



Pitt Community College
Market driven Hazard Resistant and Universal Design Upgrades
Fall 2002

The Blue Sky Foundation received a grant from the Home Safety Council to demonstrate and promote hazard resistant and universal design building technologies in the State of North Carolina. The project included surveying the high school and community college vocational programs that included home building projects and influencing them to include hazard resistant and universal design features. These vocational programs typically build and sell a house over the course of a year or two and use the proceeds to fund the next project, training the students with the hands-on project. Timing is dependant on a number of factors including scheduling, time, and liability favoring building a small house on the school campus, selling the house at auction, and the buyer being responsible for moving the house to a permanent location. A variation of this process is that a school may have an arrangement with a city 'development authority' and the permanent location of the house may be pre-selected. The program arrangements have an influence on the extent to which such universal design features as a zero level entrance can be controlled.

This report concerns the project conducted at Pitt Community College. Two houses were built during the 2002-2003 school year and sold that included features suggested by Blue Sky Foundation through information and technical presentations. All new features were included by a decision of the lead instructor at the college and upgrades were considered to be cost effective and no 'extra construction costs' were billed to the Foundation. Mr. Bill Hill was the lead instructor and his primary interest was that 'upgrades' increase the auction value of the houses. All project houses since the 2002/03 school year have included some variations of the original upgrades.

The foundation provided training and advice to the instructors and students through the funding provided by the Home Safety Council. Technical support was also provided by the North Carolina Center for Universal Design. The Foundation wishes to express gratitude to the Council for the opportunity.

Project House #1 – Pitt Community College



Mr. Bill Hill is lead instructor in carpentry at Pitt Community College. Bill has long been recognized as a leader by the residential housing industry in the Greenville, NC area. Bill leads by providing workers for the industry, by providing new independent builders into the market, and by pioneering with innovative building practices in the project houses constructed at Pitt Community College. During a typical year



starting in early September, the carpentry classes construct two project houses that are auctioned to the highest bidder in October of the next year. In October of 2002, the two houses were sold for the highest prices ever received and thus the program for constructing project houses was in excellent financial shape. The project houses are typically complete with electrical (installed by electrical classes at Pitt), HVAC (by the HVAC classes), plumbing (by plumbing classes) and come with finished custom cabinets. The vocational programs at Pitt Community College were expanding during the 2002-2003 school year due to an upsurge of students applying for this training which required scheduling and training adjustments that affected the program and this project.

Bill Hill notes that he trains workers to construct houses according to the North Carolina State Building Code and according to blueprints. The first step in the project was to have the architectural students at Pitt Community College modify the already developed project house design blueprints to include the upgrades agreed to by Bill Hill based upon the information and ideas presented to him and the students by Blue Sky Foundation. All the vocational instructors, the architectural technology instructors, and the students in all the programs to be involved in the project attended a hands-on slide/lecture program presented at the college.

The profits from project house sales are vital to continuing this vocational program and Pitt Community College decided to exercise complete control over which upgrades would be included in the project houses rather than simply accepting Blue Sky specifications for "hazard or universal design codes". An internal market analysis assured the college that the upgrades chosen were considered 'desirable' by the program's target market.

The project houses are constructed on temporary foundations on campus and moved to their owner's lot by a house moving company after the house is purchased at auction. This construction process constrains many details in the design. The house must be small enough to be moved at reasonable cost. The details of meeting the building code and or high wind suggested requirements for foundation attachment are something the program does not directly control for example. The college cannot determine the exact placement of the house on a particular lot after auction to achieve a zero level front entrance either. However, the college does serve as a consultant to the buyer and did achieve success in keeping the foundation profile low.

The Pitt Community College constructed houses were already 'above code' in a number of details – primarily because of the need for extra structural rigidity for moving the house (for example, the floor sills are 2" X 8" as opposed to the code minimum of 2" X 6"). The NC Building Code was being revised at the time of the project to change the wind speed criteria from 'fastest mile' to '3-second gust'. Although this change would impact the wind speed map for the code, the change was primarily definition and detailed changes and only affected the anchorage of the house to the foundation (the change in anchoring was from every 6 feet to every 4 feet spacing). The code in effect had Pitt County in the 90 mph wind zone and the roof wind load requirement was 345 lbs. per linear foot. The list below shows the construction details of the 2002 project house versus the 'upgraded' 2003 houses.

