

## **Pilot Post-Occupancy Evaluation of NYC Emergency Management Urban Post-Disaster Housing Prototype**

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**Figure 1. Urban Post-Disaster Housing Prototype, Brooklyn, NY 2014 All photo credits: Andrew Rugge, Archphoto**

### Context of the Pilot Study.

Loss of housing after disaster is one of the most destabilizing consequences of disaster for individuals, neighborhoods and cities as a whole. As the federal government needs option for quickly-delivered multi-story, multi-family housing that can work for cities with little open space and a wide variety of household types, NYC Emergency Management (NYCEM) led the creation of an Urban Post-Disaster Housing Prototype along with support from the Federal Emergency Management Agency and in coordination with the NYC Department of Design and Construction (DDC) and the U.S. Army Corps of Engineers (USACE). The prototype was created as a proof-of-concept for an urban type of post-disaster housing that could be rapidly deployed after an emergency to provide safe, healthy, comfortable and cost-effective interim housing for people whose homes were made uninhabitable. Interim housing is

the period of time between when a resident is displaced and when they obtain housing they can afford without disaster assistance.

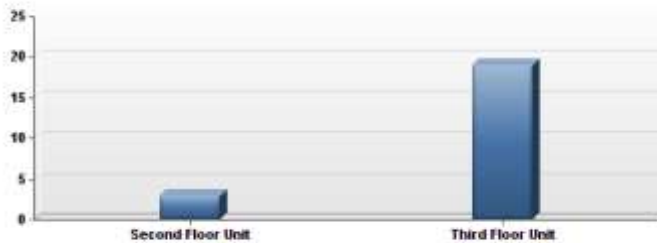
Central aims of the project are to understand how rapidly-built housing can best restore a sense of home and community, and to ensure that all post-disaster housing does this well. Key intentions of the project were to test designs that suit various household sizes and to educate the public about post-disaster housing and community planning, so the prototype is a three-story modular structure that has a one-bedroom apartment on the top floor, a three-bedroom apartment on the second floor, and a public gallery on the ground floor (Figure 1).

Another goal is to make it possible for as many manufacturers as possible to supply suitable housing to cities after disaster. The key to leveraging the full industry is to specify performance criteria, rather than design. Not all post-disaster housing will look like this prototype, but all manufacturers will be required to supply equal or better quality; NYCEM and DDC developed the Urban Post-Disaster Housing Prototype Design Guidelines and Performance Specification to serve as the basis of a request for urban post-disaster housing in the event that it is needed. The prototype was assembled in 2014, using the criteria in an initial version of this specification. Best practices that emerged from this testing both increase the efficiency and cost-effectiveness of future post-disaster housing, and ensure that this housing is comfortable and functional for all residents.

Often, building performance is evaluated only in terms of structural and mechanical systems. This study investigates the equally important aspects of how well the building works for residents. While NYCEM, DDC and USACE evaluated the building's performance in terms of constructability, maintenance, durability, and energy efficiency, NYU's Tandon School of Engineering investigated questions of environmental psychology. The findings here, based on a full year of occupancy, inform future urban post-disaster housing design, as they are incorporated into the specification developed through the prototype program. The purpose of the pilot study was two-fold. First, we hoped to get feedback from people living in the units that would provide a user's assessment of the quality, comfort and features of the units and provide their perspective on how well the design worked and what needed improvement or change before the model was ready for larger scale production. Second, this pilot was intended as a "shakedown" evaluation to allow revision of questions and instruments so that resident data could be obtained if and when these or successor units are used on a larger scale in response to an actual emergency.

For the test of this prototype, volunteers were recruited from the staff of NYCEM and DDC, to be housed in one of two of the prototype's apartments for a period of one week. During that time they were offered the opportunity to volunteer for this study. Study guidelines, as approved by NYU University Committee on Activities Involving Human Subjects (UCAIHS), required that participation be voluntary. Those willing to participate were interviewed in person or by telephone and were asked to complete online diaries describing daily activities and noting any unusual events.

There were 22 responses to these requests, representing 12 individuals, in the form of interviews and daily diaries. No "unusual event" forms were completed. Most residents in this survey stayed in the 3<sup>rd</sup> floor apartment (see Table 1). For the most part, residents engaged in passive behaviors in the apartments – reading, doing computer work, eating. Occupancy has continued through 2016, and informal feedback suggests that ongoing experiences correspond with results in this study.



**Table 1. Proportion of Inhabitants on 2nd and 3rd Floor Units**

The residents with whom we spoke spent a significant amount of time in their units. Most were home in the evenings for many of their weekdays there, and some had friends over to visit, in several cases for small parties. Many, though not all, said they made significant use of the kitchen facilities for cooking meals.

