Summary Conclusions and Recommendations

DfD Case Study Home: 71 Boulevard, Atlanta, GA 30312.

The case study home was designed according to the design regulations of the Historic Martin Luther King District. The nearby King Memorial, shops, and restaurants add to the sustainability of the project as a viable home site, and create the potential for a pedestrian friendly urban lifestyle. The site is zoned as live-work and could be adapted for home office or residential use. The design for adaptability and disassembly facilitates this feature of the zoning.

by

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Conclusions and Recommendations

Photographs from the Open House on June 3, 2006
25-50 interested participants from the public came through the home. Representatives from the non-profit community, EPA region IV, and the press were in attendance.

Recommendations:

Based on this case study, our recommendations for future adaptability/disassembly in residential construction are:

1. Strategy:
   Allocate the design for disassembly effort where change is most likely to occur.
   Working within established building practices meant? accepting some of the stability that comes with a traditional site-built home. The stability of the foundation and of the exterior walls is reasonable for a single family residential project. A commercial project with a shorter lifespan may have a different approach. Interior walls and systems, even for a residential structure, should remain flexible. Our approach was to create a system that identifies areas of flexibility and design accordingly. See *figure 1: levels of disassembly* and *figure 2: plan forms for adaptability*.

2. Convenience:
   Work within accepted trades with convenient materials.
   This is essential for the residential market, a slow changing market with deeply entrenched practices, and long building lifespans. This approach allows our case study method to be easily replicated and spread throughout the industry without calling for a revolution of residential construction. See *figures 3-7: repositionable wall section and images.*

3. Aesthetic of Disassembly:
   Allow the deconstruction method to show.
   Allow the construction method to show through in the aesthetic. Keep it simple. We create visible joints and allow them to show through in the final details, for example: brass screws are visible in all the trim throughout the home, and additionally: the joints between SIP panels are revealed at the top and bottom of all the walls. One can readily see how a wall can be deconstructed and materials harvested. *See figure 8: annotated finish photographs of the DfD case study home.*

4. Reveals:
   Allow room for the deconstruction to occur.
   Mock up a deconstruction trial. Is there space for tools? Is there space to remove the materials? Are potential reuse materials damaged in the process? In this project, joints were left as reveals were?. The reveal lends itself to adaptability and disassembly. First – there is less material to remove, and second – there is an obvious place to use as a starting point for deconstruction. *See figures 9 and 10: annotated finish photographs of the DfD case study home.*

Hierarchy of Adaptability & Disassembly:

Complete disassembly only happens at the end of the useful life of the home. At that time, we can dismantle it and reuse or recycle the parts. Until then, the home is designed for flexibility and adaptability to meet the current and future owners' needs.

Levels of Stability:

1 Most Stable

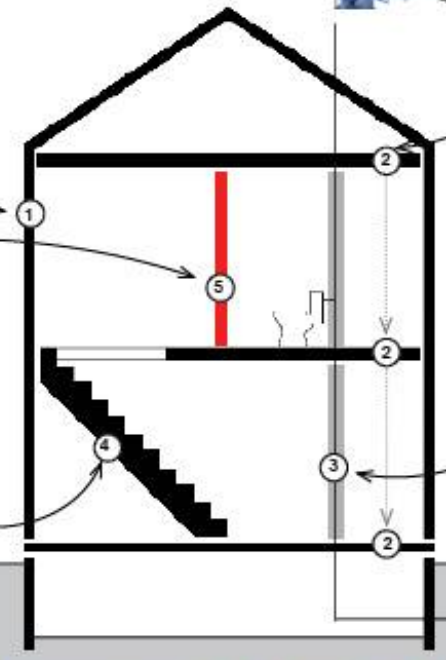
5 Most Adaptable

1 **Exterior Walls:** Exterior walls are structural insulated panels (SIPs). They are pre-fabricated off-site, eliminating waste during construction. At the building's end-of-life, the panels can be cut apart, and reused with minor modifications.

2 **Structure:** The floor structure spans from the exterior wall to exterior wall. This means that the living spaces can be totally flexible. The hardwood floors run continuously across the entire width of the house, so that walls can be moved and there is no break in the floor finish.

3 **Plumbing Walls:** Bathrooms are vertically aligned to minimize plumbing runs. These walls are installed with screws to facilitate disassembly. Walls that do not have any utilities and are entirely flexible to move (see #5).

