Takoma Village Cohousing

Final Report

December 21, 2001

U.S. HUD PATH
Demonstration Project

Steven Winter Associates, Inc.
Norwalk, CT & Washington, D.C.

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Executive Summary

The Takoma Village Cohousing project served as an interesting demonstration project for PATH. Most importantly, the project can be judged to be a success. Approximately 16 technologies were incorporated into the project. There have been numerous press items about the project, including articles in national magazines. Due to its location in Washington, DC, it is highly visible. At the same time, the success of the project points up the importance of the entire team – developer, architect, builder, residents – and their ongoing commitment to the goals of the program. On the down side, the project also demonstrated that in the field, cost and familiarity usually override new techniques and materials.

Located in northwest Washington, DC, Takoma Village consists of 22 townhouse-style buildings, which are divided into 43 one-, two-, three-, and four-bedroom units. The project is an example of urban cohousing. Each member of the cohousing community owns their own apartment (similar to a condominium). There is a shared common house with recreation areas, living room, kitchen, and dining room for group events. There is also a shared "green" in the center of the project for gardening. The project is in close proximity to the Metro line.

The Takoma Village Cohousing project has provided an excellent opportunity to demonstrate both positive and negative aspects of the PATH initiative. On the one hand, the developer/architect was open to incorporating new ideas, technologies, and approaches into his plan. Moreover, his company's specialization in affordable housing and housing for the elderly tied in nicely with the PATH goals. In addition, the Takoma Village Cohousing group residents were extremely interested in energy efficiency and sustainability – two of the PATH goals. The working relationship between the architect/ developer and the community's design team was very effective, with all proposed ideas being examined in an open-minded fashion. This allowed for lively discussion on a wide variety of technologies throughout the process. Unfortunately, when the project was bid, the issue of cost and cost overruns arose. It was at this point that some technologies were dismissed. It is safe to say the higher cost of technologies was a significant barrier. The other issue that affected the decision to use a technology was additional time needed, or perceived additional time needed for implementation. This became an even bigger

problem as the project fell behind schedule due to poor weather. It should be noted that additional delays were encountered within the DC permitting process due to holiday schedules and historic district approvals. This delay in permitting is an area that needs some investigation. Efforts to streamline the permit process should help, but the status quo in this area will likely continue to undermine attempts to incorporate new technologies.

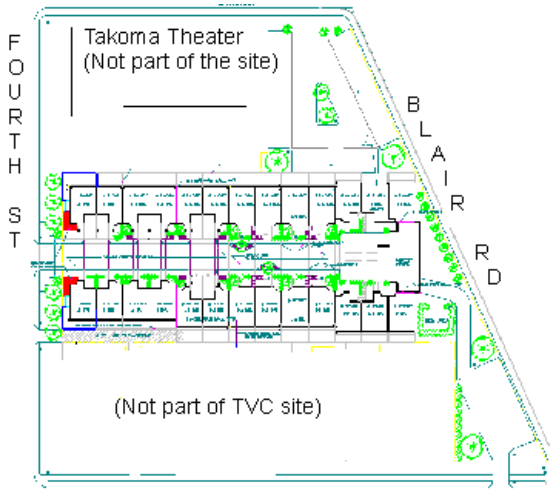
Ground was broken in November 1999. A ceremony was planned and attended by various federal and local agency staff.

Everyone was enthusiastic, as the project was viewed as a positive addition to the community. Additional delays due to unforeseen site mitigation slowed down progress. At this point the general contractor opted for "business as usual" in order to ensure that

additional time was not spent. This was particularly true with OVE. On the whole, however, because of the keen interest on the part of the architect and the community, the following sixteen technologies were incorporated into the project:

- category five wiring;
- full cut-off outdoor light fixtures;
- blower door;
- high efficiency lighting;
- horizontal axis clothes washer;
- tubular skylights;
- fiber cement siding;
- ductwork in conditioned spaces;
- geothermal heat pumps high efficiency water heaters;
- HVAC equipment and duct installation within conditioned spaces;
- recycled content carpet low-flow plumbing fixtures;
- permeable pavement;
- latex foam sealant;
- low-VOC paints and finishes; and
- low toxicity wood preservatives.

