AN EXPLORATION OF DECONSTRUCTION IN NEW YORK CITY

A Master Thesis
Presented to the Faculty of the Sustainable Interior Environments at the School of Graduate Studies, Fashion Institute of Technology in Partial Fulfillment of the Requirements for the Degree of Master of Arts in Sustainable Interior Environments

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May 2014

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ABSTRACT

Deconstruction in the built environment is the selective and careful dismantlement of building materials during or before the demolition of built structures or spaces in order to repurpose, reuse and/or recycle them. As a relatively new concept, deconstruction has not yet been widely adopted by the New York City design and construction community. This research aims to identify underlying reasons of why so few building materials are salvaged and why the practice of deconstruction is not more prevalent. This paper seeks to explore the current strategies in place for demolition waste removal, understand if deconstruction can expand in New York City and what barriers exist that are hindering further implementation.

An overview of the current demolition waste management practices in New York City was established through an exploration of government websites and publications, scholarly research and data, sustainable certification programs, construction and demolition waste management regulations in similar metropolitan areas and interviews with building industry professionals. By developing an understanding of the benefits of deconstruction and its role in New York City, several challenges that prevent its execution were identified: deficient communication, insufficient access to used building material markets, lack of government involvement, absence of materials designed for recyclability and inadequate education. Of these challenges, the most significant obstacle to deconstruction’s prevalence in New York City is the lack of government involvement. Further quantifying research could help validate this conclusion and lead to potential changes in government policy.
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INTRODUCTION

THESIS STATEMENT

With constant renovations and construction, the demolition of commercial interiors in New York City generates an extensive amount of debris. In most cases, this debris is considered “waste,” though it is often still salvageable and could be used again for a similar or the same purpose. It is an intention of this exploration to analyze why perfectly good building materials are being discarded and sent to landfills in the example of New York City when they can still serve their original function.

JUSTIFICATION OF STUDY

Designers and contractors often overlook many important questions regarding the waste stream of a commercial interior construction project. In order to design and construct low impact spaces, it is important for architects, designers, contractors and building owners to look thoroughly at the opportunities for alternative methods of demolition.

One of the main objectives of this study is to have a more thorough depiction of the practices in New York City, which cause 60% of its solid waste stream to be occupied by construction and demolition debris (Gruzen Samton LLP and City Green Inc., 2003). Understanding the process of demolition waste removal may allow for the expansion of tools and practices that will limit the amount of demolition debris hauled away for disposal in landfills. As landfills inhabit more and more space on Earth, encroaching on natural environments, polluting and depleting them, they limit and degrade the resources available for humans and other living organisms. This
research intends to provide background information on current demolition waste removal requirements and practices in order to initiate discussions about new ideas on how to reuse, repurpose and recycle building materials that can lead to improved practices in the future.

**Research Questions**

The purpose of this research is to examine the current strategies for removing demolition waste from commercial interior construction projects and how the concept of deconstruction can expand in New York City design projects and what are the barriers. This exploration will seek answers to the following questions about current practices in New York City:

- Are the spaces examined before demolition to determine if anything can be salvaged or reused?
- Are the majority of the materials that are removed from the space recycled?
- Are deconstruction and recycling of materials an important concern?
- What are the benefits of recycling versus waste hauling of building materials?
- Why is deconstruction not more widely incorporated into demolition plans?
- Why are there so few governmental regulations on construction and demolition debris removal?
DEFINITION OF TERMS

For the purpose of this study, the following definitions are applied (in alphabetical order):

**CONSTRUCTION AND DEMOLITION (C&D) WASTE:** Uncontaminated solid waste resulting from any form of construction or demolition. According to the Department of Environmental Conservation of New York State, it includes: “bricks, concrete, masonry materials, soil, rock, wood, land clearing debris, wall coverings, plaster, drywall, plumbing fixtures, non-asbestos insulation, roof shingles, roof coverings, asphalt pavement, glass, plastics that do not seal in other materials, empty buckets with less than an inch of residue on the bottom, electrical wiring, pipe and metals” (“Construction and Demolition Debris Landfills”).

**DECONSTRUCTION:** The selective, careful dismantlement of building materials during or before the demolition of built structures or spaces in order to repurpose, reuse and/or recycle materials.

**DEMOLITION:** The process of tearing down built structures and spaces.

**DEMOLITION CONTRACTOR:** A person or organization responsible for the management of the demolition of built structures and spaces.

**EXTENDED PRODUCER RESPONSIBILITY:** An approach that encourages manufacturers to be responsible for the life-cycle of their products by, for example, instating take-back programs or recycling options.

**GENERAL CONTRACTOR:** A person or organization responsible for the management of the construction and demolition of built structures and spaces.
**HAULERS:** Companies that are hired to take away debris from construction and demolition sites of built structures and spaces in order to be transported to waste transfer stations.

**RECYCLING:** The process of sorting discarded building materials and finishes into categories to be processed into new products, thereby reducing the need for virgin materials.

**REUSE CENTERS:** Facilities that house the building elements and materials obtained through the deconstruction of built structures and spaces before or during demolition.

**SUSTAINABLE:** “Involving methods that do not completely use up or destroy natural resources” (“Sustainable”).

**TAKE-BACK PROGRAM:** Programs instated by manufacturers and/or other private companies to properly and carefully remove specific building materials from demolition sites in order to recycle and/or reuse them.

**TIPPING FEE:** The charge resulting from the quantity of waste that is received at a waste transfer station.

**WASTE STREAM:** “Aggregate flow of waste material from generation to treatment to final disposition” (“What is Waste Stream?”).

