

**Building Deconstruction Policy as a Method to Address the Private
Property Abandonment in the United State**

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Chapter 1: Introduction

1.1 Background of the abandonment problem

Over the last decade, legacy cities in the United States have witnessed a trend of widespread abandonment in residential, commercial and industrial properties.

1.1.2. Nature and Scope of Private Property Abandonment

According to the U.S. Government Accountability Office (GAO) report in 2011, the vacant residential units, not including those for seasonal, recreational, or occasional use or by migrant workers, went up from 7 million in 2000 to 10 million in 2010 (HUD UESR, 2014).

Properties that have turned from productive use to disuse are founded in both big cities as well as rural area. They are with various sizes, shapes and uses, and they tend to be concentrated in certain demographic areas. According to the Harvard University Joint Center for Housing Studies, under the “vacant” category, those without being marketed for sale or rent increased to the number of 7.4 million in 2010, concentrating in the high-foreclosure South and West Area Joint Center for Housing Studies, 2013). About 40 percent of the country’s vacant houses are located in just 10 percent of all census tracts (Duke, 2012). More than half of the census tracts with vacancy rates of 20 percent or higher were in just 50 counties, most of them in metropolitan areas. For example, Wayne County in Michigan has more than 200 high-vacancy neighborhoods (Joint Center for Housing Studies, 2013).

The Table 1 shows highest vacant units (including those for rent or sale) among 75 largest metropolitan statistical areas in 2012.

Table 1 Highest Vacancy Rates among the 75 Largest Metropolitan Statistical Area, 2012

Highest Vacancy Rates Among the 75 Largest Metropolitan Statistical Area, 2012			
#	Metropolitan Statistical Area	Vacant Units	Vacancy Rate (%)
1	Houston-Sugar Land-Baytown, TX	235,299	10
2	Atlanta-Sandy Springs-Marietta, GA	232,667	10.7
3	Detroit-Warren-Livonia, MI	220,931	11.7
4	Phoenix-Mesa-Glendale, AZ	170,883	9.4
5	Tampa-St. Petersburg-Clearwater, FL	139,840	10.3
6	St. Louis, MO-IL	118,525	9.6
7	Cleveland-Elyria-Marietta, GA	108,558	11.4
8	Orlando-Kissimmee- Sanford, FL	100,412	10.6
9	Las Vegas-Paradise, NV	100,005	11.8
10	Cincinnati-Middletown, OH-KY-IN	89,880	9.8
11	Indianapolis-Carmel, IN	79,771	10.4
12	Columbus, OH	75,357	9.4
13	Jacksonville, FL	72,735	12.1
14	New Orleans-Metairie-Metairie-Kenner, LA	68,181	12.6
15	Memphis, TN-MS-AR	63,692	11.5
16	Birmingham-Hoover, AL	57,874	11.5
17	Oklahoma City, OK	56,484	10.4
18	Richmond, VA	51,088	9.6
19	Dayton, OH	42,063	10.9
20	Tulsa, OK	41,156	9.9
21	Albany-Schenectady-Troy, NY	40,524	10.3
22	Columbia, SC	36,358	10.8
23	Greensboro-High Point, NC	31,214	9.6
24	Akron, OH	30,683	9.8
25	Toledo, OH	30,426	10.1

Source: United States Census Bureau. 2012. American Community Survey 1-Year Estimates.

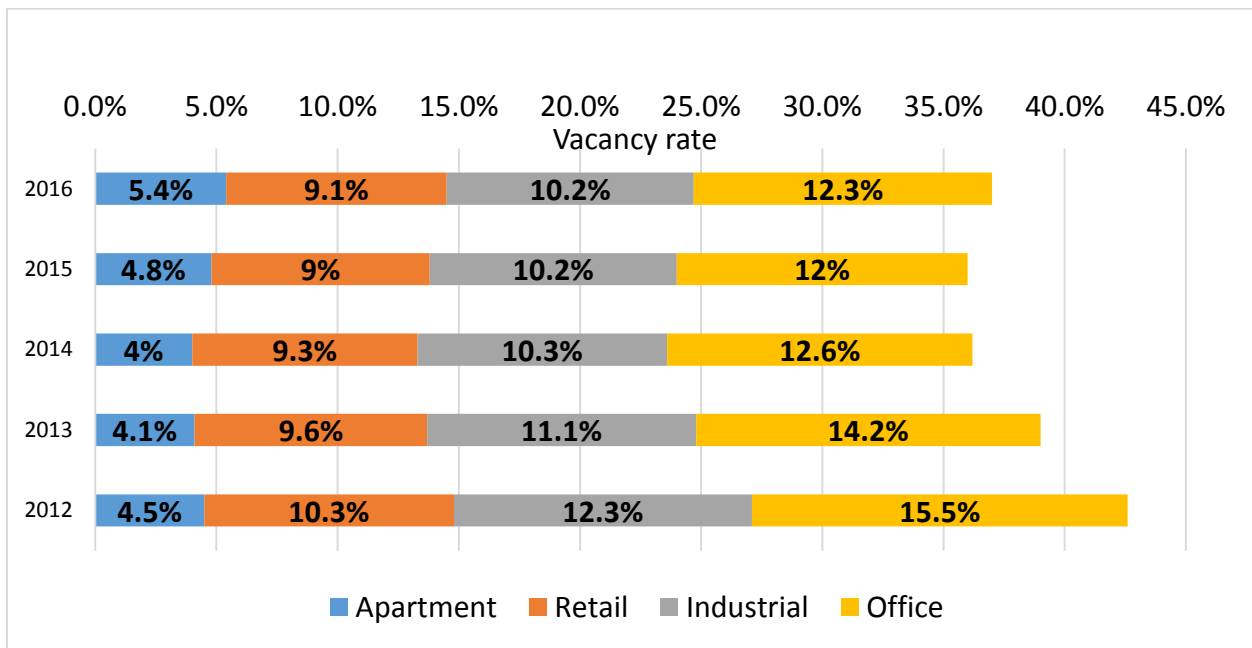
Note: Vacant units do not include seasonal, recreational, or occasional uses.

Detroit, the nation's most industrious city in the 20th century has experienced a substantial increase in the number of vacant buildings. According to The New York Times, the blight study conducted in Detroit, found that 30 percent of buildings, or about 80,000 of them, are abandoned. The Detroit Blight Removal Task Force estimated that they city would also cost significantly

more than approximately \$450 million to demolish or restore those abandoned buildings (Street, 2013).

From commercial perspective, US cities have experienced substantial declines in the number of shopping malls in the last decades. The Figure 1 shows U.S commercial property vacancy rate from 2012 to 2016. More than 40% of total commercial properties were been vacant in 2012. The vacancy rate slightly decreased in 2014 at around 35%.

Figure 1 U.S. vacancy rate forecast for commercial property from 2012 to 2016, by type



Source: United States; RREEF Real Estate, Deutsche Bank Group; IHS Global Insight; As of 2012

According to New York Times report, more than two dozen malls were closed in the past four years and another 60 malls are on the way to death. It is also predicted that about 15% of US malls would have the possibility to be converted into nonretail space in 10 years later (Peterson,

2015). The ongoing cycle of private property abandonment from decades of decline and economic transformation has littered communities throughout the United States with empty storefronts.

1.1.2. Social, economic and environmental consequences of abandonment

There is an understanding that abandonment is a serious planning issue for many central cities throughout the United State, as the public welfare would be negatively influenced if this problem cannot be treated properly. The practice of private property abandonment has created social, economic and environmental consequences in the neighborhoods.

Social consequences of abandonment

Vacant properties often provide a place for crime. The City of Austin, Texas, conducted a research of the relationship between crime rate and vacant properties. The research found that crime rates on blocks with open abandoned buildings were doubled the rates on matched blocks without buildings. The results also showed that 41 percent of abandoned buildings could be entered without use of force (National Vacant Properties Campaign, 2005)

The abandonment pattern also leads to an increase in poverty within the communities, which generates great threats to the health and safety of residents, and place unexpected costs on public resources (Galster, 1995). Individuals who live in communities with an increasing number of vacant buildings begin to feel isolated which encourage residents to move out of the community.

One popular notion of building abandonment has social impacts is the “broken windows theory” presented by James Q. Wilson and George L. Kelling in 1982. The broken windows theory assumes that physical environment encourage criminal behavior because the density of

abandoned properties is a sign of social disorder. For instance, if no one would repair the first broken window in a building, then people would think no one cares about the building and more windows will be broken (Wilson and Kelling, 1989).

Economic consequences of abandonment

Vacant properties reduce city tax revenues from the ways that their low property values often generate low taxes and the declining tax revenue can lead to financial problem like bankruptcy.

The City of Detroit, Michigan filed for bankruptcy on July 2013. The city had conflicted with deficits for ten years resulted from declining revenue. Without the support from the State and Federal government, and not rapid enough reduction on expenses, the largest municipal bankruptcy in American history could not be avoided (McDonald, 2014).

According to the Genesee County Land Bank (Flint, Michigan), the full cost of demolishing an average residential property is approximately \$10,600 from beginning to end (Genesee County Land Bank, 2015). The removal of all of the currently estimated abandoned residential properties (7.4 million) in the U.S. would cost the U.S. taxpayer approximately 78 billion dollars. Private structural abandonment places substantial economic, costs on communities.

The neighborhood property values can be negatively influenced due to commercial abandonment. According to a report by Schiling (2004), those communities close to abandoned structures suffer widespread and lengthy disinvestment. Researchers from Philadelphia found that house within 150 feet of vacant or abandoned property experienced a net loss of \$7,627 in value. Properties within 150 to 300 feet experienced a loss of \$ 6,819 and those within 300 to 450 feet experienced a loss of \$ 3,524 (Philadelphia, 2001).

Figure 2 Property Value Associated with Blight



Source: Research for Democracy. 2001. "Blight Free Philadelphia: A Public-Private Strategy to Create and Enhance Neighborhood Value." Philadelphia, Pennsylvania: Eastern Pennsylvania Organizing Project and Temple University Center for Public Policy, p. 22

Environmental consequences of abandonment

Current, the most common way to deal with abandoned properties is demolition. Demolishing abandonment properties generates large amount of building material waste. According to the Pollution Prevention Resources Exchange, there are around 245,000 residential and 44,000 commercial structures are demolished each year in the US. The US Environmental Protect Agency estimated 136 million tons of construction and demolition waste is generated and among those, construction-related waste constitutes ¼ of landfill waste (EPA, 2003).

Besides the large amount demolition waste generated from demolishing abandoned structures, hazardous materials such as lead baesd paint also increase the cost of cleaning up abandoned sites and threat public health. The negative environmental impacts create an unsustainable development in the building industry.

1.2 Statement of the Problem

Different strategies have been created to address the abandonment problems since the flood of abandonment has left cities with large number of vacant buildings. According to many researchers, the best way to deal with the abandonment is to put the property back into productive use. The city can gain property tax revenue if the property is being used rather than sitting vacant (Accordino and Johnson, 2000). What different strategies have been adopted to deal with the widespread abandonment problem and what alternative options could be implemented to end this phenomenon? This research aims to introduce the current policies and ordinances regarding private property abandonment, to propose alternative strategies to promote recycling rate of construction and demolition waste and to examine the feasibility of adopting the deconstruction policy as a method to change the built environment paradigm.

1.2.1 Policies and ordinances for removal of abandoned properties

Traditional strategies targeting the abandonment problem can be divided into two categories: pre-abandonment strategies and post-abandonment strategies. The pre-abandonment strategies can be implemented before the owner abandoned their structures. One of the most common strategies is code enforcement (Accordino and Johnson, 2000). Code enforcement is a regulation that inspects, investigates and monitors property condition. Other pre-abandonment strategies are community benefit agreements and vacant property registration ordinance. The post-abandonment strategies aim to deal with the abandoned buildings which have no visible owners or those that can be easily connected. For example, the federal funding programs are those

funding given by government or non-profit organizations to help with blight removal. The Community Development Block Grant is a program under United States Housing and Urban Development, which aims to provide communities with resources to address a wide range of community development needs. About \$3 billion was budget in 2012 in Community Development Block Grant (Community Development Block Grant Program, 2012). For instance, Environmental Protection Agency provides brownfields tax incentives every year; it is a program aims to address brownfields issues by reducing the tax burden on private sectors. After properties are abandoned, demolition or deconstruction can be adopted to deal with those structures.

1.2.2 Alternative policies to promote recycling rate of construction and demolition waste

The recycle and reuse rate of the construction and demolition waste is approximately 40% while the target in some EU members is 70% (EPA, 2013). The benefits of reuse and recycling of waste streams from building construction and demolition include diversion of waste materials from landfill sites and reduced depletion of natural resources. Both of these benefits contribute to sustainable development within building industry. The study compares the current information base and extent of recycling in the US to that of other developed countries, which in some cases are more advanced in construction and demolition waste recycling. To some extent, the recycle and reuse of construction and demolition wastes could be a possible way to abate the negative consequences of property abandonment.

Besides the recycle and reuse policies, the study put forward the building deconstruction policy as a new tool to address abandonment issues and encourage property owners to use deconstruction method as a preferred way to dismantle and remove abandoned structures. Different from traditional demolition method, the deconstruction is a more sustainable way as valuable materials would be recycled and reused after buildings are deconstructed. Moreover, a

deconstruction policy also should be applied on those new built structures, which have the potential to be abandoned in the future. The proposed study sites a statutory framework encouraging deconstruction that can be a practical and preemptive approach to address the private property abandonment.

1.3 Significance of the Study

It is worth emphasizing that abandonment is an ongoing process. The abandoned buildings may create situation that result in the subsequent abandonment of others in the surrounding areas. Abandonment has negative economic and social impacts within blighted neighborhood. These phenomena are likely to encourage future abandonment by residents and landlords, aggravate social and economic problem (Setterfield, 1997). As a result, the private property abandonment becomes a planning issue that a community can be negatively effected.