Discarded technologies included solar hot water (passive and PV) due to cost; OVE due to contractor resistance and scheduling (the project was behind and the GC felt they would get further behind); plastic composite window frames due to cost; greywater heat recovery devices because of framing issues and apartment configuration; tankless water heaters because of cost (but another plan was devised to provide desuperheating in combination with the geothermal heat pumps system); bamboo flooring due to cost; and drywall clips.



Introduction

Takoma Village Cohousing is located in Takoma (Washington, DC). The developer is EcoHousing, Inc. of Bethesda, Maryland. Don Tucker, Principal of EcoHousing, also served as architect of record for the job. Hamel Commercial Inc. was the general contractor. There are 43 units ranging from one to four bedrooms in both flats and townhouses.

The project was enrolled in April 1999, and design development was underway at the time of enrollment. Due in part to the home-owner group's enthusiasm to embrace energy and environmental performance, coupled with the developer's emphasis ion affordability, PATH involvement was expected to enhance these attributes in a cost-effective manner. Takoma Village presented an opportunity to incorporate many PATH Technologies in a highly visible, urban, multi-family context. The combination of efficient site planning and innovative technology promises high energy- and resource-efficient housing.

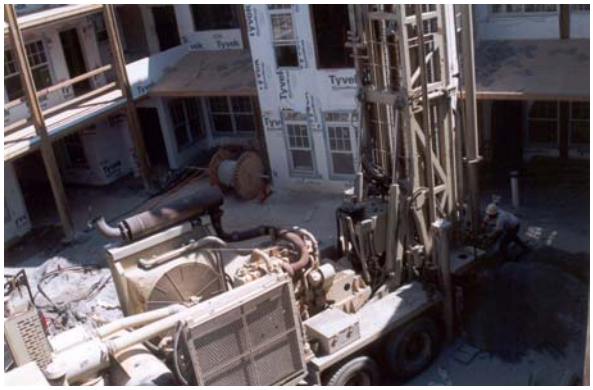
Takoma Village Cohousing is important as a demonstration project for several reasons. From the PATH perspective, it is an opportunity to incorporate technology into an affordable, low-rise, multi-family urban project. At a time of increasing concern over unchecked suburban sprawl and an over-burdened highway system, the Takoma Village project represents a renewed commitment to affordable, energy efficient, environmentally conscious urban development. Completed in the Spring of 2000, Takoma Village is more than just the National Capitol Region's first urban co-housing project; it also represents another significant stride in PATH's efforts to support sustainable urban design and construction.

This project is based on the elements of the cohousing movement begun in Denmark, and although adapted to the American lifestyle in locations throughout the countryside, the project's design, material selection, dwelling unit configuration and mix are replicable in urban areas as well. The overall make-up of the project – 22 townhouse-style buildings divided into 43 one-, two-, three-, and four-bedroom units, plus one common house – works well to fill the needs of the cohousing model, but is not limited to such applications. The common house can serve as a community center, outreach facility, or commercial anchor.

With a strong emphasis on incorporating an optimum mix of PATH's energy efficient, green building materials and systems, this project can be a strong model for technology incorporated into mainstream urban town-house projects. Preliminary investigations identified geothermal heating and cooling and the Geothermal Heat Pump Consortium as providing design assistance. Low-VOC (volatile organic compound) paints and finishes were being specified as a means of improving indoor environmental quality, and

optimum value engineering (OVE) was being deployed throughout the design process to reduce materials usage without compromising strength and durability.

Other technologies considered for inclusion in the early discussions were solar domestic hot water systems, fiberglass-frame windows, durable fiber cement siding, permeable pavement, and renewable framing materials such as engineered wood and steel.



Project Progress

June 1999

During the month of June, a preliminary assessment was made from the PATH inventory. Preliminary drawings were reviewed, and calls were made to obtain information on the following applicable technologies:

- Geothermal Heat pump
- Category 5 wiring
- Fiber cement siding
- Engineered wood products
- Blown cellulose insulation
- Wastewater heat recovery
- Flexible gas piping

A meeting was scheduled with the architect and mechanical engineer. Staff also met with the Takoma Village Cohousing group to explain PATH activities. A meeting was scheduled for July 2 with the architect and design committee. The architect targeted July 23 to submit permits and bid documents.