<u>2002 Houses</u>	<u>2003 Upgraded Houses</u>
Roof	
5/8" Plywood Sheathing	5/8" Plywood Sheathing, new layout to provide full sheets at ridge as well as at the eaves
Sheathing blocked 4' from gable ends	Sheathing blocked 4' from gable ends
4" Nail pattern at ridge, at gable ends, at eaves	4" Nail pattern at ridge, at gable ends, at eaves
Gable end bracing, cross and diagonal	Gable end bracing, cross and diagonal
Wall to roof attachments	
Hurricane straps each side of truss members	Hurricane straps each side of truss members plus additional strap on interior of top plates for trusses of porch overhang
Wall sheathing	
Fully sheathed with 1/2" OSB	Fully sheathed with 1/2" OSB

Doors

Therma-Tru DP= 47
 Patio door swinging – not sliding
 Interior doors = 32”

Therma-Tru DP= 47
 Patio door swinging – not sliding
Universal Upgrade – all interior doors = 36”

Windows

Anderson DP=40

Anderson – **next higher quality model line DP = 50**

Hall Width

Hall width = 40” (39” clear)

Hall width = 40” (39” clear)

Bathrooms

Standard tub and shower with seat models

Special order – tub and shower with seat models blocked for future addition of hand rails
All bathroom walls without cabinets blocked in cavity with ½” plywood to 5’ height for future addition of hand rails

The blueprint modifications of the house plan for the upgrade project included making all interior doors 36” (i.e. universal design) and detailing the new code requirement of foundation anchors every 4 feet. The bathroom fixture upgrades did not require plan modifications. The two project houses bathtub and shower units are reinforced for future placement of handrails if needed. A particular concern voiced by the college is that the upgrade units are not readily distinguishable from ‘standard’ units once they are in place in the house. Future owners will not be able to tell easily that they have these upgraded fixtures. A suggestion was communicated to the fixture manufacturers that a permanent label to mark this feature be made available so future owners will always know about the availability of the blocking in the walls. The college placed plywood in all the other walls without cabinets of the bathrooms to be available for possible handrail placement. This feature is sometimes known as a bathroom that is ‘fully blocked’.

The photo below shows the backside of the reinforced tub fixture (about 14" wide) around the fixture (the contrast between blocked and standard thickness is not great – look close). The college added ½” plywood blocking in all the other walls of the bath and shower that did not have cabinets.



The upgrade for all of the 36” interior doors found universal agreement that this truly makes sense in a house built in 2002-2003. This upgrade was not expensive but did require that the house plan be redrawn.



Lead instructor Bill Hill, shows universal design door detail.

As noted in the list above the windows used in the new project houses are an upgrade and are rated at design pressure DP = 50 psi (up one level from the previous DP-40 psi Anderson windows).

The college utilizes Thermo-Tru doors in the project houses. The college attempted to order doors that were ‘impact rated’ for the Miami/Dade County code but found that Thermo-Tru had only solid doors that had achieved this rating. The college considers that a front door without side panel glass is not an acceptable option to buyers. *(Note: Thermo-Tru is one of the largest door manufacturers in the nation and has a huge share of the Florida market. Thermo-Tru expected to have impact resistant doors with side panel glass approved within the next year (2004) and expects that they will be among the first manufacturers to achieve this goal.)*

The college did not include ‘safe areas’ in the two project houses. A couple of serious technical issues impacted the decision not to include a strong room. The first is that the trusses ordered for the houses were ordered to have ‘floating’ horizontal members (that is, the design interior walls of the house are not ‘attached’ to the horizontal truss members above them). Because the house is so compact the only viable way to reinforce the ceiling of the area would be to use the truss horizontal members. The second technical problem with the walk-in closet as a ‘safe area’ was that the access to the attic is typically located in the ceiling of this room.

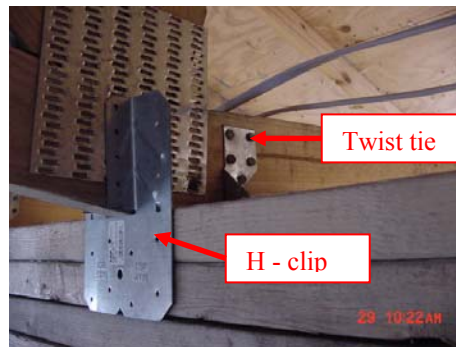
It was determined that the design would not be able to achieve the Blue Sky primary recommendation of 3 layers of ¾” plywood on the walls and 2 layers on the ceiling because of the space constraints. Two walls of the closet contain pipes for the bathroom or shower and thus layers of the plywood cannot be recessed back into these wall cavities. The area was however made much stronger than ‘standard ½” sheetrock’ by using one layer of ¾” plywood. The inside of the closet dimensions are very crowded for having a center walk area and clothes hanging on each side with the added protection.

