

Average values of heat gain for four walls of a square building show that peak loads are increased from 38 to 65% as result of less mass.

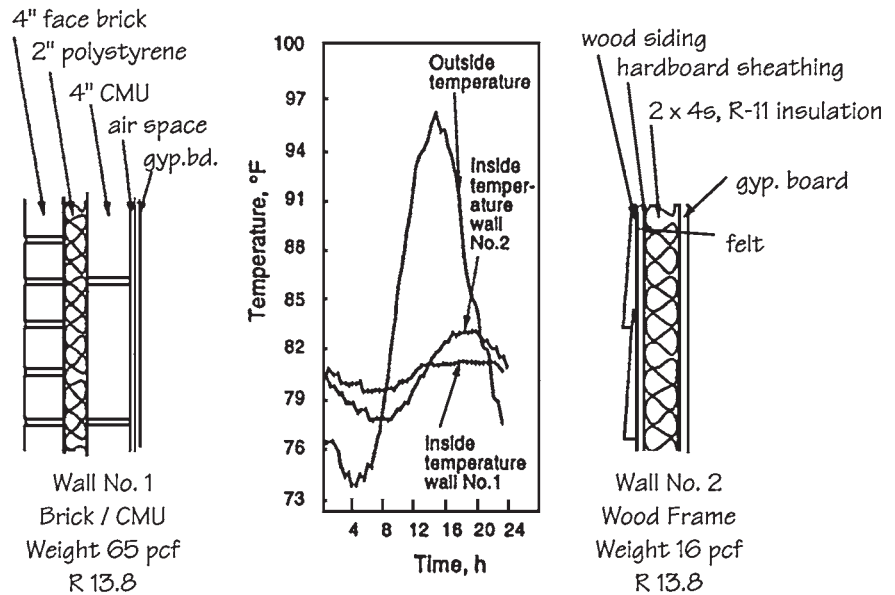


Figure 8-27 Interior temperature comparison and heat-gain curves for various wall types. (From Mario J. Catani and Stanley E. Goodwin, "Heavy Building Envelopes and Dynamic Thermal Response," Journal of the American Concrete Institute, February 1976.)

peak heating loads. It was found that, although the effects are not as dramatic for winter conditions, peak heating load requirements decreased as the weight of the building walls increased (see Fig. 8-29).

Test buildings have been used to validate computer programs for dynamic heat-loss calculations by comparing them to actual measured heating loads. The National Institute of Standards and Technology (NIST) conducted a series of tests on a full-scale building erected in its environmental chamber where both temperature and humidity can be controlled. The study also

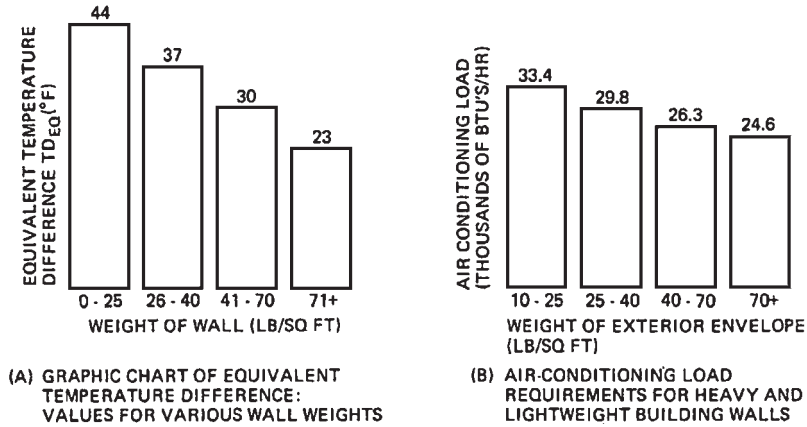
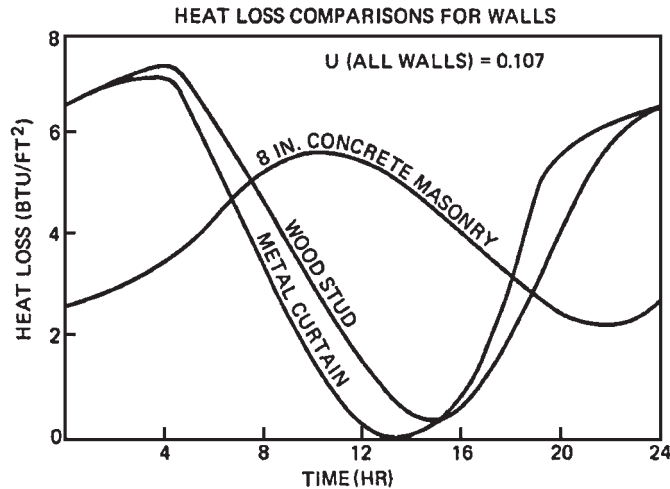


Figure 8-28 Effect of wall weight on heat transfer and air-conditioning load. (From *National Concrete Masonry Association, TEK Bulletin 82, NCMA, Herndon, VA.*)



A computer program analysis shows that heat loss through walls with identical U-factors and configuration of insulation varies considerably due to mass. The effect of glass, occupants, and lights accentuates the difference.

Figure 8-29 Catani and Goodwin's heat-loss curves for various wall types. (From *Mario J. Catani and Stanley E. Goodwin, "Heavy Building Envelopes and Dynamic Thermal Response,"* Journal of the American Concrete Institute, February 1976.)

compared maximum heat flow rates predicted by the steady-state and dynamic methods with actual measured heat flow (see Fig. 8-30). Steady-state calculations were an average of 52% higher than measured results.

8.5.2 The M Factor

The computer programs developed by ASHRAE and NIST for dynamic heat-loss calculations are so complex that they do not easily translate into a simple