**WASTE TRANSFER STATION:** A destination in which discarded building materials from demolition sites arrive to be sorted for recycling centers and landfills.
**Methodology**

This study examines the current demolition and deconstruction practices in New York City by reviewing publically available content for regulations, recommendations and requirements for demolition of commercial interior spaces set forth by the city and state of New York as well as sustainable building metrics. The author conducted four interviews – three via telephone and one in person – with building industry professionals, including an interior designer, hauler, deconstruction organization and private take-back organization to gain an understanding of the current practices in New York City from primary sources.

**Limitations**

The main limitations of this study were time available for conducting research, access and granted interview requests. Within a tight timeframe of roughly six months, only a finite depth of research could be achieved. The findings were additionally limited by the fact that only four people responded to 15 interview requests.

**Delimitations**

Commercial interior demolition practices were explored exclusively for this study. It was not the intention of this study to examine the demolition practices of residential and institutional interiors. The findings of this research are based on the exploration of practices in New York City and do not necessarily apply to other areas.
CHAPTER I:

BENEFITS OF DECONSTRUCTION

In the book *Cradle to Cradle*, Michael Braungart and William McDonough discuss the concept of a tripod of equally important aspects of sustainability: economy, ecology and equity (Braungart and McDonough, 2002). The authors submit that this theory of a “triple bottom line” must be fully recognized and adhered to in order for a system to be sustainable (Braungart and McDonough, 2002).

ECONOMY- FISCAL BENEFITS

According to research by the Washington D.C. based Institute for Local Self-Reliance (ILSR), a building deconstructed by trained employees costs $2 per square foot of the project space, whereas traditional demolition of a comparable building costs $3 per square foot (Shami, 2006). As prices of waste disposal at landfills increase, the cost of demolition waste increases as well. However, these inflated tipping fees can provide a financial incentive to incorporate deconstruction and recycling into a project by lowering waste removal costs.

The major economic elements in a demolition project are primarily the waste removal and labor fees (Dantata et al, 2005). In an ideal deconstruction project, tipping fees should be minimized and the only waste removal costs would be for the remaining unsalvageable and unrecyclable materials. To many building industry professionals who are unfamiliar with deconstruction, this concept seems like a costly venture since an extended timeline usually equates to an unexpected monetary increase. However,
lower costs can offset the cost of an extended deconstruction timeline. There are organizations dedicated solely to deconstruction, which offer labor in return for materials. This is a symbiotic relationship: the deconstruction organization obtains materials to resell, while the demolition team reduces its waste load, thereby lowering its hauling and tipping fees. Additionally, when more materials are diverted from landfills, less debris remains, which can ultimately lead to transportation cost savings for that project (Shami, 2006).

In traditional demolition, the only elements of buildings that would typically be salvaged were antique furniture, fixtures or valuable architectural details (Green Leigh and Patterson, 2006). However, as virgin building materials become more costly, salvaging usable materials has become a more attractive option for projects. As technology and opportunities for the recycling of building materials increase, the costs associated with deconstruction decrease, allowing deconstruction to become more mainstream and a more common practice for demolition waste removal (Srour et al, 2012).

**ECOLOGY- ENVIRONMENTAL BENEFITS**

According to the US Environmental Protection Agency (EPA), approximately 136 million tons of construction and demolition waste are produced annually in the United States (Shami, 2006). Only 40% of the US produced construction and demolition waste is recycled; the remaining 60% is sent to landfills (Srour et al, 2012). The EPA estimated that roughly 75% of construction and demolition waste could be diverted from landfills and incinerators through deconstruction, reusing and recycling salvageable building materials (Shami, 2006). Diverting materials from landfills and incinerators also reduces the need for virgin materials and, thus, the industry’s dependence on the environment (Shami, 2006)
According to the ILSR, when the amount of construction and demolition debris entering landfills is reduced by approximately 45% from recycling and 35% from reuse, typical landfill and incinerator problems, such as toxic fumes and dangerous particles in the air as well as water contamination, can be drastically decreased (Shami, 2006). This lessens the burden that has been placed on the natural environment, which is important because the Earth’s ecosystem cannot function properly when many of its components have been compromised.

The World Watch Institute predicted that by the year 2030, the “world will run out of several raw materials for construction” (Srour et al, 2012). Currently, “construction materials, including stone, gravel, and sand comprise around three quarters of raw materials use”, according to the United States Geological Survey (USGS) in 2012 (Center for Sustainable Systems, 2013). Those materials are necessary for construction and when the raw materials that are needed to produce them are no longer available, the construction industry will have to start looking for alternatives.

According to Paola Sassi, an architect, a closed-loop cycle of building materials can be defined as “materials and building elements that can be recovered from buildings and infinitely recycled through natural or industrial processes” (Sassi, 2008). Recycling should be implemented and adhered to for closed-loop cycles to work for building materials.

