VERIFIEDGREEN
Helping You Build Green

Advanced Systems, Products, and Possibilities

May 21st, 2008

Agenda

- Balancing the home (ERV, HRV)
- Application of Concepts – HVAC Systems
- Application of Concepts – Wall Systems
- Topics for review and discussion

Topics for Discussion

- Hydro-zoning,
- Rain-garden for storm water capture and how to calculate quantities,
- Rain barrel versus storm water retention,
- French-wells and water capture from driveways,
- Drain planes on the exterior of the home,
- 3/8” air gap behind cladding systems and which ones are exempt,
- Attached garages with walk-off mats or breezeways and the use of fans to depressurize the space,
- Calculating job site waste,
- Calculating quantities for finish material credits,

Topics for Discussion

- Reverse osmosis systems,
- Greywater systems,
- Pre-wire for PV,
- Drain Heat Recovery systems,
- T-mass versus ICF
- SIPS and Panalized
- EMF prevention strategies
- Tankless water heaters and their capacity to handle demands,
- Deconstruction and tracking quantities for credit,
- Importance of checking re-used products for lead prior to installation.

Understanding the concepts in application

HVAC System Installation

Applying the Concepts

- Unit – (assume forced air) EE, RE, IEQ
  - Size
  - Efficiency
  - Manufactured location
  - Filters

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Applying the Concepts

- Unit location - EE
  - Length of runs
- Ducting location - EE, IEQ
  - In conditioned space, ability to clean, internal pressure systems, framing as ductwork
- Supply and Return locations – EE, IEQ
  - Interior vs. exterior walls, Quantity, efficient design

Applying the Concepts

- Duct size- EE
  - –Size the ductwork in different locations, Distance between take-off
- Sealing -EE, IEQ, RE
  - –Air loss, air infiltration, pressure systems
- Controls - EE, IEQ, RE
  - –Dampers, sensors, micro-control, usability

Applying the Concepts

- Use of the SUN
  - Design for passive solar EE, RE, IEQ, SM
    - Impact on heating is at least 25% and load on cooling is 5% or less
    - Smaller HVAC system? Different HVAC system?
    - More natural light
    - Orientation on site
    - Landscaping and plantings

Applying the Concepts

- **Design for Passive Solar**
- Storage
  - Foundation
  - Load
- Ventilation
  - Window operation
  - Window placement
  - Solar Heat gain Coefficient
  - U-value

Understanding the Concepts in Application

Wall design and system

Discussion

- **Divide into groups of ten**
  - **Each member of the group represents one of the 5 concepts.**
    - **2x EE, 2x RE, 2x IEQ, 2x SC, 2x WC**

“Design a wall system that serves your concerns best. Show location on site if you think it serves your needs.”

Discussion

Develop the best solution for and existing wall condition

- 2x4 wall, plaster and lathe, no insulation, 1x sheathing and OSB sheathing, lap siding.
- No mud-sill, rim sits approx 24” above grade
- Un-vented soffit, roof vents centered on roof, Finished attic (existing) – traditional assembly

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Green Design

Understanding Mechanical Systems

Green Design – Manual J

- By properly sizing HVAC equipment rather than using rules of thumb, smaller systems can often be specified and, hence, initial cost is reduced.
- Proper HVAC sizing is an essential step in the efficient operation of HVAC systems. A right-sized system will operate for long periods of time (rather than frequently cycling on and off), resulting in the optimum equipment operating efficiency.

