
# HIGH-PERFORMANCE AFFORDABLE

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# What's high-performance affordable?

- Optimizes both up-front costs and total cost of ownership: energy, water, maintenance, and health

- Comprised common-sense, best practice design and construction techniques

- Based on building science principles + evidence-based approaches

# Traits of high-performance housing

- Energy smart + resource efficient
- Healthy
- Resilient
- Welcoming of all ages and abilities

# Why build high-performance housing?

- Save the owner/manager money (asset management)
- Save the residents money
- Enhance value of building stock
- Reduce owner risk (health claims, construction defects)
- Avoid externalizing costs to populations that can least afford them

# Design evolution

- Conventional design: sees code as maximum performance level; uses historical data as baseline ("dis-integrated design")

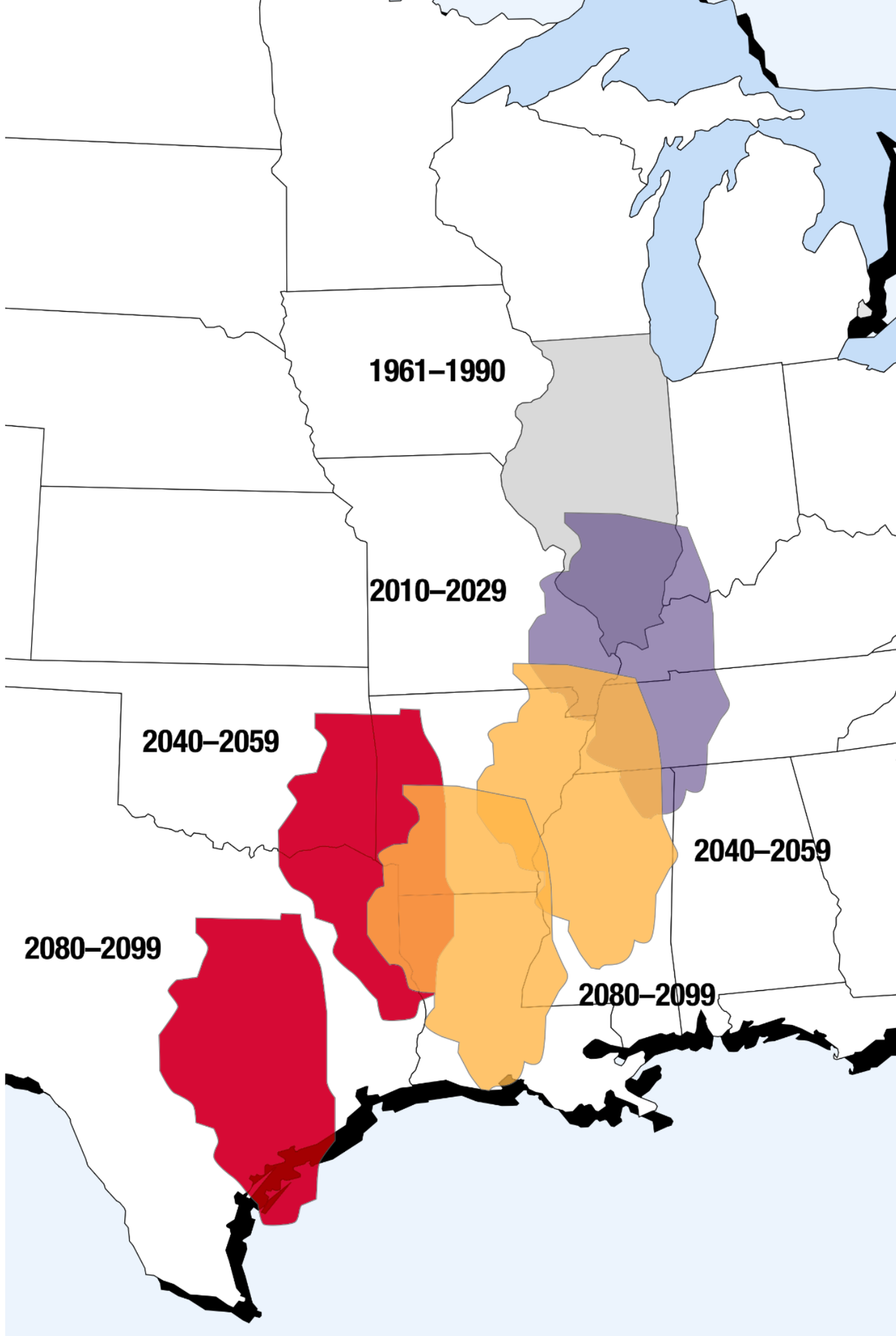
- Green building: context-responsive in that it examines existing site resources and challenges and creates designs in response ("integrated design")

