

Case Study

David Weekley Homes' Baxter Community:

High Performance Green Building

Fort Mill, South Carolina

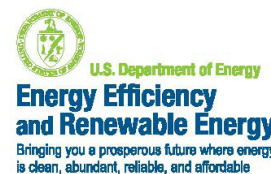


OVERVIEW

Baxter Village is a residential community located approximately 20 miles south of Charlotte, North Carolina. The development is being constructed by the Charlotte division of David Weekley Homes (DWH).

Baxter Village in Fort Mill, South Carolina is located within DOE Climate Zone 3—a mixed-humid climate. A mixed-humid climate is defined as a region that receives more than 20 inches of annual precipitation, has approximately 5,400 heating degree days or less, and where the monthly average outdoor temperature drops below 45°F during the winter months.

DWH is actively reducing the energy consumption of their homes through the implementation of their David Weekley "Green Homes" program. This program is intended to promote certain features designed to make homes more economically sustainable over the long term and reduce energy usage and the resulting environmental impact. The DWH Green Program is not only being implemented successfully in Charlotte, but nationwide in almost all DWH divisions. The Charlotte division of DWH is reducing their energy demand through a number of techniques including advanced air sealing techniques, the installation of SEER 14 air conditioners, and Low-e windows in conjunction with conventional framing and insulation. The homes built by the Charlotte division



PROJECT PROFILE

Project Team:

David Weekley Homes Charlotte
North Carolina Division
Building Science Corporation
MASCO—Environments for Living™

Address: Fort Mill, South Carolina

Description:

2,098 to 3,721 ft² one- and two-story,
3 to 4 bedroom homes

Completion Date:

To be completed 2009

Estimated Annual Energy Savings:

\$986 Energy savings per year

Project Website:

<http://tinyurl.com/bofwc6>



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Somerville, MA 02143
www.buildingscience.com

BUILDER PROFILE

David Weekley Homes started in 1976, at a time when budget-friendly housing was dull and unimaginative. We quickly made a name for ourselves with an emphasis on innovative design and Customer Satisfaction that would change the face of homebuilding forever.

Today, David Weekley Homes builds in 15 cities from Colorado to the Carolinas and is the largest privately-held builder in America. We have also been named to FORTUNE® Magazine's list of "100 Best Companies to Work For" seven times.

A home is much more than strictly shelter; it's a place where families join together to retreat from daily life. A David Weekley home is a symbol of Customer Satisfaction and personal attention. Enhancing the lives of our Customers is why we do what we do. Through numerous Customer Satisfaction distinctions from J.D. Power and Associates and the fact that 96% of our Customers would recommend us to their family and friends, we are living Our Purpose when it comes to our Customers.

PARTICIPATING PROGRAMS & CERTIFICATIONS



U.S. Department of Energy's Building America Program



U.S. Environmental Protection Agency
ENERGY STAR® Program



Environments for Living™ Diamond

of DWH have been able to maintain a competitive market advantage in all developments even within a soft housing market.

DWH is working with Southern Energy Management for ENERGY STAR verification and Masco implementing their Environments for Living® (EFL) program. Masco EFL is providing the majority of the testing and rating the homes. All homes are attaining the Diamond class under the EFL program. The Diamond level of EFL ensures the homes have enhanced water efficiency, advanced indoor air quality and attain an air tightness of 0.25 cfm/ft² of envelope area at 50 pascals as well as other performance standards (www.environmentsforliving.com). The EFL program standards have been developed with the support of BSC's Building America researchers.

The target for the DWH Fort Mill development is to achieve a 40% whole house energy savings over the BA benchmark in a mixed-humid climate. All homes built will also be part of the DWH Green Program, EFL Diamond and in 2009 they will be part of the DOE Builders Challenge.

WATER MANAGEMENT

DWH in Charlotte utilizes the Huber ZIP System® sheathing in conjunction with self-adhered membrane flashings as a drainage plane to ensure water than passes the primary water shedding layer is not allowed to penetrate into the building assembly. Sub-sill flashings are also provided below all windows to ensure that in the event a window leaks the water will not enter into the wall assembly. The photos within the Building Enclosure section of this report show both the fully flashed window and the taped

Huber ZIP System® sheathing. The quality control coaches have paid special attention to these details and have consistently achieved a high level of quality workmanship.

QUALITY ASSURANCE & QUALITY CONTROL

The Charlotte division has made noteworthy quality control advancements. They have implemented process and technology changes through special trade training. Examples of these changes are the water management and air tightness improvements made by their framing contractor. A single framing company was chosen, trained and then hired as a consultant to train their other framing contractors. DWH's insulation and HVAC upgrades were completed through partnering with a single insulation company and a single HVAC company who were extensively trained and were solely used in all developments. Through this training and partnering they were able to attain consistent performance in all developments.

DWH also employs on-staff 'quality coaches' to train trades and perform QC spot checks. The quality coach plays an important role in setting expectations for the quality of workmanship and building performance and identify 'slippages' in quality as production proceeds.