4 **Stair:** The staircase is in the core of the building and doubles as the location for two columns. As such, the location of the stair is integrated into the framing, and this location is relatively stable. It can still be disassembled at the end-of-life of the building.



5 Repositionable Interior Walls

Interior walls can be removed and relocated with no waste resulting from this process. A scale mock-up of the wall system was created to investigate the steps required to make the wall demountable. Light-gauge metal framing is used to frame the wall panels to reduce weight for portability. The wall sections can be reused as is, or combined to create new configurations to meet the needs of the homeowner.

step 1

remove trim

step 2

remove wall panel

step 3

remove top & bottom plate

2X4 top & bottom plates are attached to the finished floor and ceiling. Finish floor runs underneath all walls to prevent the need for patching.

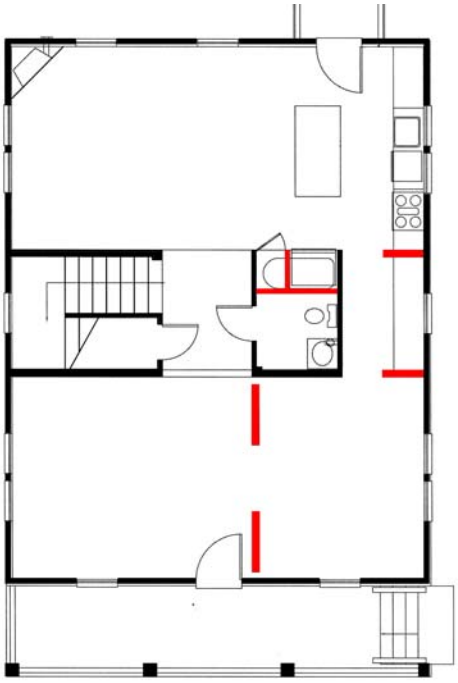
Figure 1: levels of disassembly.

Figure 1: (explained).
This case study identifies "levels of disassembly". While this system works particularly well for this design, it is appropriate to consider other residential designs in a similar way. Although there may be slight differences based on construction techniques, the general principle of taking a strategic approach to stability and flexibility will always apply. The levels identified in this case study were simplified in the figure above. A more detailed range includes more levels, from most stable(1) to most changing(8), and consists of:

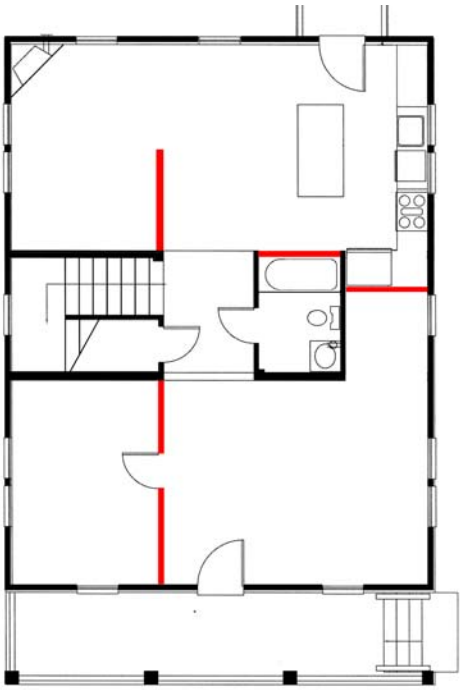
1. Foundation
2. Exterior walls
3. Staircase
4. Interior floors & ceilings
5. Walls with plumbing
6. Walls without plumbing
7. Cabinetry & fixtures
8. Furniture

What our "levels" do, in effect, is organize the construction into a spectrum of adaptability. Disassembly is more difficult for the most stable parts, like the foundation. However, a solid foundation leads to the sustainability of the home. *Design for disassembly should not and can not encourage obsolescence.* Interior walls need to be flexible, so clear span structure is a must. No interior wall can be used for structural support, or it compromises the home's adaptability. Flooring needs to be chosen with flexibility in mind. It must work for a wet location and dry location, and able to be refinished and reused. In our research, we ruled out "click install" flooring products despite their apparent deconstructability. These flooring products "float" structurally and do not allow a wall to be installed on top of flooring materials. By virtue of this warranty issue, these products were eliminated. In order for the most adaptable levels to function as such, the detailing must be simple and use no special tools or materials. The construction should be uncomplicated, so that the deconstruction is similarly easy to imagine and to execute.

