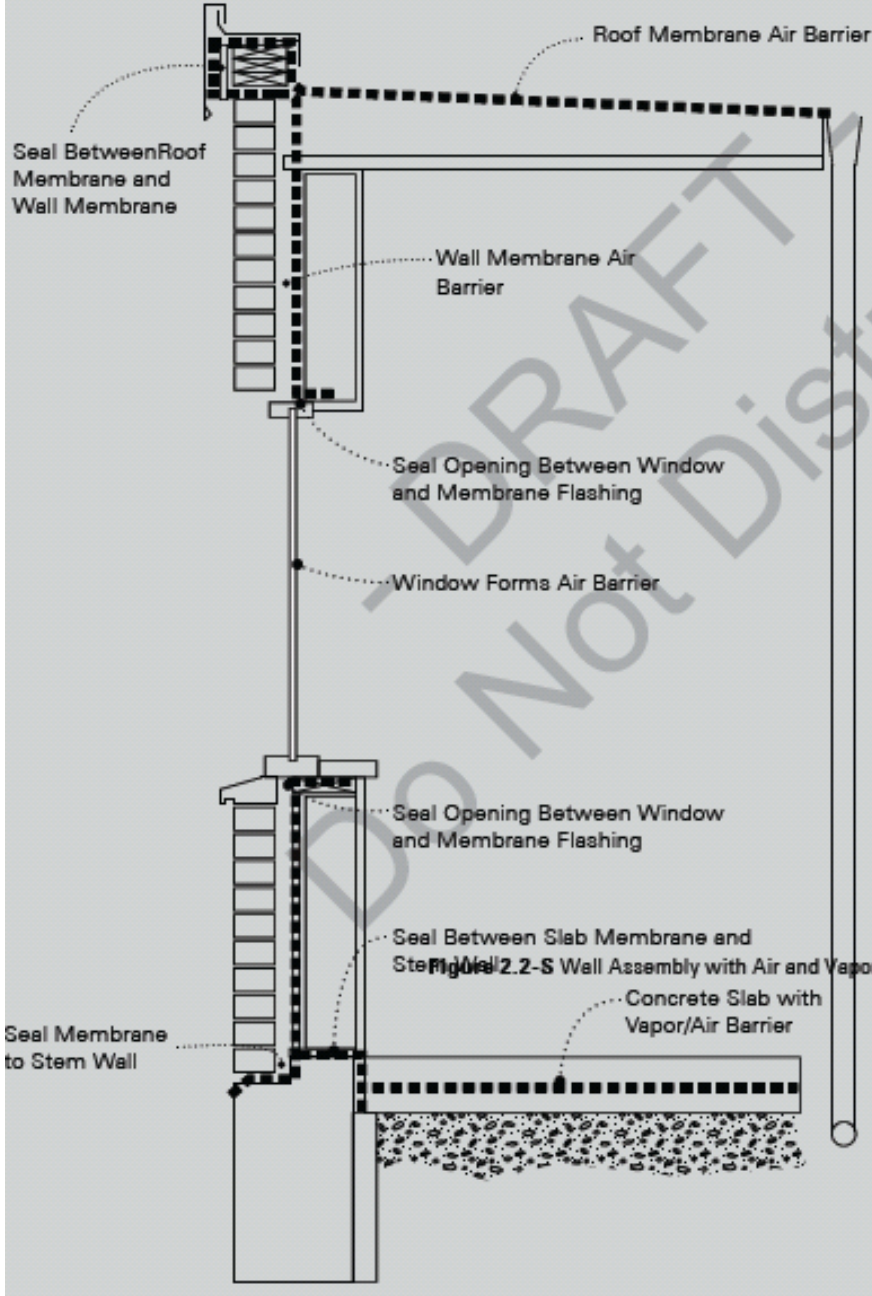


Figure 2.2-S Wall Assembly with Air and Vapor

Air Leakage

Air Barrier Continuity



Icicles due to Air Leaks
Water Vapor Control

Condensation on Cold Surfaces in Plenums



Air Leakage



**Efflorescence, Spalling due to
Air Leaks**



- **Continuous air barrier:** The combination of interconnected materials, assemblies and sealed joints and components of the building envelope that minimize air leakage into or out of the
- building envelope.