- High-performance design: accounts for existing resources/challenges, but also examines future scenarios and designs for these as well; considers the social aspect and scalar implications more than green building ("integrative design")

# Climate disruption: Illinois forecast

- Dangerously hot summers (heat and humidity)
- Heavier rains; flooding
- Wetter fall, winter + spring
- Drier summers; more frequent short-term droughts
- Increased air pollution

Source: Union of Concerned Scientists
"Confronting Climate Change in the US Midwest"



# Building location + form

- Access to transportation, infrastructure, services
- Simple geometry
- Orientation for passive solar and photovoltaic systems
- Design for community safety
- Avoidance of flood plains

Image: Belfield Avenue Townhomes, Philadelphia (Dwell)

# Brownfield beware

- Brownfield sites may be available for redevelopment
- Often excellent in-town locations with good access
- Requires thorough assessment and remediation to ensure occupant health and safety


Image: West Calumet Housing Complex, East Chicago IN (NBC News)

# The building as a system

- Heat transfer
- Air infiltration + ventilation
- Moisture/vapor
- Bulk water

How do these forces interact? What design approaches and construction details can address this?

Image: govtech.com

# Thermal envelope

- 5-10-20-40-60 "rule"
- R5 windows
- R10 under slab
- R20 foundation walls
- R40 above-grade walls
- R60 attic/roof
- Continuous thermal barrier
- Minimize thermal bridging

Image: Green Building Advisor

# Airtightness

- “Build tight, ventilate right.”
- Continuous air barrier
- At building sheathing, or at drywall
- But how tight? Passive House standard? (0.6 ACH @ 50Pa), or GBA: 1-2ACH50? Other?