July/August 1999

During the months of July and August, architectural, structural, and mechanical plans were refined and drawings were made available through the architect/developer. SWA staff attended four meetings with the Cohousing design team and architect. At each meeting, an update report was presented regarding PATH technologies; typically this included a brief question and answer period.

The Geothermal Heat Pump Consortium (GHPC) provided assistance to the mechanical engineer through a Design Assistance Agreement. GHPC has further

agreed to provide a test boring at the site. [Note: GHPC was extremely cooperative and interested in providing support for this project.]

OVE assistance was provided to the architect and structural engineer. Typical dwelling unit sketches were provided for use in the bid documents.

An energy analysis of the project was performed, as well as a life cycle cost analysis of the geothermal heat pump system.

Staff made contact with representatives from the following technologies to provide input during the bidding process:

- Geothermal Heat pump
- Blown cellulose insulation
- Engineered wood products
- Wastewater heat recovery
- Fiber cement siding
- Flexible gas piping
- Drywall clips
- Fiberglass windows
- Energy Star homes program
- Energy efficiency financing
- Energy efficient appliances

Groundbreaking was tentatively scheduled for September. SWA staff agreed to provide some support for this event, although it was anticipated that there would be another larger event for the ribbon cutting, tentatively scheduled for spring of 2000.

September 1999

During the month of September, SWA provided information and contacts for several alternates proposed to the bid documents. Among these items were fiberglass-framed windows, tankless water

heaters, recycled wood flooring, energy efficient kitchen appliances, and bamboo flooring.

SWA also worked with a GFX manufacturer and distributor to propose a combination hot water system using greywater heat recovery and tankless water heaters.
The official groundbreaking was scheduled for Thursday, September 16. It was agreed that a HUD representative would attend. SWA staff was in contact with both HUD staff and PATH office staff to ensure that printed materials on the PATH initiative would be available. Unfortunately, after much preparation, the event was postponed due to Hurricane Floyd.

SWA staff attended a meeting with the architect and the Design Committee on September 2 and presented an update on the geothermal heat pump system and other issues.

The groundbreaking was rescheduled for Friday, October 22. SWA staff has also proposed that a representative from the Geothermal Heat Pump consortium meet with the members of the Design committee to answer questions from the group on the heating and cooling systems.

December 1999

After an intense period of activity in both October (groundbreaking) and November (revisions to the construction documents), December saw considerable delays during the permit period. It should be noted that streamlining the permit process might be a target for the PATH initiative, since this can be a big problem area for developers and builders and can have repercussions affecting affordability. Also during December, some value engineering was undertaken and the architect and general contractor reviewed alternates. There was a suggestion that the common house mechanical system be specified as conventional gas heat and conventional air conditioning to save costs. However, after additional cost analysis and review by the mechanical engineer, community design committee, Geothermal Heat Pump Consortium consultant, and

SWA, they decided to use geothermal systems throughout the entire project. Additionally, the historic district representatives required a change in the window specifications to better conform to the existing architecture in the neighborhood.

Permits were finally received at the end of December and excavation was begun.

January – June 2000

Construction began in January with a completion date set for October 2000. There were some early delays due to the necessity of additional extensive site work, including soil remediation, (contaminated soil), removal of material, and additional fill.

Window specifications were changed due to the neighborhood review board's insistence that the decorative window grids be exterior instead of interior. SWA attempted to substitute fiberglass frame windows at this time, as we thought the cost difference would be narrowed (exterior grid windows

are more expensive), but the cost difference was still approximately double. Aluminum framed windows with thermal breaks were specified.

Additional coordination on foundation work did occur, but it didn't hold up the project.

Weather delays in January and February and again in April and May caused some anxiety. Slabs couldn't be poured on time. However, progress was made and the fourth floor framing got underway.

There were fairly extensive conversations with the contractor, geothermal systems subcontractor, and mechanical engineer regarding unit heat pump sizing, location of borings, and some duct supply duct locations. The subcontractor wanted to resize some of the units specified to a larger size. The mechanical engineer objected. Regarding the borings, the contractor wanted to place them closer together than specified by the ME. This is being resolved now. Drilling is scheduled for the second week of July. It was also decided that there would be no ductwork in exterior walls.

Contact was made with EPA staff to determine how best to obtain an ENERGY STAR® designation for the project.

