Performance for

A builder brings affordable, near-zero-energy homes to those most in need through a career at Habitat for Humanity

BY ROB YAGID

Dan Hines was waiting patiently in his Washington, D.C.–based office for a phone call. He could focus, but the energy in the room was amplified by the angst of a pending "big moment." He and his wife had spent years living with housemates and saving enough money to buy their own home in a competitive market turned mad during the COVID-19 pandemic. In Washington, as in many other areas of the country, homes were (and in many cases still are) receiving multiple bids the day they went on the market. Dan was waiting to see if their offer, one of several, would be accepted. Like many home buyers, Dan and his wife were looking for a good house in a good area—something decent and affordable. In the back of his mind, the opportunity seemed fleeting.

For many Americans, that feeling is far too familiar. Financially, the opportunity to buy their own home isn't viable or seems to be diminishing at increasing rates. Although homeownership in the United States currently hovers at roughly 65%, it's lower than at most any other time in the past 20 years. The most recent real estate bubble is pricing out even those who might ordinarily have the means to buy or is pushing them into homes at a compromising price point. Fortunately, there are organizations working to close the gap, particularly for those most in need of safe and affordable housing.

Dan works for one of them. He is a project manager for Habitat for Humanity, the largest nonprofit organization that has made building decent and affordable homes its mission. Dan not only helps provide housing to those who may otherwise never experience the richness of home, but he also provides it at extraordinary performance levels.

Hands on at Habitat

In its last fiscal year, Habitat for Humanity provided safe, affordable shelter for nearly six million people across more than 70 countries. While most know of the voluntary commitment that these projects demand, including from the future homeowners, few understand the working dynamics of their builds and how closely they resemble standard residential-construction projects.

Dan's job isn't all that different from that of any other construction project manager. The only major difference is having to allocate the volunteer contribution into the project scope, being mindful of the timeline and budget. That's not always an easy thing to do. The scale of the projects in the D.C. Habitat affiliate means that Dan is increasingly using subcontractors to keep job sites safe and the work on track. More and more multifamily homes are being built, some exceeding two stories. Volunteers, Dan finds, don't like working that high.

Dan has figured out what jobs best suit most of his volunteers' abilities. At times the less-skilled volunteer labor can actually help balance his construction budget to accommodate higher-end products and systems. For example, the Zehnder energy-

The basics

Myriad high-performance assemblies exist for builders seeking low-energy homes. The D.C. Habitat affiliate builds in a mild climate and so uses systems that are broadly applicable for those designing and building homes with moderate heating and cooling loads.

the People

A builder's recipe for success

INSULATION PACKAGE

STANDARD FOUNDATION R-10 subslab with 2 in. XPS

STANDARD BASEMENT WALLS 1 in. XPS over 2x4 walls with R-13 denim batts

STANDARD WALLS 1 in. XPS over 2x6 walls with R-21 denim batts

STANDARD ATTIC minimum R-49 cellulose

PASSIVE HOUSE FOUNDATION Slab with R-30 6 in. XPS above and 2x4 subfloor frame with R-15 mineral-wool batts

PASSIVE HOUSE WALLS 2x4 stud walls with R-15 mineral-wool batts and R-35 9½-in. dense-pack cellulose in TJIs

PASSIVE HOUSE ROOF R-50 8½ in. polyiso rigid foam

AIRTIGHTNESS TARGETS

STANDARD ASSEMBLY 2.5 ACH50

PASSIVE HOUSE ASSEMBLY 0.6 ACH50 or lower

PREFERRED AIR BARRIER Taped exterior sheathing

HVAC PACKAGE

STANDARD ASSEMBLY Two-zone short-ducted/ductless Mitsubishi minisplit with Aprilaire fresh-air intake

PASSIVE HOUSE ASSEMBLY Mitsubishi minisplit with Zehnder ERV

recovery ventilators (ERVs) installed in some of the Passive Houses his team has built are expensive, but because their ComfoAir tube system is so easy to install, Dan was able to keep the budget down by having volunteers do the installation instead of contractors. Air-sealing and insulation work, where success is achieved by diligence and not necessarily experience, is also an area where volunteers shine.