#### Caveats and Limitations.

This was not a scientific survey using randomly chosen people – the information described here comes from a self-selected group, many of whom had prior knowledge of the prototype project, and some of whom felt they had a stake in the outcome. Moreover, responses come from a group that differs in some ways from the intended target population of the interim emergency housing. The participants stayed in the apartments for only one week, typically brought little if any of their own materials for living other than clothes and toiletries. For many of these residents, as for most New Yorkers, staying in a newly-constructed apartment is unusual, which may have added a positive skew to the results.

More importantly, none were staying in the apartment following and because of a disaster event. None had experienced a recent trauma that brought them to these apartments and all knew when they would be able to return to their permanent homes at the end of the week. Many appreciated the ability to be so close to work for a short period. The fact that this stay was voluntary, rather than forced by events, is an important difference.

Even so, the people in the building tried hard to provide discerning assessments of the facility and gave thoughtful responses about the setting. Several spent significant time writing their own notes about the apartment. Over the period of time we collected data, the weather ranged through the seasons, so that people were there through hot, warm, cool and cold weeks.

## **Findings**

### Overview.

Overall those we spoke with had a very positive view of the units and their stay in them. Positive comments far out-weighted negative ones. Moreover, the negative points tended to be relatively specific

aspects or features of the apartment and typically minor in nature (such as water from kitchen faucets that often splashed on the counter). Even those who described (sometimes in great detail) a number of these negative points were overall quite positive about the quality of the units. Many were willing to stay another week in the apartment.

This generally positive response is even more impressive when one understands the general nature of user surveys for building evaluation. Such surveys tend to draw critical comments more easily than positive ones. It is, for the most part, much easier for people to notice, recall and identify negative aspects of a setting than positive features. For example, people will readily notice the air quality when it is stuffy or there is a bad odor, but are unlikely to comment when there is no odor unless prompted. Because spontaneous comments tend to focus on negatives, evaluators often feel the need to design questions that specifically prompt for positive attributes. In the case of this prototype, all of those we interviewed spontaneously offered positive assessments of the units, especially concerning their overall quality. There was a general consensus that this building and these apartments were well designed, well-built, and comfortable to live in. This reflects the project's premise that interim housing needs to be as well built as permanent housing, as it is often in place for longer than expected (two years is a federal guideline). The building meets all NYC building codes -therefore all standards from the U.S. Department of Housing and Urban Development (HUD)- and requirements of the Americans with Disabilities Act. It also adapts the U.S. Access Board's "Guidelines on Emergency Transportable Housing Units and Proposed Amendments," to apply to urban conditions.

#### Construction.

Construction quality. Most of the residents we interviewed saw the building in general and their unit in particular as very well-built (several used the word "solid"), and well detailed in materials and quality of work. People commonly commented positively on the solid front door, as well as windows and balcony door. No one thought the unit was flimsy and several noted that it did not feel like housing intended for temporary shelter. Several commented that the "fit and finish" of the apartment details were of good quality. For instance, most thought that the details were well executed – plumbing, electrical outlets, lighting – with a few exceptions noted below.

Specifically, residents indicated that the units were seemed "tight" - well insulated, without air leaks or drafts, and had good temperature control. While several commented that there was little external noise, within the building or from the street, it should be noted that most were there without any neighbors in the building. One resident reported that the building shook or vibrated ("like an earthquake") when there was a heavy piece of equipment digging in the street nearby, and another that the vents made "breathing sounds" when on.

"The vent sounded like a noise was coming through (it actually sounded like someone breathing)."

The quality of most specific features of the apartments was rated highly (see Table 2).

- Water. In general the water pressure was good, though a few said they had difficulty learning how to adjust the shower head. Hot water was quick and plentiful.
- Safety. Residents felt quite safe in the units, both in terms of the quality in the unit (no one was concerned about fire or collapse), and concerning crime risk. While the unit door was seen as