- **Inspections.** All building construction, *additions*, or alterations subject to the provisions of this standard shall be subject to inspection by the *building official*, and all such work shall remain accessible and exposed for inspection purposes until approved in accordance with the procedures specified by the *building official*. Items for inspection include at least the following:
 - a. wall insulation after the insulation and vapor retarder are in place but before concealment
 - b. roof/ceiling insulation after roof/insulation is in place but before concealment
 - c. slab/foundation wall after slab/foundation insulation is in place but before concealment
 - d. fenestration after all glazing materials are in place
 - ***e. continuous air barrier after installation but before concealment***
 - f. mechanical systems and equipment and insulation after installation but before concealment
 - g. electrical equipment and systems after installation but before concealment

- **5.4.3.1 Continuous Air Barrier.** The entire building envelope shall be designed and constructed with a *continuous air barrier*.
- **Exceptions to 5.4.3.1:**
 1. Semiheated spaces in climate zones 1 thru 6.
 2. Single wythe concrete masonry buildings in climate zone 2B
- **5.4.3.1.1 Building Envelope Air Barrier Design.** The air barrier shall be designed and noted in the following manner:
 - a. All air barrier components of each building envelope assembly shall be clearly identified or otherwise noted on construction documents.
 - b. The joints, interconnections, and penetrations of the air barrier components including lighting fixtures shall be detailed or otherwise noted.
 - c. The continuous air barrier shall extend over all surfaces of the building envelope (at the lowest floor, exterior walls, and ceiling or roof).
 - d. The continuous air barrier shall be designed to resist positive and negative pressures from wind, stack effect and mechanical ventilation.
 - e. Each assembly serving as part of a continuous air barrier shall be joined and sealed in a flexible manner to the adjacent air barrier component, allowing for relative movement of these assemblies and components

- **5.4.3.1.2 Air Barrier Installation.** The following areas of the *continuous air barrier* in the *building envelope* shall be wrapped, sealed, caulked, gasketed, or taped in an approved manner to minimize air leakage:
 - a. Joints around *fenestration* and *door* frames (both manufactured and site-built).
 - b. Junctions between *walls* and *floors*, between *walls* at building corners, between *walls* and *roofs* or *ceilings*.
 - c. Penetrations through the *air barrier* in *building envelope roofs*, *walls*, and *floors*.
 - d. Building assemblies used as ducts or plenums.
 - e. Joints, seams, connections between planes, and other changes in air barrier materials.

- **5.4.3.1.3 Acceptable Materials and Assemblies.** Continuous air barrier materials and assemblies for the opaque *building envelope* shall comply with one of the following requirements:
 - a. Materials that have an air permeance not exceeding 0.004 cfm/ft² under a pressure differential of 0.3” w.g. (1.57psf) (0.02 L/s.m² @ 75 Pa) when tested in accordance with ASTM E 2178. The following materials meet the requirements of 5.4.3.1.3 a:
 - 1. Plywood - minimum 3/8” (10 mm)
 - 2. Oriented strand board - minimum 3/8” (10 mm)
 - 3. Extruded polystyrene insulation board - minimum 1/2” (12 mm)
 - 4. Foil-back faced urethane insulation board - minimum 1/2” (12 mm)
 - 5. Exterior gypsum sheathing or interior gypsum board - minimum 1/2” (12 mm)
 - 6. Cement board - minimum 1/2” (12 mm)
 - 7. Built up roofing membrane
 - 8. Modified bituminous roof membrane
 - 9. Fully adhered single-ply roof membrane
 - 10. A Portland cement/sand parge, stucco or gypsum plaster minimum 5/8” (16 mm) 1/2” (12mm) thick
 - 11. Cast-in-place and precast concrete.
 - 12. Sheet metal.
 - 13. Closed cell 2 lb/ft³ (32 kg/m³) nominal density spray polyurethane foam, minimum 1 in (25 mm)

- b. Assemblies of materials and components (sealants, tapes, etc.) that have an average air leakage not to exceed 0.04 cfm/ft² under a pressure differential of 0.3” w.g. (1.57psf) (0.2 L/s.m² @ 75 Pa) when tested in accordance with ASTM E 2357, ASTM E 1677, ASTM E 1680 or ASTM E283; The following assemblies meet the requirements of 5.4.3.1.3 b.
 1. Concrete masonry walls that are:
 - i. Fully grouted, or
 - ii. Painted to fill the pores.

“SHOW ME” Blower Door Testing ASTM E 779



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- Design and construct the building envelope for office buildings, office portions of mixed office and open space (e.g., company operations facilities), dining and barracks facilities with a continuous air barrier to control air leakage into, or out of, the conditioned space.
- Clearly identify all air barrier components of each envelope assembly on construction documents and detail the joints, interconnections and penetrations of the air barrier components.
- On the design drawings, clearly identify the boundary limits of the building air barriers, and of the zone or zones to be tested for building air tightness.

- a) A continuous plane of air-tightness must be traced throughout the building envelope with all moving joints made flexible and sealed.
- b) The air barrier material(s) must have an air permeance not to exceed 0.004 cfm / sf at 0.3" wg [0.02 L/s.m² @ 75 Pa] when tested in accordance with ASTM E 2178
- c) The air barrier material of each assembly shall be joined and sealed in a flexible manner to the air barrier material of adjacent assemblies, allowing for the relative movement of these assemblies and components.