This research can be helpful to the nation as private property abandonment is an essential issue in the United States especially the mid-west region. Although many different strategies have been created to address the problem, there have been few outstanding success stories. This research on the deconstruction policy is innovative because it put forward a new idea: deconstruction, which is different from traditional demolition method.

The adaptation of deconstruction method has both environmental and economic impact in the society. The benefits of reuse and recycling of waste building materials include diversion of waste materials from landfill sites and reduced depletion of nature resources. Both of these benefits contribute to the sustainable development within building industry.

1.4 Organization of the study

To begin with, part one will look at the abandonment situation throughout the United States and

the current efforts to remove abandoned buildings such as Land Bank, code enforcement and federal government funding programs. Part two will review current status of recycling and reuse of construction and demolition building materials at the end of the building's life from a global perspective and discuss U.S waste policy options for construction and demolition. Part three will discuss alternative policies to end the future abandonment. In this part, an innovative method "deconstruction" will be discussed and compared with the traditional demolition method, talking about how it could bring benefits to the society. Then examining the feasibility of applying building deconstruction policy on both existing abandoned and newly built structures. Part four will summarize the methodology of this research to explain how the data were collected. The final part will present the findings and results of adopting this policy and discuss recommendations for the future research.

1.5 Objectives and Methodology

The rationale of the study is straightforward. The primary aim is to compile and summarize literature for the purpose of understanding current efforts regarding abandonment situation and examining the feasibility of adopting the building deconstruction policy on abandoned structures.

Following is the methodology used for achieving each objective:

1. Understand current post abandonment approaches and evaluate the outcome of those approaches;
2. Understand the principal of two different methods of dismantling buildings: demolition and deconstruction;
3. Examine the feasibility of applying the building deconstruction policy on abandoned structures and discuss strategies to encourage deconstruction

To achieve the objectives above, although literature reviews was conducted to collect enough information of pre-abandonment and post-abandonment strategies. A limited number of site visits helped to understand current situation of abandoned properties in real world. Based on site visits, conduction a survey of policy options for promoting construction and demolition waste recycling will give a perception of how different policies work to deal with the abandonment problem.

1.6 Definition of Terms

Following are definitions of key terms presented in this paper:

According to some research, it is hard to legally define “abandoned buildings” because there is no universal definition. As a result, the best way to interpret terms such as “vacant”, “abandoned”, “blight” is to use a broad description that includes a variety properties and conditions (Shane, 2012).

Vacant: From the U.S Census Bureau, it defines vacant property as “no one is living in it at the time of enumeration unless its occupants are only temporarily absent”. Some researchers define the “vacant” as there is no structure on the parcel or property (Bowman 2000).

Abandoned: Abandoned property refers to a building where there is no visible owner or one that can be easily connected. This includes with or without structures. To be classified as abandoned, a building must be considered hazardous to the public health and welfare and the property must be vacant for a period of time. There is no general definition of abandoned, but many factors can indicate abandoned. The most obvious one is tax foreclosure that is the result of failure to pay property taxes. Other indicators include parcels are not under well maintenance such as damaged homes (Beckner, 2005). Additional, the length of the property was abandoned time is a key to these indicators. For example, New Jersey’s broad definition of “abandoned”

requires a property has not been legally occupied for 6 months (Determination that Property is Abandoned, Title 55 Tenement Houses and Public Housing).

Demolition: Demolition is the tearing-down of buildings and other structures without preserving valuable elements for reuse and recycle (EPA, 2000).

Deconstruction: Deconstruction is a process of selective dismantling or removal of materials from buildings before or instead of some elements of traditional demolition. The process is also refer to as “soft demolition”, which has the primary goal of maximizing the recycled and reuse materials (Leroux and Seldman, 1999).

Waste: According to the United Nations Environmental Program, the term “waste” refers to substances or objects, which are discard of or are intended or required to be disposed by the provisions of national law.

Construction and demolition (C&D) waste: this report describes the construction and demolition waste as debris of building wastes generate during construction, renovation, and demolition.

Construction wastes usually make up of unwanted materials generated directly or indirectly form construction projects or industries while demolition wastes are waste debris originated from demolition process (Building-Related Construction and Demolition Materials Amount, EPA, 2003).

Disposal refers to dump waste to a landfill (Building-Related Construction and Demolition Materials Amount, EPA, 2003).

Reuse means the use materials again after they have been used or with minor refurbishments (Building-Related Construction and Demolition Materials Amount, EPA, 2003).

Recycling is a process to change waste materials and make them into new products in order to prevent waste generation (Building-Related Construction and Demolition Materials Amount, EPA, 2003).

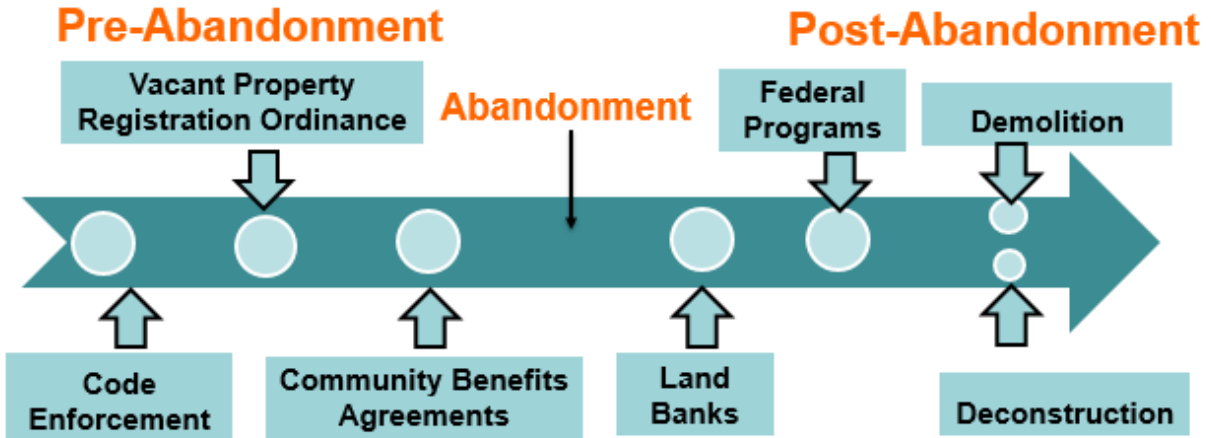
Recovery means reuse and recycling materials, as well as utilizing materials for energy recovery (Building-Related Construction and Demolition Materials Amount, EPA, 2003)

Chapter 2: Strategies to Address Property Abandonment

2.1 Introduction

In order to have a better understanding of the policies and programs within the field of property abandonment, a literature review was conducted on traditional approaches targeting the problem. This chapter will summarize strategies from two aspects: pre-abandonment strategies and post-abandonment strategies. The pre-abandonment strategies can be implemented before the owner abandoned their structures. One of the most common strategies is code enforcement (Accordion and Johnson, 2000). Code enforcement is a regulation that inspect, investigate and monitor vacant property, also responsible for rental new construction and maintenance of existing structures. Other pre-abandonment strategies are community benefit agreements and vacant property registration ordinance. The post-abandonment strategies aim to deal with the abandoned buildings which have no visible owners or those that can be easily connected. For example, the federal funding programs are those funding given by government or non-profit organizations to help with blight removal. Land Bank is another post-abandonment strategy which manage, maintain and repurpose vacant, abandoned and foreclosed properties. Currently, the most common way to deal with abandoned structures is demolition. Deconstruction is another more sustainable way to make the most use of recyclable materials. The figure 3 gives the general trend of when pre and post abandonment strategies can be put in to effect.

Figure 3 Pre-Abandonment and Post-Abandonment Strategies



Source: By Menaaiu Wu & Dr. Rex LaMore

2.2 Pre-Abandonment Strategies

2.2.1 Code Enforcement

Code enforcement has been considered as the most common strategies to address structural condition and abandonment (Accordion and Johnson, 2000). Every city has building codes, which is a set of regulations that rule the standards, design and materials for constructed structures (including both buildings and nonbuildings) (Ellingwood, 1980). Developers, architects, constructors and engineers are usually the direct receiver of building code, as public health and safety issues should be considered when starting a new construction project. Local government and private authority can enact the building code as a law (Accordion and Johnson, 2000).

Code enforcement aims to preserve the appearance of the city's buildings in residential, commercial and industrial areas in order to provide the community a better livable environmental (City of Cypress, 2014).

Code enforcement is usually a department with the city government system. The city has a code enforcement officer who are responsible of investigating complaints related to properties form residents or business and regulation the building code violation. An inspection will be made to

deter to determine the violation after the complaint is submitted to the code enforcement department. The property owner will be provided a chance to bring compliance if a code a code violation is observed (City of Cypress, 2014). The individual has the opportunity to respond to the warning from the code enforcement officer within a certain period of time. If the corrective action is not been taken, this can result in a criminal complaint with the City Attorney's office. In some cases, the results for the individual could be fines, tearing down structures or even criminal charge (Accordion and Johnson, 2000).

According to Accordion's study conducted in 1997, the code enforcement strategy was considered as a "high effective" tool to address abandoned property. Code enforcement, as an enforced policy, makes great contributions to protecting and improving the health and safety of the residents. However, it has weakness in the financial perspective. For those cities with large amount of private properties that under poor maintenance, implementing policy like code enforcement require sufficient financial or staffing resource to employ compliance officers and inspectors to reply citizens' complaints (Schiling 2004).

In addition to the financial problem, the code enforcement method also cannot be effective for those properties that have been vacant for a long period of time but still under the owner's maintenance. These kind of abandoned structures still influence the neighborhood rehabilitation.

2.2.2 Vacant Property Registration Ordinance

Because of the growing number of abandoned properties, there is a major increase in the number of local governments adopting vacant property registration ordinance (VPROs).

Creating vacant property registration ordinance aims to protect public health and safety and prevent neighborhood blight, secure properties, protect property values and neighborhood

integrity (City Of Trenton). As of May 2012, there were more than 550 local VPROs in the United States, increased fewer than 100 from the year of 2007 (Cheung, 2005).

The VPROs require property owners to register vacant and foreclosed properties with local government. In the City of Trenton, Ohio, the VPROs requires owners of real property to register all property within 30 days of the vacancy and they are required to renew the registration annually. A registration fee is often payed at the registration time to maintain and secure properties a specific period of time. Properties owner are typically required to carry a minimum amount of insurance or to provide a minimum bonds or deposits. If owners don't meet requirements of register, fails to report changes to registration information or fails to renew a registration annually will be assessed a fine penalty. Besides register vacant building, the owner also have the responsibility to perform regular weekly inspections of the property (City Of Trenton).

2.2.3 Community Benefits Agreements

Community Benefits Agreements are legally enforceable contracts between a developer (i.e. a private business), the local government, and community organizations and residents (Marcello 2007). There is always a tension between local government's desire to increase tax revenue, a community's desire to encourage business and resident's desire to have more job opportunities (Julie 2010). Community benefits agreements can be a great tool to deal with this issue with encouraging new business and providing community residents' benefits.

The "dark store ordinance" is an example to illustrate how community benefit agreement works. The ordinance require the retail stores' owners or developers to contribute certain amount of money to the fund which would be used to the demolition and renovation of the building after it has been vacated.

This is a big-box ordinance adopted by the city of Wauwatosa, Wisconsin in 2005. It requires new retail stores more than 50,000 square feet should provide 20 cents per square foot to the Land Conservation Fund before they could be granted the building permit from the city (Dark Store Ordinance- Wauwatosa, 2005). Other community have created ordinance that requires contractors or developers to provide a bond to cover the demolition costs after the retailers abandon the building. The city of Oakdale, California also enacted the Dark Store Ordinance that requires retail stores over 40,000 square feet should carry a performance bond. The bond can be used to maintain the building and develop the site after it has been vacant for more than one year (Dark Store Ordinance – Oakdale, 2005).

A community might consider entering into a development agreement with a developer to provide benefits to the municipality over the development process as well as give the developer the assurance that the a project will proceed as approved in the agreement.

2.2.4 Summary

If take the abandonment point as the transition point, a point at which the current owner is no longer held accountable for the property or the owner is no longer available, the property become the public entity owned property. Ahead of time, pre-abandonment strategies can put pressure on the property owner and require the existing owner to improve the property.

2.3 Post-Abandonment Strategies

When the owner is no longer held legally accountable for the property, the property goes to land bank and at that point the post abandonment activities can take action. Post abandonment strategies include Land Bank and federal funding programs.

2.3.1 Land Bank

Land Banks are public or community-owned entities that developed for the purpose of acquiring, managing, maintaining and repurposing vacant, abandoned and foreclosed properties. Land banks are intended to acquire abandoned properties and transfer the properties to new, responsible owners who have the ability to manage the property. Land banks can help to convert low value properties into assets for community revitalization. In general, public entities create land banks by local ordinance, other entities such as redevelopment authorities and planning development also have the right to start land-banking program(Center for Community Progress)..

According to the research conducted by the Center for Community Progress in 2014, there are approximately 120 land banks and land banking programs throughout the country. The top three states with largest number of land banks are Michigan, Ohio and Georgia.

In order to solve the abandonment and blight problem, land banks are offered special legal power to acquire properties at low or no cost through foreclosure process. After the properties go into land banks, they hold land with tax-free. Land banks can lease properties for temporary uses or sale properties to private owners with the consideration of not only sale prices but also the community's needs (Center for Community Progress).

