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Encasing Lead Hazards and Adding Energy Efficiency in Low-Income Housing

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Encasing Lead Hazards and Adding Energy Efficiency in Low-Income Housing

Conventional wisdom as well as field research has confirmed a simple truth of economics: the lower the incremental (marginal) cost of producing an outcome, the more likely that production will occur. In residential building rehabilitation that economic truth suggests that energy efficiency is likely to become part of the scope of work of a project when the additional cost of including conservation measures are relatively small. One example can be found by comparing gut rehab to moderate rehab. In a building that is gutted back to masonry walls, adding substantially to envelope insulation and air sealing is a small addition to the cost of construction since framing out from the masonry is a part of the cost of the basic rehab and not an incremental cost of energy efficiency (cf. Katrakis, et. al.: 1994). With moderate rehab, the interior surfaces of perimeter walls tend to be left in place and the cost of opening the walls to incorporate additional insulation or reduce air infiltration is an incremental cost of energy efficiency. Given equal energy savings, the lower incremental costs of air sealing and insulation in a gut rehab substantially increases the likelihood of such measures being undertaken over the higher incremental costs in moderate rehab. A second - and equally obvious - example can be found in the replacement of a furnace with an energy efficient model: one rarely finds a developer replacing a well-functioning standard furnace with a 90+ furnace, instead he generally waits until a new furnace is needed before he considers his options.

In a sense energy efficiency must fit into the overall needs and opportunities of a building retrofit. If little is being done to a building, then few measures can be expected to be justified. If much must be done, however, the opportunities for conservation are likely to be great. The efforts by public housing authorities to address the problem of lead-based paint should be seen as a great - though currently unexploited - opportunity for energy efficiency. As potential purchasers of homes ask questions in connections with the new lead-based paint disclosure requirements that took effect in the second half of 1996 (cf. HUD: 1996, pp. 1-3), a similar opportunity is likely to present itself throughout low-income housing.

Lead poisoning hazards exist in many, if not most, low-income housing that was built before 1978. Studies have found that in some urban communities with older building stocks over 35 percent of children tested have elevated blood lead levels (Hastings, et al.: 1997). Though elevated blood lead levels can result from residual lead in many parts of the environment (such as soil contamination in parks and playgrounds or solder from water pipes), substantial attention has been focused on the housing in which poorer families live - particularly public housing (Goldfarb: 1997). What is needed is a range of low-cost solutions to address lead poisoning hazards. To the extent that such solutions can include energy efficiency, the operating cost savings associated with energy conservation will be able to pay for some of the lead remediation measures.

The composite wall system described below was developed to address the problem of lead poisoning hazards on wall surfaces while adding a tight, well-insulated, and strong interior surface to perimeter walls at the lowest possible cost. The wall design is a product of Department of Energy (DOE) funded research by the Advanced Housing Technology Program at Oak Ridge National Laboratory (ORNL) and the Existing Buildings Efficiency Research Program at Argonne National Laboratory (ANL). A collaborative effort to implement the wall design included the Chicago Housing Authority (CHA), the Louisiana-Pacific Corporation, and the Celotex Corporation along with the national laboratories. A test wall was constructed at CHA headquarters with materials and labor provided by Louisiana-Pacific and Celotex. Planning is currently underway to utilize the wall in the modernization of a CHA residential development.

Wall Design and Materials

The composite wall is constructed of 1-1/2 inches of rigid insulation and 1/2 inch Fiberbond - a reinforced gypsum board. It can be installed on the inside of any exterior masonry. The wall contains no vertical studs and extends only 2 inches from the original wall (unlike conventional stud walls which remove 4 inches or more from living space). Figure 1 shows the wall design.

Fiberbond was chosen for its rigidity and strength. It is produced by Louisiana-Pacific and is available in many building supply stores. Celotex's Tuff-R was used as the rigid insulation. Tuff-R is a polyisocyanurate insulation that is foil-faced on both sides. It has an R-value of 7.2 per inch. For the adhesive, EnerFoam was chosen because it expands within cavities to fill voids and has an R-value of 5.7 per inch. EnerFoam contains no solvents that could destroy the rigid insulation.