Figure 2: Plan form adaptability.
The flexibility of the plan is demonstrated by the diagrams below, which show current and potential future plan arrangements:



Current First Floor



Potential Future First Floor Arrangement

Figure 3: Repositionable wall section

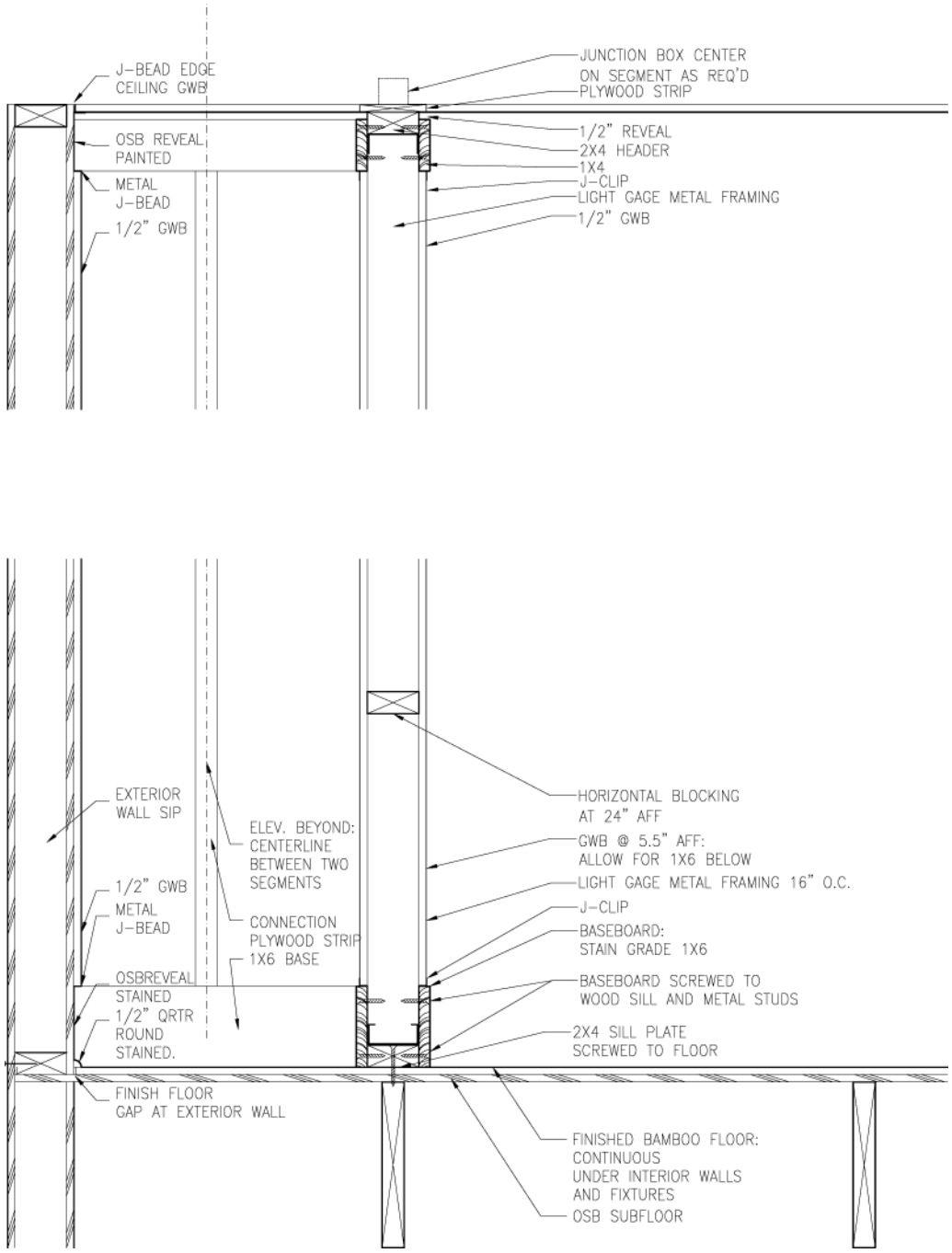


Figure 4: Repositionable walls.
An aesthetic of disassembly is created in the repositionable wall shown below.