Land banks are usually funded by a variety of sources including the sale of properties, foundation grants as well as federal and state grants. Federal Hardest Funds is one of the significant federal grants received by mid-west states, like Michigan and Ohio (Center for Community Progress).

Land bank inventories vary greatly. Inventory sizes range anywhere from a few properties to thousands of properties. Genesee County is Michigan first land bank, dates back to 2004. The

City of Flint, Michigan has experienced a great population and investment declining over the past thirty years. In spring of 2014, the Genesee County Land Bank had an inventory of approximately 11,000 properties (Center for Community Progress).

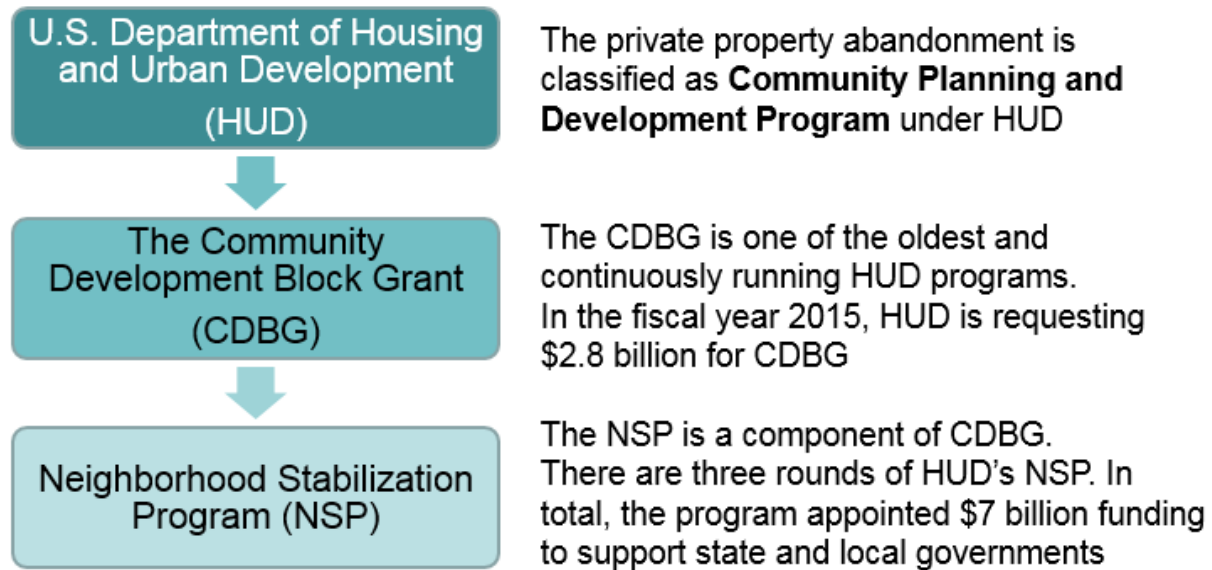
2.3.2 Federal Funding Programs

The federal and state financial programs play an important role in dealing with housing issues including property abandonment. This section summarizes the funding opportunities regarding blight removal tasks throughout the country.

Department of Housing and Urban Development Programs

The Department of Housing and Urban Development (HUD) is a federal government agency that was created in 1965, which aims to increase homeownership, support community development and increase access to affordable housing free from discrimination (HUD). HUD has a wide range of programs that are available to address housing issues and community development needs. The private property abandonment is classified as Community Planning and Development Program under HUD that aims to provide houses create a better living environment for low-income population (HUD) (See Figure 4).

Figure 4 Federal Government Funding for Blight Removal



Source: by Mengqiu Wu

The Community Development Block Grant is one of the oldest and continuously running HUD programs which provides annual grants to more than 1000 state and local governments and communities. The CDBG program areas cover from avoiding foreclosure to economic development. Started in 1974, CDBG program has invested \$144 billion in communities nationwide. In the fiscal year 2015, HUD is requesting \$2.87 billion for the Community Development fund, and the amount delicate to CDBG is \$2.8 billion, which is a reduction of \$230 million in comparison to fiscal year 2014 (Community Planning and Develop Fund 2015 Summary).

All projects receiving CDBG funds meet one of three national objectives: 1. to benefit low and moderate-income persons, 2. to eliminate slums or blight conditions or 3. to address urgent needs to community health and safety 2014 (Community Planning and Develop Fund 2015 Summary).

Neighborhood Stabilization Program

The Neighborhood Stabilization Program (NSP) is a component of CDBG that was established for the purpose of stabilizing communities that suffered from foreclosure and abandonment (NSP-HUD). NSP funds could be used to purchase abandoned homes and resell or redevelop these homes to stabilize neighborhood. There are three rounds of HUD's NSP. In total, the program appointed \$7 billion funding to support state and local governments, helping to address the negative impacts of abandoned and foreclosed housing. It is estimated that 88,000 job opportunities were created along with the construction of 75,000 units of affordable housing and completion of 25,000 blighted properties demolition projects using the funds. In the 2014 financial year, Michigan received \$113 million Community Development Fund in total (Community Planning and Develop Fund 2015 Summary).

Hardest Hit Fund

The Hardest Hit Fund (HHF) is a federal financial program that provides targeted aid to families in states hit hard by the economic and housing market downturn and deal with housing crisis including private property abandonment. In 2010, the Hardest Hit Fund provides \$7.6 billion to the hardest hit states (including Michigan) to develop programs to support their local struggling homeowners (Hardest Hit Fund).

It is estimated that the City of Detroit will need as much as \$850 million to address neighborhood blight in the next few years. In 2013, the State of Michigan awarded to Detroit the \$52.5 million Hardest Hit Funds for blight removal task. In addition to that, the city has currently allocated \$8 million of CDBG and \$7.3 million of NSP toward blight removal. With these combined funds together, Detroit still faces a gap of around \$400 million to deal with neighborhood blight (Detroit Blight Removal Task Force Plan). Through Sep. 30, 2014,

Michigan has spent on average property \$8,049 on demolition and \$1,025 on “green” – preparing the property for resale or reuse (Federal report, 2015).

2.4 Summary

The use of federal funding programs and planning regulations to address private property abandonment and blight are not a new concept. Of course, not all policies and programs deliver the results they were attempting achieve. There are many reasons for the less effective for policies, including lack of financial support, lack of understanding of the problem and limitations of the policy due to restrict regulation ([Accordino, J. and G. T. Johnson, 2000](#)).

Chapter 3. Review of the Current Status of Recycling and Reuse of Construction and Demolition Building Materials

3.1. Introduction

Recycling and reuse of the construction and demolition related waste appear to be making progress during recent years. There are a variety of benefits of recycling and reuse of building construction and demolition waste including reduced amount of waste sent to landfills and incinerators and conserved energy and natural resources, such as water, timber and minerals. All of these benefits help to sustain the environment for future generation and provide a sustainable development in the building industry. This chapter discusses the current information and extent of recycling in the United States to that of other developed countries, which in some cases are more advanced in construction and demolition waste recycling.

3.2. Building Life Cycle Assessment

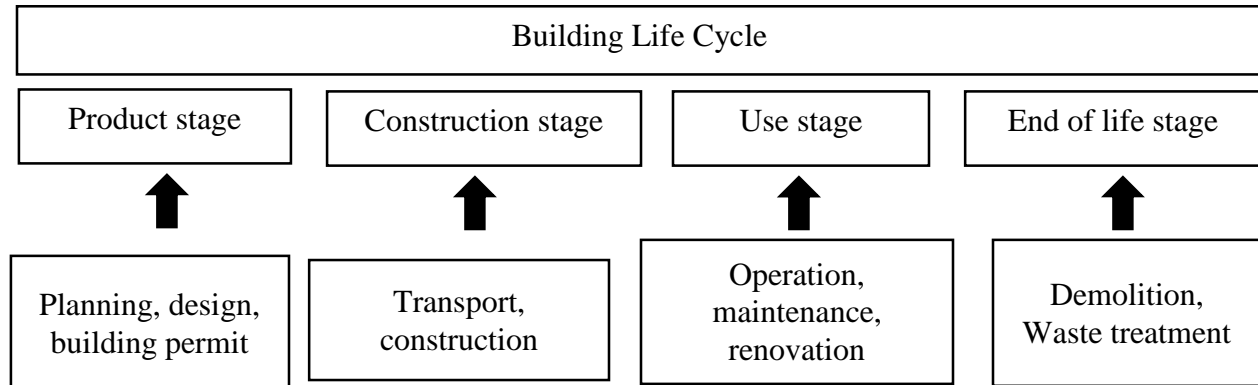
Building life cycle refers to the view of a building through its entire life from design, construction occupancy, renovation, demolition to waste management (Kotaji, 2003).

The CEN TC 350 (Sustainability of construction works – Integrated Assessment of building performance) has distinguished 4 stages for buildings and construction works: product stage, construction stage, use stage and end of life stage.

The design and construction phase are usually divide into 6 categories: the (strategic) planning phase, the programming/briefing phase, the design phase, the construction and commissioning phase, the occupancy and the adaptive reuse/recycling phase (Preiser, 2005). The construction phase includes transport of products to the building site. At the end of each phase is a review or evaluation step refers as waste management process.

Following are definitions of key terms presented in this report:

Figure 5 Building Life Cycle



Source: CEN TC 350

This chapter introduces current policies regarding construction and demolition management in the global perspective, and identifies where different policies fall into each category in the paradigm above.

3.3 European Waste Policies and Legislations

Construction and demolition (C&D) waste is one of the heaviest waste streams generated in the European Union every year. About 850 million tons of C&D waste is generated each year, this amount of waste constitutes approximately 25%-30% of all waste generated in the EU including numerous materials: asbestos, bricks, concrete, glass, gypsum, metals, plastic, and wood. Among them, many could be recycled and many could be reused (The European Commission: waste).

However, the percentage of reuse and recycling of construction and demolition waste is different across the European Union. In some member states, such as Netherlands, Germany and Denmark,

the target is between 80% to 90%., but in Hungary and Spain, the recycling percentage is only around 15% (European Topic Centre on Resource and Waste Management, 2009).

The European Commission has adopted a legislative proposal on July, 2, 2014, which reviewed recycling and other waste-related targets in the EU Waste Framework Directive (WFD) 2008/98/EC. Under this legislation, the WFD requires a minimum target of 70% (by weight) of C&D waste by 2020 for recycling and reuse or other material recovery included using nonhazardous C&D waste to substitute other materials in all member states. However, member states are still in the process of integrating the 70% target into their national legislation, and it is currently difficult to assess how this will be implemented (European Commission DG ENV).

There are five main categories of current policies and legislations that impact the management of C&D waste (European Commission DG ENV):

- **Waste framework policies**

Waste framework policies are regulations created in member states to set the general framework for C&D waste management such as targets recycling rate, and obligations set in the European WFD waste.

Waste framework policies function at the end of life stage in the building life cycle assessment.

- **Landfill legislation**

Landfill policies were recognized as the most effective driver to control the C&D waste. Almost all member states have adopt landfill legislation and the most drastic measures to prevent direct dumping C&D waste were adopted in Flanders, Belgium with strict landfill bans. This example is explained in the following section.

Besides landfill bans, land fill tax, tipping fee are also included in the landfill legislation.

Landfill legislation can be effective at the end of life stage in the building life cycle assessment.

- **Secondary raw materials legislation**

Secondary raw materials legislation refer to standards on the quality of secondary materials from C&D materials. The improvement of recycled materials was also identified as a key driver for higher recycling rates.

Secondary raw materials legislation are also go into the end of life stage in the building life cycle assessment.

- **C&D sites legislation**

C&D sites legislation are standards include criteria influencing the C&D waste management, for example the use of recyclable materials in the building. C&D sites legislation function at the construction stage.

- **Building standard**

Some building standard have been taking into account the waste management. One example is the Green Building Standards Code which aims to improve public health and safety from various aspects including material conservation and resource efficiency. The building standard can be applied at the construction stage.

Among European countries, most member states have policies and regulation specifically targeting C&D waste. The table below provides an overview of selected policy instruments for C&D waste used in selected states which have available reliable recycling rates.

Table 2 Selected policy interventions found in some of EU member countries, 2009

C&D waste		Selected policy instruments					
Country	Recycling Rate (%)	Landfill bans	Source separation mandate	Reuse targets	Recycling targets	Producer take back	Landfill tax
Netherland	98.1	Combustible fractions		Y	Y		Y
Denmark	94.9	Combustible fractions	Y		Y		Y
Estonia	91.9						Y
Germany	86.3		Y				
Ireland	79.5				Y	Y	Y
United Kingdom	67.5						Y
Slovenia	64.8		Y				Y
France	62.3						Y
Lithuania	61.0		Y				
Austria	59.7		8 materials				Y
Latvia	59.5						
Belgium	45.8	Y	Y		Y		Y
Poland	28.3						
Finland	26.3		Y				Y
Czech Republic	23.0						Y
Hungary	15.5						
Spain	13.6			Y	Y		Y
Cyprus	0.7						

: ETC/SCP,(2010b) and ETC/SCP, (2009c)

Landfill bans : a law or ordinance that forbids certain kinds of wastes disposed in a landfill directly.

Source separation madate : a law or ordinance that requires wastes need to be separate before disposed in a landfill.

Reuse/recycling target : a law or ordinance that set a reuse/recycling target for waste.

Producer take back : is a product and waste management system in which manufacturers – not the consumer or government – take responsibility for the environmentally safe management of their product when it is no longer useful or discarded.

Landfill tax: the cost of disposal waste by the owner or operators of qualifying landfills or transfer stations.