Just because he's deep in mission-driven construction work doesn't mean that Dan is immune from the dynamics of the industry, though. Finding top-quality subcontractors is a challenge, especially when project funding is tied to municipal grants that have parameters on who and what type of businesses can be hired to conduct work. His projects are not completely volunteer-built. But whether working with pros or volunteers, he's been successful in onboarding them to a performance-based mindset in order to ensure that projects hit their energy targets.

Performance-based accountability

Dan is clear that the commitment to constructing lower-energy homes doesn't stem from the homeowners. While they appreciate the energy-efficient measures from a cost-savings perspective, their priority is safety and affordability. Striving for performance is mostly based on Dan and his team's drive and is baked into the economic aspect of the work they do. For the homeowners who occupy the homes they build, the mortgage is only one of the costs of ownership. Reducing their living expenses over the tenure of their time in these homes is important and holds the build team accountable for being mindful of the impact on the community in how the projects are constructed and how they endure.

Habitat for Humanity understands that and has mandates in place that homes being built under the Habitat network need to meet "some" green building standard. There is variation in terms of which programs builds follow, and to what degree efficiency

Two low-cost solutions for high performance

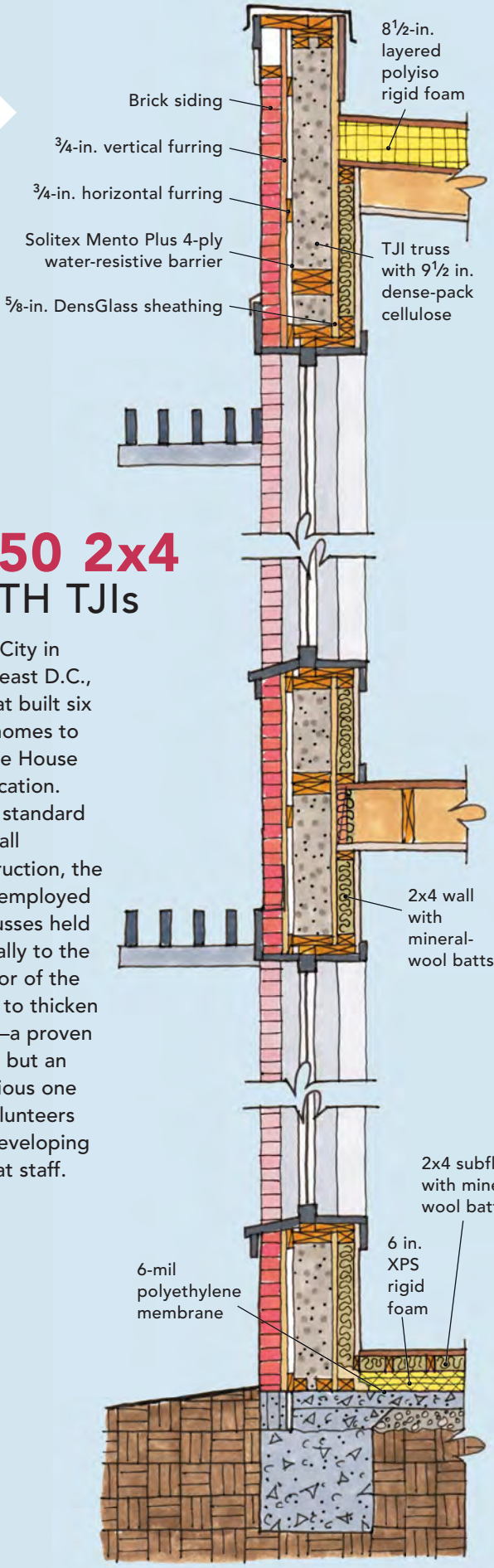
The Washington, D.C., Habitat affiliate, under construction supervision by Dan Hines and Andrew Modley, has included a variety of construction assemblies into the spectrum of its project portfolio. Here are two examples: a multifamily townhome project that meets Passive House certification—and demonstrates an ambitious assembly—and a more standard approach to building that's more commonplace in the organization's work.