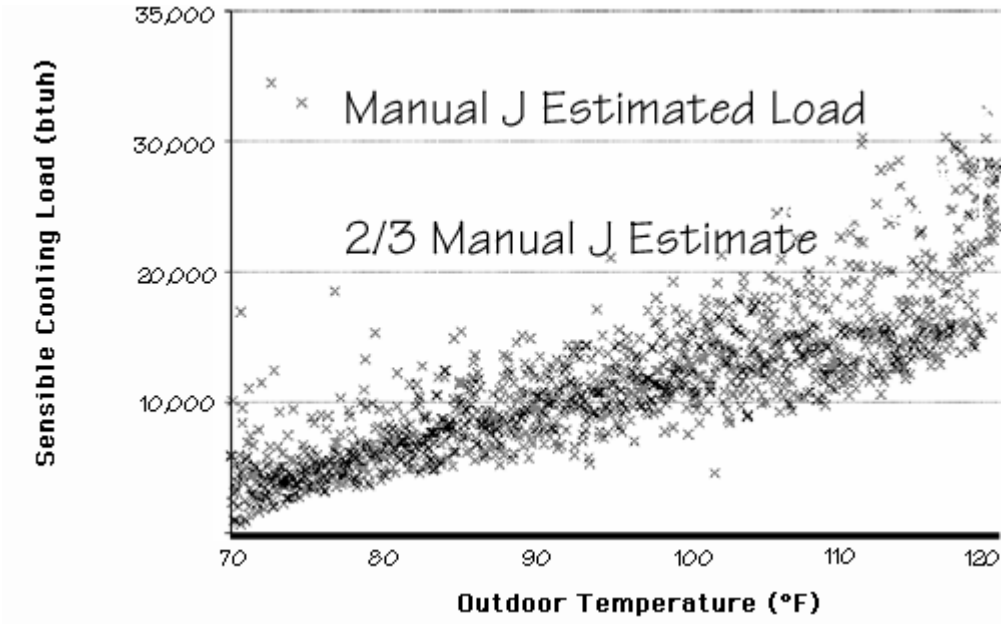
Green Design – Manual J

- Proper HVAC sizing can reduce short-cycling of equipment, resulting in longer equipment life and better control over indoor environmental conditions.

Green Design – Manual J

- Already conservative (roughly 24%)

The graph shows the hourly readings for one typical house. The outdoor temperature at this house reached 116°F. Of the 1316 hours monitored during this extremely hot summer, only 3 hours exceeded the load estimated by Manual J.



Green Design – Manual J

- Calculates heat loss from the building through walls and ceilings, leaky ductwork, and infiltration through windows, doors, and other penetrations as well as heat gain into the building from sunlight, people, lights and appliances, doors, walls, and windows, and infiltration though wall penetrations.
- Design conditions for the area are also used as inputs into load calculations.

Green Design – Manual J

- Air infiltration measurements must be estimated unless a blower door test is performed.
- The use of blower door test results will provide more accurate sizing calculations at a slightly higher design expense.
- Increases in design costs can be offset by decreased equipment size which lowers initial cost.

Green Design – Manual J

- Most of the information needed for sizing cooling loads in new homes can be taken directly off house plans.
- Essential information includes:
- solar gain, which is a function of window area, orientation of the house,
- window type and glazing (such as low-e, gas-filled),
- shading from landscaping and building overhangs, and
- shingle and siding color.

Green Design – Manual J

- In addition, infiltration levels of the house need to be determined and may require the use of a blower door test.
- In retrofit applications, blower door testing is more important for load calculations.
- Load calculations should be done on a room by room basis so that ductwork can be sized accordingly.

Green Design – Manual D

- Airflow Basics
  - Fan Laws
  - External Static Pressure
  - Blower Performance charts
  - Friction rate
- Use Manual T – Zoning, registers (throw, drop, spread), Return grilles
- Trunk and Branch design
- Testing and Balancing

Green Design – HRV vs ERV

- Tight homes have limited air exchange
- Less than .35 ACH requires fresh air
- Options
  - HRV, ERV, Depresurization
  - Homeowner education

Green Design – HRV vs ERV

- HRV – Heat Recovery Ventilator
  - Less expensive
  - Removes humidity from the home
  - Does not add humidity to the home
- ERV – Energy Recovery Ventilator
  - Removes some humidity from the home
  - Adds some humidity to the incoming air
  - More efficient
  - More expensive

Green Design – HRV vs ERV

- Considerations
- HRV – Can remove too much moisture from the home
- ERV – May require de-humidification system
  - Must be climate appropriate

Green Design – Other Options

- Depressurization of the home for fresh-air
- Controlled and tested system
  - Bath-fan
  - In-line fan (series)
- Considerations
  - Homeowner education
  - Noise
  - Combustion spillage

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Green Design - OVE

Optimum Value Engineering – (OVE)

Advanced Framing

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- Using OVE techniques results in lower material and labor costs and improved energy performance for the building.
- OVE uses engineering principles to minimize material usage while meeting model building code structural performance

Green Design - OVE

- The system can be applied as a whole package
- Many of its components can be used independently, depending upon the specific needs of the project.
  - Framers unfamiliar with the techniques may need training
  - More planning is required

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Primary components

- 19.2" and 24" On Center Framing
- Modular Layout
- Single Top Plate - Exterior and Bearing Walls
- Single Top Plate - Interior Non-Bearing Partitions
- Right-Sized Headers
- No Headers in Non-Bearing Partitions
- Ladders at T-Intersections
- Open Corner Framing
- Doubling the Rim Joist in Lieu of Header

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Primary Concepts

19.2" and 24" On Center Framing

- Floor decking, cladding and interior finish materials need to be sized to span the added dimension without undesirable deflection.
- If floor joists are chosen that have wider than usual flanges, this will reduce the clear span of the floor decking.
- 1/2" gypsum board deflects substantially more over 24" framing.
  - it is commonly used and seems to be accepted by most homebuyers.