Wall Construction

The composite wall is constructed by attaching two 2x2 wood nailers attached horizontally to the original wall at the floor and at the ceiling. The nailers should be sealed at the wall and at the floor or ceiling with caulk. The sealing will prevent lead contaminated dust from moving into the the living space from under the nailer.

An 8 foot by 4 foot sheet of 1-1/2 inch rigid insulation is trimmed to fit between the nailers against the original wall. Approximately 3 inches must be trimmed from the 8 foot height of the sheet. The rigid insulation is attached to the original wall with the adhesive. The edges of the rigid insulation must be taped at the vertical seams and at the nailers to provide a continuous air and vapor barrier and to contain lead dust particles.

The Fiberbond must be installed properly for best results. First, the adhesive is applied to the surface of the rigid insulation in 1/4 inch beads about 12 inches apart. Second, two quarter inch shims are placed on the floor in front of the bottom nailer. Third, an 8 foot by 4 foot sheet of Fiberbond is raised onto the shims. The sheet of Fiberbond should be offset from the sheet of insulation by 6 to 12 inches so that the Fiberbond edges are not aligned with the insulation seams. This will reduce the opportunity for air and moisture movement into the wall system and will provide an additional barrier to contain lead dust. Next, the Fiberbond is mechanically attached to the top nailer with six or more drywall screws and is pressed into the adhesive. Finally, the shims are removed - allowing the weight of the Fiberbond to straighten the sheet - and the Fiberbond is attached to the bottom nailer with three or four drywall screws.

The joints of the Fiberbond can be finished with standard tapes and drywall compound. At CHA headquarters, nylon mesh was used and three coats of Durabond joint compound were applied. Before painting, the wall should be primed completely for good results.

Wall Costs

The costs of this system have not as yet been fully documented because it has not seen widespread application. A comparison of costs, based on R.S. Means Estimating Guides, of the rigid insulation and Fiberbond system with wood stud fiberglass batts and standard drywall indicates that the rigid insulation and Fiberbond system is about 20% less expensive. Contractor estimates - not quotes - vary with the cost of labor (geographically and union/non-union) and the complexity of the actual project (windows, doors,

outlets, pipes, etc.). A moderately complex installation, including base cover and painting, in the Chicago area was estimated in the range of \$3.70 to \$4.30 per square foot, based on professional crafts installation. Because of the simplicity of the system, it is believed to be potentially within the capabilities of resident labor crews for public housing developments. The use of resident labor could significantly reduce the labor costs and provide job experiences for public housing residents.

Connecting Lead Encasement to Larger Energy Efficiency Efforts

The inclusion of energy conservation measures in the rehabilitation of low-income housing has taken several important strides forward in recent years. In 1990, the Department of Housing and Urban Development (HUD) and DOE joined together in a interdepartmental initiative to both investigate and stimulate energy efficiency for existing residential buildings. In the five years of the DOE-HUD Initiative, the program laid a solid research and institutional foundation through pilot projects and field studies (cf. Brinch: 1995 and Katrakis, et al.: 1994). Out of the DOE-HUD Initiative came two deployment-oriented programs that are attempting to carry the lessons learned to a much larger number of buildings. The programs are DOE's Rebuild America program for commercial, institutional and large multifamily buildings (DOE: 1996) and DOE's Partnerships for Affordable Housing (Myers, et al.: 1997). In addition to Chicago, DOE is providing technical support to public housing authorities in Boston, Atlanta, New Orleans. DOE also is developing projects with public housing authorities in Texas, Utah, and other locations.

At the same time, aggressive energy conservation in rehab has been pursued on a local level. Super insulation methods have been defined, developed, and demonstrated for gut rehab by the Illinois Department of Commerce and Community Affairs (DCCA) and Domus Plus (cf. Knight: 1997). These methods are being institutionalized by the DCCA program for non-profit community groups and the ComEd program for low-income condominiums and cooperatives. In addition, ShoreBank is exploring the opportunities in Chicago for loaning additional funds for the inclusion of super insulation in for-profit housing.

The important challenge that faces renovators of low-income housing is to include energy conservation measures whenever the opportunity presents itself. If one can encase lead and make the housing safe for children, it would be wise to use the shell measures that will also enable the parents of the children to receive lower energy bills at the same time..