Drawings: Martha Garstang Hill

CASE STUDY

R-50 2x4
WITH TJIs

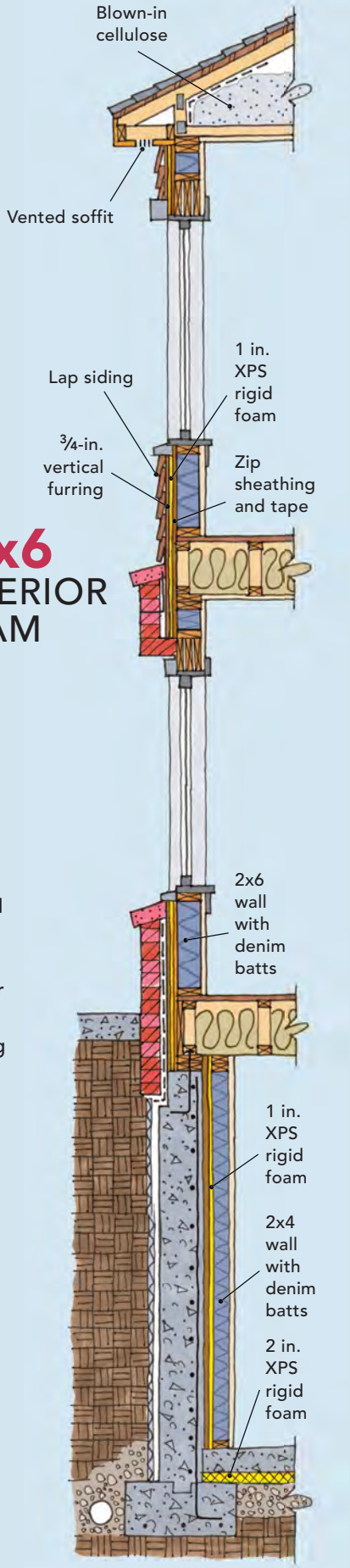
In Ivy City in Northeast D.C., Habitat built six townhomes to Passive House certification. Using standard 2x4 wall construction, the team employed TJI trusses held vertically to the exterior of the frame to thicken walls—a proven tactic, but an ambitious one for volunteers and developing Habitat staff.



CASE STUDY

R-26 2x6
WITH EXTERIOR RIGID FOAM

Habitat is currently building eight new three-bedroom, two-and-half-bath townhomes in the Skyland neighborhood of Southeast D.C. A 2x6 frame with R-21 denim batts and 1 in. of continuous rigid insulation over an air barrier of taped Zip sheathing balances efficiency and resiliency with a straightforward building approach that won't break the budget.



The evolution of a novice

Everyone needs to start somewhere, but when it comes to a career in the trades, it's getting harder to know where to begin. I didn't have woodshop in school growing up. While my dad had some tools around the house and knew how to swing a hammer, my exposure to building was limited—and my skills equally so—when I left home for college. I've always liked science, using my hands to do things, and being outside, but I'd never been exposed to working on a job site until a Habitat for Humanity build in college, where a passion for craft and building was lit inside me.

I knew of Habitat from my older sister, who did a spring break service trip in college, and I decided to follow in her footsteps. I loved every minute of it—the people, being outside, and the hard work, but most of all the building. I knew then that I wanted Habitat to be a part of my life, and while in my 20s, I took a leave of absence from my career to do a year of AmeriCorps service with Habitat. Six months in, I called my old boss and told him, "I'm never coming back. I found what I'm meant to do." After another year of AmeriCorps service, a Habitat affiliate hired me as a site superintendent. Since then, I've built all over the world with Habitat and worked on some truly amazing homes and projects. Each year, Habitat for Humanity affiliates around the nation recruit hundreds of AmeriCorps members to support their mission and their work.

