Putting it All Together

Design Specifications for High Performance Homes

April 8, 2005

High Performance Homes are . .

- Green
- Sustainable
- Environmentally responsible

What Makes a Home High Performance? …

It DOES NO HARM

- To People
- To Buildings
- To the Environment

Goals

- Create buildings that ensure a healthy environment for its occupants
- Deliver building that are durable (life expectancy of 100 years with only minimal replacement of parts needed) thereby reducing future waste and depletion of natural resources
- Deliver buildings that have low total energy consumption during their lifetime. They must have low operating energy since operating energy accounts for 70-to-90% of the total energy consumption

Operating Energy +
Embodied Energy +
Decommissioning Energy +

Total Energy

Sustainability is really about Durability .....

- Of People
- Of Buildings
- Of the Planet

How Do We Achieve High Performance Homes? …

- **Design, Construct and Operate the Homes so they are healthy to live in**

- **Design, Construct and Operate Homes so that they last a long time**

- **Do no Harm to the Earth in the Process by using its resources in a conservative manner**

Durability for People = Indoor Air Quality

- Houses are for Humans; Humans want and need safe and healthy homes that are comfortable

- We can provide the above in an energy efficient manner

Durability for Buildings = Building to Last . . .

- Design the Homes so that They Use all of Their Materials and Equipment in their Highest and Best Use
  - Understand the Building System
  - Understand the Damage Functions

Durability for the Planet = How is it Made?. . .

- Evaluate and Understand the Extraction, Manufacture, and Transportation Costs
- This is the Cradle to Gate Process
  - Scar the Landscape
  - Create Chemical Soups
    - Suspected carcinogens
    - Endocrine disruptors
    - Toxic Waste

Durability for the Planet = Conserve Energy . . .

- Embodied energy
- The combustion of fuels to make energy creates byproducts that change our planet
  - Ozone Depletion
  - Greenhouse Gases

The Energy Equation
Embodied Energy . . .

- Energy of extraction
- Energy of manufacturing
- Energy of transport
- Energy of assembly

The Energy Equation =. . .

(Embodied Energy + Operation Energy) x

Useful service Life =

TOTAL ENERGY

What is a High Performance Home? …

- An environmental separator….
  - Recognizes that humans need comfort and nurture
- That reduces heat flow and air flow….
  - No unintentional air change
  - Conserves operational energy use
- That does not trap moisture…….
  - Has liquid water shedding properties by design
  - Has a PLAN to control water in the vapor form

Make the Highest and Best Use of the Materials You Select .....

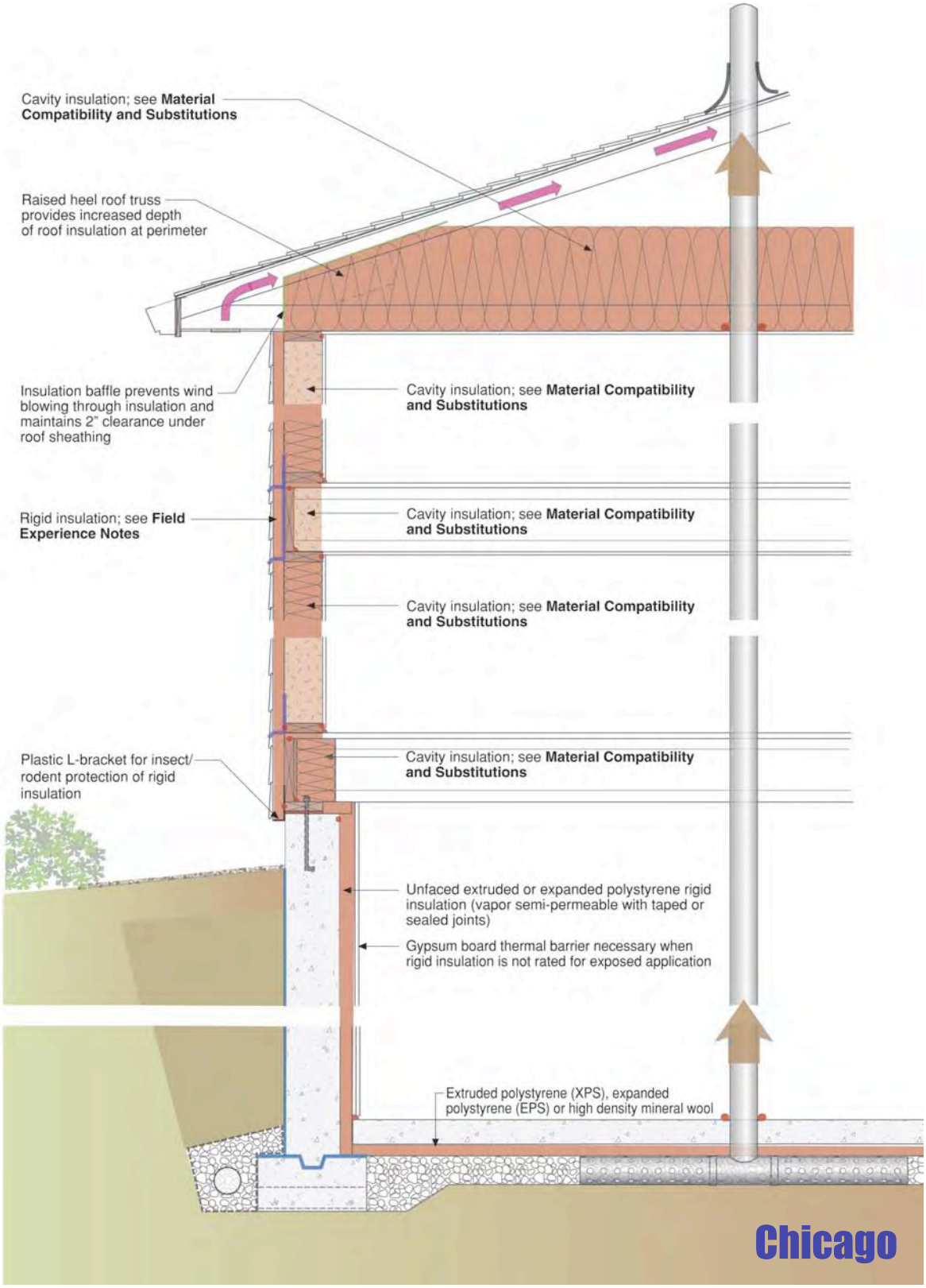
- Assess Risks
  - Manage them
- Quality Assurance
  - Design
- Quality Control
  - Workmanship