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Primary Concepts

- *Modular Layout*
  - Working to a module typically works best on simple plans.
  - Non-bearing partitions typically cannot be held to the module.
- *Single Top Plate - Exterior and Bearing Walls*
  - May not work on homes in high-wind or earthquake zones.
  - Requires purchasing a longer stud.

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Primary Concepts

- *Right-Sized Headers*
  - Determine header size on span and load for each fenestration
  - Requires cutting different sized cripples over headers.
- *No Headers in Non-Bearing Partitions*
  - Requires identification of bearing and non-bearing partitions

Green Design - OVE

Primary Concepts

- *Ladders at T-Intersections*
  Blocking should be set so that it does not conflict with light switches and outlets.
- *Open Corner Framing*
  Drywall clips are unfamiliar to some builders and subcontractors.

Green Design - OVE

Primary Concepts

- *Doubling the Rim Joist in Lieu of Header*
  - The extra member may be deeper and more expensive than the header it replaces.
  - If the rim joist is intended to act along with the extra member (or by itself), it must not have a joint over the opening.
  - If the technique is used in a 2x4 stud wall, there may be not enough bearing left for the joists, and hangers may be needed.

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Code Compliance

- *19.2" and 24" On Center Framing*
  - Codes allow load bearing walls framed with 2x4 studs spaced at 24" on center.
  - In high-wind zones, 16" on center framing may be necessary to meet with loads.

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Code Compliance

- *Single Top Plate - Exterior and Bearing Walls*
- *Single Top Plate - Interior Non-Bearing Partitions*
  - Meets codes, but is more likely than other OVE innovations to inspire questions from the building official.
  - Should be well noted on plans for plan reviewer
  - Use your local HBA or NARI chapter for assistance

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Code Compliance

- *Right-Sized Headers*
  - Code prefers headers are sized properly
- *No Headers in Non-Bearing Partitions*
  - I may be necessary to demonstrate to the inspector that a partition is non-bearing (gable end).
  - Design of the home to place all bearing on exterior walls

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Code Compliance

- *Open Corner Framing*
  - More studs may be required at corners in high-wind or earthquake zone construction.
- *Doubling the Rim Joist in Lieu of Header*
  - This is an unusual technique and may inspire questions from the inspector.
  - R-values must be maintained which would require the use of foam products, and may be impossible with 2x4 framing

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Costs and Benefits

- *19.2" and 24" On Center Framing*
  - Substantial amounts of lumber can be removed from the wall and floor framing,
  - Possible need for thicker decking, cladding and finish materials may partially reduce the savings.
  - Floor joists may need to be larger on longer spans.
  - A careful analysis is needed to determine whether the wider spans make economic sense for a particular project. In general, simpler plans designed on a 2' module are much more likely to

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Costs and Benefits

- In general, simpler plans designed on a 2' module are much more likely to result in savings with 24" on center framing than are complex plans with odd dimensions and many small offsets.
- Wider stud spacing reduces heat loss by reducing the amount of through-the-wall-wood (conduction) and increasing the amount of insulation in the wall.

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Costs and Benefits

- *Modular Layout*
  - Construction to a 24" module saves cutting and waste on sheet materials.
  - It cuts framing lumber by eliminating closely spaced members to make up a small added dimension.
  - It also makes the best use of 24" on center framing, and allows the use of a single top plate.

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Costs and Benefits

- *Single Top Plate - Exterior and Bearing Walls*
  - In a 28' x 40' two-story house, the savings are equivalent to eliminating about 35 studs.
  - The amount of wall insulation is increased improving energy performance.
- *Single Top Plate - Interior Non-Bearing Partitions*
  - Savings depend on the length of non-bearing partitions, but in a typical home the equivalent of 24-36 studs are likely to be saved.

