U.S. Department of Energy
Energy Efficiency and Renewable Energy
Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

Building Energy Codes

Achieving 30% Improvement in the IECC

Energy Savings, Reliability, Enforcement, and Design Tools

Z. Todd Taylor
Building Energy Codes Program
Pacific Northwest National Laboratory
Energy Codes 2008
St. Paul, MN

HOW to Achieve 30% Improvement?

- A few component improvements
- A few verification improvements (e.g., duct tightness)
- A few scope expansions (e.g., lighting, glazing orientation)
- A few loophole closures (e.g., glazing orientation)
- Some quality control things
  - Air distribution design?
  - Thermostat placement?
- Maybe pick up some smart things ignored out of paranoia
  - Moveable shading devices
  - Moveable night insulation
  - Deciduous trees on the south
  - Trees of any kind on the west
- _____ efficiency

HOW to Achieve 30% Improvement?

- Can that be done?
  - YES
- Can that be done cost effectively?
  - YES
- Can that be done enforceably?
- Can that be done reliably?
  - We better figure it out

What's the goal?

- Pat answer: IECC gets 30% better

  Requires IECC to get 30% better

- Better answer: Minimally-compliant IECC homes use 30% less energy

  Requires 30% better IECC and some other things:

  - Ease and certainty of enforcement
  - Certainty of energy savings in the field
  - Minimal hindrance of the design process

The Design Process

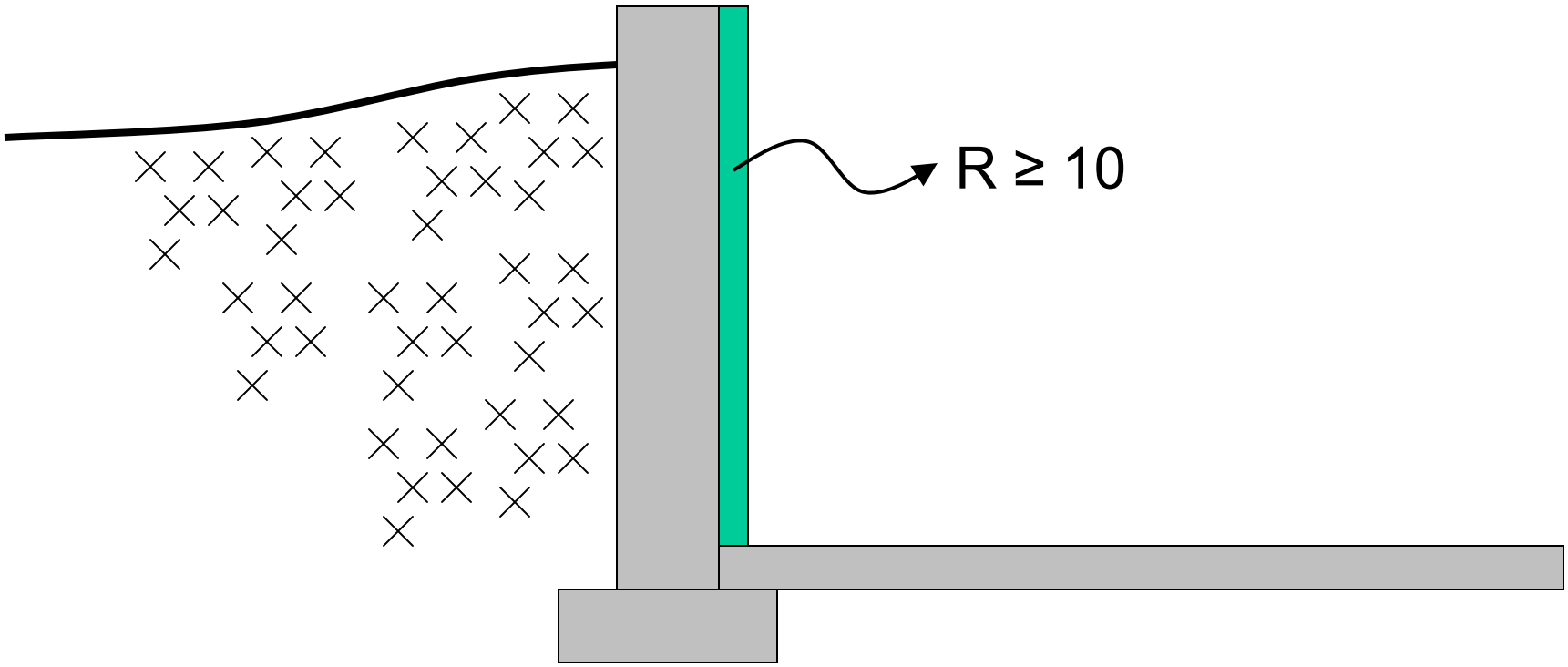
- Should…
  - code considerations be moved into the design process? (yes)
  - the design process be moved into code enforcement? (preferably not)
- Increasingly, the latter seems to be happening
  - Almost every efficient home is a unique combination of good ideas
  - Compliance tools incorporating hourly simulation

This is nothing new, right?