Understand Building Science Damage Functions

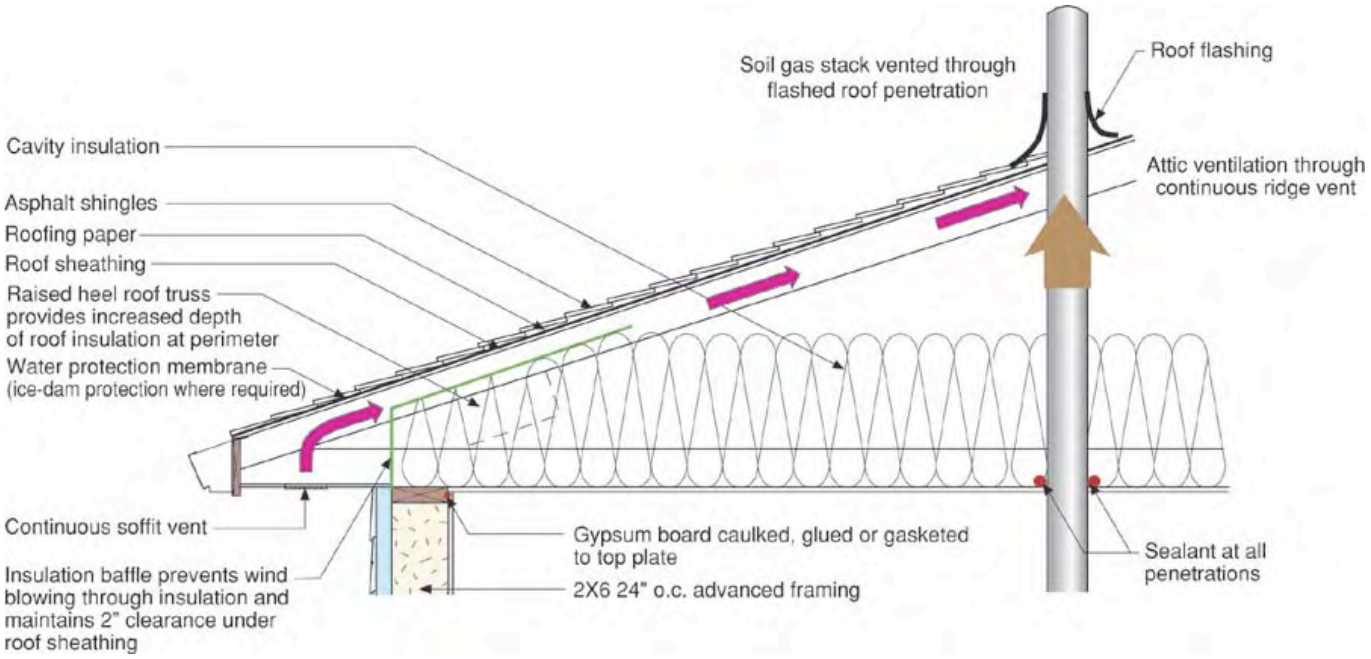
- Systems thinking to design the Building Enclosure
- DO NO HARM

- DO NO H A R M
  - (H) Heat Flow - Thermal Resistance Profile
  - (A) Air Flow - Air Leakage Resistance
  - (R) Radiation - Radiation Resistance Profile
  - (M) Moisture
    - Liquid Form - Drainage Planes Profile
    - Vapor Form - Vapor Resistance Profile