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Costs and Benefits

- *Right-Sized Headers*
  - Reducing the use of heavier framing is environmentally preferable.
  - Material cost savings may be balanced with slowing down the framing process.
- *No Headers in Non-Bearing Partitions*
  - Saves material and labor cost, and conserves resources by reducing the use of large-dimension framing.
  - No negatives

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Costs and Benefits

- *Ladders at T-Intersections*
  - Much less lumber is used, and scrap pieces can be used (more than a stud is saved at each intersection and job-site waste is reduced).
  - The joint is stiffened by the horizontal blocking.
  - Most important, the insulator can continue insulation in the exterior wall past the partition framing forming a complete insulated blanket around the house and avoiding creation of a hidden uninsulated cavity.

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Costs and Benefits

- *Open Corner Framing*
  - With a two-stud corner, one stud is eliminated. In all cases, the open cavity at the corner can be insulated along with the wall, eliminating the need for the framer to insulate a closed cavity before the sheathing goes on.
  - Insulation is typically better and un-insulated pockets are avoided

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Diagrams

Double Rim in place of header - Continuous

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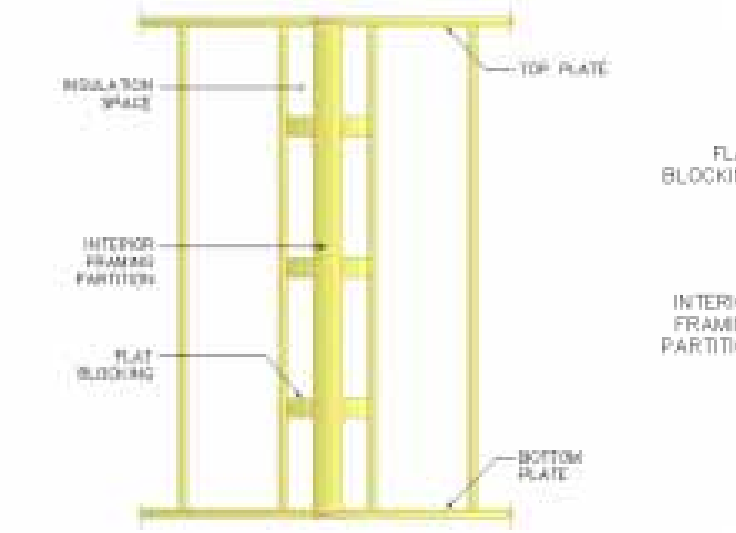
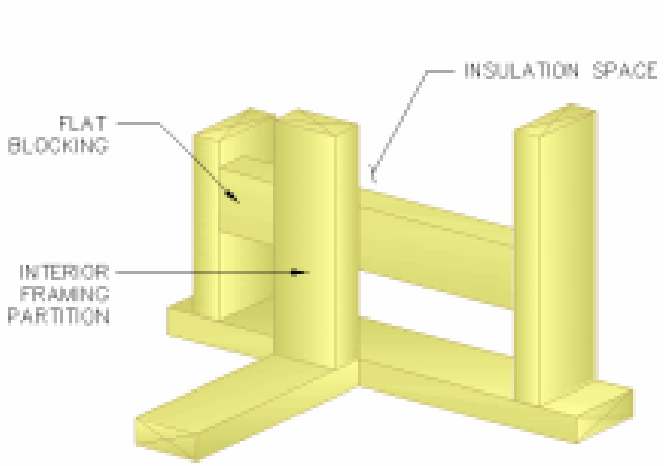
Diagrams





Ladder Blocking

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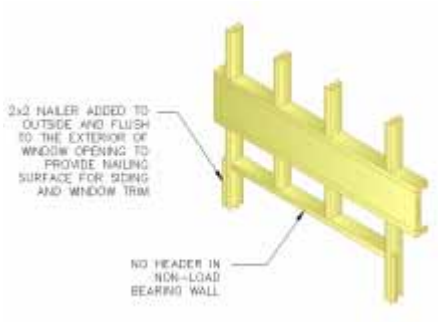
Diagrams