- Usability vs accuracy
- Enforceability vs accuracy
- Flexibility vs certainty of savings
- Richness of available products vs market transformation
- Etc.

The Problem Illustrated

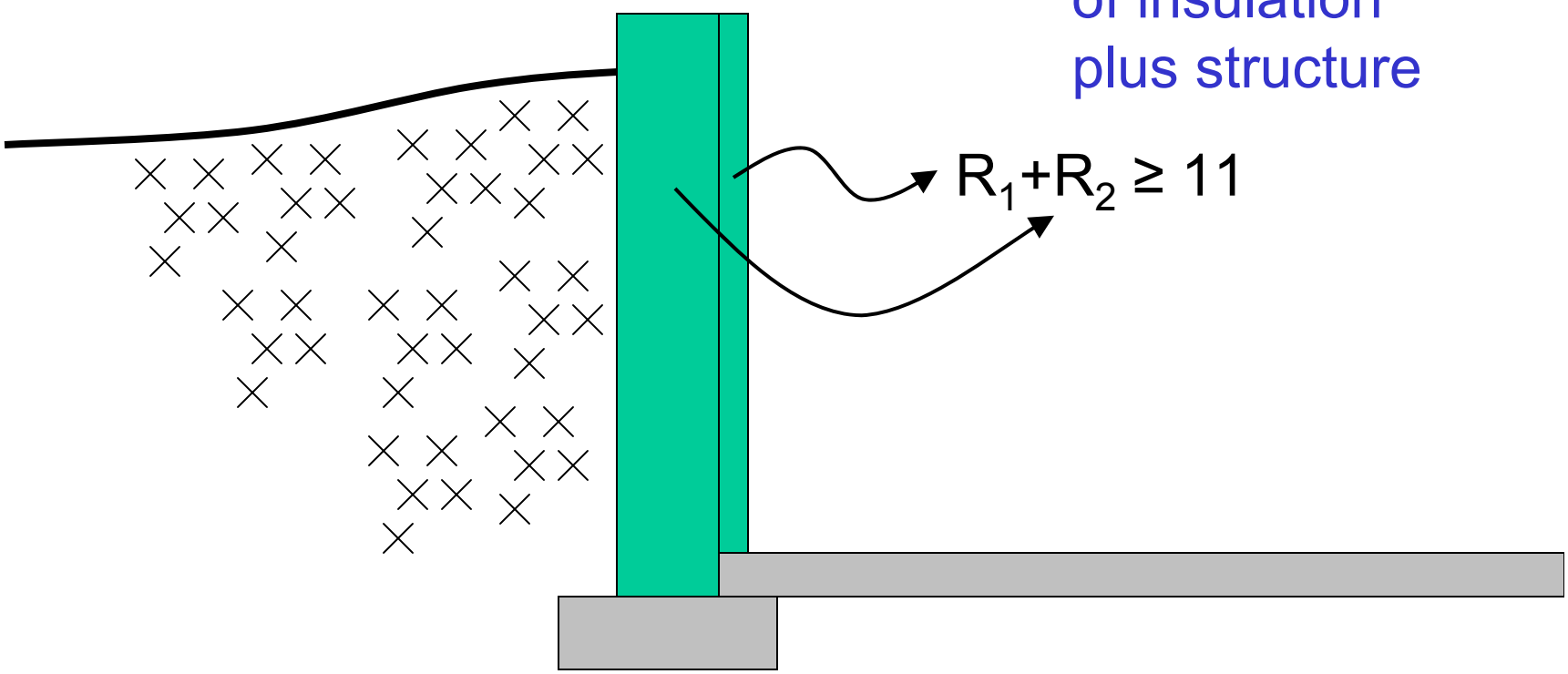
- Goal: Write code spec for basement wall insulation
  - Most Enforceable: R-value of insulation only