Thermal barrier

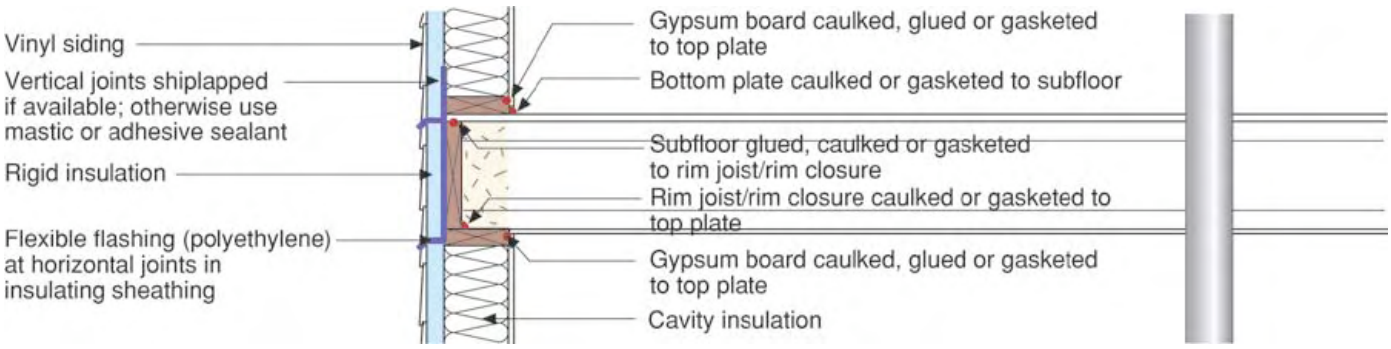


Attic section



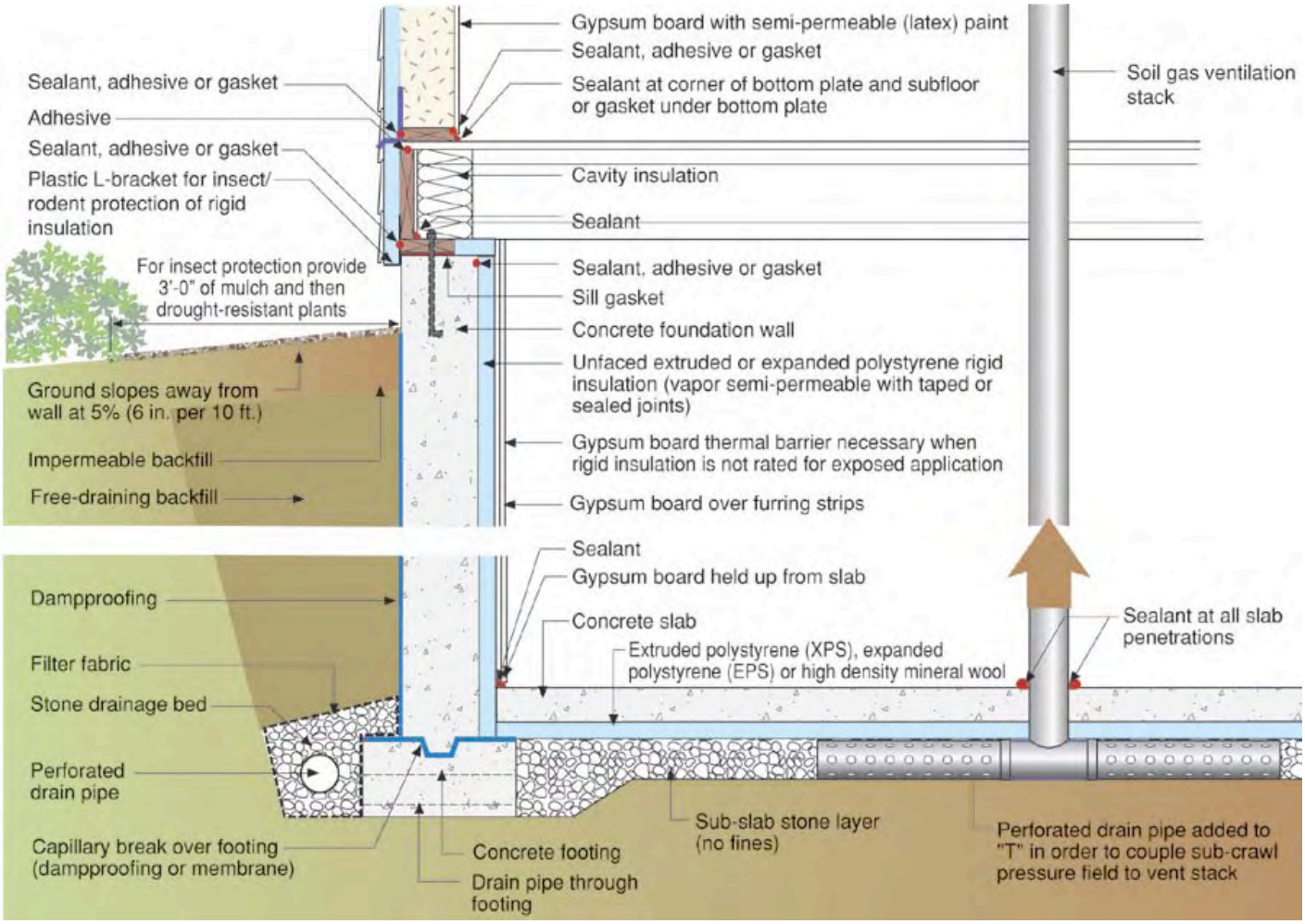
Chicago