The concept of Cradle-to-Cradle is based upon the notion that in the natural world, “organisms’ ‘waste’ cycles through an ecosystem to provide nourishment for other living things” (McDonough and Braungart, 2004). Using that model for a material production system, “Cradle-to-Cradle materials circulate in closed-loop cycles, providing nutrients for nature or industry” (McDonough and Braungart, 2004). McDonough and Braungart explain this concept further:

First, nature’s nutrient cycles constitute the biological metabolism. Materials designed to flow optimally in the biological metabolism are biological nutrients. Products
conceived as these nutrients, such as biodegradable packaging, are designed to be used and safely returned to the environment to nourish living systems. Second, the technical metabolism, designed to mirror the earth’s cradle-to-cradle cycles, is a closed-loop system in which valuable, high-tech synthetics and mineral resources—technical nutrients—circulate in a perpetual cycle of production, recovery, and remanufacture. Ideally, all the human systems that make up the technical metabolism are powered by the renewable energy of the sun. (McDonough and Braungart, 2004)

A closed-loop cycle of building materials will “reduce the demand in manufacturing of new materials that can cause significant damage to our air and environment” (Shami, 2006). Limiting the amount of raw materials that need to be extracted, refined and processed into final products can help surrounding natural environmental systems become healthy again.

**EQUITY - SOCIAL BENEFITS**

Deconstruction is labor intensive and requires more workers with specific skill sets. Deconstruction has the potential to open up new job markets for communities and develop a skilled workforce and business opportunities for organizations to take part in the growing sector of salvaged materials (Green Leigh and Patterson, 2006). In addition to the jobs that deconstruction can provide, creating a larger market for recycling can also lead to job opportunities by either expanding current recycling centers or creating new ones (Green Leigh and Patterson, 2006).

According to Neil Seldman, the president of the ILSR, “if deconstruction were fully integrated into the U.S. demolition industry, which takes down about 200,000 buildings annually, the equivalent of
200,000 jobs would be created and $1 billion worth of building materials would be returned to the economy” (Manuel, 2003). Using deconstruction for buildings has a lot of social advantages. “When buildings are deconstructed rather than demolished, employment improves, workers are trained, neighborhoods revitalized, real estate values increased and lives improved” (Seldman, 2011).

In addition to the jobs and opportunities, deconstruction can also improve the health of communities and neighborhoods. Landfills and incinerators are typically built in low-income neighborhoods, supplying few jobs and asthma-inducing levels of air pollution (Shami, 2006). By drastically limiting the amount of waste entering those facilities, the surrounding neighborhoods can benefit from the fewer airborne toxins.

In order for a system to function properly over time, all aspects of sustainability should be addressed: economy, ecology and equity. Deconstruction that is examined and understood as a system includes benefits that encompass each pillar of sustainability, proving that the benefits of the system help to maintain itself over time.
CHAPTER II:
SUSTAINABLE DESIGN AND CONSTRUCTION CERTIFICATION PROGRAMS

Over the last 25 years, several organizations have developed sustainable building metrics that have evolved in order to promote sustainable design and construction practices. The following provides an overview and explains how some of these programs approach demolition waste management and encourage using alternative methods of waste diversion. In all of the described programs, construction and demolition waste are addressed together. Additionally, these programs have all established their own criteria in order for projects to obtain certification verifying a certain level of sustainability through attaining credits related to performance.

LEED

In 1998, the US Green Building Council (USGBC) developed one of the most widely used sustainable building certification programs in the United States: Leadership in Energy and Environmental Design (LEED). In 2000, the first LEED rating system for New Construction was launched and by 2004 over 100 buildings were LEED certified (Kriss, 2014). Just 15 years after it’s launch, there are currently over 7,000 certified buildings around the world (Katz, 2012). LEED consists of nine rating systems: New Construction and Major Renovation; Core & Shell; Schools; Retail: New Construction & Major Renovations / Retail: Commercial Interiors; Healthcare; Commercial Interiors; Existing Buildings: Operations & Maintenance; Homes; and Neighborhood Development.
In the currently used version of the program, LEED 2009, there are several points awarded for promoting waste diversion from landfills as well as reusing materials from the construction site (Katz, 2012).

Of the seven sections in LEED for Commercial Interiors, only the Materials and Resources (MR) section references construction and demolition waste management. MR credit 1.2 Building Reuse: Maintain Interior Nonstructural Components states that in order to achieve one point, at least 40% of the existing “non-shell, nonstructural components (e.g., walls, flooring and ceiling systems)” should be maintained (“Building Reuse – Maintain Interior Nonstructural Elements”). To achieve two points, at least 60% needs to be maintained.

In the same section, MR credit 2 Construction Waste Management states that in order to achieve 1 point, at least 50% of the nonhazardous construction and demolition debris needs to be recycled and/or salvaged. In order to achieve 2 points, at least 75% of the construction and demolition debris needs to be recycled and/or salvaged.

MR credit 3.1 Materials Reuse states that in order to achieve 1 point, at least 5% of the construction project (based on overall cost) needs to be comprised of salvaged, refurbished or reused materials. To achieve the full two points, the overall amount of reused materials must be 10% of the whole construction project cost.

LEED V4, which was launched in November of 2013, is quite different from previous versions. In the Interior Design and Construction (ID+C) for Commercial Interiors rating system, it is required under the Materials and Resources section to “develop and implement a construction and demolition waste management plan” (“Construction and Demolition Waste Management Planning”). This requirement specifies the need to “establish waste diversion goals for the project by identifying at least five materials (both structural and nonstructural) targeted for diversion, approximate a percentage of the overall project waste that these materials represent” and “specify whether materials will be separated or commingled and describe the diversion
strategies planned for the project” (“Construction and Demolition Waste Management Planning”).

The Materials and Resources section also requires projects to describe where the materials that are to be recycled will be transported to and how that recycling facility processes them. In the Materials and Resources section, LEED V4 has similar credits to its predecessor LEED 2009. There are three options in order to receive one to two points. The first option is to “divert at least 50% of the total construction and demolition material; diverted material must include at least three material streams” (“Construction and Demolition Waste Management”). The second option is to divert at least 75% of the construction waste and must include four material streams. The last option is to reduce the total waste material and to not generate more than 2.5 pounds of construction waste per square foot (“Construction and Demolition Waste Management”).