The Problem Illustrated

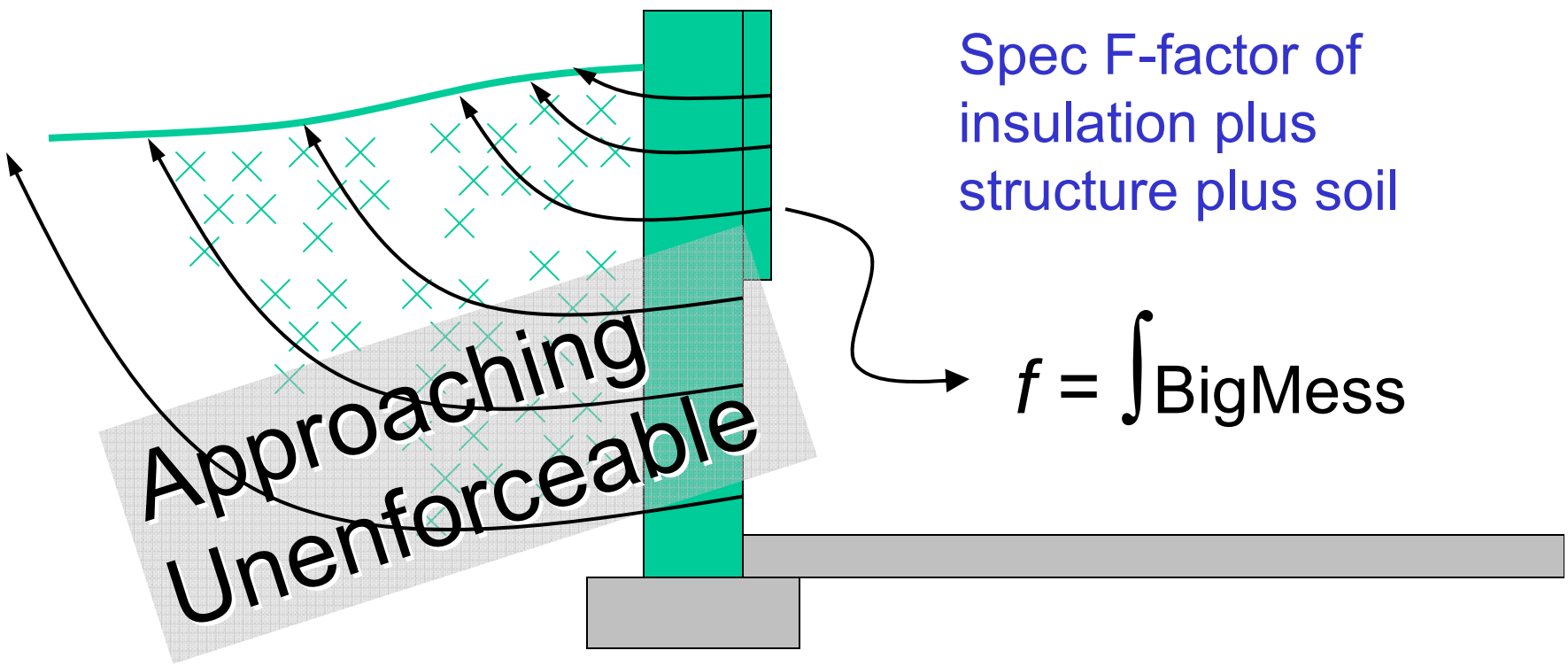
- Goal: Write code spec for basement wall insulation
  - But…what about high-R concrete?

Spec R-value of insulation plus structure



The Problem Illustrated

- Goal: Write code spec for basement wall insulation
  - But…what about half-height insulation?



How to make it work?

- An engineer can probably figure all this out
- An architect, possibly
- A designer, maybe
- A code official, probably not
  - Even if he can, he doesn’t have the time
  - If he has the time, he’ll need some tools
  - Probably a tool very similar to the one used by the engineer/architect/designer
- Is it really productive to inject design tools into the compliance process?

The Perfect Residential Energy Code (a completely fictitious example)

Code text in its entirety:

"The capacity of the electric service panel shall not exceed 100 Amps."

(works only for all-electric homes)

(change the '100' to whatever it needs to be)

Simple Amperage Limit: Advantages?

- Inspection takes 20 seconds
- 100% enforcement practically guaranteed
- No perverse incentives (builder's motivation is to actually reduce building loads)
- Continues to work for modifications/additions
- Puts the screws to Hummer Homes and McMansions
- Relatively little impact on starter homes (for which affordability is a primary concern)
- Deals with peaks (maybe even better than energy)

Service Panel ≤ 100 Amps

- Requires excellent engineering
- Requires excellent design tools

- But…it requires these of the designer, not the code official

- Distinguishing characteristic: Code is a *simple* constraint in an otherwise *unrestricted* design problem

Can this principle be applied in the limited context of specific component proposals?

Don’t Forget…

- Understandability
- Enforceability
- Compliability
- Certainty of savings
- Minimizing of loopholes
- Minimizing of perverse incentives