Wall section



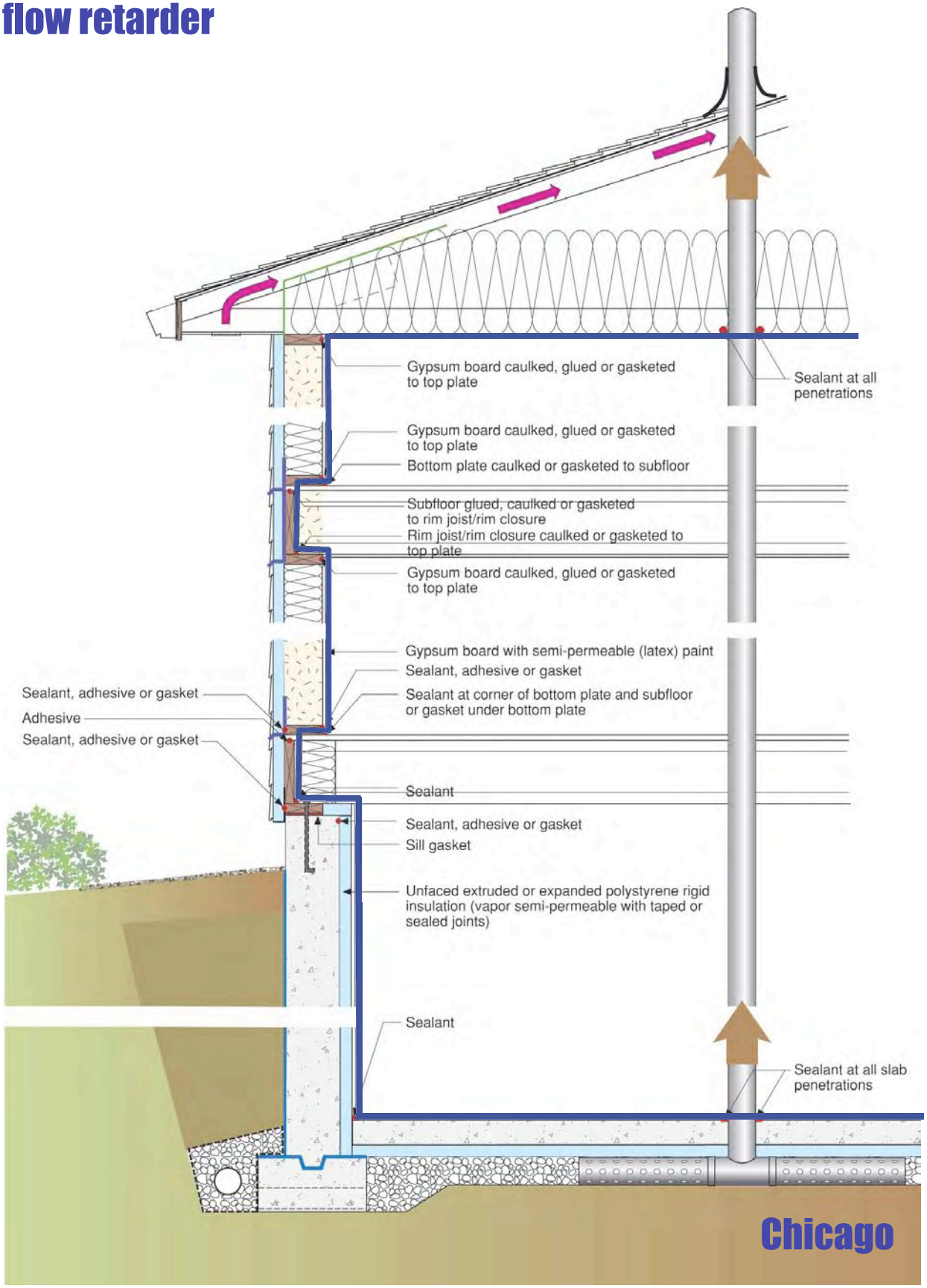
Chicago

Foundation section



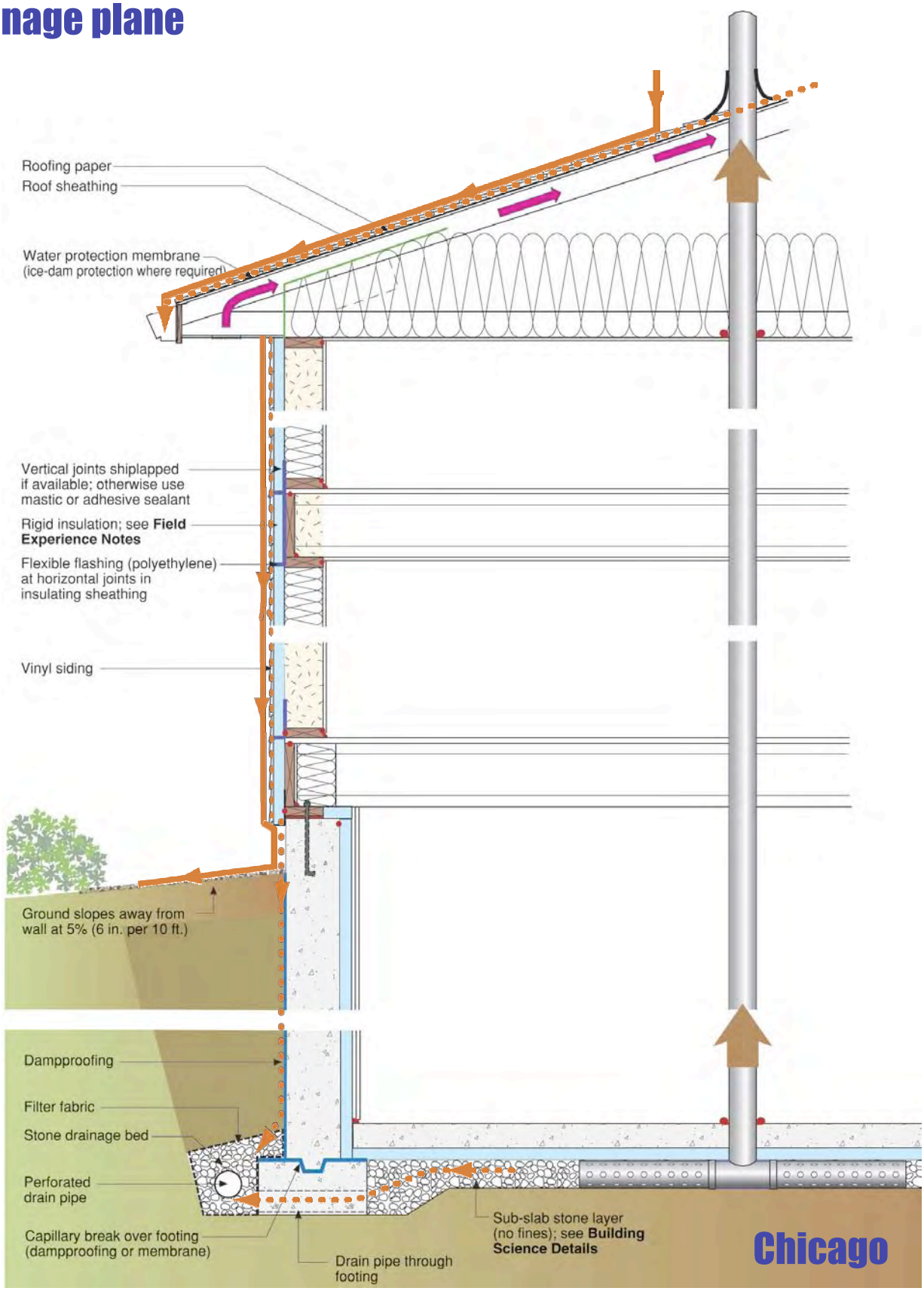
Chicago

