

Evaluation of Homes Built to the New Minnesota Energy Code

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2000 Minnesota Energy Code

Major New Features

- Air tightness
 - Rim joist air/vapor barrier
 - Attached garage air barrier
- Mechanical ventilation
 - Air quantity & distribution
- Protection against backdrafting

Objective of study

- To examine the effectiveness of energy code features in new homes
- To determine occupant understanding and practice of home maintenance
- To compare performance of homes built to 3 different energy codes
- NOT designed to evaluate compliance with the energy code

Study design

- 43 randomly selected homes in Twin Cities metro area
- 21 “Category 2” homes
- 17 “Category 1” homes
- 5 Chapter 7672 homes

Performance Indicators Studied

- Effectiveness of Building Envelope
- Ventilation and Mechanical System Effectiveness
- Indoor air quality
- Energy Use
- Comparison of 3 codes & years built
 - 1994 code / Category 1 / Chapter 7672
 - 1994 / 1998 / 2000

Envelope Detail Problems Found

- Cantilevered floors over garages
- “Bump-outs” for entertainment centers and fireplaces
- Rim joist penetrations
- Shower and tub enclosures along exterior walls
- Additional framed cavities adjacent to exterior walls and attic bypasses

Attached Garages



- Air leakage from floor cavities situated over attached garages
- Simple practices could remedy this situation

Envelope Bump Outs



Framed fireplace
cavity on an exterior
wall

Rim Joist Areas



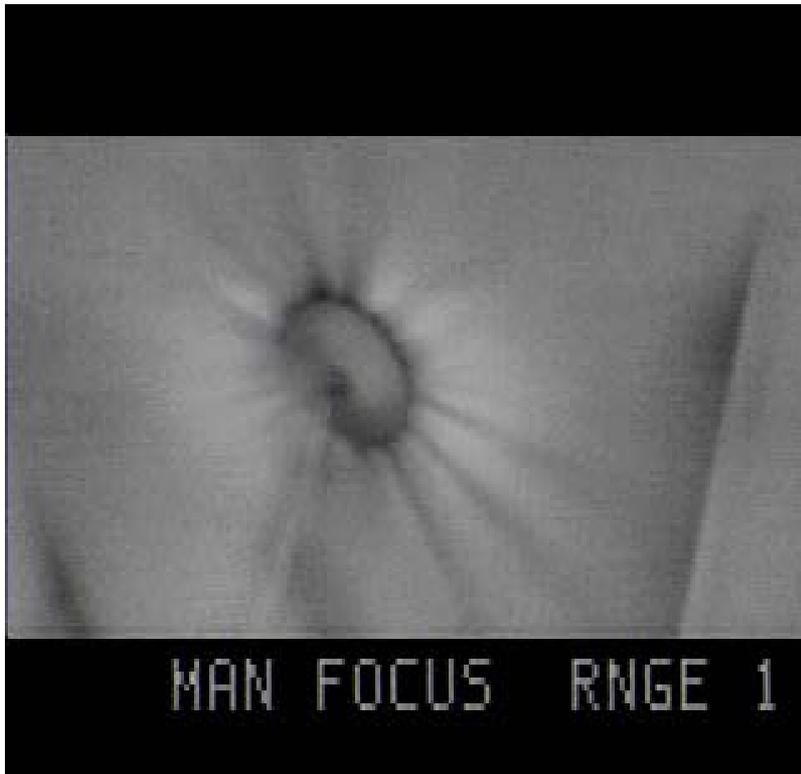
Unsealed rims make for cold floors and may contribute to stained siding

Shower and tub enclosures



Cold could lead to surface condensation and mold, as well as accumulation of water in the wall cavities

Additional Framed Cavities and Attic Bypasses



- Light fixtures, speakers, etc.
- Interior soffits
- A leading cause of ice dams

Ventilation System Performance

- Mechanical ventilation systems meet or exceed the minimum airflow requirements of the new energy code.
- Indoor air appears to be adequate
 - by measurement of humidity, and
 - satisfaction expressed by home owners

Balanced mechanical ventilation (HRV/ERV) systems (25 homes)

- Adequate airflow through the in most cases -
However, several minor installation problems
- Only 22% of these homes had controls to
distribute ventilation air out of the ductwork
- 32% of HRV/ERV systems were not balanced
- 7% of these homes had improperly placed exterior
hoods
- 30% had no condensate trap