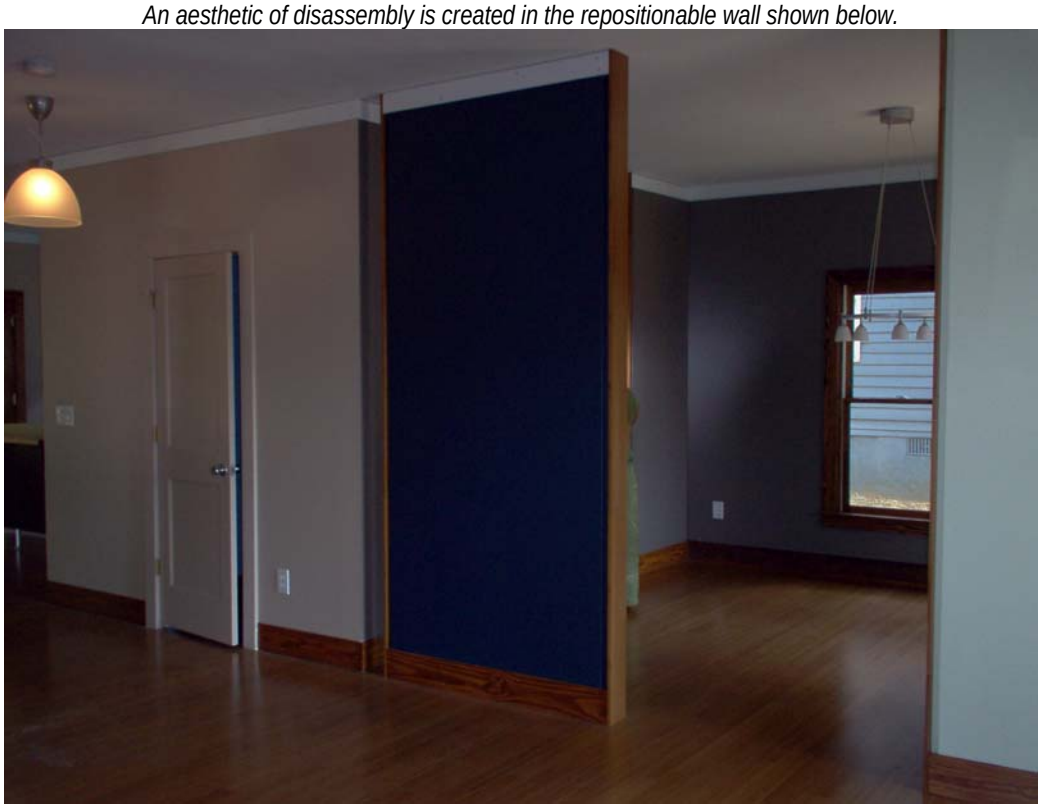


Figure 5: Repositionable walls.
The same wall segments under construction:

Figure 6: Repositionable wall.
A repositionable wall is shown below as well in a longer length which was broken into 4'wide reusable segments.

Figure 7: Repositionable wall.
The repositionable wall segments under construction.

Figure 8: Finished Interior Photographs of the DfD details.
Note the visible means of attachment, the use of reveals rather than rounded edges, and the allowance for some "unfinished" materials to be visible in the finished product. All these efforts create both a practical ease of disassembly, and an aesthetic of disassembly. In order to encourage the practice of adaptation and reuse, we left the screws visible. The homeowner will know how to remove and replace things easily via this simple tactic. We also left reveals at the joints. This reveal leaves a space for a tool to separate materials easily – rather than damaging a molding with a pry-bar. We also left the SIP panel of the wall visible and the top plate of the wall visible. If one plans an addition or remodel – they can see the construction clearly. There is no need to damage walls or do partial demolition to discover the construction method.

