Building Comparisons

Building Comparison Table								
	Deconstruction Time				Burdened Time		Supervisory Time	
Building	Dec	Dem	C	Dis	N	P	S	Total
2748 (1530 sf)								
Hours	123.68	108.49	24.89	53.35	143.76	174.01	26.27	654.45
Percent of total	18.90%	16.58%	3.80%	8.15%	21.97%	26.59%	4.01%	
Per sq ft	0.081	0.071	0.016	0.035	0.094	0.114	0.017	0.428
2736 (1785 sf)								
Hours	119.73	61.79	28.90	31.15	159.40	178.02	17.22	596.21
Percent of total	20.08%	10.36%	4.85%	5.22%	26.74%	29.86%	2.89%	
Per sq ft	0.067	0.035	0.016	0.017	0.089	0.100	0.010	0.334
2738 (1785 sf)								
Hours	121.28	47.88	19.70	53.54	171.4	163.20	18.04	595.04
Percent of total	20.38%	8.05%	3.31%	9.00%	28.80%	27.43%	3.03%	
Per sq ft	0.068	0.027	0.011	0.030	0.096	0.091	0.010	0.333
One Story Aggregate								
Percent of total	19.76%	11.82%	3.98%	7.48%	25.71%	27.92%	3.33%	
Per sq ft	0.072	0.044	0.014	0.027	0.093	0.102	0.012	0.365
2717 (5310 sf)								
Hours	303.25	163.00	160.25	26.00	721.75	533.75	34.00	1955.25
Percent of total	15.51%	8.34%	8.87%	1.33%	36.91%	27.30%	1.74%	
Per sq ft	0.057	0.031	0.033	0.005	0.136	0.101	0.006	0.368
834 (8910 sf)								
Hours	814.35	304.05	44.75	107.25	1123.05	1079.10	104.50	3577.05
Percent of total	22.77%	8.50%	1.25%	3.00%	31.40%	30.17%	2.92%	
Per sq ft	0.091	0.034	0.005	0.012	0.126	0.121	0.012	0.401
Gainesville Case Studies								
Percent of total	26.21%	10.34%	17.04%		8.83%	29.88%	7.69%	
Per sq ft	0.078	0.027	0.042		0.027	0.095	0.021	0.291

Notes:

1. Dec (Deconstruction) refers to time spent actually removing materials for salvage.
2. Dem (Demolition) refers to time spent removing materials for disposal.
3. C (Cleaning) and Dis (Disposal) refers to time spent clearing the work space prior to and after removing materials during Deconstruction or Demolition.
4. N (Non-Productive) refers time spent setting up or breaking down for the day, on break, or discussing the work. Across all Ft. Campbell buildings, Non-Productive time is far greater than in the Gainesville case studies. This is attributable to a number of factors which will be covered in more detail elsewhere but could include inefficient mobilization of a large and untrained workforce, more frequent breaks necessitated by extreme summer temperatures, or simply a more leisurely work atmosphere. In any case, such high Non-Productive rates were unusual and would not be expected in future projects.
5. P (Processing) refers to time spent readying the materials for reuse or resale.
6. S (Supervising) refers to time spent by trained professionals instructing or directing the work of laborers. Ft. Campbell supervisory rates are significantly lower than the Gainesville case studies. The Gainesville case studies were performed with a higher supervisor to laborer ratio than was seen at Ft. Campbell where many more laborers were available.
7. The One Story Aggregate values show the average values taken from the three similar one-story buildings – 2748, 2736, and 2738.

Conclusions / Lessons Learned / Further Research

Analyzing the data for this report and the on-site data collection and observations highlighted issues to address in future deconstruction process and labor rate studies.

Data Collection Issues
More careful instructions for the data collectors or insuring that the data collector had some previous knowledge of construction, particularly wood-framing techniques, is critical. The data collector needs to clearly understand construction terminology and be able to refer to different materials or components accurately and consistently. The labeling and coding must be simple enough to be almost memorized but not so simplified as to lose necessary detail. One example of a problem caused by a misunderstanding of terminology arose for Building 2717. When the second floor joists were being removed, the data collector recorded that second floor *rafters* were deconstructed. The data collector previously called roof structural elements rafters correctly. Therefore, it was difficult to know that the data collector had misused the term on the second floor structure.