Of the ten Building Design and Construction (BD+C) and three Interior Design and Construction (ID+C) rating systems for LEED V4, only the Homes and Multifamily Multirise rating systems vary in requirement structure for construction and demolition waste. For these two rating systems, Homes and Multifamily Multirise, the requirements differ from other rating systems in that the waste diverted is based on the size of the unit and the entire structure as to a fixed percentage.

**BREEAM**

Building Research Establishment Environmental Assessment Methodology (BREEAM) is an international sustainable buildings metrics program that was created in the United Kingdom in 1990 and has over 1 million certified buildings worldwide (“BREEAM In Numbers”). Today, BREEAM is used in over 50 countries and has developed several country specific versions to address the needs of countries looking to improve their sustainable building
practices. Currently, BREEAM offers four schemes: BREEAM Communities, BREEAM New Construction 2011, BREEAM In-Use and BREEAM Refurbishment.

In BREEAM New Construction 2011, the sections are split up to dedicate points solely to both construction and demolition, respectively (“Wst 01 Construction waste management”). The Construction Resource Efficiency section sets benchmarks on the amounts of waste that are allowed to be generated per 100m² of waste. One credit is awarded for less than 13.3 m³ of waste generated per 100 m², two credits are awarded for less than 7.5 m³, three credits are awarded for less than 3.4 m³ and the “exemplary level” is awarded for less than 1.6 m³. Additionally, for this section, there is a site waste management plan, which “aims to promote resource efficiency and to prevent illegal waste activities. Resource efficiency includes minimizing waste at source and ensuring that clients, designers and principal contractors assess the use, reuse and recycling of materials and products on and off the site.” (“Wst 01 Construction waste management”). If applicable, a pre-demolition audit of buildings that will be demolished should be included in the documentation for certification in order to determine what can be salvaged, reused or refurbished (“Wst 01 Construction waste management”). The survey of the buildings set to be demolished should also be included in the Site Waste Management Plan.

In the Diversion of Resources from Landfill section, to achieve one credit, at least 70% by volume of non demolition and 80% of demolition waste needs to be diverted from landfills by ways of recycling, salvaging and reuse. To achieve the exemplary level, at least 85% of non-demolition and 85% of demolition waste needs to be diverted from landfills. Additionally, the site waste management plan dictates that all waste materials need to be sorted into separate “key waste groups” onsite or offsite by a licensed contractor (“Wst 01 Construction waste management”).
Green Globes, which is operated by the Green Building Initiative (GBI), is a sustainable building certification program established in Canada in 2000 and effective in the US since 2004. The assessments of the buildings attempting to achieve Green Globes status are preformed by third party organizations with “expertise in green building design, engineering, construction and facility operations” (“Green Building Programs”). Similar to other sustainable building certifications, Green Globes provides online documentation tools and is available to commercial and governmental buildings. Green Globes offers three types of rating systems: new construction, existing buildings and healthcare.

In Green Globes for New Construction, under the section entitled Materials and Resources, section 3.5.4 Waste, credit 3.5.4.1 Construction Waste, in order to obtain two points, a project needs to divert between 25-49% of the construction and demolition waste from landfills. For four points, a project needs to have between 50-74% diverted, and for six points, at least 75% diverted (“Green Building Programs”). Green Globes includes some general information on ways to help achieve this, such as, developing a waste management plan. Green Globes also include a small section on strategies for implementing these credit requirements, for example, discussing the waste management plan with the general contractor at the start of the project (“Green Building Programs”).

In Green Globes for New Construction, section 3.5.6.3.1 Deconstruction and Disassembly under Resource Conservation in the Materials and Resources section provides an opportunity to gain two points if “the building design facilitates future deconstruction, demounting and disassembly; and re-configuration” (“Green Building Programs”). Green Globes offers such strategies as design for disassembly, which “is a technique that involves designing a product to be disassembled for easier maintenance, repair, recovery and reuse of components/materials without
substantial damage to the materials or their surroundings (“Green Building Programs”).

**GREEN COMMUNITIES**

Green Communities is a sustainable building metrics program developed in 2009 by Enterprise Community Partners, a non-profit organization specializing in affordable housing. Green Communities caters exclusively to affordable housing developments and is “the first national framework for healthy, efficient, environmentally sustainable affordable homes” (“Enterprise Green Communities Resource Guide”). “Since the program’s inception, Enterprise Green Communities has supported more than 550 housing organizations across the country to create and rehabilitate more than 35,000 green affordable homes” (“Enterprise Green Communities Resource Guide”). Green Communities offers general criteria for all projects and additional mandatory requirements for each of the three specified categories of construction type: New Construction, Substantial Rehab, and Moderate Rehab. Green Communities offers a much more prescriptive program than the other sustainable building metrics programs, although it is focused solely on residential development.

**LIVING BUILDING CHALLENGE**

The Cascadia Green Building Council, the Northwest chapter of the USGBC, developed the Living Building Challenge in 2005. It is a sustainable building certification program more rigorous than LEED. There is only one format for the program, as it can be applied to any type of building project. There are seven petals (sections) that address: site, water, energy, health, materials, equity and beauty. Currently in the US there are five Living
Certification projects, four Petal Certification projects and five Net Zero Energy Building Certification projects (“Frequently Asked Questions”).