Non Bearing wall without header at window



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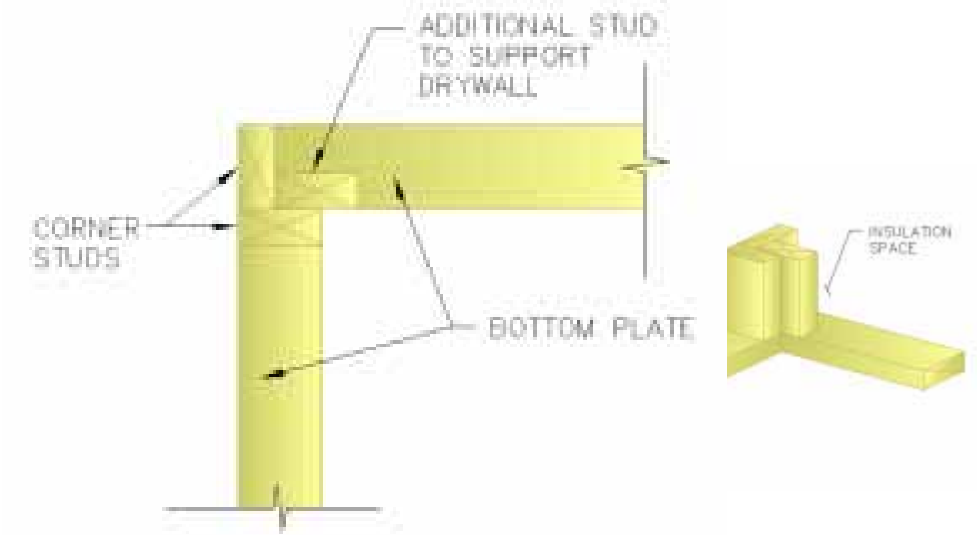
Diagrams



Two Stud-OPEN corners with optional third stud for Drywall

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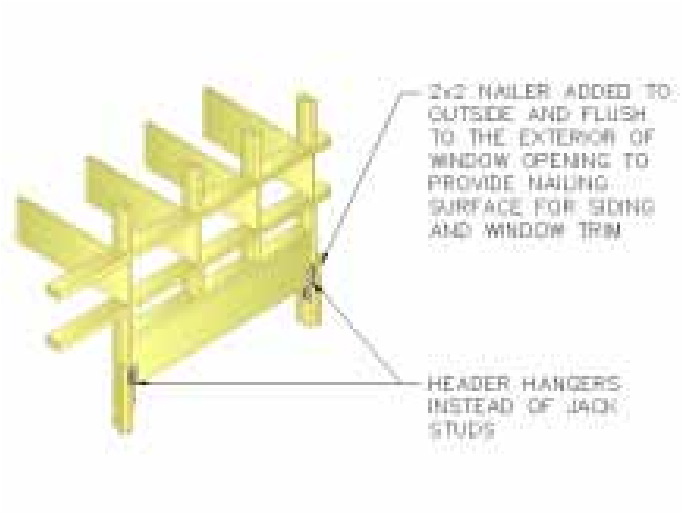
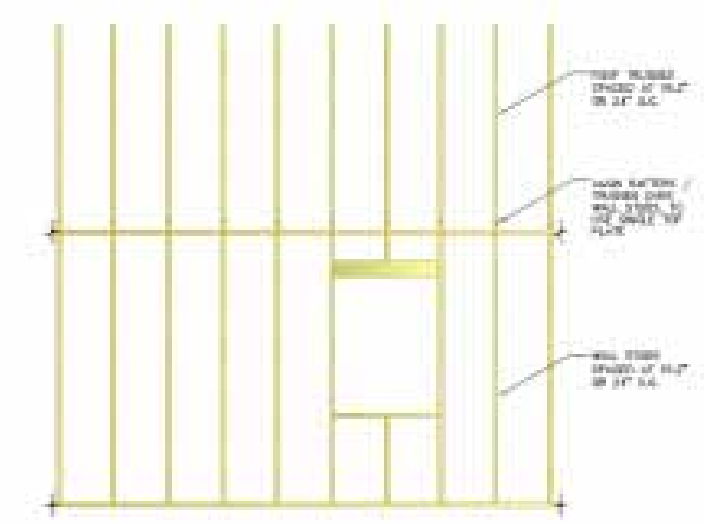
Diagrams



Right Sized Headers



Point Loads

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Diagrams

Single Top Plate

Green Design – Insulated Headers

- Uses machine stress-rated wood flanges with foam insulation sandwiched between two web panels, to create insulated headers with a thermal break, without sacrificing structural performance.

Available in 7-¼" 9-¼", and 11-¼" depths, and widths for both 2x4 and 2x6 framing.

Green Design – Insulated Headers

- The increased material costs are offset by the reduced labor and additional insulation costs
- Competitive with standard headers, but offer greater performance to the owners.
- SWII-headers are approved for use by BOCA,ICBO, and ICC.
- Indicate on plans for plan review approval prior to use.