Air flow retarder

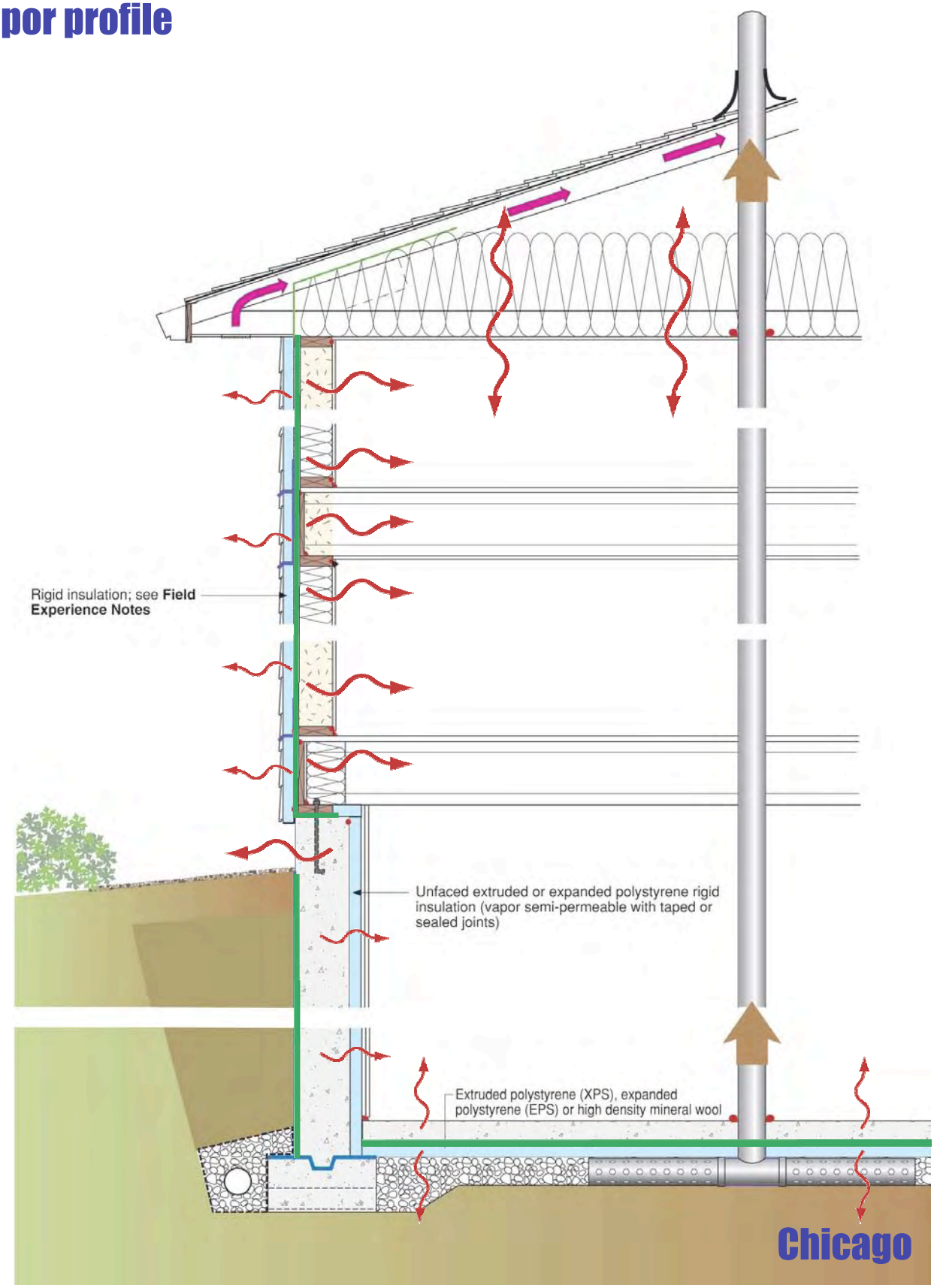


April 8, 2005

Drainage plane

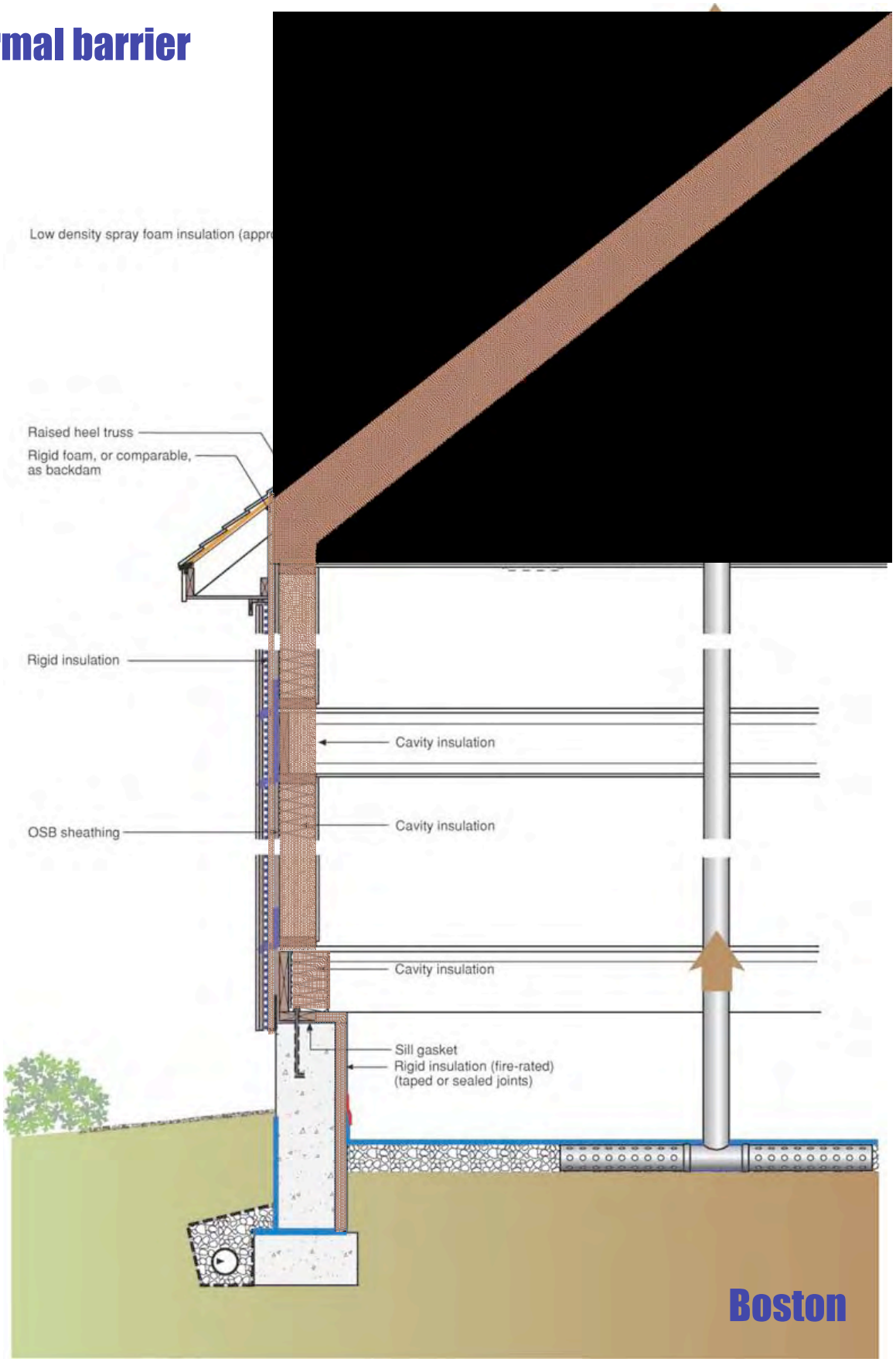