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- d) The air barrier must be supported so as to withstand the maximum positive and negative air pressure to be placed on the building without displacement, or damage, and transfer the load to the structure.
- e) Penetrations of the air barrier must be sealed
- f) The air barrier must be durable to last the anticipated service life of the assembly.
- g) Lighting fixtures with ventilation holes must not be installed through the air barrier

US Army Corps of Engineers

- h) Fixed open louvers such as at elevator shafts must be provided with a motorized damper in the closed position and connected to the fire alarm system to open on call and fail in the open position
- i) Ventilation or make-up air intakes and exhausts, atrium smoke exhausts and intakes, etc must be dampered and controlled to close when leakage can occur during inactive periods.
- j) Compartmentalize garages under buildings by providing air-tight vestibules at building access points.
- k) Compartmentalize spaces under negative pressure such as boiler rooms and provide make-up air for combustion.

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- Submit the qualifications and experience of the testing entity for approval.
- (a) Test the completed building and demonstrate that the air leakage rate of the building envelope does not exceed 0.25 cfm/ft² at a pressure differential of 0.3” w.g.(1.25 L/s.m² @ 75 Pa) in accordance with ASTM E 779 (2003) or E-1827-96 (2002)

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- b) Test the completed building using Infrared Thermography testing. Use infrared cameras with a resolution of 0.1deg C or better. Perform testing on the building envelope in accordance with ISO 6781:1983 and ASTM C1060-90(1997). Determine air leakage pathways using ASTM E 1186-03 Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems, and perform corrective work as necessary to achieve the whole building air leakage rate specified in (a) above.

In The Pipeline

- TRIFORCES, Army/Navy/Air Force: Update UFC-3-101-01 Architecture
 - Requirements similar to USACE
- GSA P-100 Design Requirements
 - Similar to ASHRAE but whole building at 0.4 cfm/ft²@75 Pa

31 USACE Buildings “Pass” 0.25 cfm / ft² @ 0.3 w.c. (75Pa)

Location	Building Type / #	Air Barrier Envelope Size (ft ²)	Result (CFM / ft ²)	% Better than 0.25 CFM/ft ²
Ft. Bliss, TX	IBCT 1 UEPH 1	71,312	0.05	81%
Ft. Bliss, TX	IBCT 1 UEPH 2	71,312	0.06	76%
Ft. Sam Houston, TX	BRAC METC Dorm 1	371,099	0.07	73%
Ft. Bliss, TX	IBCT 1 UEPH 7	71,312	0.07	72%
Ft. Bliss, TX	BCT 3 UEPH 1	72,573	0.10	62%
Ft. Polk, LA	Barracks (Renovation)	52,476	0.10	60%
Ft. Sam Houston, TX	METC Dorm 1	141,893	0.10	60%
Ft. Bliss, TX	BCT 3 TEMF1	24,632	0.13	48%
Ft. Riley, KS	COF	43,115	0.14	44%
Ft. Leonard Wood, MO	Battalion HQ	63,276	0.14	44%

USACE Buildings “Passing” 0.25 cfm / ft² (Cont'd 1)

Location	Building Type / #	Air Barrier Envelope Size (ft ²)	Result (CFM / ft ²)	% Better than 0.25 CFM/ft ²
Ft. Carson, CO	47th BCT TEMF 2	25,190	0.15	40%
Ft. Carson, CO	47th BCT TEMF 3	28,104	0.15	40%
Ft. Carson, CO	CDC	55,411	0.15	40%
Ft. Bliss, TX	BCT 3 UEPH 3	72,573	0.15	40%
Ft. Bliss, TX	BCT 3 UEPH 3	72,573	0.15	40%
Corpus Christi, TX	Controlled Humidity Storage Facility	227,867	0.15	40%
Ft. Carson, CO	47th BCT TEMF 1	28,104	0.16	36%
Ft. Carson, CO	UMF TEMF	12,855	0.16	36%
Ft. Carson, CO	47th BCT TEMF 4	25,190	0.17	32%
Ft. Leonard Wood, MO	Barracks 1	84,309	0.17	32%

USACE Buildings “Passing” 0.25 cfm / ft² (Cont’d 2)