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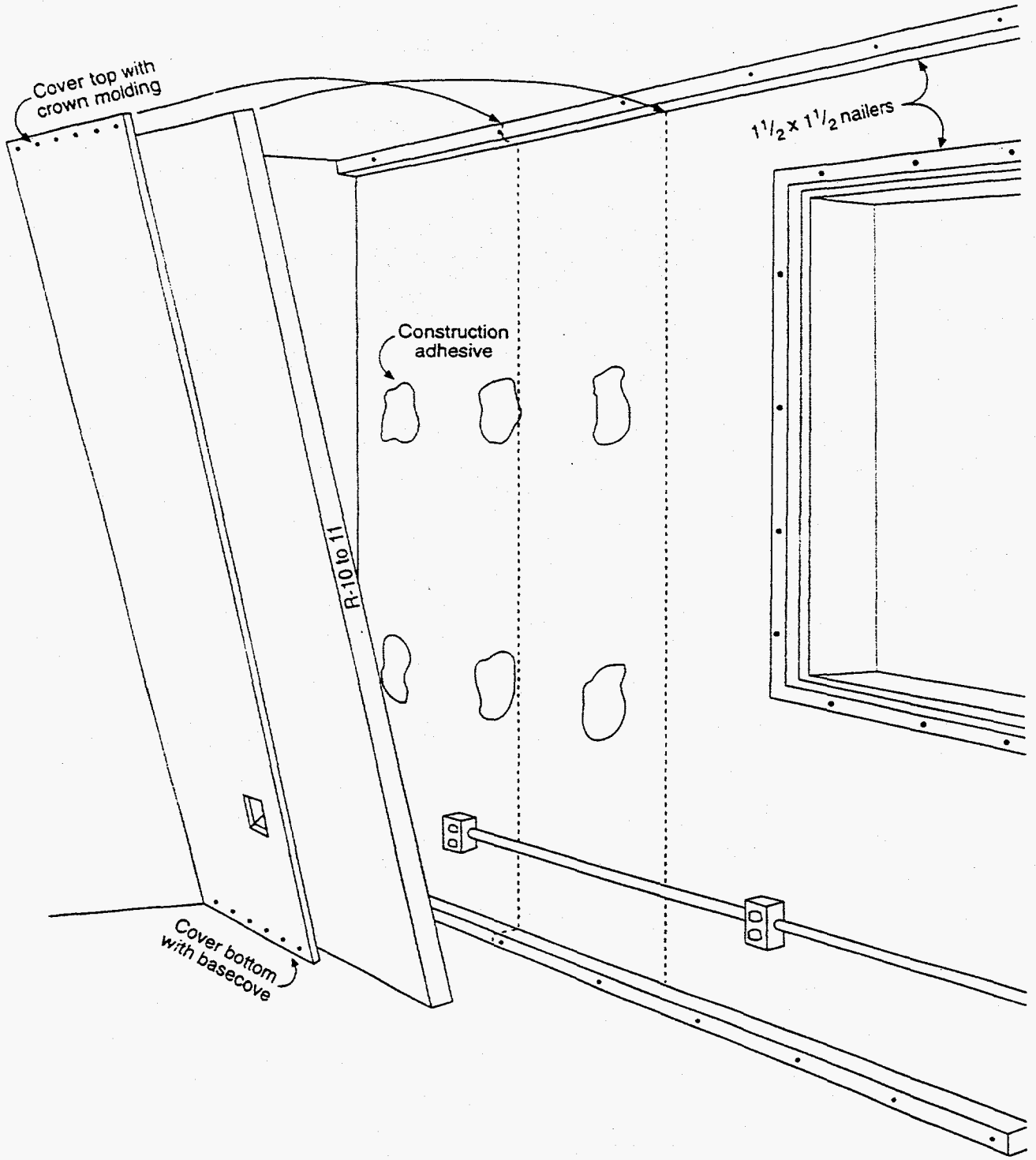
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Cover top with crown molding

1 1/2 x 1 1/2 nailers

Construction adhesive

R-10 to 11

Cover bottom with basecove

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