Vapor profile

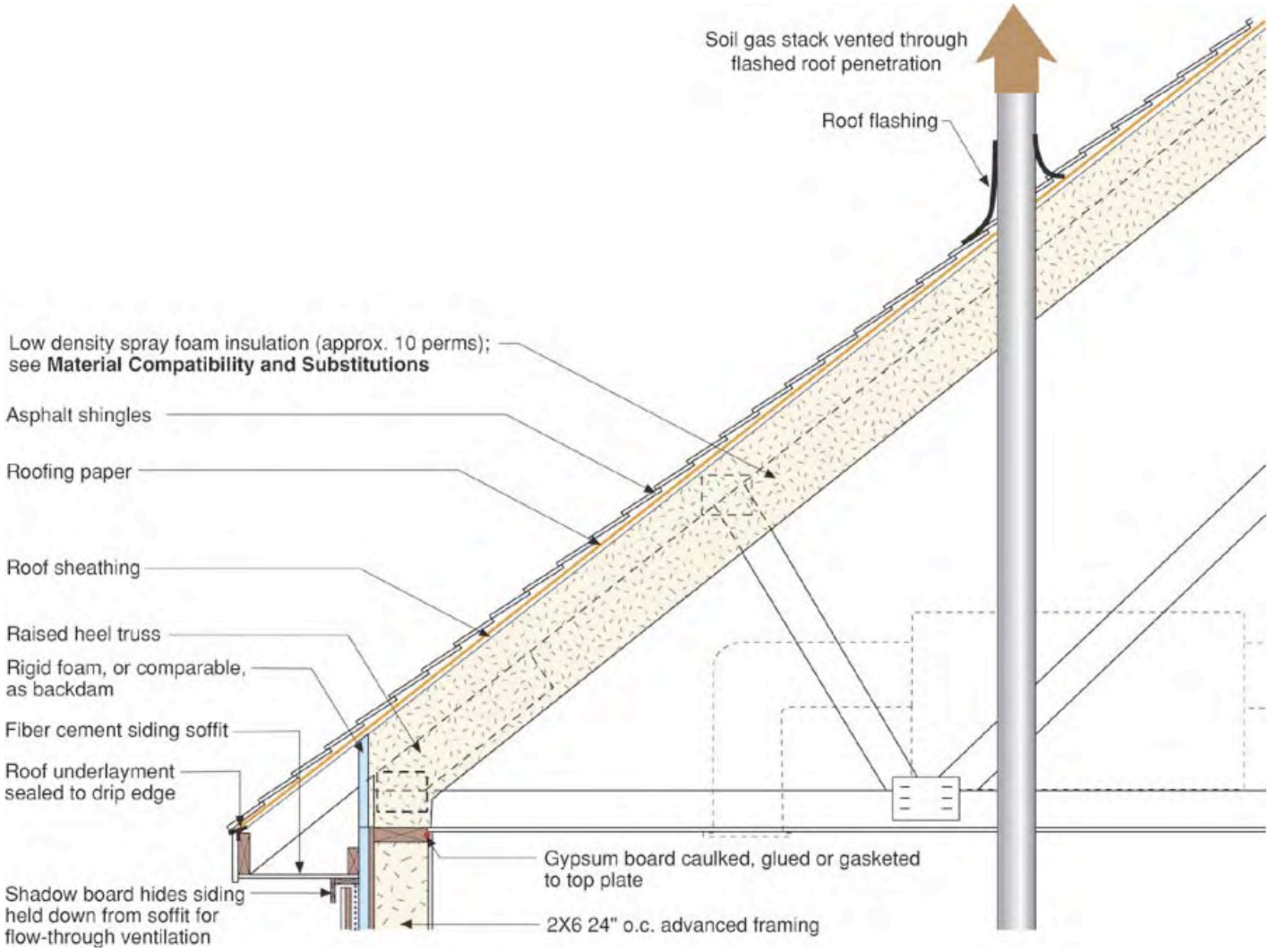


April 8, 2005

Thermal barrier

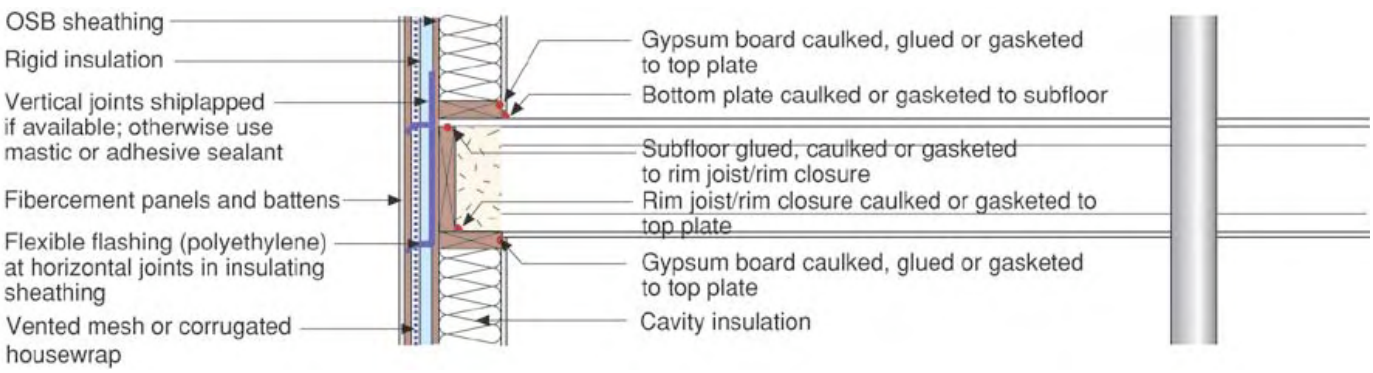