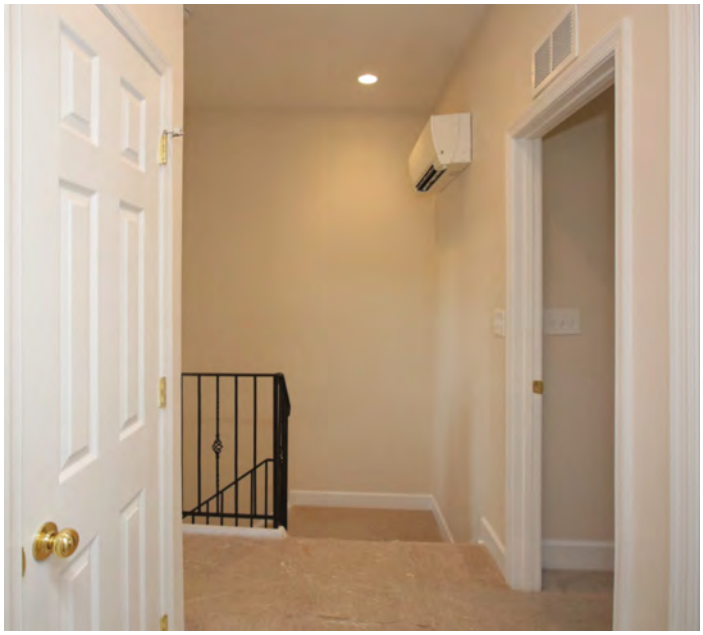
I owe everything I know about building to the people I have worked alongside at Habitat and the opportunity that the AmeriCorps program gave me. I've gone on to hire and train many AmeriCorps volunteers over the years. The overwhelming majority had never picked up a saw before their first day of service. A good number have gone on to make a career in the construction industry, but even the ones who didn't love construction left their year of service with a basic understanding of how a home is built, a feeling of accomplishment from having built something, and an appreciation for what those in the trades contribute to their communities.

Whenever I talk to people who are graduating from school or struggling to decide what they want to do with their lives, I urge them to do a year of service through AmeriCorps with Habitat. All the information can be found at americorps.gov. If they can't commit to a full year, or already have a job they love, then I encourage them to look up their local Habitat affiliate and find a day to go volunteer. They'll meet great people, serve their community, step outside their comfort zone, and learn valuable lessons along the way. They might just find out that building homes is in their bones, like I did.

—Dan Hines

It's all in the details

Energy-efficient houses are made from a combination of products that include technological tools and innovative materials. Here are some of the details used in the Passive House–certified Ivy City project.



MIXING MINISPLITS
D.C. Habitat runs Mitsubishi units, with a short-ducted unit servicing the bedrooms and a ductless one servicing the open kitchen and living area. The ducted unit is a low-static system, so it's important that it be centrally located between the bedrooms and a hallway spot for a central return that allows for short, easy duct runs. The ductless unit is most often positioned in the main stairwell to provide central conditioning without being in a spot that would blow directly on people.

SIMPLE SYSTEMS ARE STILL SMART
Basic Honeywell thermostats are used in conjunction with high-performance ducted HVAC systems. Keeping technology simple for first-time homeowners demands intuitive heating and cooling controls.

NEXT-LEVEL PEX
A PEX manifold keeps plumbing shut-offs neatly organized in the mechanical room. Set up with home runs for each fixture, the flexible PEX makes navigating compact urban townhome construction easier.