From this table 2, landfill bans is considered as the most prevalent and strongest driver to promote the level of recycling C&D waste. Setting Recycling targets and mandatory source separation are also effective methods to treat C&D waste. The two countries with the highest recycling percentage have all implemented landfill tax and recycling targets and in combination with other initiatives (a landfill ban on combustible waste). In Germany, source separation is the only adopted policy, but the recycling rate is relatively higher than other member states where more than one policy enacted, so compulsory source separation seems to be the key driver for high level of recycling in Germany. Ireland carried out producer takes back C&D waste policy, which requires producers physically and financially responsible for the environmental impact of their products after the end-of-life (Atasu, 2012). This policy may contributed to its 79.5% recycling rate that meets EU standard.

Three countries (Netherland, Germany and Belgium) are selected as examples to introduce specific C&D waste management policies. Two countries (Germany and Netherland) with higher recycling target of more than 80 percent are chosen as study cases to have better understanding of waste management policies implemented in different countries. Another example is Belgium where four policy interventions are adopted to achieve the 70% target-recycling rate.

3.4. Construction and Demolition Waste Policies Examples in Europeans and Australia

This section explains four countries as examples to discuss specific C&D waste policies. Besides three European countries, the Australian case is also explained to introduce various recycling legislation and policies.

3.4.1 Construction and Demolition Waste Management in Germany

Construction and demolition waste management in Germany is recognized as a mature market and it is a sub industry within the broader German construction market (Frank and Otto, 2006).

During 2002 and 2003, there were about 381.3 and 366.4 million tons of waste generated in Germany respectively. Construction and demolition waste contributed around 2/3 to the total amount. According to the Federal Statistical Office, the percentage of recycling was 85.6% in 2002 and reached to 86.2% in 2003.

Figure 6 Handling of Construction and Demolition Waste in Germany, 2002-2003



Source: Destatis(2005b;2005c)

In Germany, the local government takes the responsibility of managing construction and demolition waste in the proper treatment. Meanwhile, the higher levels of government, like Federal government of Germany and the EU, set up the construction and demolition waste recycling targets and the enact ordinances and regulations for Leander (state) to implementation.

While at the local level, the primary responsibility for the construction and demolition permits administration, including detailed deconstruction plans and detailed requirements for recycling materials, is in the hands of municipalities. Local authorities are responsible for dealing with the recycling, collection, sorting and disposal the household waste, commercial waste such as construction and demolition waste is solely the responsibility of the waste's owners. Any commercial use of the processing, recycling and disposal infrastructure operated by the municipality is paid for directly by the user (Frank and Otto, 2006).

The German government has a rigid regulation to treat construction and demolition waste which includes the requirements of waste prevention, recovery and disposal without polluting the environment. The Technical Instruction for Municipal Waste is one of the major ordinances to deal with construction and demolition waste in Germany. It requires that the construction and demolition waste should be collected and prepared for recovery separately. Some member states have specific regulations for demolition which require waste should be organized and separated on site or at special plants for treatment.

Table 3 shows some policies taken in order to influence the management of construction and demolition waste in Germany.

Table 3 Summary of Measures Used to Influence the Management of Construction and Demolition Waste in Germany, 1999

Policies	Comments
Restrictions or bans on disposal	Unsorted and recoverable C&D waste cannot be landfilled
Mono landfill (for possible future recovery)	Some, for inert waste and/or soils.
Other environmental or planning controls	Disposal sites tightly controlled, re-use sites less so. Destination of C&DW has to be documented from 1.1.1999. System differs for inert/hazardous wastes.
Taxes (landfill and others)	No federal tax or levy. 5 states tried to impose levies on waste incineration and disposal generally but this power was overturned in the courts. There are different prices for landfilling according to the hazardousness of the waste.
Subsidies	No direct subsidies
Positive waste planning measures	There is an obligation to draw up waste management plans. The 1996 Closed Cycle & Waste Act requires recycling where possible and economic.
Voluntary Agreements (VA)	National and local VAs to encourage separation, reuse and recycling.
Education and training	Part of VA
Advisory services	Part of VA
Waste exchanges	National and regional Internet-based exchange schemes for inert materials.
Other measures	Return systems for PVC products.

Source: Symonds, 1999

3.4.2 Construction and Demolition Waste in Netherland

According to Netherlands Report of parliamentary debates, there are about 15 million metric tons of construction and demolition waste generated in Netherlands each year. The policy regarding waste treatment aims to improve the level of recycling and reuse. In 1980, the Dutch government established a waste treatment order hierarchy, which is known as “Delft Ladder”. The steps was a designed as follow (Kowalczyk, 2000):

Prevention, Construction reuse, Element reuse, Material reuse, Useful application, Immobilization with useful application, Immobilization, Incineration with energy recovery, Incineration and Landfill. The table 4 shows the corresponding consequences of each steps.

Table 4 Delft Ladder

The 10 steps	Consequences
Prevention	Design for recycling, recovery, based on remaining lifespan
Construction reuse	Design for recycling, oversizing, selective dismantling, remaining lifespan
Element reuse	Design for recycling, selective dismantling, reprocessing, return system
Material reuse	Design for recycling, selective dismantling, reprocessing, return system, leaching and content of contaminants
Useful application	Quality equal to reference (with regard to leaching)
Immobilization with useful application	Leaching and content of contaminants
Immobilization	Dumpling
Incineration with energy recovery	Emission Limitation
Incineration	Emission Limitation
Landfill	Dumping Conditions

Source: A New Vision on the Building Cycle, Hendriks, prof. dr. ir. Ch. F

A disadvantage of such order is that it is a fixed top-down approach. The first option is always better, than the second and so on. The aim of the approach is to prevent of waste generation.

Prevention tries to prevent the production of waste. These steps must be taken before a building is demolished, in the design and building stage. Construction reuse and element reuse can only be performed when the elements are suitable for deconstruction. Recycling of materials can be performed, which is for example the use of secondary concrete aggregate.

In order to guide the construction and demolition waste market, the government published regulations to set the requirements for recycled materials and take care of related policies. Table

5 shows a range of instruments to regulate the quality and quantity of construction and demolition waste.

Table 5 Summary of Construction and Demolition waste instruments in Netherlands

Instruments	Comments
Landfill ban	Prohibits the landfilling of reusable or burnable and unprocessed construction and demolition waste. Applies not only to reusable construction and demolition waste but also to the residues from processing (sorting and crushing)
Provincial Environmental Ordinance	Intended to get more information about the waste streams and to monitor disposal and processing Requires waste collection and processing companies to present quarterly reports to the Province on the waste volumes they have received Commercial wastes may not be transported between Provinces, unless an exemption is obtained
Building Materials Decree	Introduce regulations on the use of building materials to protect the soil and water, define the materials must be removed when demolition begins Provides sufficient options for the use of unshaped (loose) materials derived from secondary materials from the construction industry cycle
Market	the demand form road building industry which need the secondary materials(asphalt, concrete and mixed granulates) for their construction

Source: Delft University of Technology

3.4.3 Recycling and Prevention Program in Belgium

The reasons why European countries can achieve high recycling and reuse target of C&D waste apparea to be related to the landfill legislation. The most drastic and useful measures to prevent landfilling of C&D waste were adopted in Flanders, Belgium, with straightforward landfill bans for recyclable fractions of C&D waste. This method was recognized as Europe’s best recycling and prevention program. (Allen, 2012)

The achievement might depend on the local context. The Flemish government implemented mandatory recycling and landfill ban regulations across the region to encourage improvements in waste separation. In order to prevent municipal waste being buried or burned, landfill and incinerator restrictions were accomplished in 2000. According to this policy, unsorted and recyclable waste was prohibited in to landfill or incinerator directly. Financial tool was also utilized to encourage recycling. There is an environment tax for residential waste treatment ranging from \$9 per ton for incineration to \$95 per ton for landfilling. In 2009, the benefit from these levies totaled \$36 million. About 40% of this amount was used to finance the subsidies in the environmental agreements, which carry out waste prevention activities with municipalities. The activities included providing technical and financial assistance to community to reduce waste or financing public education campaigns for target groups like schools, etc. Besides that, the government encourages deconstruction as a preferred method to reduce construction waste. By law, new construction projects must provide a deconstruction strategy and waste inventory if more than 1,000 m³ debris are generated duringu construction. They are also responsible for recycling the amount of waste they generate. According to OVAM (a recycling center in Belgium) , 90 percent of construction and demolition waste—11 million tons—was recycled in 2010 (OVAW 2008).

However, its applicability might depend on the local context: in Flanders, low historical landfill rates of construction and demolition waste, high density of population and scarcity of landfill space available may have contributed to the efficiency of this measure. In addition to landfill bans, high landfill taxes (e. g. in the Netherlands) have also proven to be a useful instrument to divert construction and demolition waste from landfills.

3.4.4 Recycling and Deconstruction in Australia

It is estimated that approximately 14 million tons of solid waste is sent to landfill every year and construction and demolition waste was contributed 40% of the volume of total landfill waste (Crowther, 2000).

In Australia, the recycling and reuse of building materials in residential areas have achieved great success but this is not the case of commercial and industrial buildings. It is estimate 50% - 80% of building materials are salvages after demolition process, and most of these materials are reused directly without any treatment. However, the rates of recovery of building materials in commercial sites is slightly lower, only 69% of demolished materials in some places have been recycled and made into new products (Crowther, 2000).

Australia has three levels of government: the national, the state and the local. They are: the Commonwealth Government, the State and Territory Governments and the local Governments and Councils. They have different responsibilities in the area of environment, waste minimization, recycling, and construction and demolition (Crowther, 2000). Australia seeks to improve its rates of recycling and reuse, especially in construction and demolition industry. In general, most controls over construction and demolition issues are at the state and local level.

Table 6 Australian Waste Management and Recycling Legislation and Policy by State

State/Territory	Policy	Comments
Commonwealth	Waste Management Awareness Program	Provide funding initiatives
	Waste Wise Construction Program	Improve rates of recycling and reuse Develop practices in waste minimization
	Lifecycle Assessment in Building and Construction	Provide life cycle consideration, Improve understanding of material and building impacts for reuse and recycling
Capital Territory Government	Waste Management Strategy	Aims to eliminate all kinds waste going to landfill by the year 2010
	Australian Reusable Resource Network	Market program: Internet exchange base for reusable materials and items for individuals and companies
New South Wales State Government	Protection of the Environment Operation	developed a waste exchange directory for construction and demolition materials
	Local Government Regulation	Building Approvals: Identify all reused and recycled materials before construction approval Landfill Levy: \$17 per metric ton Grants: up to \$50,000 for the development of recycling and reuse technologies and practice.
Northern Territory Government	Waste Management and Pollution Control Act	No particular actions or strategies for construction or demolition waste
Queensland State Government	Waste Management Strategy for Queensland	Develop material specification guidelines for the recycling of secondary aggregates
	Queensland Standard Building Law	Building Approvals: requires the use of any reused or recycled materials to be specified at the time of application
	Recycling Industry Incentive Scheme	Provide grants for industries use recycled and reuse materials or produces equipment for recycling process
South Australian State Government	Environment Protection Act	No specific requirements for the construction and demolition Landfill levy: \$4 per metric ton
Tasmanian State Government	Environmental Management and Pollution Control Act	Set up a target of 50% solid waste reduction before 2005
Victorian State Government	Market program	Develop market program for recycle and reused materials Landfill levy: \$3 per metric ton
Western Australian State Government	Waste Reduction and Recycling Policy	Develop guidelines to recycle concrete and masonry aggregate for use in new concrete construction
		Develop certified road base to Main Roads specifications from recycled demolition waste

Source: Waste Wise Construction Program, 1999

Overall, the recycling and reuse policies regarding construction and demolition materials are not popular in Australia, however, there are several useful strategies and programs have been developed to promote the recycling and reuse target of building materials. The most common measure is landfill levy, but levy fees in most states are generally set too low to encourage wide scope recycling. Grants for the promotion of new recycling and reuse materials and equipment are also well established in some member states. Besides landfill levy and grants, market programs, like Internet exchange database, to identify the resale outlets for recycled and reused materials are also proven to be successful to improve the recycling and reuse target in Australia.

3.5. Construction and Demolition Waste Reuse and Recycle in USA

Demolishing abandoned properties generate large amount of building material waste. According to the Pollution Prevention resources Exchange, there are around 245,000 residential and 44,000 commercial structures are demolished each year in the US. The US Environmental Protection Agency estimated 136 million tons of construction and demolition waste is generated and among those, construction related waste constitute $\frac{1}{4}$ of landfill waste. The recycle and reuse rate of the construction and demolition waste is approximately 40% while the target in some EU members is 70% (EPA, 2003).

The construction and demolition recycling and reuse industry in North America is usually recognized as underdeveloped compared with other construction related. There are several reasons contribute to the slow development in reuse and recycling sector.

- Landfill capacity and accessibility.

According to statistics from the Environmental Protection Agency, the number of landfills in the United States was 1,654 in 2005 which declined a lot from 7,924 in 1988, however, the average landfill size increased. On the other hand, the growing nationwide landfill supply also lead to the failing of disposal cost to keep pace with inflation (Association for Postal Commerce).

- Lack of legislation and policy which regulated C&D waste reduction and diversion;
- Lack the practice of design for deconstruction which can provide efficient and effective use of salvage materials
- Lack of recycling and reuse materials market and recovery or reprocessing facilities
- Lack of acceptance of used materials by owners, designers, contractors and regulatory agencies. (Nisbet, 2012)

A number of different examples of recycling policies are provided by a research conducted by University of Florida (Kimberly 2007). The Table 7 shows the US waste policy options for C&D waste management.