A durability checklist (QC) was created to address areas where quality of work has an effect on the energy

A drainage plane must be provided that is integrated with flashings

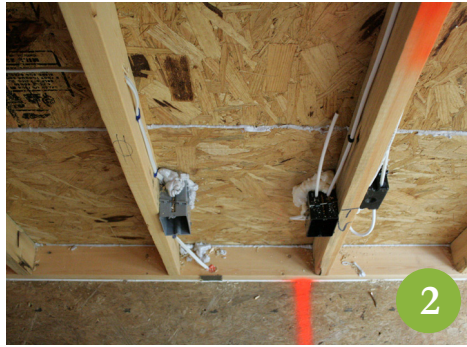
- Drainage plane has been installed in a continuous manner
- Sheet material has been properly lapped to drain water
- All flashing elements specified have been correctly installed
- Drainage plane overlaps flashing connected by a transition membrane
- Drainage holes and through-wall flashing have been provided at brick seat

A drainage plane must be accompanied by a drainage space

- Materials to create drainage gap have been installed as specified
- Intentional drainage spaces are clear of construction debris

Subsill flashing: windows and doors must be "pan-flashed"

- All windows and door openings are "pan-flashed"
- Pan-flashing installed with end dams and positive slope towards the exterior
- Flashing materials are correctly lapped



BUILDING ENCLOSURE

1 Roof: Trussed

Framing: 2x4 conventional wall framing at 16 o.c.

Air Sealing: Taped Huber ZIP System® sheathing 4; low expanding foam sealant around windows doors, 2 penetrations and base plates

Roof Insulation: R-30 fiberglass batt insulation on flat ceilings;; R-19 in sloped ceilings

Wall Insulation: R-13 fiberglass batt insulation

3 4 **Drainage Plane:** Taped Huber ZIP System® sheathing

5 **Window Specifications:** Double pane vinyl spectrally selective Low-E: U=0.34, SHGC=0.27

6 **Foundation:** Vented unconditioned crawlspace

Infiltration: 2.5 in² leakage area per 100 ft² envelope

Features:

- Very airtight construction
- Fully-flashed windows
- Continuous drainage plane

performance, indoor air quality and durability of the house. Team members then verified these items in the field to ensure they were installed or constructed as required. The following is an example portion of the checklist.

SYSTEM TESTING

Airtightness testing of the enclosure and ductwork was completed by Southern Energy Management. The tests completed were required to attain ENERGY STAR and EFL Diamond certification. The following tests were performed:

- Air leakage
- Duct leakage
- Local air flows
- System external static pressure
- Outside air duct air flow

MONITORING

BSC is currently not monitoring any homes within the DWH Fort Mill community. It is anticipated during 2009 with the occupancy of the homes that BSC will collect utility use data for comparison to modeled energy consumption.

TECHNOLOGY GAPS AND BARRIERS

Due to cost implications in a slow moving market there are a few energy efficiency upgrades proposed by BSC that could not be implemented in 2008.

The R-13 conditioned crawlspace option was not chosen in 2008. This would consist of sealing and insulating the crawlspace with a combination of foil faced polyisocyanurate foam and spray foam to ensure air barrier continuity. The floor would be covered and sealed with 6mil polyethylene with the joints taped to create an air seal.

MECHANICAL DESIGN

HERS Index Score: 72

① Heating: 92% AFUE natural gas forced air furnace

Cooling: 14 SEER

Ventilation: Honeywell supply-only integrated with AHU (CFIS)

Return Pathways: Transfer grilles at bedrooms

② ③ Ducts: R-6 flex ducts with mastic sealed joints

DHW: 0.58 EF natural gas water heater

Appliances: ENERGY STAR dishwasher, refrigerator, clothes washer

Lighting: ENERGY STAR CFLs

Site Generated Power: None



Advanced framing techniques are anticipated to be included during 2009. This would require upgrading to 2x6 construction at 24" centers, stacked framing, 2-stud corners along with the removal of redundant framing members will increase the insulation value of the envelope, decrease material costs and, once training is complete, reduce construction time.

The installation of a 0.82 EF tankless hot water heater would be a relatively easy replacement that was omitted in 2008 purely on a cost basis.

LESSONS LEARNED & FUTURE PROJECTS

It is anticipated that the changes discussed in the Technology Gaps and Barriers section will require trade training and additional site visits for review of QA/QC procedures. According to our whole house energy analysis, the as-built houses are modeled to achieve an energy savings of 34.2% when compared to the BA benchmark. Due to cost implications in a slowing housing market, the R-13 conditioned crawlspace, advanced framing techniques and 0.82 EF tankless hot water heating options were not implemented during 2008. These final three upgrades would allow the homes to achieve nearly a 40% savings of the BA

benchmark and achieve HERS scores below 70. It is anticipated that the next stage of upgrades may be implemented during the phases of the Fort Mill development that begin during 2009. The combination of implementing QA and process changes has allowed the integration of these changes to happen seamlessly and BSC has a high degree of confidence in DWH's ability to implement these additional changes.

Construction of the Baxter development will continue into 2009. The BSC assisted DWH Green program has proven successful for the Charlotte division and the construction methods developed in 2008 will continue to be implemented in 2009.

This case study has been prepared by Building Science Corporation for the Department of Energy's Building America Program, a private/public partnership that develops energy solutions for new and existing homes. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States government or any agency thereof.

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