In the Materials Petal of the Living Building Challenge, the program discusses conservation and reuse for projects seeking certification. In order to receive the Conservation and Reuse credit, projects need to create “a Material Conservation Management Plan that explains how the project optimizes materials in each of the following phases: Design Phase, including the consideration of appropriate durability in project specification; Construction Phase, including product optimization and collection of wasted materials; Operation Phase, including a collection plan for consumables and durables; End of Life Phase, including a plan for adaptable reuse and deconstruction” (International Living Future Institute, 2012). Projects must divert the following material from waste disposal during construction to the listed levels: metals to 95% diverted; paper and cardboard to 95% diverted; soil and biomass to 100% diverted; rigid foam, carpet and insulation to 90% diverted; all other materials, combined weighted average, to 80% diverted.

These sustainable certification programs address construction and demolition waste management. The majority of the programs offer construction and demolition waste diversion as an optional credit and not a requirement for certification. These credit options can help to set the framework for the entire building industry’s approach to sustainable demolition waste management and diversion strategies.
CHAPTER III:
PRECEDES IN US STATES AND CITIES

A number of cities throughout the United States have mandated requirements for the construction and demolition waste diversion. The following are three examples of present day governmental construction and demolition waste regulations and requirements in large municipalities in the U.S. Both construction and demolition waste removal requirements are acknowledged together.

CALIFORNIA

In 2001, the California Environmental Protection Agency’s (EPA) Integrated Waste Management Board produced the “Deconstruction Training Manual: Waste Management Reuse and Recycling at Mather Field”. The manual can be found on California’s Department of Resources Recycling and Recovery (CalRecycle) website as a resource for construction and demolition waste management: www.calrecycle.ca.gov. In this manual, the California EPA provides information on the local benefits of deconstruction and how the agency can help building projects in California. The California EPA uses case studies of several residential homes that were deconstructed to show how it could be successful.

In addition, several cities within California, such as Los Angeles, San Francisco and San Jose, require that a certain percentage of demolition waste be recycled (“Construction and Demolition Debris Recycling”). For example, since 2011, a Los Angeles commercial building undergoing construction or demolition must recycle a minimum of 65% of the
construction and demolition waste generated by weight according to the Green Building Standards Code (“Construction and Demolition Debris Recycling”).

PORTLAND, OREGON

The City of Portland’s Bureau of Planning and Sustainability offers information on how to recycle construction and demolition waste as well as on alternative demolition waste removal practices, such as deconstruction (“The City of Portland, Oregon”). Since 2006, the City of Portland requires that all building projects costing more than $50,000, divert at least 75% of their construction and demolition waste from landfills by recycling (“17.102.270 Businesses and Multifamily Complexes Required to Recycle”).

CHICAGO, ILLINOIS

In 2006, in order to reduce the amount of construction and demolition debris from entering landfills, the City of Chicago instated a rule that all construction sites with permits issued since 2007 are required to recycle 50% (by weight) of the recyclable construction and demolition waste produced or face a fine (“Construction and Demolition Debris Recycling”). The fines for not recycling on a project involving over 10,000 square feet are “$1,000 for each percentage point of difference between the amount required by this section to be recycled or reused and the amount actually recycled or reused” and $500 per percentage point for projects less than 10,000 square feet (“Construction and Demolition Debris Recycling”). In order to help the building industry follow this regulation, the City of Chicago created the “Best Management Practices: Chicago’s Guide to Construction & Demolition Cleanliness & Recycling”, available on their website at:
www.cityofchicago.org. This manual provides information on how projects can implement sustainable strategies into their building practices. Similar to other states’ sustainable construction guidelines, Chicago’s construction and demolition waste guide identifies sustainable construction success stories, but only within Illinois, not other states. It does not, however, offer insight into how to utilize deconstruction to minimize the construction and demolition waste produced.

These local governmental regulations and requirements are prime examples of municipalities that have successfully incorporated sustainable construction and demolition waste management practices into building procedures. They can help to develop standards for what other cities throughout the United States should instate in their building industry. Establishing city regulations could unquestionably help increase the adoption rate of deconstruction into building practices.
CHAPTER IV:
CURRENT PRACTICES IN NEW YORK CITY

New York City’s construction and demolition yields approximately 60% of the overall city waste stream (Gruzen Samton LLP and City Green Inc., 2003). When concrete, dirt, brick and asphalt are not included in the calculation, the construction and demolition debris accounts for roughly 39% of New York City’s waste stream (Gruzen Samton LLP and City Green Inc., 2003). Below is a timeline of engagement in demolition, showing the parties involved over the typical course of a project.

![Timeline of Engagement](image)

**Figure 1: Typical Timeline of Engagement**

The following is an analysis of the current procedures and protocols in New York City and the involved people and organizations within the building industry.
**Processes**

In New York City, construction and demolition waste is not managed by the New York City Department of Sanitation, but by private hauling companies and waste transfer stations (Gruzen Samton LLP and City Green Inc., 2003). There are over one thousand registered construction and demolition companies authorized by the New York City Building Integrity Commission (BIC) to “collect and remove only waste materials resulting from building demolition, construction or excavation” (“Approved Companies and Denial/Revocation Decisions”).

In order to register as a hauler, or a contractor that also has the ability to cart away construction and demolition debris, a company needs to register with the New York City BIC (“Trade Waste Applications”). The companies fill out a form that will provide the city with all information about the company and their employees. To obtain the license, the companies must pay a fee and allow the BIC to audit all financial records related to their company at set junctures in time (“Registration for the Removal of Construction and Demolition Debris (C&D Registration)”).