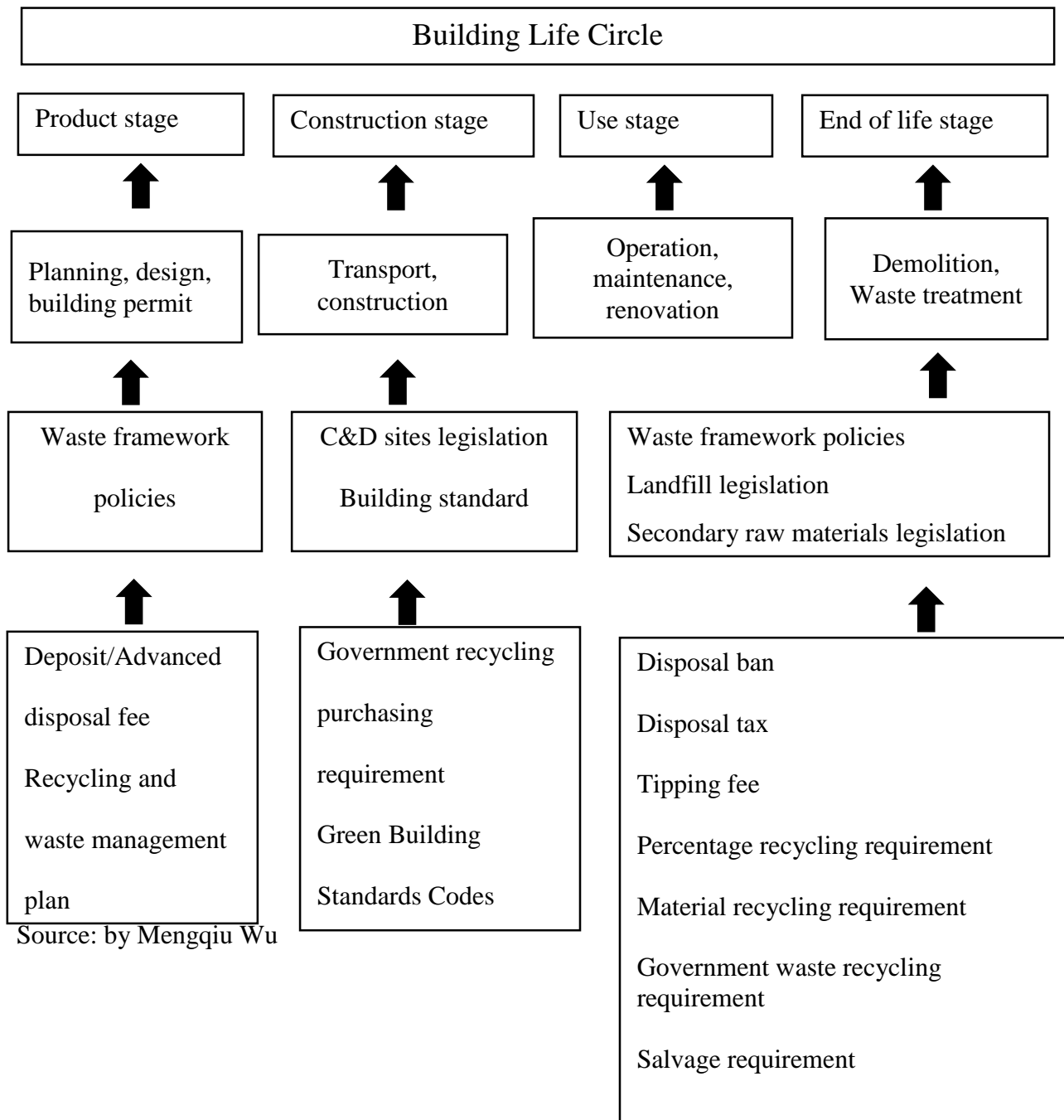
Table 7 A summary of policy options for promoting solid waste recycling

Name	Description
Disposal ban	A law or ordinance that forbids certain kinds of wastes disposed in a landfill directly.
Disposal tax	The cost of disposal C&D waste by the owners or operators of qualifying landfills or transfer stations.
Tipping fee	A gate fee (or tipping fee) is the charge levied upon a given quantity of waste received at a waste processing facility.
Percentage recycling requirement	A law or ordinance that set a recycling target for C&D waste
Material recycling requirement	A law or ordinance that requires certain kind and amount of C&D wastes to be recycled and reused
Deposit/Advanced disposal fee	A law or ordinance that requires the developers or contractors to pay for disposal fees corresponding with the amount of C&D predicted before waste generation (usually at the time that the building permit is approved). This fee can be refunded if proof is given that certain kind of materials are recycled.
Government waste recycling requirement	A law or ordinance that requires that all government agency construction activity that generates C&D waste must recycle or divert some portion of that waste from the landfill station.
Government recycling purchasing requirement	A law or ordinance that says government agencies to purchase materials that have some recycled potential.
Business development	Local government provide financial opportunity to business to encourage developing programs for C&D waste recycling and reuse
Education	Local governments develop educational programs to train the public and businesses how to recycle and reuse C&D materials after they demolished or deconstructed their buildings.
Green Building Standards Codes	Aims to improve public health and safety from various categories including material conservation and resource efficiency.
Salvage requirement	Demolition contractors are required to announce an impending demolition to allow anyone who wants to salvage materials during or after demolition process.
Recycling and waste management plan	A plan that describe how C&D waste would be recycled and reused before construction permit is granted

Source: University of Florida (Kimberly 2007)

These policy options can be categorized into different building life cycle assessment stages. The chart below shows policies corresponding with building life cycle. From Figure 7, most waste management policies are applied at the building end life stage.

Figure 7 Different Waste Management Policies by Building Stages



Source: by Mengqiu Wu

3.6 Construction and Demolition Waste Policies Examples in USA

Although there are a few actions the federal government has taken to set recycling and reuse rate targets for C&D waste, some states have adopted incentive programs to encourage C&D recycling and reuse.

3.6.1 Construction and Demolition Waste Management in California

In California, the state legislature passed a bill that requires the 75 percent recycling target for solid waste from residential and commercial by 2020, while the target was 50 percent in 1989 (Beyond Waste, 2012). To be more specific, California C&D waste loads that have not been sorted for recyclables must pay a 25 percent surcharge for the county to handle resorting in Sonoma County (Taylor, 2007). California legislature adopted the California Green Building Standards Code in 2010 which aims to improve public health and safety from various categories including material conservation and resource efficiency. According to the requirements from this standard, any new building built after the year 2011 is required to transfer at least 50 percent of construction waste into other use. Up to \$10,000 per day fines will be charged if the requirements couldn't be met. This has led to municipalities targeting C&D waste for recycling. Several different municipalities have adopted C&D waste regulations to improve recycling rates. In the City of Oakland, contractors are required to submit a recycling and waste management plan along with their building permit application. In this application, they must describe how C&D waste would be recycled and reuse. In some cases, a deposit in accord with the predicted amount of waste should be provided in the building permit application process, and this amount of money could go back only if contractors can provide certain documents after the project has been finished that appropriate amount and kind of waste was treated by a C&D waste recycling operation which obtain a valid license from the state legislature. (City of Oakland, 2011).

In the city of San Jose, contractors have the option to bring recycled waste to one of more than 20 city-certified facilities that are expected to meet pre-determined recycling rates (City of San Jose, 2011). In the city of Irvine, the city council has passed an ordinance, which requires contractors of larger building projects (more than one residential unit; nonresidential structures measuring 5,000 square feet or more and nonresidential properties that are 10,000 square feet or more) to provide recycling plans introduce how C&D waste would be treated before the building permit approval. Besides that, building companies are commanded to tender a material diversion deposit at the beginning of the project, and the amount of deposit will be refunded at the completion of the project. Specifically, At least 75 percent of concrete and asphalt and 50 percent of other construction and demolition waste must be diverted to recovery facilities for a company to get its deposit back (City of Irvine, 2011).

3.6.2 Construction and Demolition Waste Management in Other States

In 2005, Florida issued the most residential construction building permits of all states in the US. Texas, California, Georgia, and North Carolina followed as top five residential building permit states (Cochran, 2007). Along with the growing population and construction, the C&D waste have increased over the past 15 years, there are a few states have regulations to encourage C&D waste recycling or systematic data of the amount recycled in each state.

In Massachusetts, the Commonwealth set a recycling target at 88 percent statewide by 2010. In 2006, the Department of Environmental Protection adopted a landfill ban that prohibit certain types of C&D waste including asphalt pavement, brick, concrete, wood and metals go to any transfer station or disposal facility in the state from accepting these materials for disposal. These items are no longer collected as trash and must be recycled by contracting a private hauler. The aim is to increase recycling and other diversions of C&D materials to help support development

of instate processing businesses and preserves valuable, limited disposal capacity in the Commonwealth. (Taylor, 2007).

The regional government for the Portland, Oregon passed construction and demolition recycling legislation in 2009. The policy is a part of the whole plan, which aims to increase the recycling targets in Oregon to 64 percent by the end of year of 2009. According to this policy, unsorted and recyclable waste are forbidden dumped into landfill, and no more than 15 percent recyclable materials should be in the remaining materials. It is estimated that approximately 33,000 tons of C&D waste will be diverted from landfills in Portland, Oregon because of the effect of this policy (Taylor, 2007).

Recycling policies usually included recycling targets, recycling requirements, recycling grants and disposal bans. As shown in the previous section, the state with the most local government activity with respect to C&D waste recycling initiative is California. Local government interest can also contribute to recycling and reuse policies.

3.7 Summary

It is likely that C&D debris recycling will continue to grow in some areas of the state as development continues and government initiatives could result in an increase in C&D debris recycling rates in the future.

Chapter 4. Overview Current Deconstruction Status

4.1 Introduction

This Section describes how deconstruction can work to offset the environmental impact of the building related C&D industry, focusing on salvaged material perceptions, the role of demolition, and key considerations when planning a deconstruction project.

4.2 Definition of Deconstruction

Deconstruction is a “new term to describe a process of the selective dismantling or removal of materials from buildings before or instead of some elements of traditional demolition” (U.S. Dep’t of House & Urban Dev.). It is the disassembly of a building and the recovery of its materials, often thought of as construction in reverse. Usually, in a deconstruction project, a group of trained workers disassembles building components by hands or special equipment and salvages useful materials from the site. Taking apart buildings for reuses and recycle purposes is different from traditional demolition process, which knocking down buildings with large and heavy equipment and dumping all debris into a landfill. Deconstruction salvages valuable building materials, reduces the amount of waste they divert to landfills, and alleviates other environmental impacts (Deconstruction Guide).

The primary purpose of deconstruction is to make the maximum use of salvaged materials and divert the construction and demolition materials from landfill while the traditional demolition is focusing on labor and time consuming. Some case studies have shown that deconstruction can divert ninety percent of waste (by weight) away from a landfill that would ordinarily result from traditional demolition (Villwock, 2008).

4.3 Environmental and Social Benefits of Deconstruction

Deconstruction is becoming a more sustainable way than the substitute traditional demolition method. Brad Guy, the president of the Building Materials Reuse Association pointed out that there are currently more than 250 deconstruction programs going on across the United States (US EPA Lifecycle Construction Resource Guide). The social, economic and environmental benefits have been identified from those programs.

- Reduction of Waste and landfills

Using the deconstruction method can help to reduce the amount of waste from landfill in the way of converting wastes into useful materials. Studies have shown that deconstruction can reduce construction site waste by 50 to 70 percent (Lifecycle Construction Resource Guide). The disposal costs for developers would be reduced because the related construction and demolition waste are recycled and reused. In addition to the decreased cost, the lifespan of local landfills will also be extended as fewer wastes are dumped in landfills.

- Conservation of natural resource and Emission Reduction

Deconstruction helps to preserve and extend the lifespan of natural resources. Since the need for producing new materials are reduced, this helps to save more natural resources and reduce negative environmental impacts such as greenhouse gas emission.

Using materials salvaged from deconstruction projects also reduces the demand to ship materials and manufactured long distances from their ultimate use. This helps support the local economy as well as further reduce air emissions. Deconstructing a building also provides the opportunity to recycle any of the material that cannot be reused. Although the recycling process uses some energy and raw materials, and emits pollution, it is still a more sustainable option than disposing

of materials.

- Economic Benefits

Deconstruction is a new sector, which could create job opportunities and training programs to encourage economic development. Besides that, lower building material cost and salvaged materials revenue are also economic benefits created during deconstruction process. Disposal costs and some strict disposal regulations of C&D waste could be avoided as well. In some U.S. states, if property owners donate salvaged materials to non-profit organizations, they can have tax deductions including the value of the building materials. Local citizens may repurchase reusable building materials at often less than half of their retail value (Mark, 2005).

- Community Support and Revitalization

Deconstruction projects can provide educational examples in local communities to convey the sustainable development concept for residents as well as construction industries. Deconstruction can help to support community revitalization in the way of providing lower price of building materials salvaged from deconstruction procedure. In addition, using recycled historical building materials preserves culture traditions and enables next generations understand traditional culture. In addition Cities have also incorporated deconstruction into their community revitalization plan to help renovate, remove, or remodel buildings.

Overall, Deconstruction has several social and environmental benefits. Deconstruction leads to a reduction in waste generation and a conservation of local landfill space, because building materials are reused rather than discarded. Equally important, as deconstruction is a labor-intensive process, a deconstruction project often employ scores of workers, such as workers to disassemble structures, recover materials, sort, salvage, and haul; these jobs provide direct, living

wage employment and worker job training, especially in the area of construction trades (Deconstruction Guide). Also, deconstruction can reduce local energy consumption as it minimizes the need to produce new materials, in turn saving more natural resources and reducing production impacts such as greenhouse gas emission. There is less destructive site impact at deconstruction projects due to the less use of heavy equipment. Deconstruction provides second hand building materials, which can be used to building construction and repair existing houses. This is a good effect public housing authorities can benefit from as the materials can use to repair public housing (Deconstruction Guide).