Location	Building Type / #	Air Barrier Envelope Size (ft ²)	Result (CFM / ft ²)	% Better than 0.25 CFM/ft ²
Ft. Leonard Wood, MO	Barracks 4	84,309	0.17	32%
Ft. Bliss, TX	Fires Brigade TEMF	21,307	0.19	24%
White Sands MR, NM	UOF TEMF	25,924	0.19	24%
Ft. Leonard Wood, MO	Barracks 3	84,309	0.20	20%
Ft. Leonard Wood, MO	Barracks 2	84,309	0.21	16%
Ft. Carson, CO	HQ TEMF	27,500	0.22	12%
Ft. Carson, CO	47th BCT TEMF 5	12,855	0.22	12%
Ft. Carson, CO	47th BCT TEMF 6	12,855	0.22	12%
Ft. Bliss, TX	BCT 3 COF 1	24,363	0.22	12%
Ft. Carson, CO	EN TEMF	27,500	0.25	0%

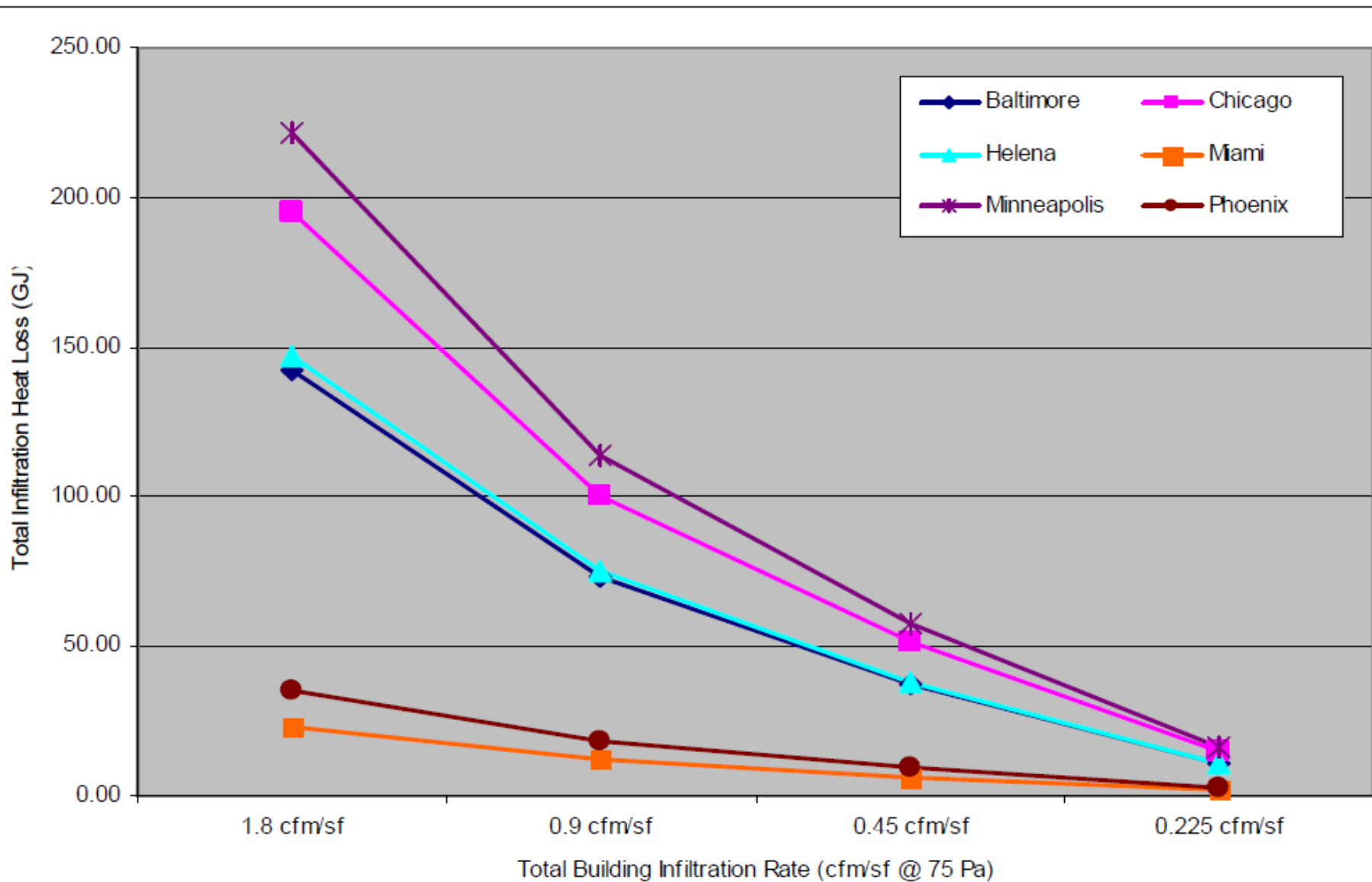


Figure 6: Impact of Infiltration Rate on Total Sensible Heat Loss