Currently, in New York State, there are 80 regulated construction and demolition waste processing facilities operated by private entities and 280 registered construction and demolition waste processing facilities controlled by local municipalities (“Construction and Demolition Debris Processing Facilities”). Until the 1990’s, construction and demolition waste picked up by hauling companies in New York City primarily went to Fresh Kills Landfill in Staten Island (“PlaNYC 2030 – The Plan – Solid Waste”). However, shortly before Fresh Kills closed in 2001, haulers began moving debris to private waste transfer facilities located in the Bronx, Brooklyn and Queens, and this continues to be the practice (“PlaNYC 2030 – The Plan – Solid Waste”). Over the last 15 years, the amount of materials being sent to landfills has decreased significantly, mainly due to the increased tipping fees, so it becomes more advantageous for hauling companies to recycle building
materials (Anonymous Hauling Company Employee). Even if the building owner does not require the discarded demolition waste to be recycled, hauling companies will opt to recycle when it can save them money (Anonymous Hauling Company Employee).

The standard process for demolition debris removal in New York City is that a hauler will pick up the waste in containers, in which the waste materials will most likely be commingled onsite, and then transport it to a waste transfer station (Gruzen Samton LLP and City Green Inc., 2003). Once the debris is transported to the waste processing facilities, the materials will be processed based on material type and either sent to separate recycling centers specific to that material or to landfills (Gruzen Samton LLP and City Green Inc., 2003). For hazardous construction and demolition waste materials, such as asbestos, lead and mercury (from certain types of light sources), the Environmental Protection Agency has a strict protocol and regulations for removal from demolition sites (Gruzen Samton LLP and City Green Inc., 2003). Those materials are handled separately and are not commingled with other construction and demolition debris.

According to an interview with an employee from a large hauling company located in New York City who requested to remain anonymous, in order for deconstruction to become more effective and widely practiced, the local city and/or state government needs to step in to a certain extent. The hauling company employee voiced an opinion that the government needs to implement more regulation and some type of incentive program to make deconstruction more economically viable (Anonymous Hauling Company Employee). As the market stands, it is often less expensive to buy new materials for commercial buildings than to purchase salvaged or recycled materials. The same applies to disposal: it is often more expensive to salvage materials as there are many steps involved, including removing the materials, shipping them to a warehouse for storage and then shipping
them after purchase to a new location (Anonymous Hauling Company Employee).

**DESIGN COMMUNITY**

Demolition waste management is an important section of many design and architecture firms’ specifications for interior projects. These specifications determine how the design team and client want to handle the demolition waste. According to Susan Kaplan, the Director of Specification and Sustainability at HLW, an international architecture and design consultancy based in New York City, there are two methods for deconstruction that design projects indicate deconstruction in the specifications: “keep in place” and “salvage off site” (Kaplan).

Deconstruction requires planning so it must be discussed among stakeholders early on in a project so that all parties understand their responsibilities and expected outcome (Kaminsky). Time and care are the most important aspects of deconstruction and in order to include deconstruction in specifications from the architect and designer’s standpoint, discussions need to happen at the very beginning of a project (Kaminsky).

Often, interior design projects are commissioned in order to refresh a space, so using most of the existing materials in the space is not an option (Kaplan). However, in projects where new tenants are moving in, it is customary for design firms survey and assess the space and see what is there and possibly get inspiration for a new design of the space (Kaplan). Depending on the aesthetic of the designer and the client, there is immense opportunity to utilize existing materials in the spaces, especially when it comes to historic character and beauty of materials like woods and metals (Kaplan).
Over the last fifteen years or so of her career as a specification writer, Susan Kaplan has witnessed a huge increase in the amount of materials recycled from demolition sites (Kaplan). Depending on the contractor for a project and their recycling protocol, most will instate recycling at demolition sites (Kaplan). However, in order to increase the number of contractors recycling and to implement more deconstruction into design plans and construction and demolition waste management specifications, Susan Kaplan suggested more government involvement.

**Guidelines**

In 2003, New York City’s Department of Design and Construction (DDC) set forth guidelines entitled, “Construction and Demolition Waste Manual,” to help the local building industry implement more sustainable construction practices (Gruzen Samton LLP and City Green Inc., 2003). It is a brief, yet informative manual that provides recommendations for incorporating sustainable construction strategies throughout a project’s timeline. The guidelines offer insight on ways of incorporating recycling building materials as well as deconstruction into a project. Additionally, the guidelines reference several west coast municipalities, such as California and Oregon, and their efforts of reducing construction and demolition waste as case studies to help understand examples where more sustainable routes were taken for handling construction and demolition debris. The DDC’s guidelines are currently available on the New York City’s Department of Design and Construction’s website: www.nyc.gov.

The guidelines provide organizations with information that can help to make informed decisions throughout a construction project in order to sustainably handle construction and demolition debris. Because New York City does not have any set requirements or regulations in regards to diverting construction and demolition debris from landfills, these guidelines
are one of the primary sources of information for alternative methods of waste removal on construction projects and they are voluntary.

The guidelines address several of the important issues that New York City faces when it comes to being more sustainable with construction and demolition debris removal. Space is limited in New York City, which makes it quite challenging to set up separate areas at construction sites for different types of building materials to be recycled and/or salvaged (Gruzen Samton LLP and City Green Inc., 2003). However, one option for salvaging materials from demolition sites in New York City, not directly addressed in the DDC guidelines, is to hire a deconstruction team.