4.4. Key considerations of Deconstruction

Deconstruction has the potential to improve the C&D industry sustainability. Recognizing the social, economic and environmental benefits deconstruction brings to the communities, it is reasonable to point out some barriers to the widespread use of deconstruction technique. Higher labor costs and longer time are primarily consideration of deconstruction activities, along with the underdeveloped end use market in North America.

- Labor and Timing

Deconstruction requires a longer time than traditional demolition process, as materials may need to be handled carefully so they are suitable for reuse or resale. There are many factors influence deconstruction time: building type, age, materials used and site access. For example, salvage materials recycled in the deconstruction requires be removing and separating before they are delivered to repurposing facilities. The demolition process does not requires materials all to be handled as carefully as they would need to be in deconstruction. As a result, deconstruction takes longer time than straight demolition (House deconstruction Information booklet, 2010).

It is estimated that it would take a crew of 5 workers to deconstruct an average 1,500 square feet

wood-structure house in 8 to 10 days, while it would take a crew 2 to 3 workers to demolish the same size building in only two days (Jacoby, R. 2001). Even when the increased time for deconstruction is not a concern, the additional labor costs must be considered.

It is important to point out that hiring the experienced construction professionals to take the responsibility of deconstruction projects is necessary. This requires the workers not only have experiences with deconstruction and demolition projects before, but have the knowledge about salvaged materials.

- Safety

Environmental safety and worker safety are key safety consideration in deconstruction process. In some historical buildings, hazardous materials particularly lead-based paint and asbestos containing materials can be easily found and need to be handle carefully and safely.

- Accessibility to Local Materials Reuse Market

Local materials reuse market in North America consists of independently retail stores that collect materials and resell them to the construction industry and to private individuals. Project managers should analyze the materials reuse markets in their areas earlier, and identify which resale outlets are available for recovered materials (NAHB Research Center. 1997).

- Transportation Cost

If salvaged materials are not resold or redistributed directly from the site, or if they are not immediately reused in new construction at the site, there can be added cost for transportation of materials or storage of materials until an adequate avenue for their use is found.

To summarize, first deconstruction takes a building apart piece by piece it takes more time than

traditional demolition that makes deconstruction less desirable for developers who may be under time-sensitive conditions. Second, deconstruction is labor intensive, so labor costs are greater while you can just use machines to do it in demolition. Also workers need to be trained in deconstruction before a project begins. There are also strict safety regulations developers; constructors and workers need to follow in a deconstruction project.

4.5 Deconstruction & Demolition Cost

The Wesley House/Reichert House case study is a deconstruction practice under the U.S. EPA Office of Solid Waste and Emergency Response (OSWER) Innovations Pilot Initiatives. The Wesley House was located in Gainesville, FL, and this project began in 2003. The recycled materials deconstructed from the house were incorporated in the new construction of the Reichert House, a social service agency under the auspices of the Black-on-Black Crime Task Force (Guy, B., and T. Williams. 2003).

This project began with the deconstruction of The Wesley House, a 1,933 square feet single-family residence built in 1930. The house had outlived its usefulness, and its abandoned state threatened to attract negative elements to the community.

A comparison of the costs for deconstructing the Wesley House versus demolition showed that deconstruction could be more cost effective.

Table 8 Cost of Demolition versus Deconstruction

	Demolition	Deconstruction (without LBP materials)
Demolition Permit	\$50	\$50
Environmental	\$0	\$1,500
Labor	\$1,625	\$3,800
Disposal	\$1,500	\$980
Salvage	\$0	-\$3,300
Net Cost	\$3,175	\$3,030
Cost per Ft²	\$2.54	\$2.42

Source: Guy, B., and T. Williams. 2003

In this case deconstruction was five percent less expensive than demolition would have been, primarily due to the resale of salvaged materials. This result does not include the cost savings to the new construction project using salvaged materials in lieu of new material (Guy, B., and T. Williams).

4.6 Financial support for deconstruction

Recognizing the benefits of deconstruction, policy leadership from government agencies and non-profit sectors is needed to pass policies to encourage contractors to consider deconstruction as a preferred way to deal with abandoned structures.

Several federal government agencies have provided limited financial and technical assistance to support deconstruction pilot projects throughout the nation. The U.S EPA provided grant funding to the National Association of Home Builders Research Center to accomplish the deconstruction of a 2,000 square-foot, 4 units residential building in the Riverdale Housing Project in Baltimore, Maryland in 1997 (US EPA Deconstruction). The Department of Housing and Urban Development HOPE VI “Revitalization Grant” awarded \$136 million to six housing authorities for rehabilitation of severely distressed houses in the year 2009 (HUD 2009).

Several local government agencies also have established citywide policies to encourage deconstruction, ranging from mandated regulations to voluntary incentives. In the City of Oakland, contractors are required to submit a recycling and waste management plan along with their building permit application. In this application, they must describe how construction and demolition waste would be recycled and reuse (City of Oakland, 2011). The Hartford Housing Authority is the first housing authority in the U.S to require a deconstruction training program support the deconstruction business and the Hartford Community Deconstruction Service Company was granted \$17 million by the Hartford government for deconstruction of abandoned homes in 1998 (Hartford Housing Authority).

Chapter 5 Methodology

The primary purpose of this research is to compile and summarize literature for the purpose of understanding current efforts regarding structural abandonment situation and examining the feasibility of adopting the building deconstruction policy on abandoned structures.

The following is a summary of methodology used for achieving each objective:

1. Understand the post abandonment approached and evaluate the outcome of those approaches;

- Literature reviews

Research papers, academic thesis, case studies and various journals and magazines were reviewed in this part.

- Site visit

A limited number of site visits were conducted in this part. Through visiting abandoned buildings in Michigan helps to understand the situation of abandonment in real world.

2. Understand two different methods of dismantling buildings: demolition and deconstruction

- Literature review

Research papers, academic thesis, case studies and various journals and magazines were reviewed in this part. The aim is to analyze the benefits and drawbacks of each method

- Site Visit

A site visit to Architectural Salvage Warehouse of Detroit conducted in October, 2014, helped understanding current situation of the salvage materials and how they would be treated after recycled.

3. Examine the feasibility of applying the building deconstruction policy on abandoned structures and discuss the strategies to encourage deconstruction

- Self-analysis

Based on the two purposes of the research above, the feasibility study of deconstruction policy was developed to analyze benefits and challenges of this policy. Examples of other states that have similar policy instruments were illustrated in this part.

- Survey

Conducting a survey of current economic climate of demolition and deconstruction industries and email the survey to demolition and deconstruction companies in Michigan including Bierlein Co Inc, Adamo Group, H&M Demolition Co, Omega Demolition Corporation etc.

- Attending Innovative Governance for Large Urban System (IGLUS) event

The event was held on April 20th, 2015 at Michigan State University. In order to collect information of successful European C&D waste management examples, a survey was conducted for researchers and professionals from IGLUS (a long-term research and education project in Switzerland). The survey results will help to understand the opinions of professionals from other countries regarding recycling and deconstruction policy.

- Forum

Attending 2015 Deconstruction Facility Strategic Planning Session on March 11th at Muskegon County, Michigan, will provide insight into the deconstruction process and recycling of valuable C&D salvage materials.

The survey instrument design for this investigation involved three different sectors: demolition companies, Land Bank and IGLUS. Two kinds of written surveys were emailed to the executive directors of demolition companies (Bierlerin Co Inc, Asamo Group, Omega Demolition Corporation and Michigan Demolition & Excavation LLC) and land banks (Ingham County Land Bank, Muskegon County Land Bank, Genesee County Land Bank and Detroit Land Bank Authority). All the demolition companies and Land Banks are based on the state of Michigan. After the preliminary analysis of the written survey with a local demolition company was completed, emailed surveys and telephone interviews were conducted among the companies and organizations mentioned above. The IGLUS survey was conducted at the April 20th event.

The written survey for demolition companies is designed in order to collect information about current economic climate of demolition and deconstruction industries (See Appendix I). There are three sections in this survey. First section is designed to help to understand the general trend in this sector. Questions included top 3 issues confronting the industry, the development trend of the industry in the past and the next 10 years. Second section is based on the construction and demolition waste policies mentioned in chapter 3 (See appendix A). The interviewees were requested to evaluate and comment on each demolition and construction waste management policy. Section three aims to examine the feasibility of applying deconstruction policy from the public and private perspectives. Questions including their attitude towards deconstruction policy for private property owners and the barriers of such deconstruction policy.

The questionnaires for Land Banks (See Appendix B) and IGLUS (See Appendix C) are similar to the survey sent to demolition companies, the only difference is in section one. In Land Bank questionnaire, the most common strategy to deal with abandoned structures was asked in order to have general understanding of current procedure of handling post-abandoned structures. In

IGLUS questionnaire, interviewees are requested to give some successful construction and demolition waste management examples in their countries since they come from different countries including Mexico, Venezuela, Brazil, Turkey, Colombia, Greece and UAE.

Two surveys were returned from emails of Land Bank authorities, telephoning a demolition company completed one survey and eight surveys were completed at the IGLUS event. A summary of the survey findings is discussed in the next chapter.

Chapter 6 Findings

These findings should be interpreted with caution. The participation is voluntary and the results of the survey only represent opinions of respondents, not the companies or organizations. The surveys were sent to chief administrative officer of each Land Bank and demolition companies, who then referred it to a treasurer, assistant manager, cost estimator, or similar key personals. The professionals from IGLUS completed the written survey at the event.

6.1 Land Bank Survey

Vacant and abandoned property is considered as a significant problem in the nation's largest central cities. Usually, Land banks are intended to acquire abandoned properties and transfer the properties to new, responsible owners who have the ability to manage the property. Land banks can help to convert low value properties into assets for community revitalization.

Ingham County Land Bank and Muskegon County Land Bank returned the two responses. Both of the directors considered Land Bank as a growing organization during the past 10 years, and it is expected to continue growing in the next 10 years as the private property abandonment problems become severer throughout the nation.

There are several challenges Land Bank are confronting right now. For Ingham County Land Bank, the top 3 issues are the sustainable funding source or revenue source, a solid relationship with developers regarding vacant commercial properties and increasing number of abandoned properties in the neighborhood area. For Muskegon County Land Bank, main challenges including maintaining property that were deeded from the Hardest Hit Grant and transitioning properties to more rehabilitation rather than land contract sales. Seeking funding opportunities

and maintaining post-abandoned structures become the major concerns of Land Banks. Funding will be used to demolish abandoned buildings if rehabilitation is not feasible.

6.2 Demolition Company Survey

According to the local demolition company, the demolition industry was a growing sectors over the past ten years and seems to continue growing in the next 10 years. The demolition industry has made great progress in methodology, safety and environment over the last decades. This is not only because of the improvement of academic and practical achievements, but also the challenges the industry confront. Demolition contractors has to deal health, safety and environment issues every day including the removal and disposal of different types of hazardous materials and the reduction and clearance of buildings ranging from single-detached families to mix-used structures. In addition, there are various kinds of environment regulations for segregation, processing, disposal and recycling of demolition wastes.

The demolition industry continues to struggle to maximize the recycling rate and demolition waste and reuse market has diminished year by year. This malady was attributed to poor quality building materials currently being removed during demolition in which many are manmade composites with no current resale or re-use value, and are invariably costly to dispose of.

6.3 IGLUS survey

The MSU Land Policy Institute (LPI) hosted a two-week Executive Master's course on Innovative Governance in Large Urban Systems (IGLUS) in Detroit, East Lansing and Chicago, IL, Apr. 13-24, 2015. Participants of this program include city managers, managers of urban infrastructures (e.g., public transport, energy, water and wastewater, waste management, parks and greens, emergency systems, airports and ports, public works, social housing, etc.), urban planners and other interested people (e.g., consultants).

Several faculty members from Michigan State University, as well as practitioners from Michigan's large urban areas, will be participating in this program, leading presentations and dialoguing with the students. Dr. Rex LaMore from Michigan State University Center for Community and Economic Development gave a presentation on private property abandonment in front of IGLUS participant. They were suggested to complete this survey after the presentation in order to help the author gathering their attitudes towards C&D waste management policy.

When asking successful examples of construction and demolition waste management in their counties, one researcher from Turkey gave a story of the recycling and reuse of C&D waste. In Turkey, debris are used for new construction projects. There is an airport construction project going on in Istanbul. As the construction site is not a flat area, most of the demolition waste in the city was used to fill and level up the site.