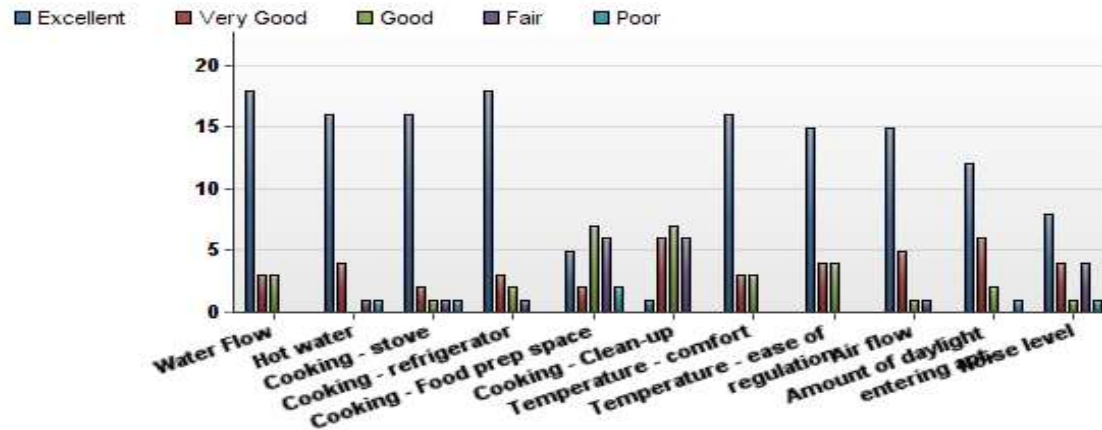


Table 2. Quality of Features

very solid, however, some noted a desire for a larger peephole (a common NYC amenity). Many also commented that the peephole should be lower; the current height of 60” was too high to see through. There were multiple recommendations that the peephole be useable from a wheelchair. This was also true of the sliding chain lock on the interior, which was also at 60”. A doorbell and/or intercom to the street, also common in NYC apartments) would also be useful. In at least one case, the external stair light was unlit at night (a problem that was quickly fixed), making the users uncomfortable climbing to their unit.

“When we were sleeping we woke up to the unit feeling like it was shaking. We looked outside and there was some digging in the street which caused the unit to shake - kinda felt like an earthquake.”

- Orientation. The residents were given an occupancy manual and brief tour with their initial check-in. One common point was that many residents felt insufficiently oriented to the unit and its systems. This was not a major concern in that most things were fairly easy to use (lighting, thermostats, appliances), but even so, some wished for a more comprehensive manual and/or tour upon initial occupancy.

Design.

- Size. The one-bedroom unit on the third floor is a 480 square-foot module that is repeated on each floor. The second floor has two additional bedrooms and a total of 813 square feet (Figure

2). Residents felt that the space did not feel overly small and several commented that it felt comfortable for several residents. None, we should note, had small children as only people over 18 were allowed to stay in the prototype during this period, so no large families were in residence. Users also noted that the space was quite comfortable for two or three people to eat, but difficult to accommodate more people than that. Some commented that it was much more spacious than it would appear from the outside, although a few noted that extended stays for a family might be difficult because of space. Some residents come from small New York City apartments and in contrast these units did not seem especially small.

- Layout. Residents commented positively on the general layout, impressed at the space and features that were available within these relatively small units. They like the layout of the kitchen, with the table and seating next to the counter and at easy conversation distance from the living room.

“The seating in the kitchen is comfortable for eating and socializing.”

“There are enough electrical outlets in the unit. The AC is also great.”

“There isn't much counter space if you are hosting on the table.”



Figure 2. Unit Layouts

Aesthetics and Fixtures.

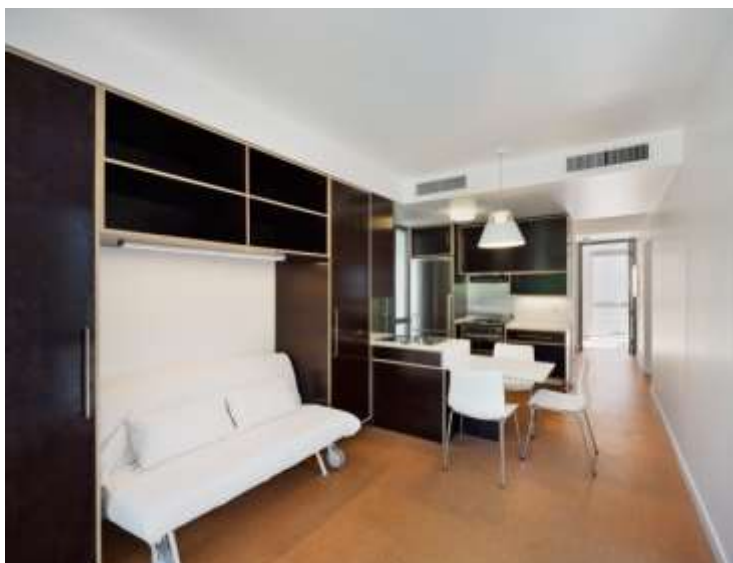


Figure 3. Living Room and Kitchen

- Most saw that their unit was attractive, clean and modern in appearance though some felt it industrial or “minimalist,” and spare – not to everyone’s taste.

- Balcony. Each unit has a 3’ x 12’ balcony with a floor of steel grating. Most were very happy with the balcony, for light, fresh air, and, for some, a chance to go outdoors – although the balcony didn’t

seemed intended for such use or designed to easily accommodate it – particularly because the grated flooring was uncomfortable to walk on with bare feet, and impossible to put a narrow-legged chair on. Further comments were that it was too narrow to adequately use with a wheelchair, and uncomfortable with crutches or canes.