**DECONSTRUCTION ORGANIZATIONS: BUILD IT GREEN!**

An example of a local deconstruction organization in New York City is Build It Green! (BIG!), a non-profit organization that provides deconstruction services for free to both commercial and residential buildings in New York City and within the tri-state area. BIG! was founded in 2004 and operates two large reuse centers of salvaged building materials in Brooklyn and Queens. In 2013 BIG! successfully diverted over 4 million pounds of usable building materials from landfills (“What We Do”).

BIG! works with homeowners, building owners and contractors to come on site prior to, or at the very beginning of demolition, to deconstruct spaces and salvage usable materials. In the perfect scenario, BIG!, or any deconstruction team, would come to the demolition site just prior to the beginning of demolition and salvage as much of the useable materials as possible. What BIG! looks for when surveying spaces before demolition are materials that will have the most resale value or those that are plentiful, such as multiple tiles of the same color. BIG! is not necessarily interested in specific building materials, but rather, ones that they know will have a high profit margin (Rubinstein). However, quite often demolition has already
begun when BIG! comes on site to salvage materials due to lack of notice from the building owner or contractor (Rubinstein).

According to an interview with Max Rubinstein, Build It Green! Deconstruction Manager, in order for deconstruction organizations like Build It Green! to become more of a standard protocol for building demolition, specific regulations pertaining to construction and demolition waste diversion would need to be implemented by the City of New York. Max Rubinstein also suggested that there should be legislation to enforce deconstruction and building material recycling, similar to how buildings have regulations pertaining to height, zoning, etc. Currently, there are no regulations in New York City that pertain to deconstruction organizations like BIG!, and the only requirement for BIG! is that they have to be a licensed contractor through the BIC (Rubinstein).

**Take-Back Programs**

In addition to deconstruction organizations, other options available as an alternative method of demolition in New York City are take-back programs from manufacturers and independent organizations.

**Independent Organizations**

CarpetCycle is one example of an independent organization take-back program that is offered in New York City. CarpetCycle will come into a commercial demolition site, tear out unwanted carpet or remove discarded carpet and bring the collected materials to their facilities in Newark, New Jersey and sort them by material type to be sent out to various manufacturers that will reuse the material in new carpet (“CarpetCycle: The
Next Step Toward a Greener Tomorrow”). CarpetCycle will also remove wallboard, metal studs and ceiling tiles and consolidate them to be recycled.

CarpetCycle’s process is similar to that of demolition teams; contractors or building owners can hire them to come into demolition sites and remove materials to be recycled. According to CarpetCycle’s President and Founder, Sean Ragiel, the majority of their business relies upon repeat clients; they provide needed recycling services at a comparable price to traditional demolition so their clientele is fairly regular.

Like to Build It Green!, CarpetCycle tries to go into a demolition site to survey the space and understand the type of materials needed to be removed and how difficult the materials are to remove. They also want to see if there are materials that can be salvaged, even though the large part of their operation is the recycling of materials. A lot of the carpet that CarpetCycle removes from demolition sites is unsalvageable and the best solution is to recycle them into new carpet materials. CarpetCycle does, however, salvage carpet tiles, which are often in good condition because they are small and manageable. Sometimes, if they salvage enough high quality carpet tiles, they will donate them to organizations like Build It Green! (Ragiel).

According to Sean Ragiel, CarpetCycle would be more effective if there were more demolition recycling and deconstruction regulations in New York City which would allow CarpetCycle to take on more projects and recycle more materials. Even without regulations over the last several years, CarpetCycle has seen an increase in their company’s growth and the carpet recycling industry (Ragiel).

**Manufacturer Take-Back Programs**

Carpet companies like Shaw, which is one of the biggest carpet manufacturers in the US, provide a manufacturer take-back program for
their own carpet materials at the end of their lifespan (“Commercial Carpet Recycling and Reclamation by Shaw Contract Group”). As the demand for extended producer responsibility increases, more manufacturers are instating take-back programs for their materials. Examples of other programs available in New York City include Armstrong ceiling tiles and InterfaceFLOR carpet tiles.

**ADDITIONAL RESOURCES IN NEW YORK CITY**

The New York Chapter of the USGBC, Urban Green Council, is another resource for the community. It offers a variety of educational programs to its building industry members that range from explaining specifics of the LEED Certification program to continuing education courses and building tours. Additionally, the Urban Green Council offers a program called Green Professional Building Skills Training (GPRO), in which it provides training for contractors and related trades involved in sustainable construction management (“GPRO | Green Professional Building Skills Training”).
Although deconstruction is a beneficial alternative to traditional demolition, it is in its infancy and there are still several challenges in New York City’s demolition industry hindering further adoption. These concerns became apparent through interviews with organizations involved in New York City’s demolition and deconstruction industries and the review of secondary resources. The most distinct challenges associated with deconstruction in New York City are described below.

**COMMUNICATION/ TIME CONSTRAINTS**

Lack of communication is one of the main difficulties (Gruzen Samton LLP and City Green Inc., 2003). The design team on a project will often delegate the responsibility of demolition waste removal solely to the contractor, without developing a plan (Gruzen Samton LLP and City Green Inc., 2003). This causes a gap in the understanding of the flow of materials throughout a project. It is hard to implement any type of deconstruction plan when the involved parties are not aligned. Effective and structured communication between the parties involved is crucial, especially when the planning process for deconstruction of buildings and spaces needs to begin in the first phase of a design project (Kaplan).

In order for deconstruction organizations like Build It Green! or take-back programs like CarpetCycle to prosper and be a valued resource, their services need to be instated in a project plan from the very beginning. For
design projects to take full advantage of the services that are offered by those organizations and for their presence to be effective on a project, they need to be brought in early on and utilized to their full potential.