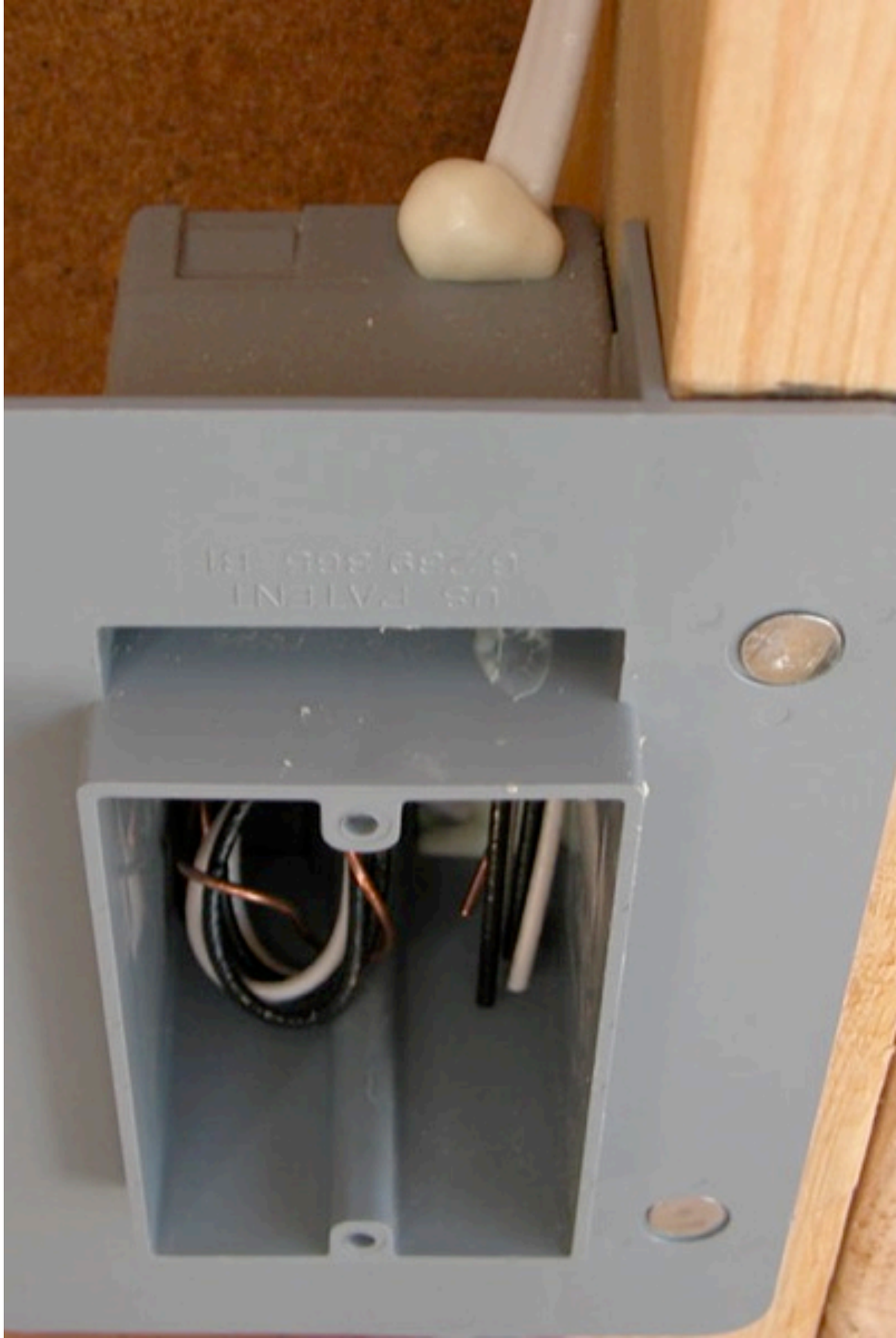


Image: Airfoil Inc.

# Mechanical ventilation

- Ventilation with energy recovery
- Spot ventilation in kitchen, bath, laundry (occupancy sensors or humidistat controls)
- Balanced systems
- Direct-vent or no combustion appliances
- No unvented fireplaces!


Image: www.builditsolar.com

# Moisture management

- Water vapor and bulk water
- Proper flashing
- Ample overhangs
- Clear, layered drainage paths (down and away from building)
- Sufficiently pitched roofs
- Rain screen siding / cladding drainage gaps


Image: Green Building Advisor

# Adaptable design

Design and construct to allow future modifications. If HPB strategies are beyond budget, then create designs that lower barriers for future installation

- "Solar ready" strategies
- Pre-plumb for rainwater harvest and graywater reuse
- Design for disassembly
- Service cavities inboard of air barrier layer; open-web truss floors, etc.

Image: Bensonwood Homes

# Healthy design + construction

Low-income populations are already vulnerable

- Proper ventilation
- Moisture management
- Low-emitting materials
- Easy-clean surfaces
- Minimize carpet
- Permanent walk-off surface at entries
- Design for shoe-free occupancy

Image: Armstrong Linoleum

# Performance verification

Set performance specs up front + in contract docs; then professionally verify achievement

- Airtightness
- Insulation levels
- Ductwork/air handling equipment
- Combustion equipment function
- Refrigerant charges


Image: 363 House

# Occupant/building manager training

- More complex systems require training and education
- Mechanical systems operations and maintenance
- Occupant behavior tips (cooking, shoes, cleaning supplies etc.)

Image: Clean Energy Action

# Architect and contractor skills

- Green design + engineering knowledge
- Each trade has something new to learn; general contractor needs orchestrating skills
- Look for demonstrated experience in each desired application
- Examine professional designations

Image: seia.org


Can you spot the 5 design fails on this building?