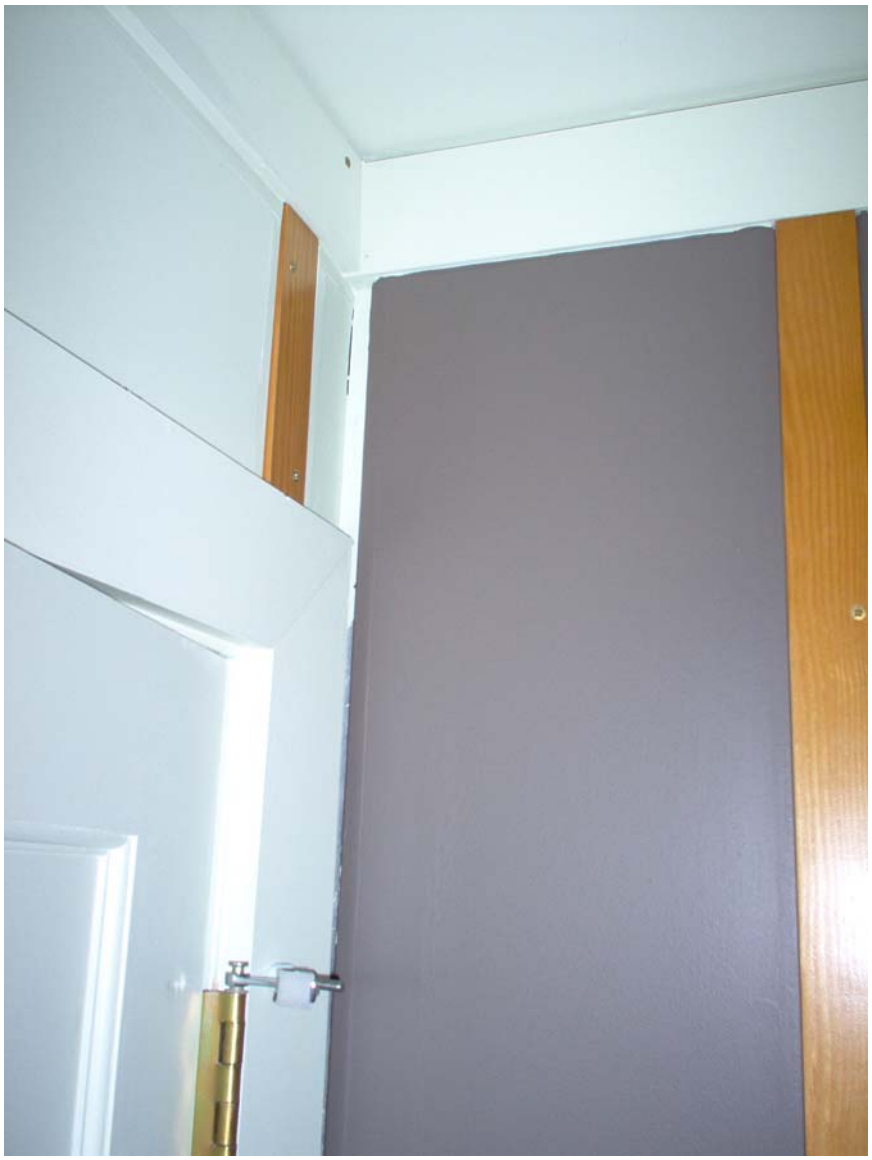


Figure 9: Crown & base details.
An interior wall (right) meets an exterior SIP wall (left). The interior wall crown mold is finished with a 1x4 attached with visible screws and leaves a ½" reveal. The exterior SIP wall leaves the OSB revealed and painted to match the crown mold.

Figure 10: The same corner under construction.

Conclusions:

The case study home provided lessons in the reality of how DfD fits into accepted methods of single family residential construction. DfD is not a typical process in residential construction. DfD naturally occurs in a rapidly changing environment, as in a temporary office or short term retail facility. The precedents we considered during the design phase of this case study came from a pre-fabrication strategy, utilizing off site labor and higher levels of technology. These high-tech conditions are typical of the commercial construction industry, not the residential construction industry. Although pre-fabrication is making headway within single family residential construction, the vast majority of residential homes are still site built. We chose to work within that paradigm for this case study.

We adopted a strategic framework that worked within site-building constraints and that placed adaptability before disassembly. The adaptability concept is something that contractors and homeowners alike can readily appreciate. We used typical materials and standard subcontractors. None of our subcontractors had ever thought about or heard of DfD before the project began.

Our case study taught us a system of adaptability, and allowed us to test out a brand-new methodology of repositionable interior walls. These walls were a unique feature of this project. For this case study, design for adaptability and disassembly works to encourage lifecycle thinking. Our version of DfD encourages this lifecycle thinking and allows it to grow within the residential construction industry. This case study reduces the ecological footprint of the project during initial construction, future remodels, and eventual deconstruction. We consider this model a best practice toolkit for future residential projects.