In demolition, project timelines are very important (Kaplan). Time is money: elongated timelines equate to increased costs. Deconstruction requires more precision, which, in turn, requires more time that projects simply do not have to spare (Rubinstein). When deconstruction is not addressed early on in a project’s timeline, it can become a time consuming issue having to include unaccounted for time into a project’s timeline to allow for a deconstruction team to come in before the demolition team.

**Used Building Materials Market/Accessibility/Cost Effectiveness**

According to the US Census Bureau, New York City covers 468 square miles with a densely packed population of about 8.3 million people (Chappell, 2013). With such limited physical space and a high demand for commercial and residential buildings, New York City builds vertically. More spacious metropolitan cities, such as Portland, tend to build outward. New York City does not have much space available for demolition sites to be able to sort materials on-site and maintain saved materials in storage facilities (Rubinstein).

The lack of space in New York City for the used building material market equates to the need for storage facilities in the nearby tri-state area that can hold large amounts of building materials. This, however, can turn into an additional cost, both financial and environmental. Building materials that are salvaged from demolition sites need to be transported to remote storage facilities and then transported back to project sites in New York City when they are purchased or ready to be installed. The travel and storage expenses of the materials can potentially increase their selling price, preventing them from being competitive with new building materials.
Additionally, the salvaged building material market is still small, especially in New York City, with only a few companies specializing in it (Srour et al, 2012). Markets can only expand with time and resources. Until the market demand grows, organizations like BIG! and other used building material companies will have a hard time growing. The lack of regional markets for salvaged building materials plays a large role in why there is an absence of deconstruction organizations and material reuse centers (Srour et al, 2012).

Even though research has shown that using deconstruction strategies for building demolition is less expensive than traditional demolition, it can become less cost effective when there is a shortage of materials that are salvageable or recyclable (Srour et al, 2012).

LACK OF GOVERNMENT INVOLVEMENT

As discussed in chapter three, some large US metropolitan areas have begun to require construction and demolition waste diversion through regulations. Without similar regulations and requirements in New York City, deconstruction and take-back programs will continue to have difficulty in becoming an inherent part of the demolition process (Rubinstein). The situation is a catch-22: without the need for deconstruction organizations they will not exist, and without their existence, projects cannot utilize potential benefits of deconstruction.

Many of the interviewed representatives of the industry pointed out that without local government involvement in construction and demolition waste management, there is no incentive for projects to make more of an effort to incorporate deconstruction strategies into their practices. At the time of this exploration, aside from inflated landfill prices and the increased availability of building material recycling facilities, there is no other
governmental involvement in construction and demolition waste management in New York City that would encourage deconstruction.

**Better Material Designs**

As building material recycling capabilities and accessibility have increased, the need for designing for recyclability has increased as well. In order to make deconstruction and recycling more feasible, the design of materials and products should include end-of-life planning that accounts for how easily they can be taken apart and recycled or salvaged. Additionally, designing for recyclability falls into the concept of closed-loop cycle of building materials, which relies on extended producer responsibility.

**Education/Understanding/Knowledge**

There is a lack of information easily available about the general concepts of deconstruction and how to implement them into design projects at early phases. This void of information limits the amount of education that trickles into the design community.

Among the selection of published books dedicated solely to sustainable interior design, such as *Sustainable Building Systems and Construction* by Lisa M. Tucker, *Health, Sustainability, and the Built Environment* by Dak Kopec and *Sustainable Commercial Interiors* by Penny Bonda and Katie Sosnowchik, nothing is mentioned in regards to deconstruction and sustainable construction and demolition waste management strategies. In *Environmentally Responsible Design Green and Sustainable Design for Interior Designers* by Louise Jones, *The Integrative Design Guide to Green Building* by 7group and Bill G. Reed and *Sustainable Design for Interior Environments* by
Susan Winchip, there is very minimal content discussing construction and demolition waste management.

As described in Chapter II, the currently developed sustainable building certification programs include only optional credits available for sustainable construction and demolition waste management plans. However, the newly introduced LEED V4 makes it a requirement to have a thorough waste management plan (“Construction and Demolition Waste Management Planning”).
CHAPTER VI:
CONCLUSIONS

SUMMARY OF EXPLORATION

The lack of governmental involvement in construction and demolition waste is one of the main issues that were brought to the researcher’s view during the course of this study was. Each of the four experts interviewed during this research independently acknowledged the need for government involvement and regulations that would support deconstruction, demolition waste recycling and material reuse. Without regulation and requirements for waste removal practices, advancements in deconstruction will be more difficult to achieve. The figure below depicts the preferred timeline of engagement, in which deconstruction is a standard function of any demolition project.

FIGURE 2: PREFERRED TIMELINE OF ENGAGEMENT
**Future Research Direction**

In order to fully understand deconstruction and how it can be better implemented into standard protocol for building demolition on an example of New York City practices, more quantitative research needs to be conducted. This research could benefit from case studies of buildings undergoing demolition that utilize deconstruction, analyses of actual costs of deconstructed buildings and further access to broader interviews to produce a larger collection of data and experiences. Further quantifying research could help validate this study’s conclusion and potentially lead to new regulations in New York City surrounding construction and demolition waste management.
REFERENCES


Kaplan, Susan. Personal interview. 3 Apr. 2014.


Ragiel, Sean. Telephone interview. 8 Jan. 2014.


Rubinstein, Max. Telephone interview. 25 Nov. 2013.