*Hint: most architects can't!*


1. Roof design concentrates flow to a single point.


2. Porch roof design directs water/snow to side wall.


3. Bath fan vent location encourages snow melt and ice damming.


4. Ice dams indicate air leaks and heat loss to attic.

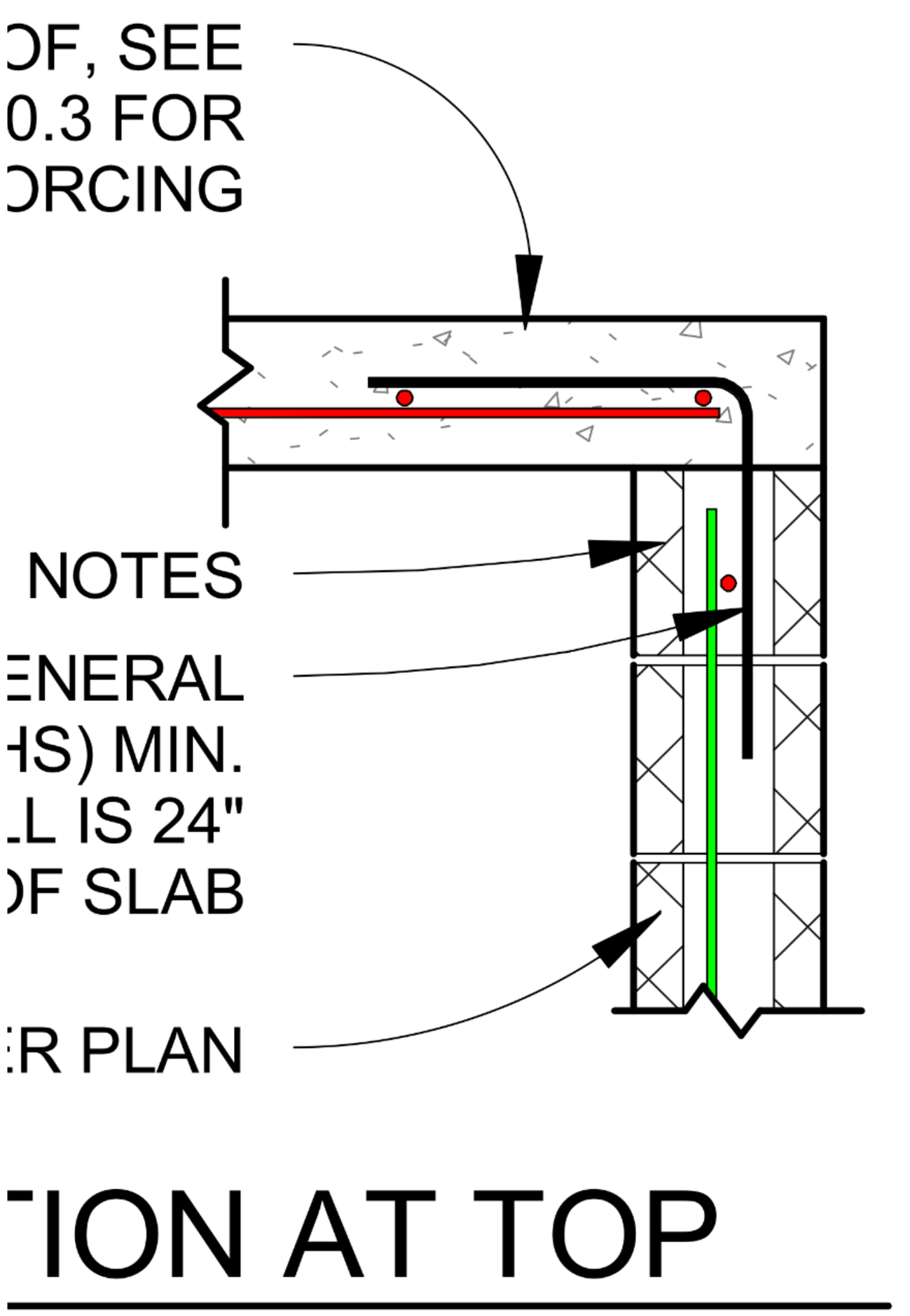

5. Lack of “kick out” flashing to guide water away from wall.

# In summary:

- Survey project's existing context: site resources, challenges, and relationship to larger/nested systems
- Consider future scenarios and their probabilities; use them to inform design
- Build flexibility into designs, or, more importantly, avoid building inflexibility into them
- Use an integrative design approach to capture opportunities and avoid pitfalls
- Set performance goals and explicitly communicate them

# Resources

- Enterprise Green Communities
- Green Building Advisor
- Energy Star Homes and solar ready design
- Building Science Corporation
- Building America



# Thank you!

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