Photo top left: Bryan Abdallah, soshelBuilder

PASS ON PASSIVE WINDOWS
Ultra-high-performance windows, like units from Klearwall, make the most building sense in cold climates and in mild climates when certification is sought, but it can be hard to justify the added costs on more conventional builds. D.C. Habitat uses domestically sourced windows with an approximate U-factor of 0.3, a solar heat gain coefficient (SHGC) of 0.19, and a visual transmittance (VT) of 0.44 for its better-than-code-built homes.

VENTING WITHOUT THE ENERGY PENALTY
A Zehnder ComfoAir 200 ERV helps temper fresh air coming into the home with conditioned exhaust air, minimizing energy losses within the ventilation process. Each ComfoTube destination is labeled with painter's tape to help volunteer installers keep organized.

measures are met, but the message is clear—if you're a Habitat affiliate not building to a better and more efficient standard, you're doing it wrong. Dan's next build is using Enterprise Green Communities Criteria as a guide, but he's always wringing as much performance out of his build budgets as possible and future-proofing his projects to accommodate renewables as they become more readily available.

Pushing the envelope

The D.C.-based Habitat affiliate has eight certified Passive Houses in its build portfolio. It was deeply involved in building the Empowerhouse, the acclaimed project generated for the Department of Energy's Solar Decathlon in 2011 by design teams from New Jersey's Stevens Institute of Technology and New York's Milano School of International Affairs, Management, and Urban Policy, and The New School of Design. Habitat partnered with the teams to move the competition model and complete it, and it built an identical version next door in the Deanwood area of D.C. Priced below $250,000, the home took top honors in the affordability category and served as a case study for a pragmatic approach to environmentally and socially responsible building. Dan and his colleagues have built six additional certified Passive Houses since and are always vying for the opportunities to get their ongoing projects back to the standard.

For the area's moderate climate, Dan's Habitat projects prioritize airtightness and insulation values. Habitat has a strong relationship with Dow and receives donated insulation materials. Dan has been using denim batts for cavity insulation and XPS exterior insulation due to its relatively high R-values, but he has concerns about the carbon footprint of foam-insulation products. While it's difficult to turn down donated products, he's exploring alternative exterior insulation options for future builds, including reclaimed XPS, and is particularly drawn to developments in wood-fiber options.

Two critical assembly details are important to achieve approximately 90% energy savings over conventional code-built houses: energy recovery and windows that meet Passive House specs. Those keys details need to be done within a Habitat budget. Before the pandemic, the price of ERVs was coming down, so Dan was working on swapping his approach to heating, cooling, and ventilation—which typically relies on a two-zoned minisplit with fresh air provided by an Aprilaire system—without raising construction costs and budget scrutiny within Habitat. Efficient, high-R-value, Passive House–certified windows are becoming more domestically available, and their prices are coming down. Despite the falling costs, though, Dan and his team have yet to be able to make the numbers work. But they're constantly adjusting window placement, size, and type to try to integrate them.

Dan knows that resiliency in housing is important and that the housing stock to which he's contributing needs to be built in a fashion that takes advantage of opportunities to curb energy consumption when they present themselves. Incentives for solar installation, when available, are typically available to homeowners rather than builders. There are also organizations like Grid Alternatives that focus on offering PV to low-income families and fit well within the Habitat program. Accordingly, every house the D.C.-based affiliate builds is solar-ready and prewired, with junction boxes installed near the roofline and labeled for future connection. The homes tend to be compact, and building in urban lots doesn't always yield the best exposure, but they are oriented for solar as much as possible to help the homeowners reach as close to zero energy as possible, when possible.

In April, Dan and his wife closed on their first home together, starting a new chapter in their lives. Through his work with Habitat, Dan has been able to help provide the same experience for countless families in communities from California to the Carolinas and across Washington, D.C. With each home-closing comes the opening of a new opportunity, both for the families who will go on to own the houses and for the communities who will bear witness to a better way of building for all. □

Rob Yagid is a former editorial director of *Fine Homebuilding* and the founding director of Keep Craft Alive. Photos courtesy of D.C. Habitat for Humanity, except where noted.