The data collector also needs to consistently record where work is being done. At times when work was being done simultaneously on 2736 and 2738, the building was not recorded but the activity was. This made it difficult to accurately determine how much time was spent on each building for some materials. The most difficult aspect of this tracking process is the ability to review drawings and coding labels in the field using a clipboard or even a handheld computer. The construction site can be dirty, and rain and early morning dew, sweat, etc. can make it difficult to maintain the forms in an organized manner. Data collection was also complicated by having as many as 42 workers on site simultaneously and spread over a large area such as the 9,000 square foot Building 834. It can be very difficult for one person to track the movements of so many people at once.

All the lumber that was salvaged for reuse in this project was deconstructed and moved to a central location for de-nailing and trimming. It was very difficult to track the time devoted to processing individual pieces of lumber. For this report, processing times that were attributed to specific materials where noted and then the remaining unspecified processing time was added as a percentage to the total deconstruction time based upon the proportionate deconstruction time for each wood assembly or component. To more accurately understand the time required to process different building components, it would be necessary to establish a processing station for each type of lumber on site, and match the actual quantity of lumber that was de-nailed to the number of workers and the time each spent on that type and size of lumber. Another difficulty with tracking specific processing times per materials is that the type of construction and the amount of de-nailing accomplished within the process of removing the materials at the building will influence the additional time required for further de-nailing. It can be more efficacious to remove drywall nails for instance, from the in-place wall stud, whereby the stud is held vertically in place and the nails are falling to the hard-surfaced floor, and more readily cleaned-up. It may be possible that removing as many nails as possible at the same time

the lumber is removed from the building will be somewhat equal in overall time to deconstruction and de-nailing as separate tasks, except in the cases where the pneumatic de-nailing tool can be used to better effect in a separate location. The de-nailing tool was used throughout this project and the comparison between its use and un-assisted nail removal would make another area of future study.

A future study might look more accurately at the time required for the processing of materials to ready them for resale, specifically by the type and size of framing, and by the ultimate reuse or remanufactured product. This is an important consideration since the added effort to increase value of the lumber through processes such as re-milling, re-planing and remanufacturing into new products cannot be ignored. This additional effort may exceed the labor required to extract the materials from a building.

Finally, particular care needs to be taken to ensure that the times required to deconstruct materials that come down in a relatively small amount of time are accurately documented and meaningfully accounted for to facilitate future deconstruction estimating. In this study, materials such as asphalt shingles or floor joists that absorbed a large percentage of the overall deconstruction time show very consistent rates. Materials that took little time to remove such as windows, acoustic ceiling tile, and even walls, which come apart quickly compared to roofs and floors, exhibit much greater rate variation between buildings. This may be the result of varying deconstruction or laborer skill and/or enthusiasm, but it could also be the result of data error. Perhaps checking in the field to be sure that data collection for these rapid activities is accurate could be sufficient to yield more consistent and reliable numbers, but it might be fruitful to alter either the data collection or deconstruction process at these times. Having workers remain at one task until completing the removal of a discrete amount of materials will help insure an accurate count and also average out the removal times. For instance, the removal of all light fixtures in the building by the same worker(s) from start to finish will insure a good averaging of the time per fixture and remove any confusion over who did the work and how long it took.

Deconstruction Process Issues

Safety was a constant concern during the Ft. Campbell deconstruction project. Americorps*NCCC team members were engaged in hazardous activities related to working at heights and the use of power tools mainly a circular saw and the de-nailing tools.

There was some confusion over whether HfH is covered by OSHA regulations as a non-profit organization. The Appendix section titled OSHA Compliance for Non-Profits and Volunteer Workers seeks to clearly answer this debate by demonstrating that non-profits are indeed covered by OSHA.