Exhaust-Only Ventilation Systems (3 homes)

- All had adequate air flow (one measured 69 cfm for a required 70 cfm flow)
- Each of the systems had controls to distribute fresh air

Cost of ventilation systems

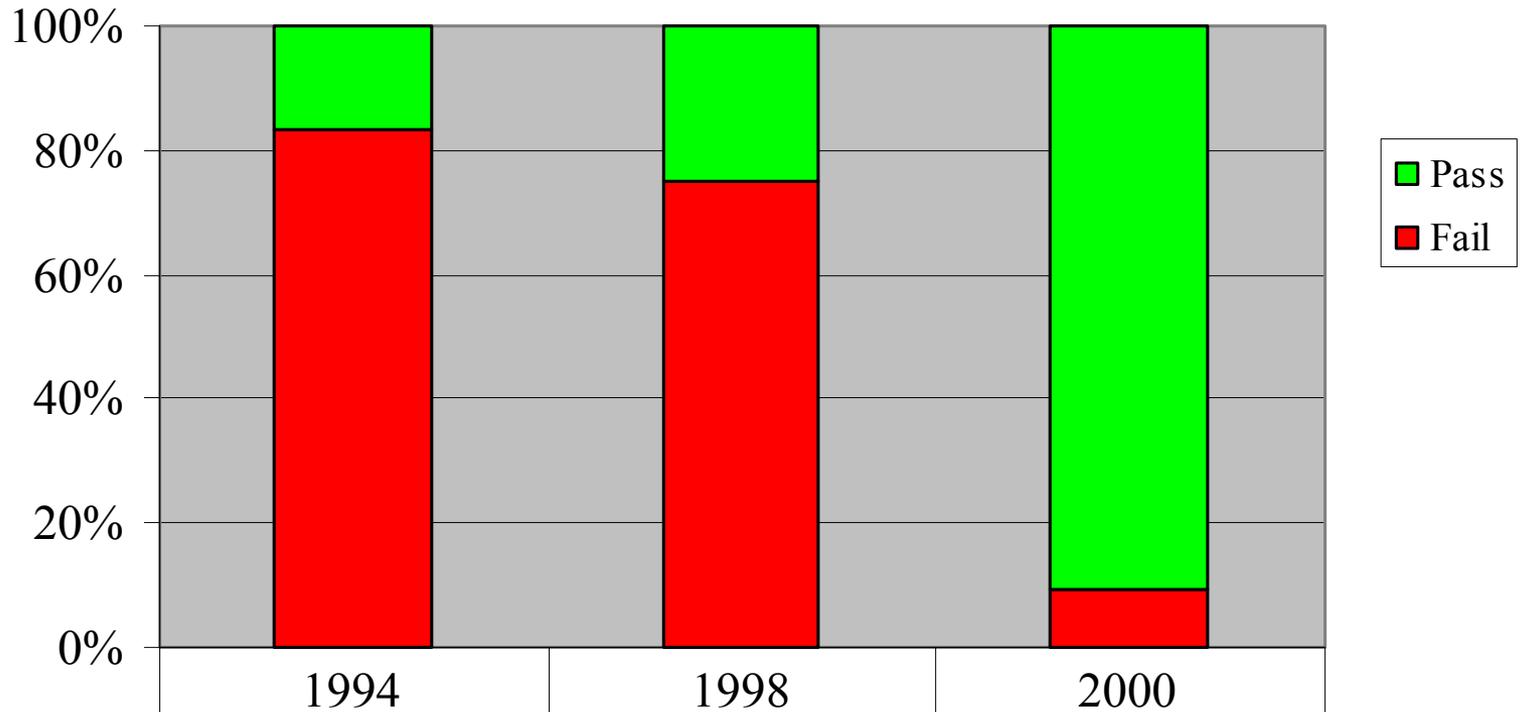
- Balanced mechanical ventilation systems - \$2200 to \$2800
- Exhaust-Only - \$300 to \$500
- Other reports have compared overall cost/benefit of these approaches

Indoor Air Quality

- Indoor winter relative humidity is being maintained at healthy levels
- Because these homes are tighter, there is less potential for entry of indoor air pollutants
- Potential for backdrafting is much lower for 2000 code homes than 1994 code homes