Attic section



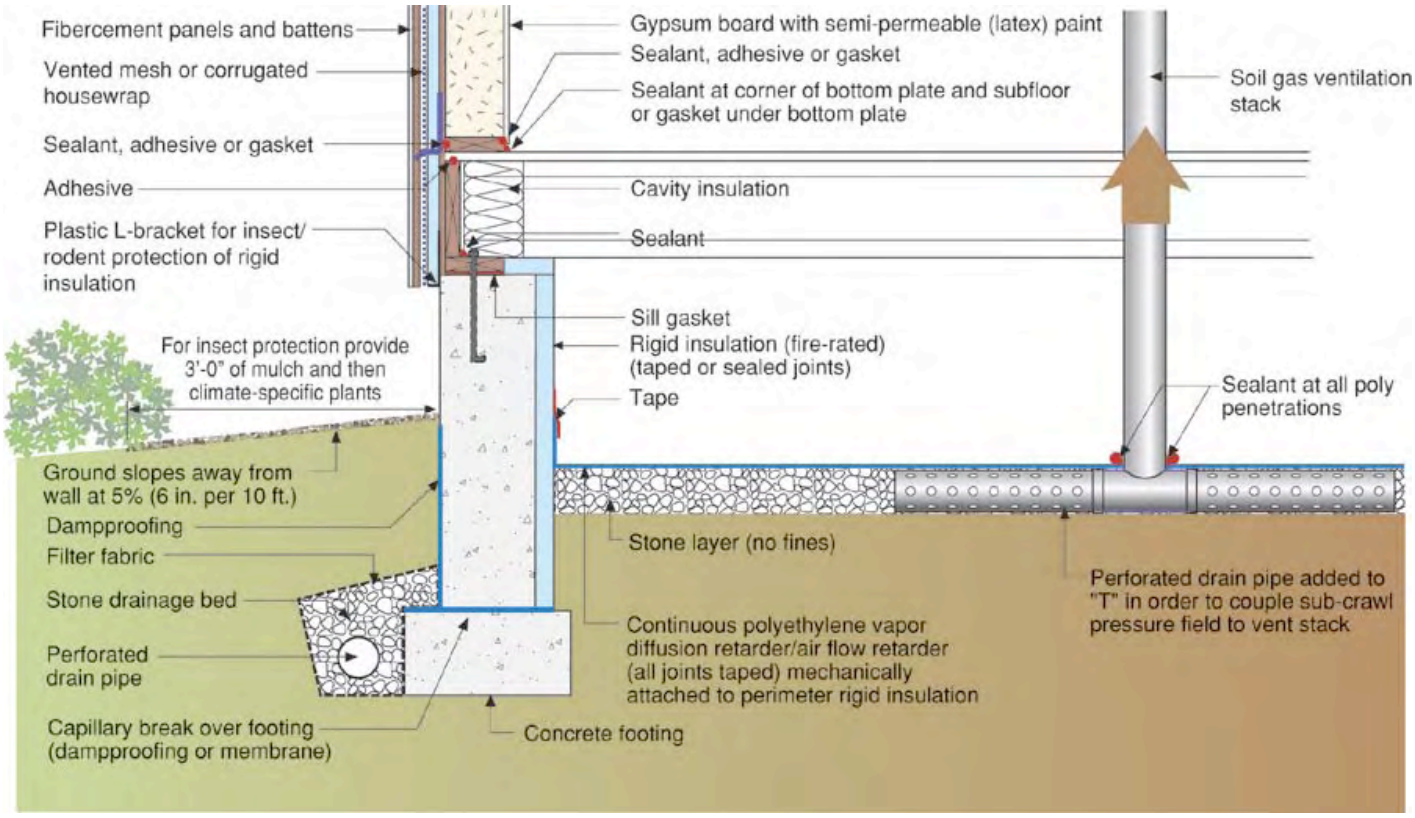
Boston

Wall section



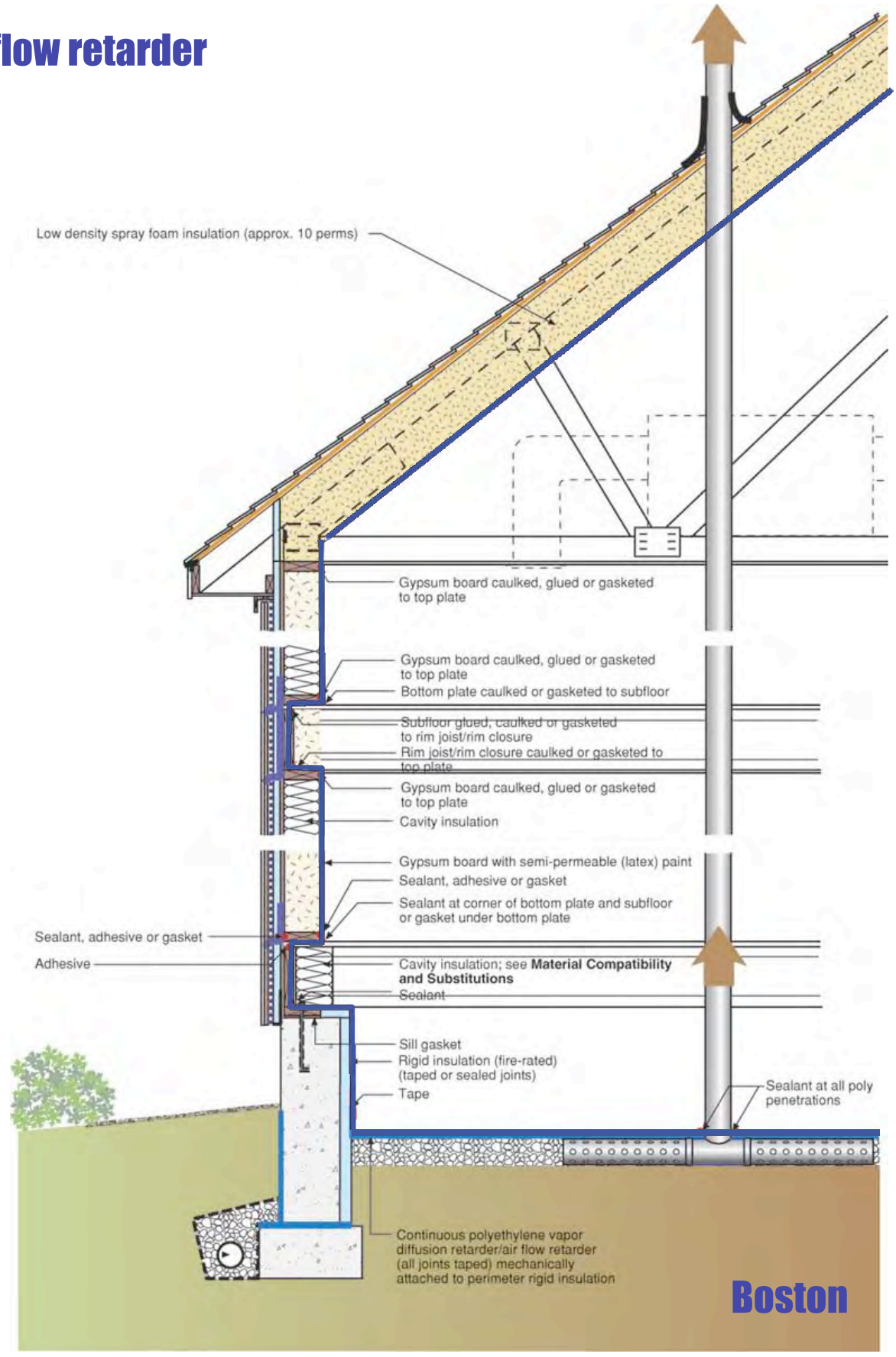