In one instance, workers initiated the removal of structural bearing walls from the first floor of Building 2717 while the roof and second floor structures were still in place and supporting workers. This incident points out the need for clear planning and communication, particularly over the deconstruction chronology and the need for supervision of in-experienced workers who might take it upon themselves to carry out tasks without a full understanding of building structures.

A constant materials management problem was the placement of salvaged and processed materials. Failure to plan for the smooth flow of materials can impede work, require additional labor hours to move repeatedly and pose safety hazards. Due to limited storage space, Building 834 was used for materials storage although it was also to be deconstructed. This resulted in stored materials in the building while it was being deconstructed.

The scheduling of removal or relocation of roll-offs also posed a problem in regards to using the roll-offs effectively as work progressed. This can be one of the most difficult scheduling problems once the work begins as this is not completely within the control of the deconstructor. In the cause of cost savings, 40 C.Y. roll-offs were used throughout the project. However given the difficulties in using the 40 C.Y. roll-offs due to their height and the requirement to leave them in one place until full, they may have impeded the work to some extent.

The use of 40 cubic yard roll-offs, while allowing twice the volume of debris as a 20 cubic yard roll-off, posed safety hazards, damaged equipment and impeded the efficient loading of waste. They are too high to see into, thereby creating the possibility for someone who might be in one to be at risk from someone throwing materials blindly into it. The height also was greater than the average first floor window sill height making it impossible to set up chutes or have a horizontal line from inside the building over the top edge of the roll-off for direct removal of waste into the roll-off. The excessive amount of masonry and concrete debris placed into one caused it to break when the operator tried to load it on to their truck. Persons often were unable to throw debris high enough to get it over the top of the roll-off causing it to fall back on themselves or others.

The size of the roll-offs and desire for minimizing relocation or hauling meant that they sat in awkward locations for long periods while the workers had to accommodate this location rather than the roll-off being emptied or relocated as per the movement of the deconstruction process per the building.

The location and cross-location of workers posed hazards for workers in the warehouse Building 834 whereby workers worked directly above other workers. This was caused by working towards the areas where materials were being de-nailed and loaded for transport or sale instead of away from those areas. By working towards the de-nailing and processing areas, the workers below who were carrying the lumber were always under the workers above. By working away from the processing areas, the structure above has already been removed over the area where workers traverse as they take materials away from point of deconstruction. In general the warehouse Building 834 was used simultaneously for storage, de-nailing and its own deconstruction. Materials stacked throughout prevented the use of rolling scaffold and prevented the set up of ladders sufficiently close to work areas on occasion to be safe. Whenever possible it is clearly important to remove all loose materials from the work area as work proceeds and plan processing and storage accordingly.

Other key considerations for deconstruction that came to light in this project include the adequate shoring of exterior walls to prevent collapse as other lateral supporting sections are removed.

The importance of pre-deconstruction investigation was also highlighted as the means to understand the construction of the buildings and the condition of individual salvageable materials. Understanding the building construction pertains to: determining the best methods (sequence, tools/equipment) to dismantle parts of the building; the number of layer of finish materials that may pose an impediment to reaching other salvageable materials; the structural make-up of the building - bearing walls, bearing points, connections, lateral structural support. Understanding the condition of the materials enables more efficient planning to focus on the parts of the building and the individual materials that are worth deconstructing within the ever-present constraint of time, money and labor skill and resource. An instance of this would be the discovery of the fire damage in Building 2748 before work commenced.

In general the issue of managing the salvaged materials and waste materials and insuring basic personal protective equipment (PPE) is issued and used at all times are fundamental components of a safe and efficient deconstruction process.

One very important lesson of the Ft. Campbell project was the issue of marketing and marketability of the salvaged materials. It is also worth noting that marketability and desirability of materials can be very idiosyncratic based upon regional conditions and the potential or lack thereof of individual buyers with a large demand for a single material.