Depressurization by Year Built

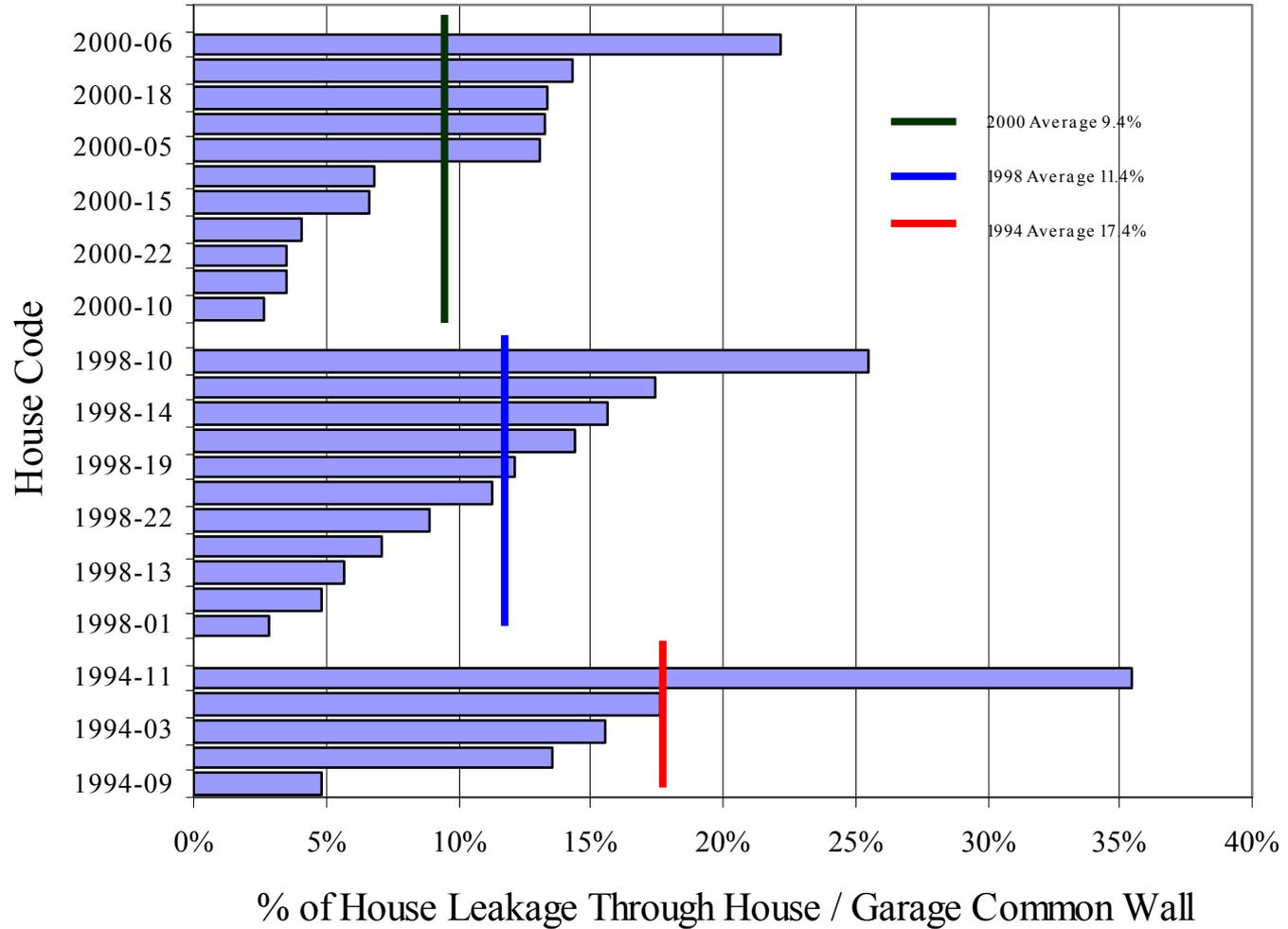
7672.0900 Subp. 8, Section D



	1994	1998	2000
Pass	1	4	19
Fail	5	12	2

Potential for spillage or backdrafting of combustion appliances

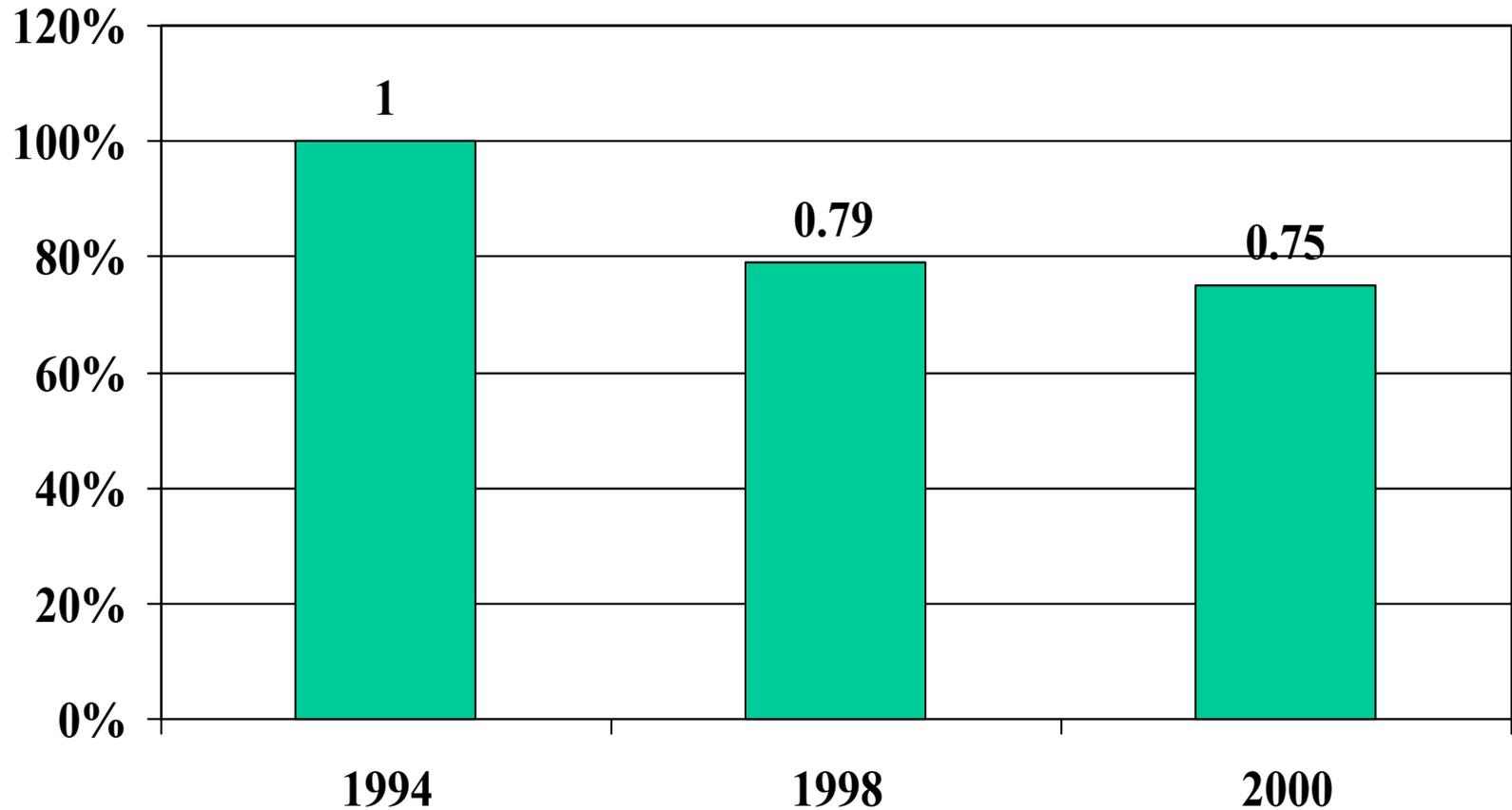
Measured Leakage From Attached Garages



Building practices that needed to change

- Rim Joist
- Space Heating
- Domestic Water Heating
- Combustion air
- Ventilation
- Make-up Air

Relative Energy Consumption



Overall Cost to Comply with the New Energy Code

- added \$1.00 to \$1.15 per square foot (approximately 1% of the total cost of the home)
- Considering current energy cost only, a simple payback of about 9 years
 - Additional benefits to occupant health and building durability would shorten this payback period

Recommendations for Energy Code Writers

- The new features of the Minnesota energy code do work:
 - Homes are tighter
 - Potential for backdrafting is significantly reduced
 - Energy Performance appears to have improved significantly

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Complete report
available at

www.commerce.state.mn.us

Energy / Specially for Builders page