July 2000

Installation of ductwork was completed and inspections were scheduled. The drilling of wells for the geothermal heat pumps was begun with the well digger recommending placing fewer but deeper wells. The Geothermal Heat Pump Consortium engineer was consulted. He reviewed the new specifications and made some recommendations on the potential replacement of flow centers for some units.

Greenstone Industries was contacted regarding the installation of insulation. The insulation contractor was a Greenstone certified "Cocoon" installer, and Greenstone coordinated with the contractor to have someone from Greenstone on site at the beginning phases of the insulation installation to ensure that the cellulose insulation was being installed properly.

Efforts to engage Lucent in the demonstration project – possibly providing materials for the high tech wiring scheme being provided to some units – were not successful. Lucent, although listed as a PATH technology provider, was unresponsive in general. They were undergoing yet another reorganization. Perhaps SWA should have suggested that the list of technologies

be reviewed and "weeded." It is less than helpful to get information that is worthless or just leads to a dead-end.

Preparations began for a "Ribbon Cutting" event. The approximate date was to be mid- to late-October, hopefully with good representation from HUD, the DC government, and possibly the federal government (Gore).

August 2000

Drilling of the ground source heat pump wells was held-up due to rain. There were also some sizing issues regarding the HVAC system. Bob Dooley (Geothermal Heat Pump consortium) was contacted by the architect again in order to resolve a question on the common housing unit that arose between the HVAC contactor and the mechanical engineer.

Phase I (common house) and back on both legs (to the outside walkways) was insulated and drywall was installed. It was anticipated that Phase One would be painted (2 coats) by September 16. At that time, HVAC would be installed in Phase One. Arrangements for blower door testing on Phase One – in compliance with ENERGY STAR® Certification – were being finalized.

Delivery of Phase One units was scheduled for October 31. This represented a delay of approximately 2 weeks.

Phase II was divided into two phases (North wing and South wing).

The approximate date for the ribbon cutting was moved back to late October.

September 2000

The project moved toward completion.

Building diagnostics, including blower door testing, were scheduled for Phase One on Tuesday October 17. Successful completion of this testing was necessary for compliance with ENERGY STAR® certification. Blower door tests were to be performed on 7 of 43 units, divided between Phase I and Phase II construction schedules.

The following is a list of units:

Phase One

- Apt. # 211, Unit B (4-br in Common House)
- Apt. # 309, Unit D (2-br, upper floors)
- Apt. # 313, Unit H (2-br, top floor)
- Apt. # 316, Unit J (1-br, top floor)

Phase II

- Apt. # 303, F1 (2-br, top floor)
- Apt. # 101, C1 (3-br)
- Apt. # 121, A1 (4-br)

Delivery of Phase One units was rescheduled for October 31. This represented a delay of approximately 2 weeks. Move in for Phase I units was tentatively scheduled for November 4th and 5th.

October 2000

The project moved toward completion. Punch-outs on apartments in Phase I were underway. Building diagnostics, including blower door testing, were scheduled for Phase I on Tuesday October 17. However, due to construction oversight, the testing had

to be postponed. Problems encountered included 1) units not being sufficiently competed for accurate testing, and 2) excessive infiltration beneath baseboard trim above sub-floor; beneath and around kitchen cabinets; and at electrical outlets, bath exhaust fans, window edges, HVAC supply registers, and washer boxes.

These infiltration and duct leakage measurements were far from satisfying the ENERGY STAR® requirements. This should dramatically improve when the units are completed. For example, the penetrations in the mechanical closet had yet to be sealed (penetrations to be foamed and drywall installed around it for fire rating), the plate was not yet installed on the washer box (which is to be caulked and sealed), and the register was not installed on the exhaust grill (which could reduce infiltration there).

Diagnostics were rescheduled for November 16th and 17th.

Delivery of Phase One units was rescheduled for November 16th and 17th. This represented an additional delay of approximately 2 weeks. Move in for phase I units is tentatively scheduled for November 18th and 19th.

The use of flooring adhesives did not meet the specification for low VOC. Resolution of this issue appeared to be a letter from the adhesive manufacturer regarding the toxicity and off-gassing of the adhesive.

November 2000

Phase I units were turned over to their buyers just before Thanksgiving on November 17. Construction continued on Phase II units and the common house.