Appendix

OSHA Compliance for Non-Profits and Volunteer Workers
Regulations (Standards - 29 CFR)
Coverage. - 1975.4
Regulations (Standards - 29 CFR) - Table of Contents

- Part Number: 1975
- Part Title: Coverage of Employees under the Williamns-Steiger OSHA 1970
- Standard Number: 1975.4
- Title: Coverage.

1975.4(a)

General. Any employer employing one or more employees would be an "employer engaged in a business affecting commerce who has employees" and, therefore, he is covered by the Act as such.

1975.4(b)

Clarification as to certain employers -

1975.4(b)(1)

The professions, such as physicians, attorneys, etc. Where a member of a profession, such as an attorney or physician, employs one or more employees such member comes within the definition of an employer as defined in the Act and interpreted thereunder and, therefore such member is covered as an employer under the Act and required to comply with its provisions and with the regulations issued thereunder to the extent applicable.

1975.4(b)(2)

Agricultural employers. Any person engaged in an agricultural activity employing one or more employees comes within the definition of an employer under the Act, and therefore, is covered by its provisions. However, members of the immediate family of the farm employer are not regarded as employees for the purposes of this definition.

..1975.4(b)(3)

1975.4(b)(3)

Indians. the Williams-Steiger Act contains no special provisions with respect to different treatment in the case of Indians. It is well settled that under statutes of general application, such as the Williams-Steiger Act, Indians are treated as any other person, unless Congress expressly provided for special treatment. "FPC v Tuscarora Indian Nation," 362 U.S. 99, 115-118 (1960); "Navajo tribe v N.L.R.B.," 288 F.2d 162, 164-165 (D.C. Cir. 1961) cert. den. 366 U.S. 928 (1961). Therefore, provided they otherwise come within this definition of the term "employer" as interpreted in this part, Indians and

Indian tribes, whether on or off reservations, and non-Indians on reservations, will be treated as employers subject to the requirements of the Act.

1975.4(b)(4)

Nonprofit and charitable organizations. The basic purpose of the Williams-Steiger Act is to improve working environments in the sense that they impair, or could impair, the lives and health of employees. Therefore, certain economic tests such as whether the employer's business is operated for the purpose of making a profit or has other economic ends, may not properly be used as tests for coverage of an employer's activity under the Williams-Steiger Act. To permit such economic tests to serve as criteria for excluding certain employers, such as nonprofit and charitable organizations which employ one or more employees, would result in thousands of employees being left outside the protections of the Williams-Steiger Act in disregard of the clear mandate of Congress to assure "every working man and
woman in the Nation safe and healthful working conditions . . .". Therefore, any charitable or non-profit organization which employs one or more employees is covered under the Williams-Steiger Act and is required to comply with its provisions and the regulations issued thereunder. (Some examples of covered charitable or non-profit organizations would be disaster relief organizations, philanthropic organizations, trade associations, private educational institutions, labor organizations, and private hospitals.)

Coverage of churches and special policy as to certain church activities -

1975.4(c)(1)

Churches. Churches or religious organizations, like charitable and non-profit organizations, are considered employers under the Act where they employ one or more persons in secular activities. As a matter of enforcement policy, the performance of, or participation in, religious services (as distinguished from secular or proprietary activities whether for charitable or religion-related purposes) will be regarded as not constituting employment under the Act. Any person, while performing religious services or participating in them in any degree is not regarded as an employer or employee under the Act, notwithstanding the fact that such person may be regarded as an employer or employee for other purposes - for example, giving or receiving remuneration in connection with the performance of religious services.

1975.4(c)(2)

Examples. Some examples of coverage of religious organizations as employers would be: A private hospital owned or operated by a religious organization; a private school or orphanage owned or operated by a religious organization; commercial establishments of religious organizations engaged in producing or selling products such as alcoholic beverages, bakery goods, religious goods, etc.; and administrative, executive, and other office personnel employed by religious organizations. Some examples of noncoverage in the case of religious organizations would be: Clergymen while performing or participating in religious services; and other participants in religious services; namely, choir masters, organists, other musicians, choir members, ushers, and the like.