6.4 Construction and Demolition Waste Policy Response

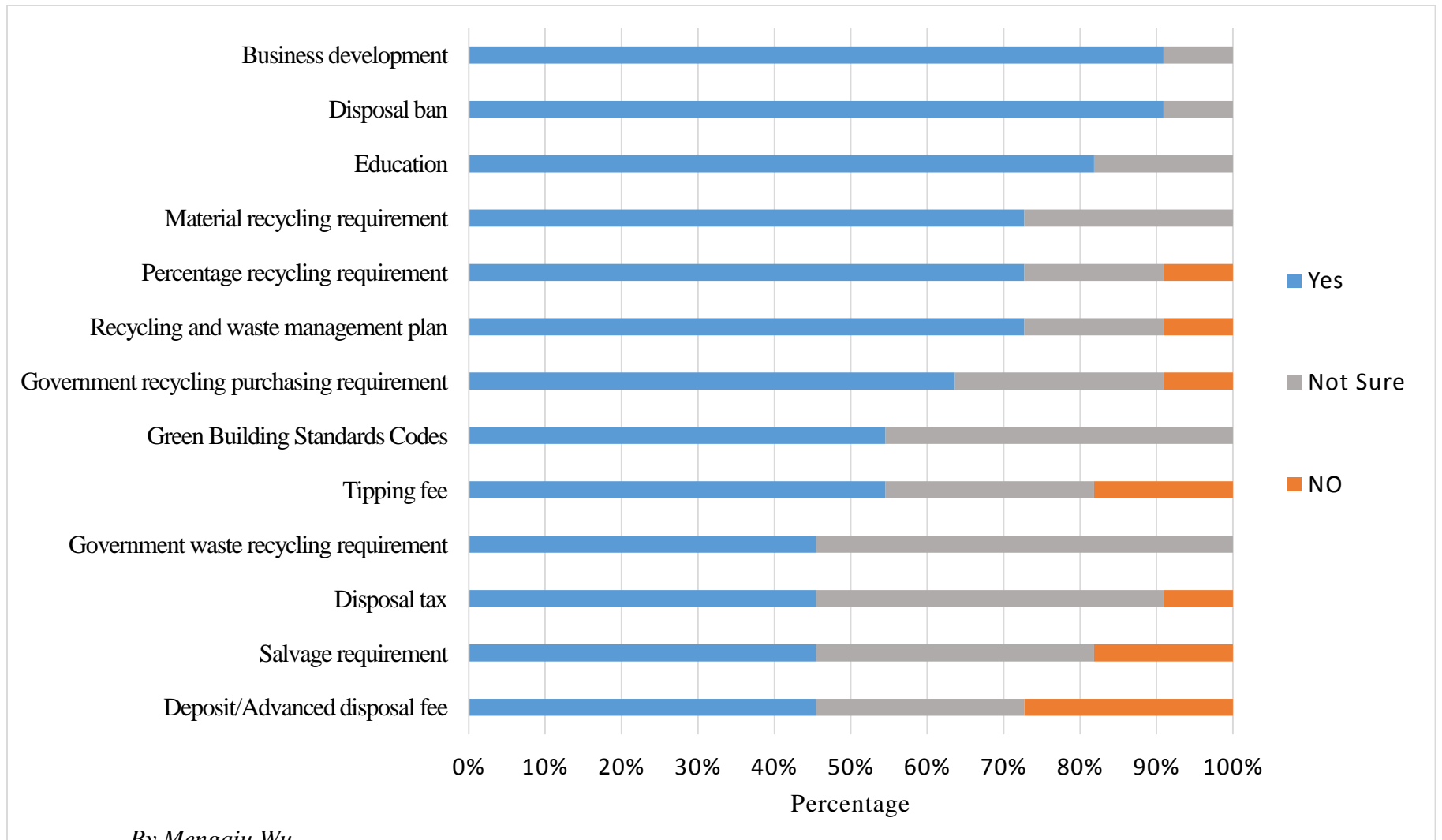
There are 13 kinds of policies regarding C&D waste management summarized in chapter 3 from three categories: direct regulation, market incentives and education program. In the surveys, interviewees are required to evaluate whether each policy is useful to the promotion of recycling rate with their comments. The Figure 8 shows their opinions towards different policies.

As we can see, the disposal ban, business development programs and education programs seem to be the most welcome strategies to encourage recycling C&D wastes with more than 90% of the participants' support this method. Strict regulations rely on government that regulates certain kinds and amount of C&D wastes to be recycled or disposed in landfill. Material recycling requirement, recycling and waste management plan, percentage recycling requirement are also considered as useful by more than 70% the interviewees. Around half of 11 responses recognized green building standard codes and government waste recycling requirement could contribute to

promote higher recycling rate. People held positive attitude towards some direct regulations, but had ambiguous opinions toward tipping fee and disposal tax. Nearly 20% of participants did not recognize tax and fee would have positive impacts on higher C&D waste recycling rate. The deposit and advanced disposal fee ordinance is less popular which requires the developers or contractors to pay disposal fees corresponding with the amount of C&D waste predicted before waste generation. The increasing demolition costs may be one of the concern of such policy. Nearly 30% of interviewees considered such policy was not useful.

From comments interviewees made along with each policy, one of the most important consideration was whether such policy would increase the cost of managing C&D waste and demolition. Other concerns included the funding sources for business development and education programs, and the feasibility of implementing such policy, such recycling and waste management plan and government recycling purchasing requirement, etc.

Figure 8 Poll of Construction and Demolition Waste Management Policy

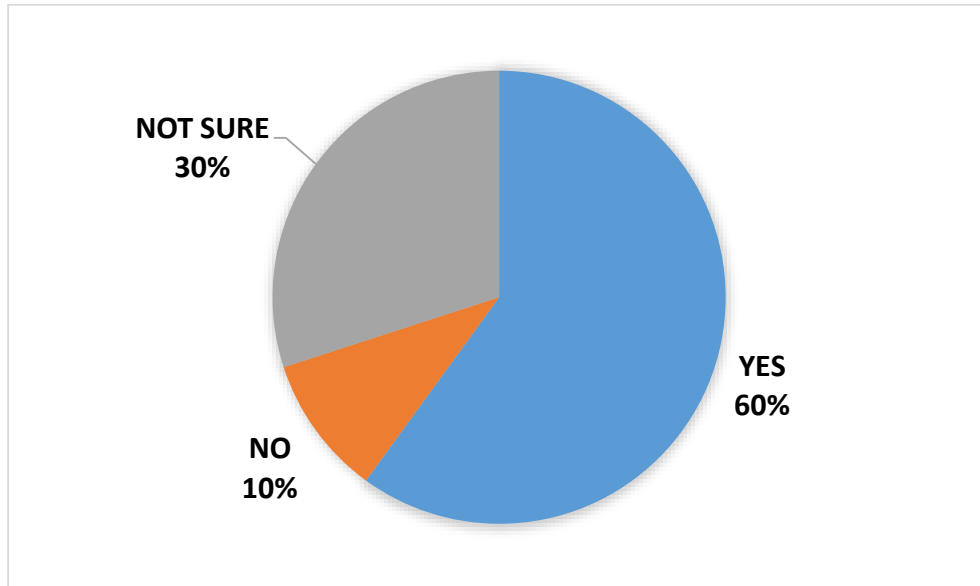


6.5 Deconstruction Policy

As introduced in chapter 4, different from traditional demolition method, the deconstruction is a more sustainable way as valuable materials would be recycled and reused after buildings are deconstructed. The study put forward the building deconstruction policy as a new tool to address abandonment issues and encourage property owners to use deconstruction method as a preferred way to dismantle and remove abandoned structures.

In order to examine the feasibility of such policy, section three of the survey was created to gather their attitudes toward the deconstruction policy. When asking them whether they would support a policy that would require deconstruction at the end of the useful lifetime of a structure, the majority (60%) of all participants reported they would support such policy as a tool to address private property abandonment issue. Only 10% (one person) affirmative indicated he/she would not support such policy (see Figure 9).

Figure 9 Poll of Construction and Demolition Waste Policy



Source: By Mengqiu Wu

When considering the barriers of the deconstruction policy, the key consideration is the enforcement of such a policy. If the policy lacks support, property owners could walk away from structures and give it up for taxes, which may encourage property abandonment in the future. Another challenge for this policy is that the existing property in disrepair would be difficult to deconstruct, while more modern properties would be easier to manage. This may also force the use of more easily deconstructed materials in the future buildings.

6.6 Summary

Although several federal government agencies have demonstrated financial and technical assistance to support deconstruction pilot projects throughout the nation, deconstruction policy is still an innovative idea that needs to be examined before applying on abandoned structures.

Chapter 7 Recommendation

The recommendations are based on the literature review and survey results mentioned in previous chapters. First recommendation is regarding to the waste policy options for construction and demolition materials and the second recommendation aims to encourage deconstruction as a preferred way to deal with structural abandonment.

7.1 Waste Policy Options for construction and demolition

A literature review was conducted to examine different types of policies used to encourage the reuse and recycling of C&D waste. According the summary, there are a few federal regulations to improve the statues of C&D waste. In general, Policies that have the potential to promote waste management could fall into three categories: 1. Direct regulation, 2. Market incentives and 3. Education (Barron and Ng, 1996).

1. Direct regulation

Direct regulations including disposal bans, recycling targets, recycling material requirements, green building requirements and salvage requirement, etc. For example, disposal ban is a law or ordinance that forbids certain kinds of wastes disposed in a landfill directly. This is partly due to the landfill capacity and accessibility particularly in high-density population areas. Also in order to encourage recycling, tipping fee is choice, which can increase revenues for the county or the state as well. Most policies described above go into this categories.

2. Market Incentives

Compared with direct mandatory regulation, market tools have more economical benefits and seem more appealing for promotion of waste management. Market incentives including disposal tax, advanced disposal fees or deposits, subsidized recycling and

business development, etc. Market incentives contribute to the C&D waste recycling and reuse in an appropriate way that benefit developers as well.

3. Education

Many local governments in US states have educational programs to train the public and businesses how to recycle and reuse C&D materials after they demolished or deconstructed their buildings. Several recycling guides that introduce how to recycle at the construction site for business have been developed by state legislations and non-profit organizations. For example, US Environmental Protection Agency released a guideline “Recover Your Resource - Reduce, Reuse, and Recycle Construction and Demolition Materials at Land Revitalization Projects” to teach community basic information about C&D waste, give success stories across the nation and show how new technology such as deconstruction can be employed (EPA-560-F-09-523).

7.2 Incentive programs for deconstruction

In order to encourage contractors and owners of private properties to choose deconstruction as a more preferred way to deal with abandoned structures, certain incentives should be granted to promote deconstruction strategy.

7.2.1 Private property deposit

Private property deposit is the first and most crucial aspect in a framework choosing deconstruction as a method to deal abandoned structures (Bell, 2011). Local and state governments should establish a mandatory deposit program that requires the property owner to carry on a monetary deposit to ensure the deconstruction cost at the end of the structure’s life. This method needs rely on strict ordinances. The purpose of the deposit program is to shift the cost of dealing with abandoned structures away from local government and taxpayers to the

building owners. There is a need to set up a collection infrastructure that is empowered to take deposits from the user or owner of that building. The deposits could be forfeited or refund if certain requirements would be fulfilled. For example, if certain amounts or kinds of building materials were recycled in the deconstruction process, the owner or user could have the some deposits back. However, if owners abandon their properties in the future, the deposits are also abandoned. On other words, who holds the deposits will have the opportunity to negotiate the property transfers, and the buyer can have certain credits for the deposit.

At the end of the building's lifetime, a deposit refund system could be active to ensure the deconstruction of local private properties that property owner may choose demolition rather than deconstruction. Using private property deposit can cover the cost of deconstruction.

7.2.2 Building Material Tax Credit

In conjunction with private property deposit programs, the state or federal government should authorize a state tax credit for the fair market value of donated building materials (Bell, 2011). When used with the refund of a deposit, the state tax credit supplements the value of local deposit programs and helps make deconstruction the preferred way of dealing with abandoned structures rather than demolition.

If the state provides a tax credit for the value of recycled construction or demolition materials, the contractors would choose a more efficient and effective way to disassemble a structure and maximize reusable materials as tax incentives would be granted. In essence, the property owners can have certain amount of cash back corresponding with the amount of salvageable building materials through donating them to charitable organizations. Since more efficient deconstruction process will provide greater tax credit to customers, the contractors may search for new technics

to drive down the deconstruction cost. Thus, more successful bids against competitors will take place.

The proposed building material tax credit encourages deconstruction in the way of providing incentives to donators. In essence, a tax credit corresponding with salvageable materials that are donated to a non-profit organization enables the property owners to sell the recycled materials to the local government. In return, the local government buys them in the form of tax credits.

By allowing taxpayers to reduce tax liability through donation of building materials recycled by deconstruction, the local government helps coordinate the policy of repositioning blight into opportunity.

7.2.3 Local Policy Support

In order to support the private property deposit and building material tax credit, there is a need to create a third level of legal system to ensure the deposit/credit system run effectively and efficiently.

There are a few other measures at the local level to support policy incentives for boosting deconstruction. For example, in the City of Indianapolis, the local government proposed approximately \$700,000 for demolishing abandoned structures, and mentioned, “The City is researching environmentally friendly deconstruction. If employed, this strategy will encourage green deconstruction on all future demolition projects.” (Bell, 2011). This would be a good start for deconstruction of government owned houses that are scheduled for demolition in the land bank. This may also increase the demand for deconstruction services. Land banks should compare the cost of deconstruction and rehabilitation of abandoned buildings altogether and

choose a more economic and environmentally friendly way to minimize the negative impacts in the neighborhood.

Chapter 8 Study Limitations

- Sample size

The number of the interviewees in this study is only 11, which is too small. It was difficult to find significant relationships from the waste management policy data. In addition, most participants in the survey were from IGLUS group which consists of government officials and professionals from European and South America countries. Their point of views represented the policy instruments in their countries. More reliable data from U.S government officials are expected to be collected in the next step.

- Measure used to collect the data

More than 30 emails were sent out to demolition companies and Land Banks, and only 3 responses were gathered from them. In order to collect more reliable data, phone interviews and site visits are necessary.

- Lack of prior research studies on the topic

Deconstruction is a new idea of dealing with abandoned structures. Citing prior research studies formed the basis of the literature and helped lay a foundation for the understanding the research problem that were investigated. Depending on the current situation of deconstruction, there is a little resource, especially in the policy aspect. The limited policy examples were explained in the previous section and more comprehensive policy cases are expected to study in the next step.

Chapter 9 Future Research and Conclusion

There are several research questions to be further investigated for encouraging deconstruction policy as a preferred method to deal with structural abandonment.

- What other kinds of policies and programs can eliminate private property abandonment?
- What national, state and local policies and ordinances can encourage deconstruction?
- What factors may determine a city's or a state's competitive advantages to engage widespread deconstruction?
- What are the current reuse and recycling market for construction and deconstruction salvage materials in the U.S?