Blower door testing of Phase I units, scheduled for November 16 and 17, was postponed. At this time, testing was tentatively set for early January 2001. This would enable the contractor to finalize all units and the common house. Furthermore, all testing would be performed at the same time.

The completion schedule for the project was:

- Phase II-A: closing mid-December
- Phase II-B: closing December 29
- Common House: final punch list scheduled 12/22.

Preliminary duct blaster testing indicated a potentially daunting issue. The combination of attached housing, small apartments, and tight envelopes reduced HVAC loads to only 350 CFM. Since ENERGY STAR® specifies maximum leakage as a fixed percentage, only 35 CFM is allowed. Despite the tester's observation that "ducts were sealed and looked fairly tight," this rate may be difficult to achieve, as the normal leakage around the air handler will thus be a significant portion

of total leakage, disproportionately driving up leakage relative to air flow.

The applied flooring adhesive did not meet specified requirements for low-VOC. SWA has reviewed literature and correspondence between the Takoma Village membership Association, the developer, and the adhesive manufacturer, and issued guidelines for the manufacturer to submit a letter regarding toxicity and off-gassing of the adhesive.

December 2000

By the end of December, 35 of the 43 units were occupied, and all of the other units were substantially complete. A few residents were held back by some remaining punch list items, mostly relating to air sealing in anticipation of blower door testing. Some of the ground source heat pumps had not been adjusted before the start of a colder than normal winter, prompting the electric resistance heating to kick in. Fine-tuning was performed on all occupied units, and the systems are performing as intended.

January/February 2001

The as-built photos you see here were taken in January, when landscaping and final punch list items were being completed. By mid-February, 41 of the 43 units were occupied, with the remaining two available for occupancy but vacant due to owner preference and moving logistics. Reaction on the part of the surrounding community has been highly

favorable, and the new residents of Takoma Village are well on their way to building their "conscious community," one that's bound to thrive in the supportive and sustainable setting of PATH's hometown demonstration site.

May 2001

The ribbon cutting was held on May 4, 2001. The following is the agenda for the event.

Takoma Village Cohousing
Ribbon Cutting Agenda – Friday, May 4, 2001 11:00 a.m.

Introductory Remarks
Jean Huff, President, TVC Homeowners Association
Milton Bailey, Director, DC Housing and Community Development
Zoreana Barnes, Director, D.C. Housing Finance Agency
David Engel, Director, Affordable Housing Research & Technology, US HUD (for PATH)

Sam Rashkin, National Director, Energy Star Homes, US EPA/US DOE
Don Tucker, TVC Architect and Developer, Eco Housing Corporation
Adrian Fenty, Ward 4 Council member, D.C. Government

After the presenters and Q&A, the ribbon cutting took place and refreshments were served, followed by home tours of the participating units.

Conclusion

Takoma Village is a welcome addition to the neighborhood. It provides attractive, reasonably priced, high quality housing that is sustainable and resource-efficient. With PATH's help, Takoma Village shows other area builders and developers how it's done. Perhaps more importantly, the project has taken shape right in our nation's own backyard, where policy- and lawmakers can see for themselves how sustainable, green buildings serve as a real asset – both to their surrounding communities and to the nation as a whole.

The successful outcome was due to a number of factors:

- Owners met weekly during the planning process to surface and address a wide range of suggestions and ideas.
- Design preferences and other concerns were then brought to the developer/ architect for review.
- Unlike most multi-family housing developments, where the eventual occupants have little or no say in the design process, a large percentage of Takoma Village property owners were on board from day one. Many of them played an active role in the decisional process, developed a good rapport with developer/architect Don Tucker, and now have a much better understanding of the "give and take" that's involved in seeing a building from concept to completion. In a real sense, they started forming a community long before the first moving trucks arrived at the site.
- Technical assistance was provided throughout design development and construction, providing help in green building materials/systems research and selection, performing energy analyses, and providing logistical support to both the design team and owner's group representatives.

In addition, it was apparent from "move-in day" that members of the Takoma Village community appreciate the many advantages of an energy and resource efficient urban development. Takoma Village is more than just the National Capitol Region's first co-housing condominium. Located in Washington, DC's upper Northwest sector, Takoma Village represents a renewed commitment to affordable, energy-efficient, environmentally conscious urban development.