Boston

Foundation section

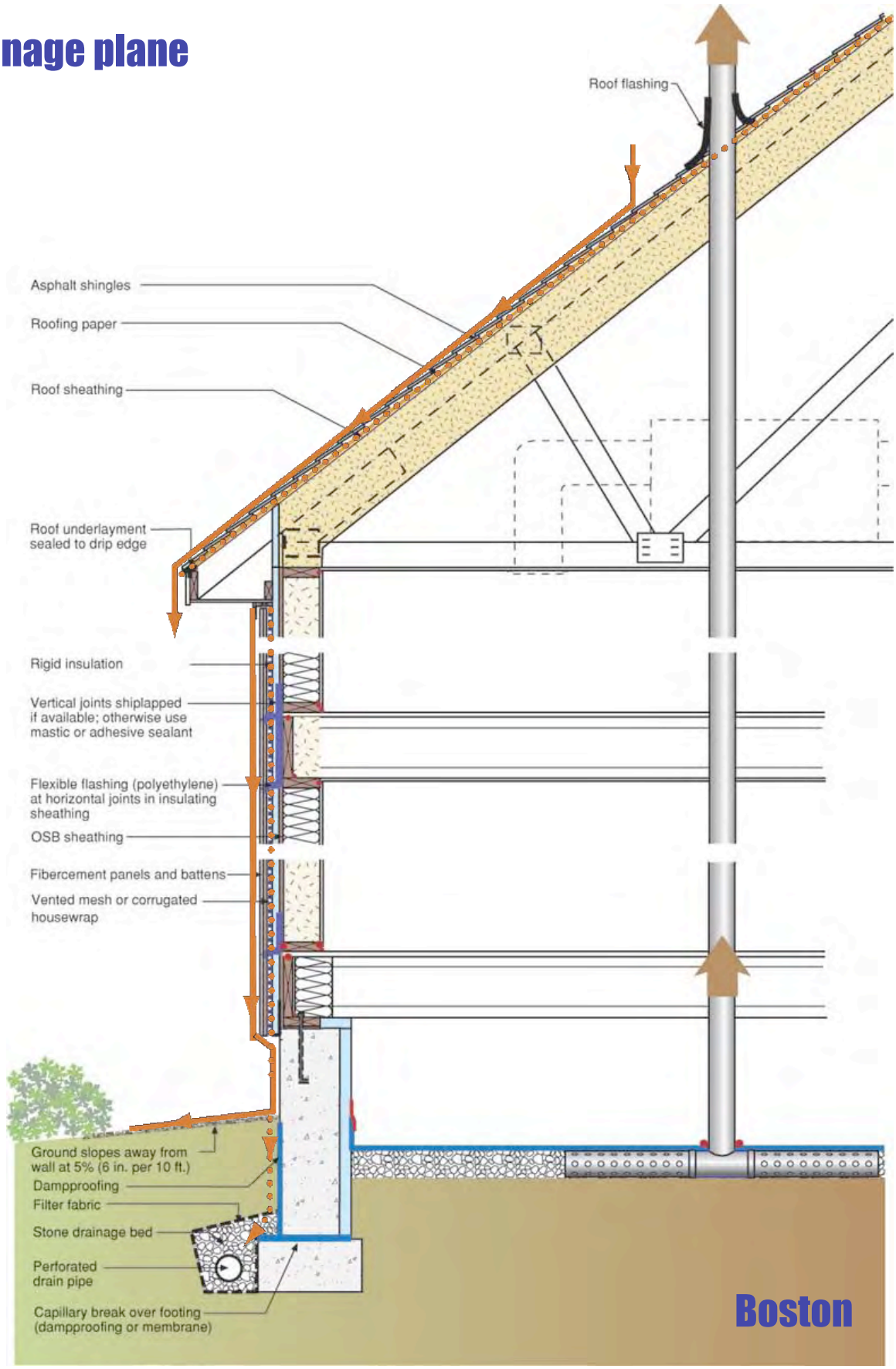


Boston

Air flow retarder



Drainage plane



Vapor profile