This is a photo of the walk-in closet (as framed). Note the larger door (39" opening/36" door). Note also that the wall on the left side and the wall in the back contain plumbing pipes. The college means opted to include 1 layer of 3/4" plywood in the cavity to reinforce the closet for additional wind protection.



Interior closet to be reinforced with 3/4" plywood for wind protection.

The final design elected to use two hurricane clips for roof ties. The H clip and twist tie together exceed the NC Building Code requirement of 345 lbs. per linear foot but do not "wrap" the top plate as recommended.



Use of two metal hurricane clips for additional uplift protection

Perhaps as significant as the design details included in the houses were those that were not included as a result of the college analysis. Secondary water resistance in the form of flexible bitumen flashing tape was not included primarily because no one could see the feature and the shingles were considered sufficient to repel water and wind in the 90 mph wind zone. The 5/8" plywood roof sheathing is above code and the layout of the sheathing was modified to place full 4' X 8' sheets at the ridge and at the eaves. [Note: Blue Sky had recommended 110 mph rated shingles, heavier felt, and secondary water resistant seal on the sheathing joints.]

Exterior OSB siding was standard practice for project houses and was considered sufficient to provide shear wall component for this environment. Shutters and extra door protection were considered too expensive once it was determined the door with side windows could not be purchased for the exterior door.

A recommended 4' on center foundation anchor detail and shear wall metal bracing at the floor joists were considered and rejected for several reasons. Note: This detail would provide the 'continuous load path' from the foundation to the roof of the house. First, special expertise is required to move the house and locate it on an existing foundation with embedded bolts. Second, the building code wind zone for Pitt County was judged to low to merit this level of hurricane protection. Finally, this was considered an unseen 'technical upgrade' that would not impact the auction price of the finished houses. The updated NC Building Code foundation anchor requirement of every 4 feet was met with provision for anchor straps.

The two houses were completed and sold at auction in October 2003. The purchasers of the houses were: Mr. Antonio Blow of Snow Hill, NC and Mr. Alton Strickland of Macclesfield, NC. The houses are shown on their permanent sites in the photos below. Note that both buyers added features to the basic houses for their final design.

*Mr. Antonio Blow
28 Green Acres Road
Snow Hill, NC 28580
[added 2-car garage
and rear deck]*



*Mr. & Mrs. Alton Strickland
145 Lake Lane
Macclesfield, NC 27852
(Interior & exterior)
[added 2-car carport,
sunroom, and rear deck]*





Pitt Community College project houses continue to use the chosen upgrades of these project houses as 'standard' features for all 'live project' houses with the exception of the extra-cost, special reinforced bathroom shower. Mr. Bill Hill determined that this is a desirable universal design feature but that it could be accomplished more cost effectively by simply having the carpentry students install plywood blocking behind a standard fixture as shown in the photo below for the project house under construction in March 2006.



*Additional blocking behind standard shower fixture
innovation used by college*

Blue Sky Foundation wishes to thank Bill Hill and Pitt Community College for considering all options presented and selecting the ones they felt best served the public in the Greenville area. The use of these features in this educational program helped expose the local builders to the technology. The features have been put forth to the Greenville Utility for consideration as design features in their market leader E-300 program and training was also provided to the local homebuilders association. The extensive use of 36" interior doors even in small houses in this market is receiving wide acceptance.



Pitt Community College and East Carolina University featured hazard resistant construction and universal design features in their submittals to the North Carolina Sustainable Home Design Competition (a parallel educational effort of Blue Sky Foundation and others to promote residential building innovation). Further information on this design program can be found on the Blue Sky Foundation WEB site under Publications and at the North Carolina Sustainable Design Competition WEB site, www.sustainabledesigncompetition.org.

The prediction based on this project is that the features selected by Pitt Community College will diffuse into the local building industry over the next decade. Pitt Community College continues to include the upgrades in their project houses. This diffusion will be accelerated if the Greenville Utilities residential energy standards program (E-300) adopts any of the features.

Mr. Bill Hill of Pitt Community College indicates that there is a distinct possibility that his program will become involved with the Greenville Redevelopment Authority building houses in future years. These houses will be constructed on lots in the City of Greenville and there will be much greater opportunities to control landscaping and location decisions to include more universal design features.