Solutions to the immense problem of abandoned housing accumulation in American cities are elusive. Absent creative solutions, a large burden continues to be exacted on society in the form of economic, social and environmental costs.

Building deconstruction addresses abandoned housing problems from a different direction than current efforts. Not only will laws encouraging deconstruction seek to eliminate abandonment before it exists, but the practice itself gains economic and social benefits while seeking to cure the present problem. But deconstruction poses unique challenges as compared to traditional demolition of abandoned structures. Yet, these challenges are not insurmountable. Economic incentives provided by a building material tax credit, property deposit, and supportive ordinances help boost deconstruction beyond mere competitiveness against traditional demolition.

Moreover, because of the hidden social costs to the public from abandoned structures, perhaps deconstruction and laws supporting it should not be considered on economic terms alone. An abandoned property imposes measurable costs on the entire taxpaying public and sacrifices estimable levels of revenue, but its costs to society in blighted neighborhoods and dying cities cannot likely be measured.

For all of these reasons, a system of laws that use building deconstruction to help fight the war against abandoned houses should be supported.

APPENDIX

Appendix A

Deconstruction Industry Questionnaire

Dear Company Owner or Manager,

I am a graduate student from Michigan State University Urban and Regional Planning program, and I am doing my master research on eliminating private property abandonment in Michigan.

The purpose of this survey is to collect information about the current economic climate of deconstruction. Deconstruction is a process of the selective dismantling or removal of materials from building in order to make the maximum use of salvage materials. Your responses will help in understanding the general trend in the deconstruction industry and the feasibility of applying deconstruction policy, which can eliminate the private property abandonment. Your participation is voluntary. If you have any questions or comments, please feel free to contact me. I greatly appreciate your time and participation in this survey. The survey will take approximately 20 minutes. Thank you for your assistance!

Mengqiu Wu

Graduate Student

School of Planning, Design and Construction

Michigan State University

SECTION 1. Overview of Deconstruction

(These questions are designed to help us understand the general trend in the industry.)

1) What are the top 3 issues confronting the demolition/deconstruction industry right now?

1. _____

2. _____

3. _____

2) What has been the trend over the past ten years in the deconstruction industry? Please circle one.

Has declined Has stayed the same Has Grown Don't Know

3) Based on your experience, what do you believe the deconstruction trend will be in the next 10 years? Please circle one

Decline Stay the same Growing Don't Know

SECTION 2. Recycling and Reuse Policy

(The following questions are based on the construction and demolition waste policy that have been identified to promote the recycling rates)

- 4) Please circle one of your opinion about the policies options for promoting construction and demolition waste recycling with your comments.

Name	Description	Useful for the promotion of recycling rate	Comments
Disposal ban	A law or ordinance that forbids certain kinds of wastes disposed in a landfill directly.	YES NO NOT SURE	
Disposal tax	The cost of disposal C&D waste by the owners or operators of qualifying landfills or transfer stations.	YES NO NOT SURE	
Tipping fee	A gate fee (or tipping fee) is the charge levied upon a given quantity of waste received at a waste processing facility.	YES NO NOT SURE	
Percentage recycling requirement	A law or ordinance that set a recycling target for C&D waste	YES NO NOT SURE	
Material recycling requirement	A law or ordinance that requires certain kind and amount of C&D wastes to be recycled and reused	YES NO NOT SURE	
Deposit/Advanced disposal fee	A law or ordinance that requires the developers or contractors to pay for disposal fees corresponding with the amount of C&D predicted before waste generation (usually at the time that the building permit is approved). This fee can be refunded if proof is given that certain kind of materials are recycled.	YES NO NOT SURE	

Government waste recycling requirement	A law or ordinance that requires that all government agency construction activity that generates C&D waste must recycle or divert some portion of that waste from the landfill station.	YES NO NOT SURE	
Government recycling purchasing requirement	A law or ordinance that says government agencies to purchase materials that have some recycled potential.	YES NO NOT SURE	
Business development	Local government provide financial opportunity to business to encourage developing programs for C&D waste recycling and reuse	YES NO NOT SURE	
Education	Local governments develop educational programs to train the public and businesses how to recycle and reuse C&D materials after they demolished or deconstructed their buildings.	YES NO NOT SURE	
Green Building Standards Codes	Aims to improve public health and safety from various categories including material conservation and resource efficiency.	YES NO NOT SURE	
Salvage requirement	Demolition contractors are required to announce an impending demolition to allow anyone who wants to salvage materials during or after demolition process.	YES NO NOT SURE	
Recycling and waste management plan	A plan that describe how C&D waste would be recycled and reused before construction permit is granted	YES NO NOT SURE	

SECTION 3. Deconstruction policy

(I examined a possible approach to eliminate the private property abandonment -- the deconstruction policy, which requires property owner to deconstruct the property at the structure's useful lifetime. In this section, your attitude towards this policy will help me examine the feasibility of such deconstruction policy.)

5) Would you support a policy that would require deconstruction policies for private property owners to ensure deconstruction at the end of the useful lifetime of a structure? Please circle one.

Yes

Not sure

No

6) What do you think would be the barriers of such deconstruction policy? (Rank in order. 1 being the most significant part.)

1. _____

2. _____

3. _____

7) Is there anything you would like to tell me about the challenge and opportunity regarding building deconstruction policy?

Thank you for your assistance! We greatly appreciate your time and participation in this survey! If you have any questions or comments, please feel free to contact me at:

Wumengq2@msu.edu or 517-775-4807

Appendix B

Land Bank Questionnaire

Dear Land Bank Director,

I am a graduate student from Michigan State University Urban and Regional Planning program, and I am doing my master research on eliminating private property abandonment in Michigan. The purpose of this survey is to collect information about the current policy regarding private property abandonment. Your responses will help in understanding the policies options for promoting construction and demolition waste recycling and the feasibility of applying deconstruction policy which can eliminate the private property abandonment. Your participation is voluntary. If you have any questions or comments, please feel free to contact me. I greatly appreciate your time and participation in this survey. The survey will take approximately 20 minutes. Thank you for your assistance!

Mengqiu Wu

Graduate Student

School of Planning, Design and Construction

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SECTION 1. Overview of Land Bank

(These questions are designed to help to understand the general trend in Land Bank.)

1) What are the top 3 issues confronting the Land Bank right now?

1. _____

2. _____

3. _____

2) What has been the trend over the past ten years in the Land Bank? Please circle one.

Has declined

Has stayed the same

Has Grown

Don't Know

3) What is the most common strategy Land Bank used to deal with abandoned structures?

SECTION 2. Recycling and Reuse Policy

(The following questions are based on the construction and demolition waste policy that have been identified to promote the recycling rates)

- 4) Please circle one of your opinion about the policies options for promoting construction and demolition waste recycling with your comments.

Name	Description	Useful for the promotion of recycling rate	Comments
Disposal ban	A law or ordinance that forbids certain kinds of wastes disposed in a landfill directly.	YES NO NOT SURE	
Disposal tax	The cost of disposal C&D waste by the owners or operators of qualifying landfills or transfer stations.	YES NO NOT SURE	
Tipping fee	A gate fee (or tipping fee) is the charge levied upon a given quantity of waste received at a waste processing facility.	YES NO NOT SURE	
Percentage recycling requirement	A law or ordinance that set a recycling target for C&D waste	YES NO NOT SURE	
Material recycling requirement	A law or ordinance that requires certain kind and amount of C&D wastes to be recycled and reused	YES NO NOT SURE	
Deposit/Advanced disposal fee	A law or ordinance that requires the developers or contractors to pay for disposal fees corresponding with the amount of C&D predicted before waste generation (usually at the time that the building permit is approved). This fee can be refunded if proof is given that certain kind of materials are recycled.	YES NO NOT SURE	
Government waste recycling requirement	A law or ordinance that requires that all government agency construction activity that generates C&D waste must	YES NO NOT SURE	

	recycle or divert some portion of that waste from the landfill station.		
Government recycling purchasing requirement	A law or ordinance that says government agencies to purchase materials that have some recycled potential.	YES NO NOT SURE	
Business development	Local government provide financial opportunity to business to encourage developing programs for C&D waste recycling and reuse	YES NO NOT SURE	
Education	Local governments develop educational programs to train the public and businesses how to recycle and reuse C&D materials after they demolished or deconstructed their buildings.	YES NO NOT SURE	
Green Building Standards Codes	Aims to improve public health and safety from various categories including material conservation and resource efficiency.	YES NO NOT SURE	
Salvage requirement	Demolition contractors are required to announce an impending demolition to allow anyone who wants to salvage materials during or after demolition process.	YES NO NOT SURE	
Recycling and waste management plan	A plan that describe how C&D waste would be recycled and reused before construction permit is granted	YES NO NOT SURE	

SECTION 3. Deconstruction policy

(I examined a possible approach to eliminate the private property abandonment -- the deconstruction policy, which requires property owner to deconstruct the property at the structure's useful lifetime. In this section, your attitude towards this policy will help me examine the feasibility of such deconstruction policy.)

5) Would you support a policy that would require deconstruction policies for private property owners to ensure deconstruction at the end of the useful lifetime of a structure? Please circle one.

Yes

Not sure

No

6) What do you think would be the barriers of such deconstruction policy? (Rank in order. 1 being the most significant part.)

1. _____

2. _____

3. _____

7) Is there anything you would like to tell me about the challenge and opportunity regarding building deconstruction policy?

Thank you for your assistance! We greatly appreciate your time and participation in this survey! If you have any questions or comments, please feel free to contact me at:

Wumengq2@msu.edu or 517-775-4807

Appendix C

Dear Innovative Governance for Large Urban Systems:

I am a graduate student from Michigan State University Urban and Regional Planning program, and I am doing my master research on eliminating private property abandonment in Michigan.

The purpose of this survey is to collect information about the current policy regarding private property abandonment. Your responses will help in understanding the policies options for promoting construction and demolition waste recycling and the feasibility of applying deconstruction* policy which can eliminate the private property abandonment. Your participation is voluntary. If you have any questions or comments, please feel free to contact me.

I greatly appreciate your time and participation in this survey. The survey will take approximately 15 minutes. Thank you for your assistance!

Mengqiu Wu

Graduate Student

School of Planning, Design and Construction

Michigan State University

*Deconstruction: is the process of the selective dismantling or removal from building components in order to make the maximum use of recycled materials.

SECTION 1. Recycling and Reuse Policy

(European countries have relatively high recycling target of construction and demolition waste. The following questions are based on the construction and demolition waste policy that have been identified to promote the recycling rates)

1) What do you think are the most useful policies and regulations for promoting construction and demolition waste recycling? (Please rank in order)

1. _____

2. _____

3. _____

2) Can you give me some successful European construction and demolition waste management examples?

3) Please indicate your opinion about the policies options for promoting construction and demolition waste recycling below.

Name	Description	Useful for the promotion of recycling rate		
		YES	NO	NOT SURE
Disposal ban	A law or ordinance that forbids certain kinds of wastes disposed in a landfill directly.	YES	NO	NOT SURE
Disposal tax	The cost of disposal C&D waste in a landfill.	YES	NO	NOT SURE
Tipping fee	A gate fee (or tipping fee) charge levied upon a given quantity of waste received at a waste processing facility.	YES	NO	NOT SURE
Percentage recycling requirement	A law or ordinance that sets a recycling target for C&D waste	YES	NO	NOT SURE
Material recycling requirement	A law or ordinance that requires certain kinds and amounts of C&D wastes to be recycled and reused	YES	NO	NOT SURE
Deposit/Advanced disposal fee	A law or ordinance that requires the developers or contractors to pay for disposal fees corresponding with the amount of C&D predicted before waste generation (usually at the time that the building permit is approved). This fee can be refunded if proof is given that certain kind of materials are recycled.	YES	NO	NOT SURE
Recycling and waste management plan	A plan that describes how C&D waste would be recycled and reused before a construction permit is granted	YES	NO	NOT SURE
Government waste recycling requirement	A law or ordinance that requires that all government agency construction activity that generates C&D waste must recycle or divert some portion of that waste from	YES	NO	NOT SURE

	the landfill station.			
Government recycling purchasing requirement	A law or ordinance that requires government agencies to purchase materials that have recycled potential.	YES	NO	NOT SURE
Business development	Government provides financial incentives to business to encourage developing programs for C&D waste recycling and reuse	YES	NO	NOT SURE
Education	Governments develop educational programs to train the public and businesses how to recycle and reuse C&D materials	YES	NO	NOT SURE
Green Building Standards Codes	Adopts Green/LEAD Building Codes that includes material conservation and resource efficiency.	YES	NO	NOT SURE
Salvage requirement	Demolition contractors are required to announce an impending demolition to allow anyone who wants to salvage materials during or after demolition process.	YES	NO	NOT SURE
Other	Please Specify:			

SECTION 2. Deconstruction policy

(I examined a possible approach to eliminate the private property abandonment -- the deconstruction policy, which requires property owner to deconstruct the property at the structure's useful lifetime. In this section, your attitude towards this policy will help me examine the feasibility of such deconstruction policy.)

4) Would you support a policy that would require deconstruction policies for private property owners to ensure deconstruction at the end of the useful lifetime of a structure? Please circle one.

Yes

Not sure

No

5) What do you think would be the barriers of such deconstruction policy? (Rank in order. 1 being the most significant.)

1. _____

2. _____

3. _____

6) Is there anything you would like to tell me about the challenges and opportunities regarding building deconstruction, material salvage & reuse and structures abandonment?

Thank you for your assistance! We greatly appreciate your time and participation in this survey!
If you have any questions or comments, please feel free to contact me at:

Wumengq2@msu.edu or 517-775-4807

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