- The balcony blinds were difficult to use and seemed to have broken strings (these were replaced with vertical blinds in all three units, though many residents had similar problems with them and said they would prefer a light curtain). Comments beyond the scope of this study confirmed that especially after disaster, as blinds may be difficult to obtain quickly, it is best to use a simple curtain rod. Residents favored being able to personalize the space with a choice of curtain, especially if these were donated.

- Storage. There are built-in cabinets and shelves in the kitchen and living room, closets in each bedroom, and two pull-out drawers under each bed (all beds are queen-sized). While some participants appreciated the overall options for storage, and the amount available given the small size of the apartment, several noted problems. The kitchen cabinets, for instance, were high – harder to use for those with limited reach, and shallow. One noted that these cabinet doors were awkward to use. Bedroom storage was also an issue, with insufficient shelving. Several noted that additional hooks for hanging clothes and towels would be helpful.



Figure 4. Exterior towards entry

“All kitchen cabinets are really high and that makes cooking a bit difficult. Also, the shelf in the bedroom is really high, which made organizing my clothes difficult. I'm 5'4" tall.”

“The bedroom space is a bit small due to the bed size. I would suggest a full size bed instead. Also, the closet could have shoe rack at the bottom and storage shelves in the lower half. Also, an outlet near the futon would be helpful if one is sitting there.”

- Food prep. In the kitchen a frequent comment was that water from the sink faucet splashed easily over the counter, which they felt made it harder to keep the kitchen clean and orderly. Some suggested a longer faucet would reduce the problem. They also noted lack of a space for drying dishes. Others noted the limited kitchen prep space, even though some were impressed at the amount of space available in such tight quarters. One suggested raising the small eating table to counter height (presumably also providing counter height stools) so that it could also serve as additional prep space.

“Cooking was easy enough as long as you free your counter space first. Otherwise it can get tricky.”

- Water fixtures. One of the most common negative comments concerned bathroom and kitchen water faucets. In particular, in both cases, water tended to run out or splash outside of the sink, making a mess.

“It’s hard to wash dishes in the sink. The spout is too close to the edge so all the water splashes over and not in to the sink.”



Figure 5. Shower with Roll-over Water Barrier

- Showering. In the bathroom, there was a particular problem with the shower. The shower floor was not sufficiently depressed or graded toward the drain, and had no water barrier on the floor, causing the entire bathroom floor to get very wet during a shower. This issue was spotted early on and addressed with a soft barrier added to shower floor that seemed to work reasonably well. The barrier was chosen to support the universal design aspects of the bathroom. The spongy material can easily be rolled over by a wheelchair. It is an off-the-shelf product that is compliant with the Americans with Disabilities Act (Figure 5).

- Beds. The beds are heavy plywood and were fixed in place in the factory. They were bolted to the floor so they did not move in transit. Several noted that it was difficult to make the beds since they were fixed and, at least in some cases, against the wall (Figures 6 and 7).



Figure 6. Bedroom in 1-Bedroom Unit

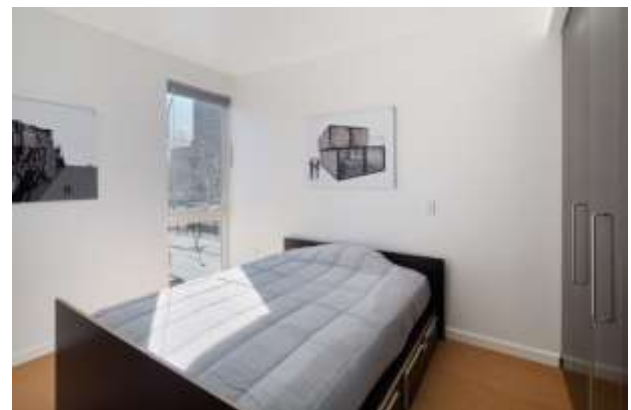


Figure 7. Bedroom in 2-bedroom Unit



Environmental Conditions.

- Heating, Ventilation and Air-Conditioning (HVAC). The HVAC system seemed to work very well. In summer residents were happy with the air conditioning, and in winter people were satisfied with the heating. Most felt that the controls were fairly straightforward to learn.
- Ventilation. The designed features operable windows to encourage passive climate control. Natural ventilation and air flow was generally rated very well. There were no significant air leaks or drafts, and odors did not linger. In some milder days, residents made use of the balcony door to let in outside air.
- Daylight. Large window area in the design was intended to keep energy use low, as power supply may be limited after disaster. Residents commented positively on the daylight, especially in the living room, mostly by virtue of the balcony window. One mentioned a preference for bigger windows in bedrooms. The bedroom window size and coverings also let in too little light for some.